

AC 2010-1066: A COMPARATIVE STUDY OF LAND SURVEYING EDUCATION AT THE UNIVERSITY OF LAGOS AND THE PENNSYLVANIA STATE UNIVERSITY

James Olaleye, University of Lagos, Nigeria

Dr. James Olaleye enrolled on the Surveying Degree program at the University of Lagos, Nigeria in 1976. As a result of his brilliant academic performance, Dr. Olaleye became a shell scholar in 1976 and graduated in 1981 with a first class degree in Surveying. In 1987, he was awarded the prestigious commonwealth scholarship for doctoral studies in Canada. With a brilliant record of graduate work, Dr. Olaleye obtained his Ph.D degree in 1992 from the University of New Brunswick, Canada. He has continued the pursuit of academic excellence through the publications of his research findings in mapping in both national and international Journals. He has authored or co-authored over forty publications. He was awarded the prestigious "Talbart Abrams Medal" by the American Society for Photogrammetry and Remote sensing in recognition of his outstanding Publication in Geoinformatics in 1994. Dr. Olaleye is an Associate Professor in the Department of Surveying & Geoinformatics, University of Lagos. He is also the immediate past Head of Department. He teaches Digital Mapping

Emmanuel Abiodun, University of Lagos, Nigeria

Mr. O. E. Abiodun is currently an Assistant Lecturer in the Department of Surveying and Geoinformatics, University of Lagos. Born in Nigeria in 1970, Mr. Abiodun obtained his National Diploma in Surveying from the Federal Polytechnic, Idah, Nigeria in 1994. The same year, he proceeded to the University of Lagos where he obtained his B.Sc. in Surveying in 1999 and M.Sc. degree in Surveying and Geoinformatics in 2004.

Mr. Abiodun worked briefly as Assistant Manager, GIS Research and Development with Anthony Adeoye and Co. (now AAC Consulting) in 2002. He was appointed Lecturer III in the Department of Surveying and Geoinformatics, Osun State College of Technology, Esa Oke, Nigeria in 2004. From there, he was appointed as Assistant Lecturer in the Department of Surveying and Geoinformatics at the University of Lagos.

Mr. Abiodun emerged as the best graduating student in the Department of Surveying, Federal Polytechnic, Idah in 1994 and the best graduating M.Sc. student, Department of Surveying and Geoinformatics, University of Lagos in 2004. He has many papers to his credit both local and international. He is a member of many professional organizations in Nigeria. He is married with children.

Joseph Olusina, University of Lagos, Nigeria

Dr. J. O. Olusina is a Senior Lecturer and the current Head of Department of Surveying and Geoinformatics, University of Lagos. He obtained his Ordinary National Diploma in Surveying in 1984 and Higher National Diploma in 1987. He later proceeded to the University of Lagos where he obtained his B.Sc. in Surveying in 1991. In 1995, he obtained his M.Sc. degree in Surveying from the same University. He was awarded a Ph.D degree in Surveying and Geoinformatics of the University of Lagos in 2008.

Dr. J. O. Olusina worked between 1989 and 1997 with the Survey Department of the Federal Government of Nigeria's Ministry of Works and Housing. He later joined Yaba College of Technology, Lagos, as Lecturer II between 1997 and 1998. From there he joined the University of Lagos as Lecturer II in the Department of Surveying and Geoinformatics in 1998.

Dr. Olusina was awarded the best graduating student of Department of Surveying, University of Lagos in 1990 and Federal Government of Nigeria's Scholarship for his M.Sc. in 1995. He is a member of many professional organizations in Nigeria and has many publications to his credit. He is married with children.

Francis Derby, Pennsylvania State University-Lehman

Dr. Francis Derby obtained a doctoral degree from the University of Florida in Gainesville, where he specialized in cadastral systems and Geographic Information Systems. He is currently Associate Professor of Surveying and Geographic Information Systems at The Pennsylvania State University. He teaches traditional surveying and mapping courses as well as introductory and advanced courses in Geographic Information Systems, Photogrammetry, and Remote Sensing. His previous work experiences include surveying activities in Africa, England, South America and the Caribbean. He has also worked for the Commonwealth Secretariat of Great Britain, where he served as technical advisor to the government of the Commonwealth of Dominica on infrastructure development. He also consulted for the World Bank on various projects in Peru and Tanzania. Dr. Derby is an active member of the American Congress on Surveying and Mapping, and since 2005 he has served on the Geographic and Land Information Systems (GLIS) Board. He is also a member of American Society for Photogrammetry and Remote Sensing (ASPRS), and the American Society for Engineering Education (ASEE). He currently serves on the executive of the Minorities in Engineering Division (MIND) of ASEE.

A Comparative Study of Land Surveying Education at The University of Lagos and Penn State University

Abstract

Recent efforts in globalization have extended beyond commerce, travel, technology transfer and sporting activities. In higher education, globalization has become a catalyst for world class education, diversity in problem solving methods, and improved international understanding. Many institutions of higher learning in developed countries are forming partnerships with sister institutions in developing countries and conducting collaborative learning and research activities through asynchronous teaching and learning, webinars, as well as faculty and student exchange programs. The success of these collaborations depends on a careful examination of overall program objectives as well as expected outcomes of individual programs.

Among other related courses, the curricula in both surveying programs include common courses in land Surveying, geodesy, photogrammetry, remote sensing, law and Geographic Information Systems. In addition, University of Lagos provides cartography, hydrography, finance and management studies.

This paper presents a review of program objectives and course outcomes for the two institutions. It concludes by identifying areas of opportunities with regard to course alignment, undergraduate research opportunities, faculty and student exchange and asynchronous collaborative learning. These opportunities form the basis for future collaboration in teaching and research in support of globalization in higher education.

Introduction

Globalization is influencing, and indeed facilitating, interaction between societies, cultures, businesses, and even politics around the world. The drivers of the globalization process have been recent technological advances such as the Internet, telecommunications and geospatial technologies. These technologies are helping to create geographically dispersed but interconnected communities around the world. Again, the catalysts to these technologies are information management and innovation, both of which are dependent on knowledge. Carnoy² contends that globalization increases the demand for education and since knowledge is the product of education, knowledge is therefore fundamental to globalization. This assertion supports the fact that institutions of higher education have a responsibility to export knowledge outside the geographic boundaries for the benefit of the global community.

In recent years, institutions of higher education, especially in developed countries, are also engaging in globalization by connecting with sister institutions in developing opportunities so as to exchange ideas, explore research opportunities so as to empower graduates to compete globally. It is believed that knowledge development and commercialization of knowledge should

be among the primary objectives of the 21st century universities. Institutions of higher education embark on international programs for various reasons ranging from a desire to address global issues to a desire to provide exposure for the institution, its faculty and students to the international market.

Whatever the reason for exporting knowledge, internationalization of higher education resources in the form of sisterhoods should be conducted with clear expectations on both sides. It is important to recognize that international collaborations, whether in pursuance of globalization or to enhance the higher education system in a developing country, the exercise should be conducted with clearly defined objectives to ensure the mutual interests and expectations. This exercise will help to identify specific areas within the collaborating institutions to which attention should be focused.

The International Program at Penn State

For many years, Penn State University has had memoranda of understanding for collaboration with many Universities in African universities and governments. One such agreement is the Alliance for Education Science Engineering and Development in Africa (AESEDA) program. The AESEDA program seeks to explore collaboration between Penn State and stakeholders with regard to education and research. Among other things, the education component of AESEDA's activities focuses on graduate research, faculty and student exchange. It also offers opportunities for undergraduate and graduate students from foreign countries to take courses at Penn State. Through this program, major international collaborative activities in research and teaching have been initiated.

The collaboration between the geomatics program at the University of Lagos (UNILAG) and the surveying engineering program at Penn State University is something that has the potential to be rewarding to both programs. However, to establish the level and scope of the collaboration it was necessary to conduct a comparative evaluation of program objectives and course content. It was believed that the outcomes of the evaluations will help identify any preliminary activities in terms course alignment, available resources faculty and student needs, and thereby provide an insight into the extent and scope of collaboration.

Program objective and course content

The geomatics program at UNILAG was established in 1973 as an undergraduate program. In 1997 its name was changed from surveying to geomatics. Over the years, masters and doctoral level programs have been added. In this evaluation, attention was focused on the baccalaureate degree program only. In Nigeria, the Surveyors' Council of Nigeria (SURCON) is responsible for accreditation of Surveying programs and registration of graduate surveyors while Council for the Registration of Engineers (COREN) is responsible for accreditation of engineering programs and registration of graduate Engineers. The surveying program at the University of Lagos is designed to balance the accreditation requirements with the vision of the institution. The vision of the surveying program at the University of Lagos is to produce professional surveyors who are

also geoscientists with a sound knowledge of theory and practice of the profession to enable them to provide spatial and other environmental information.

The vision is to produce professional surveyors who are also geoscientists with a sound knowledge of theory and practice of the profession, and have the ability to provide spatial and other environmental information. The curriculum of the geomatics program is reviewed regularly to maintain its competitiveness in view of societal demands and advancing technologies. In recent years, the baccalaureate degree curriculum has been reviewed to include new subject -areas such as computer applications, Geographic Information Systems (GIS), Remote Sensing, Digital Mapping, and Environmental Management. The new curriculum promises to prepare our students, in addition to their traditional roles as surveyors, for a new role also as information managers, environmental and coastal management experts, as well as remote sensing experts. The new program also incorporates the General Studies (GST) courses, which are requirements for undergraduate studies by the university.

One striking difference between the two programs is that the UNILAG program takes five years to complete whereas the Penn State program takes four years. The geomatics program has been designed in conformance with other engineering programs at the university. First year students take the same courses as engineering students in the other departments, including Engineering Mathematics at all levels. Students spend the summer vacations of the second and third years, and the whole of second semester of the fourth year on industrial attachments. As part of the degree requirements, each student is also required to undertake an independent research project supervised by a faculty member.

The surveying engineering program at Penn State was started in 1964 as an associate degree program. The baccalaureate degree component was started in 1986 with a vision to provide an educational experience that enriches the lives of Surveying Engineering students by providing them with the necessary discipline-related knowledge and skills so that they are prepared to enhance the surveying profession and protect the health and welfare of the public while expanding the base of knowledge through research and scholarship. Surveying Engineering programs in the United States gain accreditation by meeting the requirements of the Accreditation Board for Engineering and Technology (ABET). The associate degree program is accredited by the Technology Accreditation Commission (TAC) of ABET while the baccalaureate program is accredited by the Engineering Accreditation Commission (EAC). Program and course objectives have been designed to address this vision and to meet the requirements for continued accreditation by the appropriate commission. Unlike the UNILAG program, the surveying engineering program takes four years to complete. Both the associate and the baccalaureate degree programs are accredited by the Accreditation Board of Engineering and Technology (ABET).

An evaluation of UNILAG and Penn State Surveying programs

A side-by-side comparison of the program contents at the two institutions is shown in Appendix A. Clearly both programs create student-centered environment which includes providing the necessary educational foundation which will produce an extremely knowledgeable graduate who

is capable of performing the responsibilities a professional surveyor. The training prepares students from both institutions to successfully take the professional licensing examination in their respective countries.

General overview

In general, the program contents are identical except that the UNILAG program includes hydrographic surveying which is not included in the Penn State program. However, the Penn State program includes storm water management and land development design, both of which are requirements in the professional licensing examination. Professional licensing examinations in surveying and engineering are governed by the National Council of Examiners for Engineering and Surveying (NCEES). In addition to meeting the professional licensing requirements, the Penn State surveying program has to meet accreditation requirements. For accreditation purposes the program and course outcomes have to be measured and documented. Such documentation should demonstrate that both the program and course objectives are meeting predefined accreditation requirements. Although neither the licensing nor accreditation requirements include a need for graduates to demonstrate an ability to compete in the global market, the changing dynamics of globalization is compelling institutions to explore and provide opportunities for graduates to compete globally.

Major differences

There are a few significant differences in the program content. Firstly, and the most significant difference is the duration of the programs. Whereas the Penn State, and indeed all baccalaureate degree engineering programs in the United States, takes four years, the UNILAG programs take five years to complete. Secondly, the UNILAG program includes one semester of field practical experience as an integral component of the program. Including the summer holidays, the students have to complete three semesters field practical training in addition to the normal laboratory exercises that are associated with individual courses. Clearly, the UNILAG program contains a lot more hands-on exercises than the Penn State program. Thirdly, student in the UNILAG program do not get exposure to any form of surveying until the second semester. Students at Penn State, on the other hand, get involved with surveying courses in the first semester. The objective is to expose students to the profession as early in their career as possible. Because of the rapidly changing equipment and technology, employers in the United States are more interested in graduates who have the skills to apply the most recent technology and use the most modern technology. As such, the use of modern equipment such as Global Positioning Systems (GPS) units is introduced into the curriculum by the second semester of the first year. Electronic data collectors are introduced in the first semester of the first year. Unlike the Penn State program, the latest technologies are not introduced in the UNILAG program until later in the program. This is mainly because many of the employers in Nigeria are not familiar with the recent technology. Those who are familiar with modern technology are not willing to discard existing surveying equipment just for the sake of technology. They are willing to phase new technology into their businesses over time. As such, UNILAG is compelled to continue

training students in the use old technology such as analytical and semi-analytical photogrammetry using stereo plotters.

Areas of mutual benefit

An obviously missing component of both programs is an opportunity for preparing students for international exposure as well as an ability to compete in the global market.

There are various opportunities for collaboration which have the potential to be mutually beneficial to both faculty and students on both institutions. Since UNILAG offers the geomatics program to the doctoral level, there are opportunities for to involve graduate students in graduate research activities involving faculty members a Penn State. Results of such research activities and resulting publications will provide international exposure to the graduate students. Another area will be opportunities for student exchange both graduate and undergraduate levels. There are various options for exchanging students. One choice will be for students do three semesters at Penn State (after the second year at UNILAG and return to complete one semester of industrial attachment and the final year. While at Penn State, the students will be enrolled in the third year courses as well as any elective courses. This opportunity allows students to experience education and teaching methods in a developed country. Penn State students also gain the experience of interacting with their international colleagues. In particular, they get to learn about the culture, the land tenure and cadastral system of a developing country. This experience provides them with the knowledge that is needed to participate in international consultancy in land information management.

Faculty members at both institutions can benefit from aligning courses so that professors from UNILAG get exposed to new tools and technologies in the surveying profession which are readily available at Penn State. They will then be able to modify the courses to include the newer technologies and tools. Faculty members at either institutions can also accept sabbatical appointments to spend some time at sister institutions to conduct research and to experience local surveying activities. Likewise, Penn State faculty member can use the exchange program to learn more about local conditions and to introduce international components into their surveying courses. Specifically, land tenure and cadastral systems in developing countries would be used to supplement the boundary principles courses that are taught in Penn State and other surveying institutions within the United States. Recently, various states in Nigeria have begun developing Geographic Information Systems (GIS) to manage land and related resources. Although the state governors' offices are inviting consultants from outside the country, such advice could have been provided through collaboration between faculty members at both institutions under the AESEDA agreement.

Conclusions

International collaborations among institutions of higher education, in response to globalization, are here to stay. Just as students in developing countries aspire to continue their education abroad, the universities have a responsibility to advance knowledge by exporting education to developing countries. There is a risk to transpose what works in the developed country into a

developing country. Such approach has a potential to fail if local conditions and cultures are not considered. In the case of surveying programs between Penn State and UNILAG, a comparative study has highlighted areas where faculty and students from both institutions can benefit from such collaboration. Through the evaluation, it was possible to identify opportunities. Some of the modalities for implementing those opportunities have to be developed through administrative arrangements, logistics, technology, scheduling and other means. The good thing is that it was possible to identify possible failures before they occur.

References:

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Appendix 1: Course offerings in Geomatics at UNILAG and Surveying Engineering at Penn State

University of Lagos			Penn State Unive	
Course	Title	Credits	Course	Title
	Year 1 Semester 1			Year 1 semester 1
SVY 101	History of Surveying	1	SUR 111	Plane Surveying©
EAG 101	Pure Math I	3	MATH 140	Calculus with Analytical Geo
EAG 103	Applied Math I	3	ENGL 015	Rhetoric and Composition
MEG 101	Workshop Practice	1	EDSGN 100	Engineering Design and Grap
MEG 103	Technical Drawing I	2	GEOG10 or CHEM110	Introduction to Physical Geo Chemical Principles
FSC 105	Introductory Physics I	3	SUR 100S	Freshman Seminar in Survey
GST 103	Nigerian People & Culture	2		Total
GST 102	Intro. to Logic and Philosophy	2		
GST 105	Use of English	1		
	Total	18		
	Year 1 Semester 2			Year 1 Semester 2
SVY 102	Basic Surveying I	1	SUR 112	Curve Geometry
EAG 102	Pure Math II	2	SUR 162	Methods in Large-Scale Map
EAG 104	Applied Math II	2	MATH 141	Calculus with Analytical Geo
MEG 102	Workshop Practice II	1	MATH 220	Matrices
MEG 104	Technical Drawing II	2	GA, GH, GS	Arts (GA), Humanities (GH) (GS)
PHS 101	Introductory Physics II	2	GHA	Health and Activities
PHS 102	Introductory Physics III	3		Total
PHS 103	Lab (Physics)	2		
GST 104	History & Philosophy of Science	2		
GST 106	Use of English	2		
	Total	18		

University of Lagos			Penn State Un	
Course	Title	Credits	Course	Title
	Year 2 Semester 1			Year 2 Semester 1
SVY 201	Basic Surveying II	3	SUR 241	Surveying Measuremen
GRY 203	Cartography	3	STAT 401	Experimental Methods
EAG 203	Engineering Math I	3	MATH 230	Calculus & Vector Ana
EEG 201	Fund. of Elect. Engr. I	3	GA/GH/GS	Arts, Humanities, & So
PHS 201	Classical Mechanics I	2	ECON 2/4/14	Social Science (GS)
PHS 219	Practical Physics I	1		Total
PHS 261	Geophysics I	2		
GAS 201	General African Studies I	2		
PHS 207	Optics	2		
	Total	21		
	Year 2 Semester 2			Year 2 Semester 2
SVY 202	Engineering Surveying	3	SUR 222	Photogrammetry
EAG 202	Intro. Engr. Stat. & Computer System	3	SUR 262	Coordinate Systems &
PHS 208	Intro. To Astrophysics	2	MATH 251	Differential Equations
SVY210	Photogrammetry I	3	PHYS 211	Mechanics
PHS 220	Practical Physics II	1	CMPS 201C	C Programming for Penn
GAS 202	Gen. African Studies II	2		Total

SVY 204	Remote Sensing I	3		
SVY 206	Computer Application in Surveying I	2		
	Total	20		
	Elective			
PHE 207	Introduction to Swimming I	1		

University of Lagos			Penn State Uni	
Course	Title	Credits	Course	Title
	Year 3 semester 1			Year 3 Semester 1
SVY 305	Cadastral Surveying I	3	SUR 272	Cadastral Surveying©
SVY 307	Spherical and Field Astronomy	3	SUR 341	Adjustment Computati
ESM 351	Applied Town Planning	2	SUR 351	Geodetic Models
SVY 309	Adjustment Comp. I	3	CAS 100A	Effective Communicati
SVY 311	Hydrographic Surveying I	3	PHYS 212	Electricity and Magneti
SVY 313	Principles of Geo. Information System I	3		Total
PHS 301	Classical Mechanics II	3		
	Total	20		
	Elective			
PHE 207	Introduction to Swimming I	1		
	Year 3 Semester 2			Year 3 Semester 2
SVY 302	Geodetic Surveying	3	SUR 362	Multipurpose Land Info
SVY 306	Cadastral Surveying II	3	SUR 372W	Legal Aspects of Land
SVY 308	Geodetic Astronomy	2	Tech. Elec.	Technical Elective (or 5
SVY 310	Electronic Surveying	3	PHYS 213/214	Fluids & Thermal Phys
SVY 312	Computer Appl. In Surveying II	3		Quantum Phys.
SVY 314	Principles of Geo. Information System II	3	Engl 202C	Effective Writing: Tech
SVY 316	Digital Mapping I	2	H & A	Health and Activities
	Total	20		Total
	Elective			
SVY 300	Industrial Training	4		
	Plus at least 2 Units of Electives below:			
EAG 302	Operational Methods	2		
PHE 207	Introduction to Swimming II	1		
CEG 304	Engineering Geology	3		

University of Lagos			Penn State Uni	
Course	Title	Credits	Course	Title
	Year 4 Semester 1			Year 4 Semester 1
SVY 401	Map Projection	3	SUR 471	Professional Aspects of
SVY 413	Photogrammetry and Remote Sensing I	3	SUR 490	Seminar in Surveying
SVY 415	Geodesy I	3	Tech. Elec.	Technical Elective
SVY 417	Digital Mapping II	2	Tech. Elec.	Technical Elective
EAG 405	Engineering Statistics	2	GA, GH, GS	Arts, Humanities, & So
EAG 403	Numerical Methods in Engineering	3	GA, GH, GS	Arts, Humanities, or So
GEG 401	Tech. Communications	1		Total
	Total	17		
	Plus at least 5 Units of Electives from below:			
SVY 405	Mining & Underground Survey	3		
SVY 409	Potential Theory & Spherical Harmonics	2		
SVY 411	Special Surveys	3		

	Year 4 Semester 2			
SVY 400	Industrial Attachment	8		
	Year 5 Semester 1			Year 4 Semester 2
SVY 501	Adjustment Comp. II	3	SUR 441	Data Analysis and Proj
SVY 505	Survey Laws and Regulation	2	SUR 482	Land Development Des
GEG 501	Engineering Economics	2	Tech. Elec.	Technical Elective
SVY 511	Project	3	Tech. Elec.	Technical Elective
	Total	10	GA, GH, GS	Arts, Humanities, or So
			H & A	Health and Activities
				Total

University of Lagos			Penn State Uni	
Course	Title	Credits	Course	Title
	Year 5 Semester 1			Technical Elective Co
Plus at least 7 Units of Electives from below:				
SVY 503	Special Studies in Digital Remote Sensing	3	SUR 313	Practical Field Problem
SVY 509	Geometric Geodesy	3	SUR 425	Advanced Photogramm
SVY 517	Photogrammetry & Remote Sensing II	3	SUR 455	Precise Positioning Sys
SVY 523	Intro. to Coastal Mapping & Management	2	SUR 465	LIS Applications
SVY 525	GIS Tools & Applications	3	SUR 285	Drainage Design
GEG 503	Surface Water Hydraulics	2	SUR 485	Stormwater Design
GEG 519	River Engineering	2	GEOG 352	Image Analysis
SVY 519	Mathematical Geodesy	2		
	Year 5 Semester 2			
SVY 502	Adjustment Computation III	3		
SVY 506	Prof. practice and Ethics	3		
SVY 512	Project	3		
GEG 502	Engineering Law & Management	2		
	Total	11		
Plus at least 9 Units of Electives from below:				Additional Elective Co
SVY 510	Physical Geodesy	3	ACCTG 211	Financial and Manageri Decision Making
SVY 508	Hydrographic Surveying II	3	ACCTG 311	Accounting Systems an
SVY 516	Marine Surveying	3	B A 243	Social, Legal, and Ethic Business
CEG 504	Ground Water Hydrology	3	B A 250	Problems of Small Busi
SVY 504	Spcl. Studies in Analytical & Digital Photogrammetry	3	B A 321	Contemporary Skills fo Professionals
SVY 513	Satellite Geodesy	3	B A 322	Individual and Interpers for the Bus. Prof.
SVY 515	Applied Geophysics	2	CE 360	Fluid Mechanics
SVY 528	Close-Range Photogrammetry	3	EMCH 11	Statics
			EMCH 12	Dynamics
			FIN 301	Corporation Finance
			IST 210	Organization of Data
			IST 211	Advanced Topics in Re Management Systems
			IST 221	Introduction to Telecon
			IST 222	Voice and Data Commu
			INS 301	Risks and Insurance
			MGMT 301	Basic Management or
			MGMT 341	Human Resource Mana

				MKTG 301W	Principles of Marketing
				R EST 301	Real Estate Fundamentals
				SUR 211	Construction Surveying
				SUR 496	Independent Studies
				SUR 497	Selected Topics in Land