# CONSTRAINTS ENCOUNTERED IN THE TEACHING OF CARTOGRAPHY IN PUBLIC UNIVERSITIES IN KENYA - A CASE STUDY OF KENYATTA UNIVERSITY, NAIROBI

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**ABSTRACT**

Kenyatta University (1972 – 1984 as a constituent college of Nairobi University, 1985 to date as a full-fledged university), is the second oldest university in Kenya, after Nairobi University. Kenya has six public universities and several constituent colleges. The government funds all the public universities and as such they tend to have similar problems where limitation of resources is a factor. Cartography is one of the technical courses taught to undergraduate students at the Geography Department, Kenyatta University as well as remote sensing and survey. Cartography is taught to undergraduate students in the first two years upon admission in the university, after completion of four years in secondary schools. This course is designed to train students in the practical skills of data collection, analysis and presentation for geographical research. Cartography, the art and science of map making, has undergone tremendous changes during the second half of the 20th century. The traditional training of cartography in which pen and pencil played an important role has now been replaced with computer technology.

This paper examines the constraints encountered in the teaching of cartography in a university in a developing country. The three broad-based issues addressed are; 1) the equipment and materials including pantograph, planimeter, stereoscopy, maps, air photos, drawing pens, drawing sets, set square, tracing paper reading literature - text books and cartographic journals 2) cartography instructors - their level of education in cartography, desire for higher education in cartography, need for refresher courses in the same, and assistance given by technicians during practical exercises, and 3) the cartography curriculum (revision term, lengthy of teaching, practical exercises offered, relevance of curriculum to modern trends - automated cartography, website cartography and geographic information system). Recommendations and short-term measures on how to curb the problems at Kenyatta University are discussed. This paper is based on review of cartography teaching, interview with cartography instructors in geography department and my experience as a cartographer in this department for twenty years.

## 1. INTRODUCTION

The Department of Geography falls under the School of Humanities and Social Science, Kenyatta University. Geography is a broad based discipline concerned with study of physical and human environments The main objective of the department is to impart knowledge for intellectual and moral development, provide relevant skills and training for the job market and to undertake research. Its particular perspective is spatial and temporal, mainly focuses on the distribution of phenomena over the earth's surface, over time. Being a social and physical science, geography is committed to the study of natural environment and its central theme is the description and explanation of spatial structures and processes.

The geography curriculum in all the Kenyan universities includes cartography; surveying and remote sensing under the unit called techniques. This course is designed to train students in the practical skills of data collection, analyses and presentation for geographical research. Much of what is taught is theory with very little practical aspects. There is need to move from theory to practical and technical areas. To enable geography graduates to compete in the marketplace there is need for them to acquire skills in advance techniques in cartography and related subjects like remote sensing and surveying. Cartography is defined by Robinson *et al* (1984) as any of the following activity; 'teaching the skills of map use; studying the history of cartography; maintaining map collections with associated cataloguing and bibliographic activities; and the collection, collation, and manipulation of data and the design and preparation of maps, charts, plans, and atlas'.

Cartography is taught to undergraduate students in the first two years upon admission in the university, after completing four years in secondary schools. Geography students at secondary school learn map work and photo interpretation, which serve as an introduction to cartography at the university level. On completion of their undergraduate studies, a geography graduate from Kenyatta University should be able to perform activities such as teach geography in secondary schools, teacher colleges and tertiary institutions; carry out research in various aspects of geography, and apply the acquired geographical knowledge and skills in resource management. Ogutu (1994), stresses that 'the study of geography whether at regional or strictly local should be supported by practicals involving various skills and techniques such as data collection, storage, manipulation, data analysis and eventual interpretation and presentation skills'.

## 2. CONSTRAINTS

### 2.1 Equipment and Materials

Cartography is a practical oriented subject, hence the need to involve the students in practical training by using the appropriate equipment, however, this equipment is lacking as indicated by Appendix 1. The process of purchasing new equipment or repair of old ones is cumbersome because all finances are controlled by a central committee within the university administration and not in the department. The same problem is encountered in the replacement of torn or wore-out materials such as maps or air photos.

Most of the equipment is out-dated and can not keep up with modern trends and development in the subject. Ogutu (1994) emphasise that 'the new generation of cartographers must, not only be trained in the traditional aesthetically pleasing and scientifically accurate maps, they must also be well trained in computer technology'.

Shortage of teaching materials is experienced such as air photos, tracing paper maps, and drawing pens .The process of acquiring large scale maps (maps of 1: 50 000 and larger) is cumbersome as it requires getting permission from the department for defence with the approval of survey of Kenya. Survey of Kenya is the national mapping organisation. It may take more than a month to be able to purchase a map.

As mentioned earlier, since all the purchases are done by a central committee from the university administration, the department experiences delays in obtaining teaching materials. An example of this is the technical pens for use by students in the first year where the students on arrival pay some money and the university supplements, a process can take up to four weeks.

The process of acquiring air-photoshas become less cumbersome since there are now private organisations in Kenya that are involved in acquiring and selling air-photos to the public. Thus delay in purchasing will only be experienced due to the university bureaucracy in this case.

### 2.2 Text Books

Tremendous change has been experienced in the field of cartography in the recent past with the introduction of computer assisted cartography hence the need to acquire new literature on the subject. Journals and textbooks which reflect such change are not stocked in the library and the textbooks found there are very old (Appendix 2). A careful look at this list reveals that most of these textbooks are older than twenty years, that is, they were published between the year 1960 and 1999 (1960 - 1964, six books; 1970 -1979, fifteen books, 1980 - 1989, five books and lastly 1990 -1999, one book). This means that the course content is out-dated and therefore does not reflect the trends in contemporary cartography. The implication of this is that geography graduates will be out of touch with what is happening in this particular field hence, they can not seek for jobs or even to seek further training in a career in cartography. This sad state is also experienced by the other branches of geography including physical and human according to Murimi (2003) and Wambugu (2003). According to Ogutu (1994) 'to enable our students to compete effectively in the marketplace, we should allow them to gain familiarity with advanced techniques in cartography, survey, photogrammetry and remote sensing, and Geographical Information System.

The quantity of textbooks was found to be inadequate because most of the textbooks are no more than two copies and they are in bad condition. This is expected given that they are very old and have been used by many students.

Lack of modern equipment such as Computers or Global Positioning Systems (GPS) is a constraint found at the Geography Department. For a long time the department did not have suitable computers with a large enough memory to cope with the normally large cartographic data or even enough space for GIS software to be installed. In 2001 Trier University in Germany had donated the GIS software (an Arcview), which could not be installed since the department lacked a suitable computer. During this academic year, the department now has four suitable computers donated through Deutscher Akademischer Austauschdienst (DAAD).

### 2.3 Training For Instructors

There are only two cartography instructors in the department and their qualification in cartography are; a diploma in cartography from Kenya Polytechnic, which is a middle level college, as well as other qualifications in related fields from International Institute for Geo-information Science and Earth Observation (ITC) in The Netherlands

For effective teaching of cartography, competent personnel in cartography are required. Higher training in cartography is conducted abroad, and individuals rely on scholarships in form of funding because of the expenses involved. The desire for the cartography educators for higher education has not been successful because of lack of financial support from within and outside the university. There is stiff competition for scholarship/fellowship in the university between different departments.

There are no refresher or short courses for the instructors to broaden their knowledge on the subject as well as acquire the latest techniques in the same. Refresher courses within the country should be given priority, since they are less expensive, as well as favourable for elderly instructors who might not want to leave the country for higher training overseas and for a longer period.

### 2.4 Curriculum

The time allocated to the teaching of cartography is not adequate given the large course content (Appendix 3). In the first year for instance, Cartography section is taught together with Map Analysis and Introduction to Statistics in one semester (a semester is 12 weeks with three hours of teaching in a week).

The fifteen topics indicated are required to be taught in four weeks, over a total time period of twelve hours. A rough estimate shows that each topic is assigned one hour. It is therefore not practical to adequately teach all the topics within such a short time period. Furthermore, the time allocated for the subject does not allow enough exposure on the subject to create interest on the students or to encourage them to pursue the subject in higher education. In the last twenty years, for example, only two students have attempted to do a Masters degree in cartography, but have later changed to do something else.

Revision of the curriculum has not been a frequent activity (see Appendix 3). Between 1985 and 2003, it was done five times, in the academic year 1989/1990, more topics were added to the curriculum in comparison to the previous years. This made the curriculum to be very loaded. In the same year, cartography was introduced in the second year, but only as an elective unit, meaning not compulsory, but for interested students. In the first year, Cartography is a core unit and therefore a degree requirement fo all the students.

Eight years later, 1998/2000, another revision was done. A close look on this revision will reveal that most topics in the 1989/90 curriculum were retained but three topics were left out namely, relief representation, chorochromatic and chloropleth, and dot maps. In the third year series, map design, representation of ground features and map evaluation were also left out.

The most recent revision to be done was in 2001/2003 and many topics have been removed from the unit. This unit which was originally composed of Cartography and map analysis now shares with Introduction to Statistics, hence the need to reduce some topics from cartography to create room for statistics. Some topics were moved from first year to second year and they are compulsory to all students. Take note that in the 1998/2000 revision, in the third year, cartography was an elective unit.

The revision on the curriculum does not reflect the changes that have occurred during the computer era to include topics in automated cartography and web-site cartography. Although automated cartography was included in the 1989/90 revision it was not taught. This can be attributed to the fact that instructors are either not aware of the modern trends in the subject or there was lack of equipment required to facilitate the teaching.

The teaching methodology involves theory, practical and attachment. It is difficult to achieve the last two because of the large number of students in a class. First year geography students are between 150 and 200 in total. Such a class is quite large and it becomes difficult for instructors to reach individual students hence the need for assistance from technicians. Indeed practical groups in five sessions during the week have an average of 40 students, which is still a large number for effective practical teaching. The department has just one technician at the moment. As for the attachment, this becomes impossible as most mapping organisations are not willing to accept such a big number of students.

## 3. RECOMMENDATIONS

### 3.1 Equipment and Materials

There has been some support from departmental partnership with Trier University through which the Kenyatta university obtained some equipment; a scanner, overhead projector, slide projector and Arcview software. Between

1998 and 2001, the link helped the department to acquire some remote sensing textbooks and also GIS software. There is need therefore to encourage such partnerships.

It is also recommended that linkages with local universities and research institutions, such as between Nairobi University and Kenyatta University should be enhanced for sharing of equipment. For example in the past years, Nairobi University borrowed pocket stereoscopes for their practical exercises in air-photo interpretation from Kenyatta University.

The department can also acquire equipment through research funding. The first computer in the department was donated by a staff member at the end of his research.project. Such donations of equipment should be encouraged, and can be inbuilt into research proposals from the department.

**3.2 Text books**

Recent literature can be obtained from the Internet. The university cyber café allows every department one-hour use without paying. This is not sufficient time for a department like Geography Department because it has twenty staff members. Use of material can be improved through sharing. Currently, a Geography Department staff member has subscribed two online GIS journals (GIS monitor and ARCNEWS) which she downloads and prints them once a week for the department to use. The avenue should be done for cartography journals and other relevant publications to increase the information exchange and flow.

There is also need to establish internal linkages with mapping and surveying institutions to allow geography staff to use their libraries. The mapping institutions have recent textbooks and journals in cartography. Instructors can therefore keep updated and at the forefront of new information, and and share them with students as well as other interested staff.

**3.3 Training for Instructors**

Using experts from outside the country can also benefit the department. Through the partnership between Trier University and Kenyatta University, a staff from Trier University came and taught interested Kenyatta University members how to use Arcview. It is of interest to note that the whole of Kenyatta University community benefited from this gesture (both members of staff as well as students from the whole university and not just geography department). Such training are therefore likely to benefit large number of people at less expense than sending out individuals to learn out of the country. Indeed the recommended refresher courses can be done using experts not only from outside the country, but also from within institutions in the country.

Exposure on the part of the instructors is necessary through short courses, seminars, and workshops. ITC normally offers refresher course and short courses as well as distance education for its alumni and all the instructors are ITC alumni. In Kenya, there are several mapping institutes including Kenya Institute of Surveying and Mapping and Regional Center for Services in Mapping and Surveying which offer short courses and sometimes they are sponsored. On the Internet, ITC is always advertising fresher courses in different subjects for its alumni and they are always paid for.

In addition, part-time lecturers can be recruited to teach courses where the full time lecturers are not conversant with for example automated cartography or website cartography. This is not a new practices since for some time the department used to recruit part-time lecturers to teach remote sensing when the department did not have competent people in that area.

**3.4 Curriculum**

As it is not possible to have the students attached to mapping organisation because of their large numbers, study tours can be organised is an important exercise as it exposes the students to what actually happens in the industry. Cartographic classes can further be subdivided into even smaller groups with fewer students depending on subject combinations. Five groups to be conducted in a week because the instructors can be able to reach individual students. The workload of the instructor is increased, but this helps the students to have better understanding on the subject.

Recruitment of technicians is encouraged to help the instructors during practical classes. In the early 1990s, there were five technicians, but four have left the department, without any replacements. There is brain drain of instructors and technicians from the university to the private sector where there is better remuneration than at the university. The higher training of the instructors and technicians should go hand in hand with remunerating them adequately, as they are likely to leave as soon as they acquire the higher qualification

More time should be availed for cartography teaching. According to Murache (2003) and Mahiri (2003) the most adequate amount of time required for effective teaching is the whole semester, that is 12 week of three hours a week. This course should also be taught and applied in three years consecutive, so as to serve as introduction to Geographical Information Systems which should be a taught as a fourth year unit.

Some topics such as the practical part of free hand lettering should be removed and the hours assigned to them can be used for recent topics in cartography like automated cartography. The free hand writingis currently not very useful at this computer era, given that different font are already provided for the computer. More practical exercises should be included in topics such as map design and map compilation to give students some hands-on experience on map making.

## 4. REFERENCES


[1] Commonwealth Geographical Bureau, Newsletter no.26 (2000). http:/www.thecommonwealth.org

[2] Kenyatta University Calendar (1989/90), Nairobi, Kenya

[3] Kenyatta University Calendar (1998/2000), Nairobi, Kenya

[4] Kenyatta University Calendar (2001/2003), Nairobi, Kenya

[5] Mahiri O.I. (2003). Lecturer, Department of Geography, Kenyatta Univeristy, Personal Communication

[6] Murache,G.M.(2003).Chief Technician Department of Geography, Kenyatta University, Personal Communication

[7] Murimi S.K.(2003). Physical Geography Lecturer, Department of Geography, Kenyatta Univeristy, Personal Communication

[8] Ogutu Z.A. (1992): Integrating of Geographic Information system (GIS) into department of Geography in the National universities. Proceedings of a Symposium organized by the Kenya Agricultural Research Institute, Kenya.

[9] Ogutu Z.A. (1994): Prospects and problems of graduates of Kenyan public universities: issues for the 1990s and beyond. Journal of Eastern Africa Research and development

[10] Robinson H. A., Sale D. S., Morrison J. L. and Muehrcke P. C. (1984): Elements of Cartography, Fifth edition John Wiley and Sons, New York

[11] Wambugu S. K. (2003) Human Geography Lecturer, Department of Geography, Kenyatta Univeristy, Personal Communication

## APPENDIX 1: LIST OF EQUIPMENT IN THE CARTOGRAPHIC LABORATORY AT KENYATTA UNIVERSITY, GEOGRAPHY DEPARTMENT

1) Cabinets - horizontal and vertical
2) Drawing tables
3) Light tables
4) Mirror stereoscopes
5) Pocket stereoscopes
6) Planimeter
7) Pantography
8) Straight edges - non-graduated
9) Graduated
10) Drawing set
11) Triangular scale
12) Curvimeter
13) Leroy lettering set
14) T-square
15) Ammonia printer
16) Paper cutter
17) Magnifying lens
18) Line spacers

## APPENDIX 2: CARTOGRAPHY TEXT BOOKS IN KENYATTA UNIVERSITY LIBRARY
**By title, author, year of publication, publishing firm and place.**

1. A Map History of Our Own Times: From the 1052s to the present. Catchpole, Brain **(1983**): Heinemann, London
2. Basic Cartography for Students and Technicians, Vol.1 and 2: Ansons R.W. (Ed). Ormeling, R.J. (1993). Elsevier Applied science, London
3. Cartograpic Methods. Lawrence G R. P. (1979): Mathueu, London
4. Computer Cartography. Peucker, Thomas (1972): Association of American Geographers, Washington D.C.
5. Elements of cartography (fifth edition- (1984): Robinson A. H. et.al: John Wiley and Sons
6. International Year Book of Cartography -Main volume. Edited by Kirkshbaunn, Gregor M. and Merien, Karl-Heinz (1977): Kirschbaum-Verlag, Bonn
7. Map and Photo Reading. Birth T. M. (1968): Edward Arnorld, London
8. Mapping and Topographic Drafting. John D. B. and Rober A. L. : South Westhern Publishing C. Cincinnati
9. Maps and Airphotographs. Dickinson G.C. (1970) Edward and Anold, London
10. Maps and Diagrams. Monkhouse F.J. and Wilkson B.R. (1963): Richard Clay Ltd
11. Maps and Map-makers. Tooley, Ronald (1978): B.T. Batsford, London
12. Maps and Their Makers as an Introduction to the History of Cartography. Crone Gerald Roe (1978): Dawson and Son, Folthestone, Kent
13. Maps for America: Cartographic Products of a U.S. Geological Survey and Others. Thompson, Morris M. (1979): U.S. Department of Interior, Washington D.C.
14. Maps for Books and Theses: Illustrated by the author. Hodgkiss, A.G. (1970): David and Charles, Newton Abbot, Devon
15. Maps, Topographical and Statistical: Birch, T. W. (1964): Clarendon, Oxford
16. Modern Maps and Atlas: An Outline Guide to 20$^{th}$ Century Production. Lock, C. and Mariel, B. (1969): Bingley, London
17. Ordinance Survey Maps; Their Meaning and Use With Description of Typical Sheets. Newbigin, Marion (1973): Johnston, London
18. Practical Map Production. Loxton John (1980): Wiley, Chichester
19. Practical Works in the Geography. Garniee, E. J. (1963): Arnold, London
20. Principles of Cartography. Keates J. S. (1973): Longman, London
21. Principles of Cartography. Raisz, Erwin (1962): MaGraw-Hill, New York
22. Physical Geography in Diagrams. Bunnett, R. B. (1966): Longman, London
23. Sources Materials for Mapmaking. Rabenharst, T. D and Modernoh,D (1980): Merril, Columbus
24. Techniques in Map Analysis. Worthington, B. D. R. and Gant Robert (1975): Macmillan Education Ltd, London
25. The Computers in Contemporary Cartography. Taylor, D. R. France (1980): Wiley, New York
26. The World of Maps and Mapping: A Creative Learning Aid. Tyner, Judith (1973): McGraw-Hill, New York
27. Thematic Cartography. Muehreke, Philip (1972): American Geopraphers, Washington D. C.

## APPENDIX 3: CURRICULUM CHANGES IN CARTOGRAPHY

| 1981/82 | 1984/85 | 1989/90 | 1998/2000 | 2001/2003 |
|---|---|---|---|---|
| **First year Units**<br>1. Simple cartographic methods<br>2. Map interpretation | **First year Units**<br>1. Co-ordinate system<br>2. Map legend<br>3. Map orientation | **First year Units**<br>1. Use and care of drawing instruments<br>2. History of cartography<br>3. Conventional signs<br>4. Map orientation<br>5. Map legend<br>6. Relief representation<br>7. Thematic map<br>8. Chorochromatic and chloropleth<br>9. Dot maps<br><br>**Second Year (Elective unit)**<br>1. Map design<br>2. Map projections<br>3. Grids and scales<br>4. Representation of ground features<br>5. Map evaluation and compilation<br>6. Place names<br>7. Marginal information<br>8. Map revision<br>9. Map reproduction<br>10. Automated cartography<br>11. Drafting equipment and materials<br>12. Drafting methods and cartographic techniques<br>13. Map and graphic design<br>14. Thematic mapping | **First year Units**<br>1. General draftmanship<br>2. History of cartography<br>3. Map scale<br>4. Freehand lettering<br>5. Symbols and convention signs<br>6. Relief representation<br>7. Map reduction and enlargement<br>8. Map revision<br>9. Map interpretation<br>10. Thematic maps<br><br>**Third year (Elective unit)**<br>1. Comparison between line-map and photo-maps<br>2. Image maps<br>3. Aerial photo interpretation<br>4. Photo-mapping<br>5. Map projection,<br>6. Map reproduction<br>7. Colour separation<br>8. Map grid system | **First year Units**<br>1. History of cartography<br>2. Use and care of drawing instruments<br>3. Map design and compilation<br>4. Thematic and chloropleth maps<br><br>**Second year unit (core)**<br>1. Thematic maps<br>2. Map reduction and enlargement |