Report on GIS and indicator development for the LEAP project

John M. Mendelsohn

October 2003

Introduction

The Policy component of the Literacy Enhancement Assistance Project (LEAP) seeks to increase and improve discussion on the performance and nature of the education sector in Nigeria. One way of doing this is to increase the availability and use of indicator information on education, and the work reported here discusses the development of a GIS (geographical information system) database for the production of maps of indicators and other features. The report given here covers a second stage in the development of a GIS for schools, and follows a first consultancy in August 2002 when the initial steps towards the database were taken.

During the past six months, staff from the LEAP project and Kano and Nasarawa State Primary Education Boards (SPEB) had used global positioning systems (GPS) to plot the positions of all state primary schools in their respective states. The initiative to do this came from the Chairmen of both SPEBs. This second consultancy had three main purposes. First, to check, correct and assemble datasets of geographic co-ordinates for all primary schools in Kano and Nasarawa, and to link these with selected sets of EMIS (education management information system) information for the same schools. Second, to present selected indicators and other products from these databases to staff in the Kano and Nasarawa SPEB offices. Thirdly, to provide training on the use of GIS and EMIS data.

Results

The Kano data consisted of co-ordinates for 2,615 schools and associated information on enrolment and numbers of teachers and classrooms (see the file 'kano schools gis and emis.shp/dbf'). The structure of these data is described in Appendix 1, as are minor problems of incorrect co-ordinates and missing EMIS data. Appendix 1 also provides information on the structure of the database compiled for 1,104 primary schools in Nasarawa (nasarawa gis and emis data.shp/dbf). There were many more problems with this set of data, most of which were caused by the fact that quite different codes were given to the GIS and EMIS sets of data. I spent almost two days trying to match schools on the basis of their names, and probably matched 90% of the schools successfully. Many co-ordinates were also found to have been typed incorrectly. All of these data should be checked, however, and more effort made to resolve the remaining problems that are listed in the database and in Appendix 1.

Both the Kano and Nasarawa school location data were assembled together with other contextual GIS data (such as roads, state borders, LGA (local government area) boundaries and major towns) for purposes of demonstrating the data. The EMIS data were also used to create various thematic maps such as of pupil:teacher ratios, school sizes, and average pupils per class. Presentations were made to senior management of the

SPEB offices in Kano and Nasarawa, and also separately to technical EMIS and planning staff in both offices. The presentations were well received with considerable enthusiasm being voiced about the value of the GIS information and indicators. A similar presentation was also made to staff in the USAID (United States Agency for International Development) office in Abuja. Many of the maps shown during the presentations were printed and left in the LEAP office in Abuja.

Training in the use of the GIS and EMIS data was provided for one day to EMIS and planning staff in the Nasarawa SPEB office. Mr Habila Alaku of the LEAP also attended this session and I provided him with additional training on a one-to-one basis.

On a technical level, I saw Muhammed Zikirullahi Ali of the Geography Department at Bayero University to discuss fixing errors in data he had assembled for the project. He and his colleagues had digitized a map of Kano as an AutoCad file, but this could not be imported into ArcView for use with the other GIS data. It became clear that he and his colleagues were unable to resolve the problem. I loaded AutoCad on to my computer and managed to solve some of the difficulties, but other problems remain.

Development of GIS data for public primary schools in Kano and Nasarawa is now essentially complete, and both states have useful sets of data. The efforts made to plot the locations of all primary schools in these states are to be applauded. It is also clear that the development of the GIS datasets has been worthwhile, especially in using thematic maps to stimulate useful discussion on education and to create a demand for mapped information. Further GIS work will involve collecting small outstanding pieces and correcting some elements.

Recommendations

1. The training provided during this and the previous consultancy was of a preliminary nature and intended to provide people with the basic principles of developing and using a GIS. In all the sessions, I stressed the need to spend time practicing, experimenting and learning the programme themselves. Nevertheless, additional training is most certainly required, and the LEAP project should make every effort to provide that training. Both Kano and Nasarawa have enthusiastic and competent staff that will benefit from training.

   The training should be combined with instruction and assistance in the development and use of EMIS databases and systems so that trainees understand the linkages and complimentary relationships between GIS and EMIS. Indeed, a good deal of the focus in the future should be on the EMIS data, both in its own right for purposes of planning and monitoring, and for expanded uses with the GIS information. The importance of obtaining good statistical data to be used as indicators cannot be overstated.

   The training should also stress yet again the importance of using standardized and permanent codes for all schools. Each school should thus be given a unique code (ideally in an alpha-numeric format), which will identify **all** EMIS and GIS data for

that school. The code should not have any meaning (for example by containing abbreviated letters for the LGA) and the code given to each school should never change. For example, codes containing LGA abbreviations would have to change if the boundaries of the LGAs were adjusted, or new LGAs were created.

Many of the sets of school data are now being produced in MS Word reports. To use these data in ArcView, they first have to be stripped of certain formatting parameters and then exported into Excel or Access, an unnecessary and time-consuming process. The use of Excel and/or Access should be encouraged, therefore.

2. In taking both the GIS and EMIS developments forward, there is the clear assumption that most training should focus on technical issues concerned with the data processing and analysis, map production etc. Most training would therefore be devoted to statisticians and other technical staff in the SPEB offices. There is also the assumption that senior managers will understand what these data sets can offer for purposes of improving their ability to manage and plan education in the states. This is an adjunct to a further assumption that managers will request the technicians to produce analyses, maps, tables and graphs to aid them in their work. However, these two assumptions are unlikely to be valid for most senior SPEB managers. Thus, I strongly recommend that efforts be made to develop and train suitable people who will proactively identify useful analyses and products from the GIS/EMIS data systems, have those products produced and then take them to managers and others stakeholders. In a sense, these should be 'information brokers' who are really interested in having the education system improve, in the analyses and products, and in bringing these out for discussion.

3. During a meeting of senior managers in Nasarawa it was agreed that there should be a single school census form and that all schools should complete the form each year. The current duplication of effort caused by different departments independently collecting data at different time would thus cease. Subsequent discussion also resulted in the resolution that a SPEB or LGEA official visiting the school would administer the census form, and that the official would verify the information provided. The meeting also discussed and agreed upon the topics to be covered in the form, and these are listed in Appendix 2. It is recommended that the LEAP project facilitate the design or this form, and that the design should go hand in hand with the production of data capture sheets to be used when keying in data to a networked Access database in the EMIS offices of the Nasarawa SPEB.

4. The production of simple maps of schools in each LGA is recommended. These would really be "road maps" to orientate people on the locations of existing schools, thus showing how neighbouring schools relate to each other geographically and also relate to towns, villages, roads and other landmarks. The maps would increase the general knowledge of schools in the LGAs to a great degree, and would also play valuable roles in planning the locations of new schools. Many copies of the maps should be printed.

5. USAID should consider promoting the development of clusters of schools as a method of providing frameworks to organize and improve education in a variety of ways. The cluster groupings will also do much to increase information and transparency on what is happening at schools, and will provide mechanisms for neighbouring schools to share good practices. GIS maps will greatly aid the identification of potential clusters, therefore making the process of clustering much easier.

6. USAID should consider extending the mapping of schools to all other states in Nigeria. In addition to the many benefits that emerged during the mapping work in Kano and Nasarawa, mapping will provide a way in which all schools can be audited to verify whether they exist or not.

7. Additional efforts should be made to improve the quality of contextual information, especially on the positions of local government area boundaries, roads and major towns or villages. Some features can easily be copied off the satellite images that were provided to LEAP, and more recent images can also be obtained.

8. The Nigerian government has declared that all children must complete nine years of universal basic education (UBE). This means that many existing primary schools might be extended to provide an additional three years of schooling, and many new secondary schools will have to be built or existing schools expanded. All of these expansions will require careful planning for which school mapping will be an absolute necessity. As a first step towards such planning, all secondary schools should be plotted to see how the existing provision of secondary education relates to the locations of primary schools.

A final recommendation (restated from my previous report) is that if the GIS work is pursued, it should be done so with vigour and commitment. This may seem obvious, but far too many GIS systems are developed half-heartedly, only to be abandoned when the initial enthusiasm dissipates or when key people move to other responsibilities.

Finally, it is my pleasure to acknowledge the friendly and courteous help given to me while doing this work. To all concerned, my sincere thanks and best wishes in taking this work forward.

John Mendelsohn
RAISON (Research & Information Services of Namibia)
PO Box 1405, Windhoek, Namibia.
Tel: +264-61-254962; Fax: +264-61-253361
E-mail: mendelso@iafrica.com.na

Appendix 1

Structure of NASARAWA EMIS AND GIS DATA

LGA	Name of LGA
EMIS_CODE	Code given by SPEB
EMIS_NAME	Name given by SPEB
MAP_CODE	Code given during mapping
LAT_DEG_	Degrees of latitude
LAT__MIN	Minutes of latitude
LAT__SEC_	Seconds of latitude out of 1000
LONG__DEG_	Degrees of longitude
LONG__MIN	Minutes of longitude
LONG__SEC_	Seconds of longitude out of 1000
LATITUDE	Decimal latitude figure
LONGITUDE	Decimal longitude figure
PROBLEM	Notes of records with problems (**see below**)
YEAR_ESTAB	Year school established
CLASSES	Number of classrooms
PUPIL_MALE	Number male pupils
PUPIL_FEMA	Number female pupils
PUPIL_TOTA	Total pupils
TEACH_MALE	Number male teachers
TEACH_FEMA	Number female teachers
TEACH_TOTA	Total teachers
CLASS_SIZE	Pupils per classroom
PT_RATIO	Pupils per teacher

List of 'Problems'

Check	Co-ordinates were possibly typed incorrectly and should be checked against original forms
Co-ords	Co-ordinates have been checked and found to be wrong on the original forms. Schools must be plotted again
EXTENSION	Two sets of co-ordinates for the same school; one is possibly the parent school and the other an extension school. Find out which is which.
LGEA office	Plots of LGEA offices
No emis	No EMIS data could be found for these plotted schools
Not mapped	No plots could be found for these schools which were mapped

Kano schools gis and emis

SPEB_CODE	Code given by SPEB
LATITUDE	Decimal latitude
LONGITUDE	Decimal longitude
SCHOOL_NAM	Name of school
ESTAB	Year establishes
CLASSES	Number of classrooms
MALE_PUPIL	Male pupils
FEMALE_PUP	Female pupils
TOTAL_PUPI	Total pupils
MALE_TEACH	Male teachers
FEMALE_TEA	Female teachers
TOTAL_TEAC	Total teachers
ERRORS	Problems

List of 'errors'

Classes	Number of classes missing
Co-ordinates	Co-ordinates have to be checked and the schools possibly plotted again
Pupils	Number of pupils missing
Teacher nos	Number of teachers missing

Appendix 2. List of information items to be collected from all primary schools in Nasarawa each year by the SPEB EMIS department

a. Name of school
b. School code number
c. Year established
d. Enrolments for each class, giving numbers of male and female pupils separately
e. Number of streams for each class
f. Ages of pupils: number of male and female pupils of each year in each class
g. Promotion: for each class, number of pupils promoted from previous session/year, number failed
h. SCEE: number of pupils in previous year/session promoted or failed
i. Teachers, for each teacher: name, type of qualification, date employed, salary grade, date promoted
j. Religious instructors: number for each type of religion
k. Non-teaching staff: number of males of females, number doing each type of job, number having different types of qualifications
l. Classrooms: number in good, medium and bad condition, number of new classrooms required
m. Water supply: type
n. Building projects: type and source of funding
o. Dual desks: number available, number required

Appendix 3: Record of activities and people seen during the consultancy:

Monday	29-Sep-03 Depart for Abuja
Tuesday	30-Sep-03 Arrive 05h00 in Abuja. Briefing by LEAP and assembling of GIS and EMIS data sets.
Wednesday	01-Oct-03 (Public holiday). Depart for Kano. Meet and prepare work with LEAP staff from Kano. Meet Muhammed Zikirullahi Ali, Geography Department at Bayero University, to discuss fixing data he had assembled for the project.
Thursday	02-Oct-03 Presentation on GIS and linked EMIS data for all Kano primary schools to senior management of Kano SPEB. Further work on fixing mapped data from Muhammed Zikirullahi Ali.
Friday	03-Oct-03 Presentation on GIS and linked EMIS data for all Kano primary schools to EMIS and planning staff of Kano SPEB. Depart and travel to Abuja.
Saturday	04-Oct-03 Assembling and experimenting with GIS and EMIS data for Nasarawa
Sunday	05-Oct-03 Cleaning GIS and EMIS data for Nasarawa
Monday	06-Oct-03 Travel to Lafia. Introductory meetings with Nasarawa senior officials, and checking/cleaning of GIS and EMIS information
Tuesday	07-Oct-03 Presentation on school mapping and uses for planning and management to senior staff of Nasarawa SPEB. Further checking and corrections to databases.
Wednesday	08-Oct-03 Training in ArcView for Nasarawa staff in the Planning and EMIS divisions. Presentation on school mapping to Chairman of State Education, Science and Technology Committee. Further checking and corrections to databases.
Thursday	09-Oct-03 Return to Abjua. Prepare maps of Nasarawa schools
Friday	10-Oct-03 Presentation to USAID. Prepare and copy final data sets. Prepare and print maps for Kano.
Saturday	11-Oct-03 Depart for Windhoek, Namibia

Appendix 4: Terms of Reference

Literacy Enhancement Assistance Project - Nigeria
Short Term Consultant

Consultant Name**:** **John Mendelsohn**

Objective of Visit: To support the development of Graphic Information Systems (GIS) and other presentational tools, using school profile indicator data and school plots (Kano and Nasarawa states).
Related Activity: Policy Support Systems
Directly reporting to: Policy Advisor
Expected Arrival Date: 22 September 2003
Expected Departure Date: 4 October 2003
NB: **This is the second of a two phase ToR**
In-country Itinerary: Nasarawa 4 days; Kano 2 days, Abuja 4 days
Consultancy Activities:

In Kano,), the consultant will:

i. Present the revised map of Kano with all schools linked to basic educational data on those schools, including an initial demonstration of the uses of GIS for school clustering; a particular emphasis will be placed on presenting the school profile indicators for the 3 LEAP LGAs to stakeholders and educational administrators
ii. With SPEB DPRS, personnel identify additional data sets required to enhance the power of GIS mapping (population data, etc).

In Nasarawa, the consultant will:

i. Present the revised map of Nasarawa with all schools linked to basic educational data on those schools; a particular emphasis will be placed on presenting the school profile indicators for the 3 LEAP LGAs to stakeholders and educational administrators
ii. Based on this presentation, assist the Nasarawa DPRS to explore possible benefits and uses of GIS, (e.g. school clustering, mapping supervision visits, etc)
iii. Develop modules and provide introductory training in presentation of data using GIS software;
iv. Identify available and potential data sets to add to database.
v. Identify additional training needs.

Deliverables
Trip Report: before leaving country provide a brief (3-5 pages) written report and oral debriefing on (i) training programs; (ii) available data sets; and (iii) GIS presentation. Identify additional training needs for Nasarawa SPEB personnel.
Training Modules: Guidelines for data presentation using GIS.
Presentational Data: complete school positioning maps of Kano and Nasarawa states using data previously supplied.