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**Abstract:** The Glen Lean Ethnomathematics Centre in Papua New Guinea has set up a website through four countries collaborating. It brings the diverse mathematics of this country to the world and assists its own appreciation of their culturally rich mathematics. This is the story of how the website was set up. It will be viewed during the presentation or you can look at it yourself in the address given below.

**Author Address:** kowens@csu.edu.au

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The Ethnomathematics Website
Kay Owens
Charles Sturt University

The Glen Lean Ethnomathematics Centre in Papua New Guinea has set up a website through four countries collaborating. It brings the diverse mathematics of this country to the world and assists its own appreciation of their culturally rich mathematics. This is the story of how the website was set up. It will be viewed during the presentation or you can look at it yourself in the address given below.

Its Origin as a Posthumous Gift from Glen Lean

In 1994, Glendon Lean died just weeks after being bestowed with his doctorate for his life’s work on the Counting Systems of Papua New Guinea and Oceania. In 1999, the hardcopy collection of photocopies and some disks from Glen Lean’s estate were transported back to Papua New Guinea. Half this material found its way to the University of Goroka. Glen collected data for 22 years and the appendices of his thesis had 22 volumes of data from each of the provinces and the neighbouring Melanesian countries. This is the story of bringing this wealth of information to the rest of the world.

The Vision of the Ethnomathematics Centre

The Head of Mathematics and Computing Science, Dr Musawe Sinebare and two staff, Dr Wilfred Kaleva and Mr. Rex Matang both with degrees in ethnomathematics decided to set up the Glen Lean Ethnomathematics Centre. They applied and received funds from the University of Goroka (UOG) to set up the centre. It is housed in an historical building in the grounds of the University. It is pleasantly and comfortably well-equipped.

Beginning the Challenges

In 2000, Chris, my husband, and I spent a month at the centre fascinated by the papers dating back into the 1800s. The oldest record is from the 1600s. The nationals who helped later were fascinated that Europeans went bravely from village to village around 1900 recording their experiences of the people and the languages. After a month, we had started up a database of the counting systems, produced a bibliography of hundreds of papers, and made a copy of the thesis from the disks. This required a visit to get coloured copies of the maps held at the PNG University of Technology (Unitech) in Lae where Glen did his doctorate. All the staff with whom we had worked in the past assisted us as much as possible. After finally finding there were no coloured photocopies and locating the two coloured printers in town (both running out of ink during our visit), we obtained copies by scanning and printing. In our travels, the scanner was damaged and the adapter cord (used also for musical instruments) was stolen and not easily replaced. We also made copies of Geoff Smith’s thesis on the Counting Systems of Morobe, a province of PNG.

The electronic copy of the thesis and appendix volumes was originally produced on a mainframe and then several Macintosh computers. Subsequent transfers of data to an IBM compatible computer meant the data was not easy to work with. I learnt many tricks to convert from these into our database. We also scanned maps and other pictures that had only been in hard copy. These pieces from the thesis I put together to make an electronic and hard copy of the thesis.
To make the bibliographies required sorting out who was publisher and who was editor and who was author on a German or Dutch document. This was surprisingly tricky. Chris filed all the documents alphabetically into the filing cabinets as well as developing the bibliography.

Mid-year, Geoffrey Saxe who had visited the Oksapmin on several occasions returned to open the Centre. He and many others like Alan Bishop and Ubitan D’Ambrosio have continued to show their interest in the centre and encourage the director Rex Matang and Wilfred Kaleva.

**Beginning the Database**

The PNG University of Technology houses the Architectural Heritage Centre and they had produced a Filemaker Pro database of the carvings and other artefacts of the Sepik and Ramu river areas based on Mac Ruff’s long term studies. It is beautiful. I thought that it would be good to produce a similar one of the counting systems. Thanks go to Carol who previously maintained the MANSW database for an initial few hours instruction.

I began the task of structuring the database. Counting systems of 700 languages have been recorded. For each language, there are from 1 to 6 sources of the counting systems with slightly varying word lists plus from half a page to 5 or 6 pages of information that Glen had collated from the original records, field visits and questionnaires completed by Unitech students and teachers. In a separate part of each volume, Glen had recorded the analyses of the counting systems. We needed the hard copies held at UOG’s library to finalise our data entry. The word lists and words are complex and of course foreign to us although I gained a good understanding of the structure of the systems and could often use the patterns of words to straighten up the records. For two short periods, staff members at the University of Goroka were employed to understand the database and assist with the data entry. Rex helped too.

**The Website Vision**

Out of the blue, I received a call from Nancy Lane, then Communications Director of Pacific Resources in Education and Learning (PREL). “Do you know about ethnomathematics in Papua New Guinea?” “Yes.” “Would you like some funds to share this information on our website?” “Yes but I have to check if the Centre Director wants to do this. They have a website at the University of Goroka.” “How much would you need?” With approval from the Centre Director and UOG staff, we applied for the funds through PREL that came from the US National Science Foundation. Some went to UOG and some for my expenses to UWS. There was fortunately twice as much as we expected since the task proved to require more visits from me than we had first anticipated.

By email, Rex, Wilfred, and I worked out what we needed to do and approximate costs for equipment, travel and accommodation. By this time they had the assistance of Kiyu, the Japanese JICA volunteer who advised on software and hardware. We had to try to retrieve the other half of Glen’s hard copy data. We needed to scan in papers. We needed to set up the website with all the necessary pages. We needed to connect the database into the website. At this stage we had Filemaker 5. Kiyu said we needed to work with Macromedia. He used Javascript, Flash and Dreamweaver htm. He had been able to read the Japanese manual of Filemaker and Macromedia and had worked out that we needed Filemaker 6, a computer dedicated to the database, another for the website data connected to UOG’s server.
Multinational Work on the Website

In October, 2002 I made a six week visit and met Kiyu. Six weeks is a bit too long in the Lodge without easy phone access but I could enjoy the company of a number of nationals (often my ex-students from Unitech) also away from their families for long periods working on Goroka projects such as the new library and the roads. Martin Imong was a temporary lecturer and able to help me and Rex with the database entry. He was both a Mathematics and Computer Science teacher. He could do the difficult work of entering the data from other languages but complex lives interfere with time on task in PNG. Kiyu and I communicated by doing things on the computer. Tok Pisin was the common language between us all. We employed a lady to help the secretary with the scanning of papers. By the end of the six weeks, Kiyu had crafted the basis of the homepage. I had selected sections of the papers and earlier student projects to be scanned. We finished the entry of 700 language counting systems. I had a brief one night chance to use the updated version of Filemaker Pro 6 unlimited before the disk was returned to the post office for a three month red tape delay about customs money despite the software being for an educational institution.

During this visit, Francis Kari went back home to Manus to collect the remaining documents from Glen. The story goes that the salt water trip and insects had destroyed them. Lost at sea (See the Parrot’s theorem for a nice contrast). We proceeded to replace the data from SIL sources, the Goroka library and, on my return, through the UWS database systems but some original photocopies (probably collected in the Netherlands, England, Germany, US from both libraries and government archives) and who knows what else were irretrievably lost.

A couple of three day visits were possible over the next year when I was in PNG for other projects. This brought Kiyu back on task briefly. Despite good intentions between visits, Rex and I found little time to continue work on the website. We did however write several papers over the years.

During one of these visit, we found out that UOG needed to upload all their website to the Datanet server in Port Moresby because the lines between Moresby and Goroka were unbelievably slow and often down.

Time is Running Out for Finishing the Task

Another call from Nancy, “do you need to go back to PNG to finish off the website, time is running out fast. We can find some more money. I’m likely to leave this job by mid-year.” “Yes, I do need to go back.” Kiyu had left. The task had proved to be too difficult for him to finish despite his incredible amount of self-instruction. I had three weeks.

After breaking into his temperamental computer, I taught myself how to use Dreamweaver to continue the website connections and planning. I was able to organise further scanning of documents and Wilfred’s wife Roa helped collate the jpeg images of the scans while I wrote a brief description for 100 or so papers. I also wrote some elementary school activities.

At the end of the trip, I had some IT help back in Australia. I sent off the improvements for uploading. But before this could be done, the disk and one of our computers, printer, and UPS were stolen.

With GLEC agreement, PREL uploaded the website onto their computers but the lack of Filemaker Pro connection knowledge was still a problem.

By August 2004, the new JICA volunteer, Masa, had settled in and had used the May version and remade links so the basic website was improved. I sent up a new copy of
the website with a few more papers included but it didn’t reach Masa’s hands. In August, Nancy and Rex said, Kay you must go back. I hesitated as I did not think I could at all help with the IT work that now needed to be done. But my last trip for a week, brought huge success. Masa had already read the manuals and with his years of experience had both improved the UOG website (there was another JICA volunteer helping with that) but also made the connection between the database and the main website. After a day, the two parts of the basic site were live. I had a chance to find out what was wrong with the database when it was up on the web and to make corrections to the controlling scripts. Only the search engine had to be redone on the main website. One task was to re-enter all the counting system tables. The spacings for columns were all lost and so the complex number words made the lists unreadable on the web. With the help of Roa, I began the tedious cut and paste and check of each of the counting system lists. It took a week for the files to be downloaded to the Moresby Datanet site. We had more than 5000 files on the site. Back in Australia I tested the site at a distance. I was particularly worried that the scanned papers would not be readable or printable. But they were working. Masa proved an invaluable member of the team at the last minute. Our four nation collaboration and the stretching of our ITC skills has expanded everyone’s knowledge of Papua New Guinea counting systems enormously. There is still a huge amount of material that could still be added to the website. During March, Rex went to his village area and interviewed a number of children learning to count in vernacular and Tok Pisin. In April, I went to a couple of elementary schools in the Highlands to trial some activities similar to those used in NSW’s Count Me In Too project. We were really pleased with how the use of the vernacular languages was helping children understand number. The website should assist teachers in elementary schools if only they had access. But the languages in PNG are changing so much that the counting systems are rapidly changing from those recorded in Glen’s work.

The Future

There is so much that we can investigate and record and reintroduce into the curriculum in other areas of mathematics besides counting. Each of the 800 cultures have different measurement and space knowledge. In PNG there are living counting systems that are not base 10 systems. The NSW Stage 4 syllabus makes particular reference to these systems. Now you can have a go at exploring the website yourself. http://www.uog.ac.pg/glec/index.htm

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Technical Details

Counting System Databases

The structure of the counting system database involves 7 related databases.

1. The menu page is really just an introduction and links to the language database. It also gives more details about abbreviations and links to the other databases.

2. The languages database. This database has three layouts
   a) “interesting examples” gives buttons to connect to 30 common or interesting examples of different cycle systems (systems are generally not base 10),
   b) the form layout which links every record to the general background of how Glen collected the data, a page on the province available to every language in that province, a brief summary called important notes, a map of the province in the country, and some other details such as the language classification. Each record is connected through a portal to one or more counting system pages.
   c) A search page.

3. There are two layouts for the counting systems database.
   a) The form layout lists Glen’s analysis of the counting system in terms of the frame or counting words from which all other number words are formed, the patterns of number word combinations by which the larger numbers are made, and the cycles of the system (like a base). It also contains list of the counting words as collected from different sources. A large part is devoted to the details that Glen collected or recorded on the language and counting systems. In particular some languages have extensive notes on classifier systems in which different objects are counted by different words. Another section gives the links to body-parts and to cultural contexts for counting. The sources of data and updates are recorded. In order to assist the search as many different variations of the language and dialects are listed. At the moment this is an incomplete section.
   b) A search page.

4. Each counting system page is linked to one of the maps that gives the regions in Papua New Guinea where you can find the same cycles. It is notable that many start off with a 2 cycle although they may also have a 5 and even a 20 cycle system too. There are 4 and 6 cycles and 5 cycle, 5 and 20 cycle or 5, 10 and 20 cycle as well as body-part tally systems.

5. Each counting system is also linked to a map indicating where the system is found in the province. Neighbouring systems are indicated on the same map.

6. If the system is a body-part tally, then there is generally a picture showing which body parts are used in the tallying.

Before searching, the records need to be refreshed using the appropriate button.

The Website

Dreamweaver was used to make the basic pages. Kiyu also used extensive javascript and flash systems. This helps in particular with the long list of counting systems given
in an Excel format. This banner was put at the top of each main page requiring each to have the drop down menus and links activated. Having so many lists of papers and so many papers required careful thought to ensure there were reasonable links if appropriate to Glen’s work or to the centre’s subsequent collections. Several theses and key papers can also be found on the website. The GLEC team have also been captured on videotape counting in their own languages.

**Where to from here**

We hope that Indigenous people from around the world will be encouraged to develop and preserve their mathematical understandings. We hope that the material will be available for elementary teachers in remote villages at least if they visit regional centres. We also hope that Australian and New Zealanders will recognise the rich diversity of their near neighbour. The struggle for recognition of Melanesian culture to the west in West Papua, Timor and the other Indonesian islands is a human rights issue for these people. The site has links to the ethnomathematics sites in Australia and Hawaii. We hope other mathematics education sites might make links to it too.

**Further Research**

Rex and the students at UOG are making efforts to continue research. There is much work needed on other aspects of mathematics. Music, measurement, space, time, sailing and traditional technologies all have extensive mathematical thinking that is quite different to our western mathematical thinking. We need to record these and maintain them before it is too late.