INQUIRY-BASED SCIENCE: Africa – Kenya (Lake Victoria Region)
Teacher Professional Development Workshop
Led by: José I. Pareja (PhD/ABD) and Gabriel O. Akura (PhD)

Statistics for the Republic of Kenya from CIA Fact book:
- Population: 34,707,817
- Unemployment rate: 40% (2001 est.)
- Population below poverty line: 50% (2000 est.)
- Exports: tea, horticultural products, coffee, petroleum products, fish, cement

Document prepared by: José I. Pareja Ph.D. Candidate, January 2007
Edited by: Gabriel O. Akura (PhD)
Demographics About the area. [Data from: Village 14 concept paper, World Bank and Kenya Ministry of Education]

Statistics for Bondo and Siaya Districts (Lake Victoria Region – Kenya)

- Population in the area: 666,154 (World Bank, 1999)
- Number of students taking the KCPE exams from Siaya and Bondo districts at the end of grade level 8: 16,568 (Kenya Ministry of Education, 2006)
- Total number of students in primary school: 132,544 (times 8 multiplier on previous value)
- Resolution: In 2003 the Kenyan government declared free primary education (FPE) for all Kenyan Children

(A) Primary School Information (Village 14 Pilot schools)
- Average No. students/desks: 3 (2006) [Range: 2-5]
- Classroom state: inadequate (no windowpanes or door shutters), some walls cracking or part of the classroom used as storage area.
- Textbooks: Inadequate and outdated
- Additional Materials: Little or no materials available to conduct science experiments other than their surroundings.

(B) Bondo Teacher’s Training College
- Average number of primary school teachers taught on a semester: 200
- Number of years in the program to obtain teaching diploma: 2 years

(C) Potential impact of IBS workshop

On future primary school teacher’s every year
- Four Lecturers at 40-50 students (future teachers) per class. They teach at least 2 or more classes every semester (i.e. 200 students/year) = 800 teachers total
(Note: Considering that lecturer’s see different students throughout the year, which is probably not the case)

On primary school children
- Six primary school teachers at an average of 61 students per class. Total 366 students.
(Note: The teacher’s were asked to lead mini-workshops in their schools so what they learned could trickle down to other teachers in their school environment.)
After many months of hard work and jumping hurdles along the way, packing became another challenge. With the many donated educational materials received, with the new limit of 50lb per suitcase, and the potential of loosing part of our luggage on our way to Nairobi–Kenya, a good packing plan needed to be in place. Very creatively Dr. Akura, Mr. Benson Ameka and I managed to separate materials in a way that no suitcase exceeded 50lb and if we lost one of the suitcases we still would have been able to conduct the workshop.
After a 20-hour flight, we arrived in Nairobi. The next morning we traveled from Nairobi to Kisumu (10 hours). Our first scheduled meeting was with Bondo Teacher’s Training College (TTC) Lecturers(1). Edwin, Janet and Barrack waited patiently for our arrival. We were delayed by minor road problems, which turned out to be an incredible and quite exciting experience. Instead of arriving at 5pm we did at 9pm. During our meeting the lecturer’s informed us that they would join us for the first two days of our workshop only. They ended up joining us for the entire week.

(1) Lecturers prepare future teachers. In the case of Bondo TTC they prepare primary school teachers. Lecturer’s education level is usually a bachelor degree or teaching diploma with very rare cases of graduate work.
Day 01
Day 01A: Preparation of materials. Bondo TTC lecturers were asked to help set-up the workshop. While doing this, it was interesting to see how they observed very carefully the materials we brought. The idea behind this request was to strengthen the collaboration between the different partners. We provided teachers who teach other teachers with hands-on experiences; alternative ways of conducting professional development workshops; and alternative methods of teaching in their classrooms. Lecturers were asked to give a demonstration of how they approached teaching in their own environment using some of the new ‘kits’ provided by the Kenya government. (Picture bottom right)
Day 01B: The introductions began. Present in this inauguration meeting were: Bondo and Siaya District Education Officers; Quality Assurance representatives from the Ministry of Education; chairmen and principals of the different participating schools; two teacher’s from each of the three primary schools; the principal of Bondo TTC; four lecturers from Bondo TTC; and Village 14 officials. After a long introduction, Bondo TTC Lecturer’s demonstrated a variety of activities and science teaching aids, including bimetallic strips, pulleys, heat conductors, and some electromagnetic principles. It was evident from this presentation that content knowledge was present and that lecturing was the main delivery strategy used.
Day 01C: The IBS 2007 Professional Development workshop began. Teacher’s were given Pre/Post content and pedagogical knowledge tests. Emphasis on the role of assessment in learning environments and connections to their own teaching practices were made.

(Note: This happened not only during the pre/post assessment periods but throughout the workshop, and during the evaluation part of the learning cycle model).
Day 01D: Participants learned about research-based teaching and learning strategies including science inquiry; discovery learning; the nature of science (NOS); constructivism; and the learning cycle. The District Education Officer and the Quality Assurance representative participated very actively in this first portion of our workshop. They were very good ‘students’ I should say. You could see the wheels turning in their heads as they experienced the different activities.
Day 01E: Participants also learned about question boards; note booking; concept mapping; and the importance of being a reflective practitioner. The latter was emphasized throughout the workshop, using index/exit cards, question boards and group meetings. These approaches allowed us to de-brief what were learned and to deconstruct the strategies that were used. Teachers could thus look at ways to improve their own practices and reflect upon the applicability of the new strategies in their own teaching and learning environments - which involve small classroom with large number of students and inadequate materials, depth vs. breadth, etc.
Day 01F: Participants were asked to assume the role of students for this next session. The session was based on ELECTRICITY UNIT, also designed based upon the Kenya National Education Standards for grades 5-8. Just like the other units of the workshop, the learning cycle and other strategies were used. Participants explored electricity concepts such as electric circuits; lighting a bulb; conductors and insulators, while the 5E learning cycle, inquiry-based approach, and question boards as teaching strategies were modeled. Questions were posted on our question board and exit cards used at the end of the day.
Day 02
Day 02A: After a long first day (we actually finished day 01 at around 11:00pm) students were up and ready to wrap up our first unit at 8:30am. Minds of our Own was a great wrap up video. Very interesting discussions followed this video. Participants posted additional questions to our question boards and the post test was taken.
Day 02B: The Life Science unit in action. This unit was also designed based on the Kenya National Education Standards for grades 5-8. Participants explored concepts in germination, the scientific method, experimental design and the effects of humans in the environment. The 5E learning cycle, inquiry-based approach and question board were modeled. The environment unit involved a field trip to a neighboring swamp and was an extension of the scientific method/experimental design session.
Day 02C: The field trip to Yala Swamp Wetlands. Teachers learned how to use digital cameras to capture instances during the trip that could be used as evidence for their projects. Upon arrival at the swamp, Dr. Akura reviewed and explained what the activity was going to be about. Participants explored the question: “Why are wetlands important in nature and for the community?”
Day 02D: Evidence gathered by the participants in the form of pictures, observation notes and interviews to locals and security guards. Images of how the wetlands are used in this area have been portrayed in the slide: fishing, transportation, agriculture, laundry, bathing, dam construction, recreational and transportation through roads. Once the participants gathered this information they were asked to come up with a testable hypothesis based on their observations. They were also asked to reflect on the activity in terms of the application of the field trip process to their own teaching/learning environment.
Day 02E: The Yala swamp Wetland team.

Sunset at Yala Swamp wetland area
Day 03
Day 03A: On the morning of day 3, participants: (1) revisited some of the content knowledge and pedagogical strategies used during the first two days of the workshop; (2) Presented their field trip findings to the class; (3) Reflected on their own practices and (4) shared with their team members insights on the new strategies learned.
Day 03B: The afternoon was dedicated to three main activities: (1) Participants planned or changed a lesson they have already taught in the past into a form that included the learned strategies, (2) Participants prepared a lesson presented during the workshop to field test the following days at their schools and (3) Participants shared with the team and peers their lessons for a constructive critique. The emphasis of team work and self/group reflection was encouraged and emphasized. At the end of this day final post tests were taken and feedback from participants was obtained through the use of exit cards. (Note: Bondo TTC lecturer’s were asked to take a facilitator’s role during group work, they were coached how to do this along the way.)
Day 03C: Donated materials (mainly books and office materials) were handed to Bondo TTC and each participating school. Science kits (with materials on life science, electricity, solar system and magnetism) were also handed out. These kits were handed to the teachers in advance so that they could get familiar with the materials and be able to use them during the following two days when they implemented the lessons in their classrooms.
Day 04
Day 04A: Teachers, chairmen, lecturers and workshop leaders traveled to the different schools. For the teacher’s, lecturers and chairmen this was their first experience in another school outside their own area. Some of the pictures in the slide show different ways in which children get to school (top left, bottom right) or else use bicycles for recreation (bottom left).
Day 04B: Teachers (Josephine and Josiah) from Muguna Primary School put in practice the germination/experimental design lesson and used question boards. Josephine used a question from the board posed by a pupil to set up a new experiment testing how different amounts of water affect germination.
Day 04C: A look at Lweya Primary School. Some of the classrooms were used both for learning and for storage. Upto 5 pupils shared desks. Some pupils go to school barefoot, but nevertheless you always find a smile on their faces, especially for some when it could be the first time for them to see a white person!
Day 04D: Caleb and Beatriz field testing the classification lesson. During the enactment of this lesson it was evident that the teacher was juggling between his old teaching approach and the learned one. Caleb did a superb job, since he jumped the hurdle pretty well and successfully implemented the different strategies.
Day 05
Day 05A: Last stop Uyoma Primary School. Some classes had 80 or more students seated at 4 or more per desk. Every morning the entire school will gather around the flag and they will sing the national anthem and then the eldest women in the school will conduct a prayer. School buildings are portrayed very well in the pics.
Day 05B: Olenge demonstrating the learned strategies using the electricity unit. Students were very engaged and the teacher did a great job implementing the different strategies learned in the workshop.
Day 05C: Teachers were asked to reflect on their own practices. They were asked to write about two things that went well in their classrooms while implementing the learned strategies and two things that they could improve in the classrooms. They were asked to do the same for an assigned team member’s teaching. Then the group de-briefed. Bondo TTC lecturer’s were asked to comment on all participants.
Day 05D: The graduation ceremony took place in Siaya. Teacher’s were given a certificate acknowledging the number of professional development hours they invested in the workshop.

(Note: In the future exploring the possibility of making this hours count through UMSL continuing education might be a good idea.)
To remember
Acknowledgments
Acknowledgements

Lweya, Uyoma, Muguna and Bondo Teacher training college
Acknowledgements in detail

University of Missouri- St. Louis (UMSL)

Institute for Mathematics, Science Education and Learning Technologies (IMSELT)

A) Dr. Charles Granger- For his mentorship (SKILLS summer workshop) and science education material contribution to the workshop.

B) Dr. Bill Kyle- For his support as evaluator of the IBS workshop, mentorship, fund allocation to support workshop related expenses and donation of science education materials.

C) Dr. Hal Harris- For his mentorship (SKILLS summer workshop) and science education material contribution to the workshop.

D) Dr. Patricia Simmons- For her mentorship and donation of science education materials for the workshop.

E) Dr. Jim Shymansky- For his mentorship and donation of science education materials for the workshop.

F) Dr. Wendy Saul- For her mentorship (SKILLS summer workshop) and science literacy education material contribution to the workshop.

G) Ms. Jodi Kriebaum- For her ideas with regards to the preparation of workshop materials

Center for International Studies

A) Dr. Joel Glassman- For his support with regards to fund allocation for workshop related expenses.

Technology and Learning Center

A) Dr. Carl Hoagland- For his mentorship

B) Mr. Brian Huxtable- For his support with technology implementation and use

Graduate School

A) Dr. Judith Walker de Felix- For her support with regards to fund allocation for workshop related expenses.

Village 14

A) Naman Opiata- Chairman of Village 14, B) Mercy Odhiambo- Secretary of Village 14.

Bondo Teacher Training College, Lweya Primary, Uyoma Primary, Muguna Primary and all the Education Officers, Principals and Chairmen and teachers from these institutions.