ACTIVE LEARNING IN PHYSICS IN DEVELOPING COUNTRIES

Minella C. Alarcon
Division of Basic and Engineering Sciences
UNESCO
Paris, France

Formerly of the Department of Physics
Ateneo de Manila University
Quezon City, Philippines
Purpose of Presentation

To share information on the work of UNESCO in promoting active learning in physics in selected universities in developing countries.
Why Promote Active Learning?

- To foster use of laboratory and hands-on activities in physics classes
- To promote innovative modes of content delivery
- To improve conceptual understanding
- To encourage the instructor to do research and find creative ways to improve teaching and student learning
Physics teaching in some countries

- Lack of qualified physics teachers in universities
- Old equipment in teaching laboratories, if any; no computers used
Physics teaching in some countries

- No system of equipment maintenance
- Lack of lab development plans and resources
- Physics mainly taught as lecture course
What Active Learning does UNESCO preach?

- An innovative mode of physics teaching
- Student centred
- Minds on – students are mentally engaged, think in class
- Hands on - activity-based, students do physics in class
Teachers

- Prepare the class activities
  - Experiments, exercises, discussion questions
- Facilitate the learning process
  - Predict, discuss, observe, resolve
  - Provides opportunities for learning process to take place
    - *Lectures kept to minimum*
    - *Ask questions, guide students*
Students

- Busy with class activities, work in groups with materials, equipment
- Predict, present and talk about predictions
- Observe, present and talk about observations
- Exchange ideas with classmates and teacher: ask, answer questions
- Resolve, present synthesis
Active Learning in Physics

- Students are actively engaged in the learning process
  - Students cease to be mere receivers of information, no longer subject to mindless note-taking in class
- Teachers prepare learning environment, act as guide and facilitator
  - Teachers give up role as source of all information
- Assessment and evaluation are an essential part of the approach
  - How well are students learning physics?
    - Assessment instruments, such as FMCE, CSEM
- Adapting active learning to context in developing countries
Promoting active learning in developing countries: workshops

- Visits to department, physics teaching classrooms and labs, computer facility
- Presentations / discussions on local physics curriculum and teaching methods
- Introduction to active learning
- Workshop proper
- Practice sessions; participants’ presentations
- Feedback; implementation
Promoting active learning: workshop proper (sample)

- Pretest (FMCE)
- Conservation of Linear Momentum
- Conservation of Angular Momentum
- Computer-based Activities in Force and Motion (interactive lecture demonstrations)
- Electricity and Basic Electronics
- Post test; discussion
Conservation of Linear Momentum

A steel ball on a curved track

Table top

$h_1$

$h_2$
Conservation of Angular Momentum
Promoting active learning: simple materials and equipment

Non-computer based activities using simple, locally-available materials have been developed.
UNESCO Active Learning Team

Identify with physics teachers and understand conditions in developing countries, especially Africa

- Asian Physics Education Network (ASPEN): Swinburne University of Technology, Australia; Ateneo de Manila University, Philippines
- Friends of ASPEN/UNESCO: University of Oregon, USA
- More are being trained (Thailand, Tunisia, Brazil)
Training resource persons

- Prepare learning modules with clear objectives
- Design hands-on class activities
- Formulate probing questions for discussions
- Formulate assessment tools (pretest/posttest)
- Practice sessions- ask questions, explain less, encourage students to discuss
- Share references, document procedures and experiences
Trainees are presented with all kinds of available devices & materials, both computer and non-computer-based.
Training resource persons

Trainees practice interactive demonstrations with peers.
Adapting active learning to context

- Teachers in developing countries have diverse needs and cultural contexts
- Existing resources have to be adapted when applied to a different setting
  - Context-based curriculum development
  - Suitable approach to lab development
Context-based active learning

- Current mode of teaching introductory physics; available textbooks and references
- Language used in instruction
- State of physics teaching laboratories; available materials and equipment, repair and maintenance facilities
- Space/s available for physics teaching
- Local efforts to improve physics teaching; local acquisition of new equipment
- Government support; salary levels of teachers, number of teacher/pupils.
Adaptation: what has been done

- Development of modules with activities, using simple materials and equipment
- Fabrication of simple materials and equipment
- Adaptation of FMCE
A woman works in an ice-making factory. She moves a large block of ice around the factory by sliding it along a very smooth polished floor. The friction between the ice block and the polished floor is so small that it can be ignored. The woman wears non-slip rubber-soled shoes when standing on the floor, so she can apply a force to the ice block and push it along the polished floor. The ice block can move along the floor in the ways described in questions 1-7.
Happy faces of those . . .
... who appreciate and
. . . enjoy doing physics.
May we have more like them!