Fusion of technology, assessment and cross-curricular connections in teaching physics
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Brief Topic Notes: VIPP Presentation (13 August, 2004)

A central aim in teaching physics is “understanding,” and here are my beliefs…

• Understanding has many operational definitions based on subject area and intention, therefore one specific definition is not the only possible/reasonable basis of measurement
• More limited definition of understanding = more restrictions on teaching and learning
  o Teachers who feel they are restricted will include those restrictions in how/what they teach
  o There is a direct connection between assessment format and what is taught and learned, so broader teaching and assessment = broader understanding
• Understanding of a concept is continuous, not a dichotomous state
• Understanding is too complex to be gauged by one single style of assessment, and the teacher is always essential in the process
• Technologies can allow for broader assessment techniques and teaching/learning styles, while also permitting access to “reality” in the classroom
• Including the ideas, concepts and techniques of multiple disciplines of human knowledge is a central strategy for broad understanding
• Fusing many forms of technology and assessment along with cross-disciplinary connections allows for

So, teachers can improve their students’ understanding of physics by augmenting their teaching with technology and assessment strategies in cross-curricular environments.

Technologies examples to be discussed:
Software
• STELLA for visualizing, modeling and simulating – borrows concept of “systems thinking” from computer science and engineering
• Geometer’s Sketchpad for creating, manipulating and simulating – integrates Euclidean and non-Euclidean geometry

Internet
• History of Physics (http://www.aip.org/history/exhibit.htm)
• Physics Time-Line (http://www.weburbia.demon.co.uk/pg/historia.htm)
• Physics Cabinet (http://spazioinwind.libero.it/gabinetto_di_fisica/summaryu.htm)

Assessment technique examples to be discussed:
• Concept Mapping – note cards on paper where connections are drawn and explained
• Predict-Observe-Explain (POEs) – individualized experiments which can be self-checked, discussed, or collected
- Interviews About Instances and Events – individualized conversation directed by initial questions usually regarding a drawing or picture
- Interviews About Concepts – individualized conversation designed to bring out knowledge of a specific concept (facts, as well as beliefs, opinions, etc.)
- Drawings – shows individual ideas of a concept or subject using other-than-verbal communications
- Fortune Lines – allow quick verification of students’ conception of time-dependant topics (especially stories, historical developments, but also laboratory phenomena)
- Relational Diagrams – closed figures show how students mentally overlap objects, events and abstractions
- Word Association – probes the association that students perceive for a set of concepts
- Question Production – structured and focused activity where students show their understanding in the construction of more and more probing questions

**Cross-curricular connection examples to be discussed:**
Physics and…
- Mathematics
  - Time, geometry
- Society
  - Warfare (ballistics and nuclear weapons), energy conservation and alternatives, communications
- Arts
  - Light and pigments, music and sound, dance, literature and poetry

Below is an example of how each of these categories can fuse together to create a broader definition of understanding physics. The purpose of this presentation is to examine how such fusions can be generated.

**Physics Topic:**
Mechanics – Circular motion, Centripetal Acceleration, Inertia, Friction

**Example:**
The Physics of Curves ([http://www.ncsec.org/team21/default.htm](http://www.ncsec.org/team21/default.htm)) was developed by teachers regarding a local landmark – a curve on a San Antonio highway that had already proven dangerous in a toxic chemical spill. From the home page:

“In this module students will explore the affect of changing the radius of this curve, the weight of the vehicle, the linear speed, and the coefficient of static friction. The end product is expected to be a multi-media presentation in which each group of students will explain their solution to this problem. The group is expected to use the data and information they have gathered in this module to back up their position.”

This one site incorporates aspects of physics, general scientific inquiry, mathematics, computer programming, communications (speech and English), social studies (local and state politics), and chemistry.