

Pedagogy 101

Presentation notes: [Rosanne W. Fortner, Director, COSEE Great Lakes \(fortner.2@osu.edu\)](mailto:fortner.2@osu.edu),
[Jeff Reutter, Director, Ohio Sea Grant \(reutter.1@osu.edu\)](mailto:reutter.1@osu.edu),
[Theresa Bills, Science Teacher, Pierce Middle School \(theresabills529@gmail.com\)](mailto:theresabills529@gmail.com)

Pedagogy

- from the Ancient Greek *παιδαγωγέω*; literally, “to lead the child”
- the art, science or theory of being a teacher, generally refers to strategies of instruction

Keywords

Research indicates that many scientists are unfamiliar with the vocabulary of education, and that becomes a barrier to interaction with educators.

Tabula rasa

- The conception of a learner’s mind as a blank slate [aka “if you tell them, they will know!”
- Good teachers don’t just deliver information.
 - They PACKAGE it for consumption by people with different learning styles and experiences.
 - They GUIDE the consumption for incorporating into mental maps.

Learning for retention

["One must learn by doing the thing, for though you think you know it, you have no certainty until you try." -Sophocles, 400 BC]

Learning Pyramid from National Training Laboratories shows % of information retention from

Lecture	5%	Discussion group	50%
Reading	10%	Practice by doing	75%
Audio-visual	20%	Teaching others	90%
Demonstration	30%		

Perspectives on learning environments

Schools exist in the context of a community, which has some influence on how schools function. The environment of a classroom can be Knowledge centered [and to some extent needs to be]. This is the way most scientists were trained. The environment can also be Assessment centered, such as we have seen with No Child Left Behind. Excellence in education is more likely to occur in a Learner centered environment.

Constructivism

- a philosophy of learning: by reflecting on our experiences, we construct understanding of the world we live in.
- We generate personal “rules” and “mental models” to make sense of experiences.
- Learning is the process of adjusting mental models to accommodate new experiences.

Guiding principles of constructivism

- Learning is a search for meaning. Learning must start with the issues around which students are actively trying to construct meaning.
- Meaning requires understanding **wholes** as well as parts. And parts must be understood in the context of wholes. Therefore, the learning process focuses on primary concepts, not isolated facts.
- To teach well, we must understand the mental models that students use to perceive the world and the assumptions they make to support those models.
- The purpose of learning is for an individual to construct his or her own meaning, not just memorize the “right” answers and regurgitate someone else’s meaning.
- Assessment of the learning process provides students with information on the quality of their learning.
- Concept mapping is a tool to help teachers identify student conceptions of relationships in a topic. Concept maps prior to instruction can reveal misconceptions and incomplete ideas among students, and thus aid in constructing effective instructional strategies.

The Learning Cycle: Use for planning a lesson with maximum impact!

5E Learning cycle

engage
explore
explain
elaborate
evaluate

7E Learning cycle

elicit
engage
explore
explain
elaborate
evaluate
extend

Example from Ducks in the Flow – Where do they go?

Found at http://www.windows.ucar.edu/tour/link=/teacher_resources/ocean_education/currents_main.html



Hands-on Instruction

Takes many forms, but does not include reading and writing directly as a learning tool.

Cooperative Learning

Many kinds of collaborative learning exist. They consist of methods for students to learn from one another and together. Jigsaw method consists of dividing class into Base groups that will begin study of a topic with an overview. Each student in a group gets a different assignment and begins gathering information about it. Expert groups form from students who have the same assignment, and they clarify together what are the important parts of the information. The Experts then return to their Base groups to help the entire group learn about the topic. [Aronson]

Science Inquiry in the Classroom

An inquiry investigation is a complex task in which students are asked to think as scientists—to ask a testable question about the world they have experienced, to generate quality data, to evaluate these data and use them to answer the question they have posed. There are four phases to an inquiry investigation: Connecting to students' previous experience, Designing a method to answer a question, Investigating by collecting and organizing data, and Constructing Meaning [analyzing the data and considering its implications].

The National Science Education Standards [1996] include standards for inquiry, including for grades 9-12:

- Identify questions that guide investigations
- Design and conduct investigations
- Use technology & math to improve investigations & communications
- Formulate and revise explanations using logic and evidence
- Recognize and analyze alternative explanations
- Communicate and defend a scientific argument

Pedagogical Content Knowledge

To teach all students according to today's standards, teachers need to understand subject matter deeply and flexibly so they can help students create useful cognitive maps, relate one idea to another, and address misconceptions. Teachers need to see how ideas connect across fields and to everyday life. This kind of understanding provides a foundation for pedagogical content knowledge that enables teachers to make ideas accessible to others (Shulman, 1987). In Shulman's theoretical framework, teachers need to master two types of knowledge: (a) content, also known as "deep" knowledge of the subject itself, and (b) knowledge of the curricular development.

Best Practice for Science Teaching

- Hands-on activities, student inquiries
- Focus on underlying concepts
- Questioning, thinking, problem solving
- Application of science to contemporary issues
- In-depth study of a few thematic topics
- Curiosity about nature; positive attitude toward science for all students
- Integration of language arts and math in science
- Collaborative small-group work
- Teacher as facilitator of investigative steps
- Evaluation focused on concepts, processes, attitudes; synthesis and application of information

NOTE: **Lecture** is not on the list of best practices!

Your choice: The sage on the stage, or a guide by their side

References used to construct the presentation

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