

Ill-structured Problem  
Solving:  
you take the high road and  
I'll take the low road and we  
will both arrive at a solution

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20. September 2002

Welch Hall 4.308

11:00 AM

Chemistry Education Group Meeting



# inert or tacit knowledge

Knowledge which cannot be used or recalled spontaneously

Knowledge which is only used or recalled with the proper prompt

# I believe that this problem exists on five levels:

Horizontally within one course  
CH302

Horizontally within a set of related courses  
CH301 and CH302

Vertically within courses of a subject  
Chemistry courses

Vertically within a discipline  
Science

Between formal education and real world practices

Disconnected Learning

# A problem of disconnect

Ways must be found to reintroduce elements of traditional apprenticeships to connect formal education to practices found in the world of professional practice.

## Cognitive Apprenticeship

# Cognitive Apprenticeship

The simulations used in a cognitive apprenticeship model environment could act as a bridge between theoretical classroom learning and the actual practices and culture of a particular discipline.



Constructivist learning theories

Problem-based learning

Ill-structured problem solving  
techniques



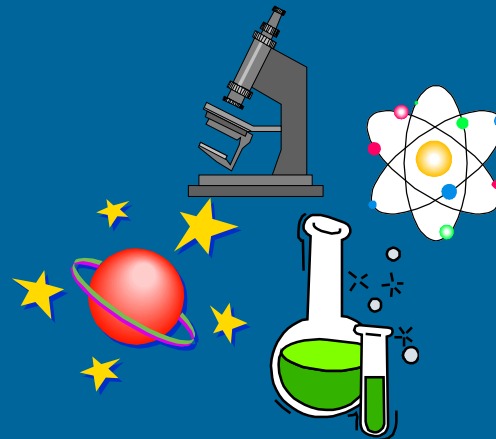
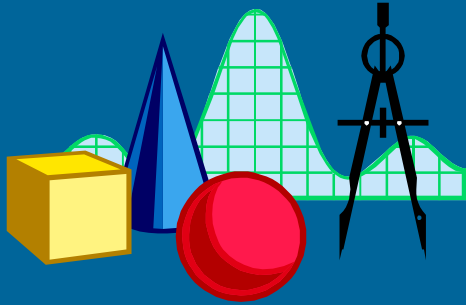
# Constructivist learning theories

The learner is constructing knowledge (or transforming information into knowledge) within the context of their learning environment.

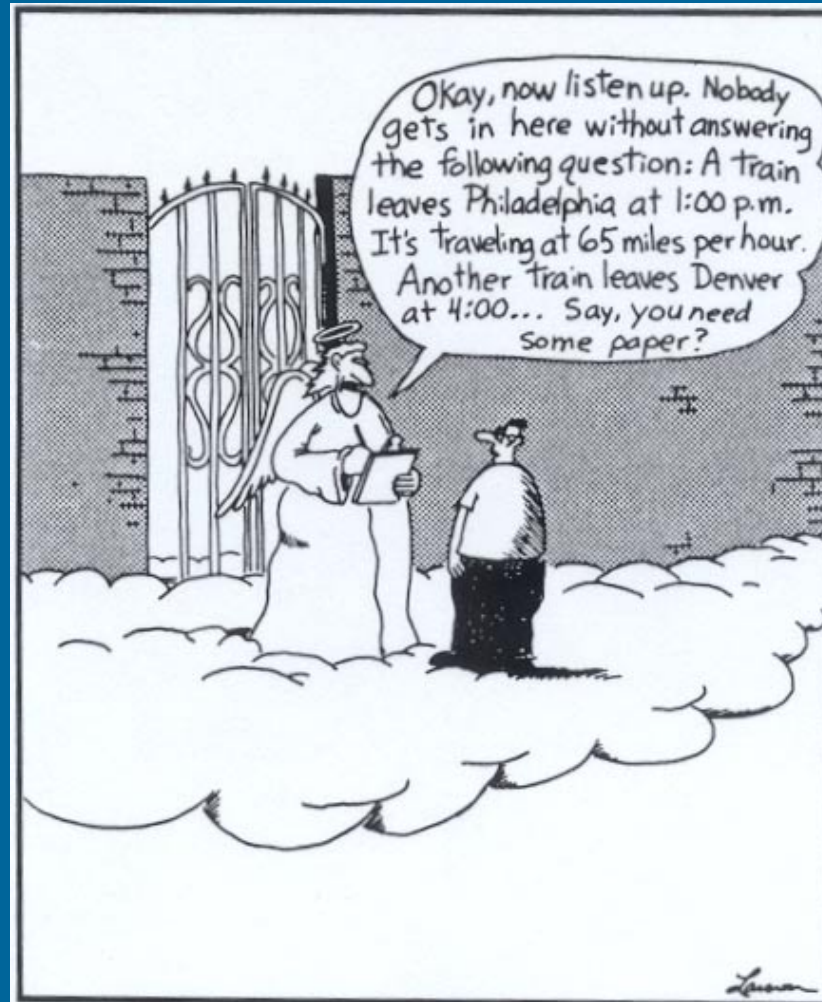
The learner is knitting together individual pieces of information into a useful knowledge bank.

Toolbox

# Toolbox



# Problem-based learning



Math phobic's nightmare

# Problem-based learning

Learning is situated within a problem to be solved

The learning context is a real world simulation

The concept, activity, and culture of a discipline are interdependent

The learning is authentic

# The learning is authentic

Authentic activities versus school activities  
laboratory experiences

Coherent activities

Meaningful activities

Purposeful activities

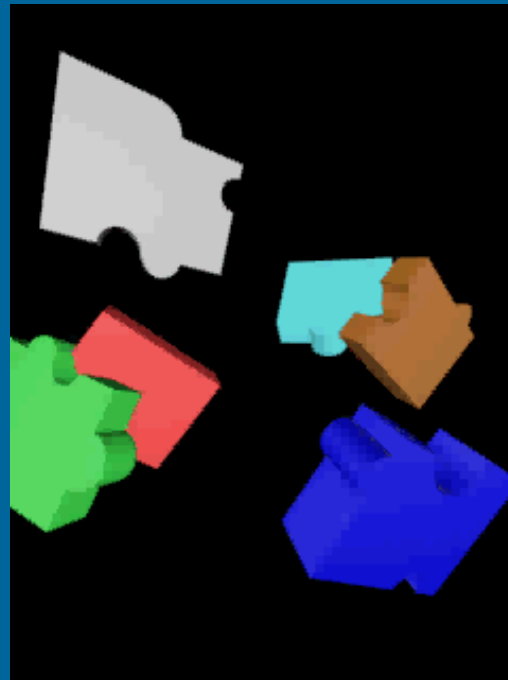
= the ordinary practices of the culture

# Ill-structured Problem Solving

- In situ practice
- Solving emergent problems
- Concepts are progressively developed and used throughout the activity
- Students will travel different paths to arrive at solutions

# Ill-structured Problem Solving

This technique of teaching and learning will hopefully eliminate the breach between learning of information and the use of knowledge and help learners put the pieces of the puzzle together.



# References

Learning, Creating and Using Knowledge  
Joseph D. Novak

Theory, Perspectives, and Practice  
Catherine Twomey Fosnot

Understanding by Design  
Grant Wiggins and Jay Mctigth

The Challenge of Problem-Based Learning  
David Boud and Grahame Feletti

The Case for Constructivist Classrooms  
J.G. Brooks and M.G. Brooks

Problems as Possibilities  
Linda Torp and Sara Sage

Teaching Science for Understanding  
ed. Mintzes, Wandersee and Novak

Assessing Science Understanding  
ed. Mintzes, Wandersee and Novak

Making Natural Knowledge  
Jan Golinski