

# Inquiry Based Learning

# Why Care?

- If we are going to claim that a course is inquiry-based then we have a responsibility to deliver it in this form. [accountability]
- Our numbers are dwindling, this approach has a chance of attracting and retaining good students. [recruitment & retention]

# It's just teaching, isn't it?

- Most people have particular styles with which they are more comfortable.
- DO NOT attempt to teach using a style you don't/can't support.
- If your style is cognitive, then don't teach an inquiry course unless you are willing to learn more about how it's done.
- Where does Inquiry Based Learning fit? →

# Disclaimer

- This talk is NOT inquiry-based, even though people are welcome to ask questions.
- This talk is NOT constructivist, either.

**What is constructivist?**

# Main Learning Theories

- *Behaviourist*
- *Cognitive*
- *Case-Based*
- *Brain-Based*
- *Constructionist*

Few are “pure”.

There exist many variations.

# Behaviourist

Tell them about it; test them on it;  
reward them; show stimulus – get  
response

- This is the most common style in our department.
- In some cases it is the most efficient and effective way to get the material across.
- This talk is essentially behaviourist.

# Cognitive

Make them think about it – give them a/the pattern for how to think about it.

- Present a brief outline and summary of what you want them to learn.
- Assignments: reading; essays; exercises (including many programming assignments); question sheets
- Many back of the chapter exercises are of this sort.

# Case-Based

Show them examples of it; interact with specific examples of it.

- Problems that begin by describing a scenario.
- Working through examples.
- Law is taught this way; and Medicine to some extent.



# Brain-Based

Involve them in doing it - taking into account individual needs; learning styles; developmental stage.

- Some of our larger assignments / projects fall into this category.
- Practicum portions in medicine; teaching;
- Conservatory style learning in fine arts.

# Constructionist

Coach them on how to learn it - ensure active engagement in authentic activity.

- Open-ended problems requiring learners to BUILD meaning; draw conclusions
- Inquiry fits primarily in this category
- Simply writing code is not, in and of itself, constructionist learning

# INQUIRY → EXPLORATION

# Essential Elements for Inquiry

- Students drive content by asking questions.
- Instructors do NOT control, they guide.
- Learning is individualized for pace, depth, even content (up to a point).
- Formal exams are largely inappropriate.

# Inquiry

Teachers must draw out and work with the pre-existing understandings that their students bring with them.

# Inquiry

**Students must be permitted to pursue some topics in depth.**

**Resist the temptation to cover topics by going a “mile wide and an inch deep”.**

# Inquiry

Emphasis is on developing meta-cognitive skills (higher order thinking - HOTS) as opposed to simple fact retention.

HOTS: Formal Reasoning Level:

- Control of variables
- Proportion
- Compensation
- Probability
- Combinatorial
- Hypothetico-deductive

# Inquiry

**Note: 25% of freshman CS students are still below the formal reasoning level on higher-order-thinking-skills.**

**This value has not changed since it started to be measured ~30 years ago.**

**What does this mean?  
WE have to TEACH them.**



# Inquiry

Uses positioning questions to help guide learning.

*Example:* In what ways does knowledge of theory facilitate program design?

# Inquiry

Provides opportunities for reflection, revision.

Work is often assessed several times before it is complete.

Work may often be resubmitted.

# Inquiry

- Offers detailed feedback & critiques\* (as opposed to right/wrong).
- Assessment is also used for learning.
- Requires greater investment of instructor's time for assessment.

\*NOTE: critique is not just criticism

# Inquiry

- Allows for discovery
- Often allows students to proceed at their own pace
- Often allows students to choose sequence
- Allows students to choose a learning style suited to them.

# The Challenge:

- Great to have this freedom in a capstone course.
- Different story if the course is core or serves as a pre-requisite for something else:
  - Then we have an obligation to meet certain criteria.
- Also different story in the freshman and sophomore years – different expertise / experience.

# Fitting Inquiry into a Traditional Curriculum

Course content is specified in terms goals and outcomes [not in terms of class time spent on a topic]:

- How will students demonstrate mastery of a topic?
- When finished, what will successful students be able to do?

# Fitting Inquiry into a Traditional Curriculum

Final grade is built using a measure of mastery of the individual components.

Assessment must be competency-based rather than traditional tests that primary measure retention of facts.

# Making it Work

- Students must know the goals and outcomes *in advance*.
- Instructor must be prepared to adapt to students needs, but do not make the goals into moving targets.



# Making it Work

- Instructor must be prepared to speak on any topic in the course *at any time* (even without slides)
- Instructor must remain *responsible for* but not *in control of* the class.

# Making it Work

- Get to know the students
- Trust them
- Set deadlines but remain flexible
- Be clear on what you want them to learn and why they should learn it.



**End**

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