A ‘C’ Change for Fisheries Education: from Course Content and Coverage to Curiosity, Cognition, and Constructivism
‘C’ Change

Sea change (noun) - 1) a striking change, often for the better; 2) any major transformation
A 'C' Change for Fisheries Education:

from

Course Content and Coverage

to

Curiosity, Cognition, and Constructivism

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Find this PPT and all references at my Virginia Tech homepage:

www.fishwild.vt.edu/

- Faculty
- Murphy
Abstract

Faculty often decry students’ poor critical thinking skills, but have we designed our teaching to develop such skills?
THE FINAL EXAM...
What are the consequences of poor critical thinking?
Poor thinking skills affect people all over the world!
Are college students any better thinkers than the general populace?
Student caller:

“I am writing a paper on the Fair Tax for an economics course. I’ve read your book, but I can’t tell what are the main points supporting the idea of the Fair Tax. Please tell me the main points in your book, so that I can put them in my paper . . .”
WHY ???
The 'Coverage' model:

Course Content: It is my responsibility to 'cover' all the important material; it is the students' responsibility to learn it.
Fr. Guido Sarducci, Educational Philosopher
Fr. Guido Sarducci, Educational Philosopher
The “Coverage” Model
('transferring' or 'imparting' information)
'Knowledge Transfer'
ca. 1200 AD
‘Knowledge Transfer’
ca. 1200 AD

lektor (Latin): one who reads
'Knowledge Transfer'
c.a. 1200 AD

*auditorium* (from L.) "lecture room," literally "place where something is heard"
“Modern” lecture: conducted in an auditorium, where ‘lecktor’ reads and students transcribe
The “Coverage” Model: 900 years of tradition can’t be wrong!
UNIVERSITIES NO LONGER THE KEEPERS OF KNOWLEDGE!
The Nashvi

Thursday, September 3, 2009

Universities no longer the keepers of knowledge for all of human society.

Today the United Nations declared that “universities should no longer be considered the keepers of knowledge for all of human society.”

Said Secretary-General Ban Ki-moon, “That is an antiquated idea that should have died out long ago. Sure that was true in the Middle Ages, and before the invention of the printing press, but the Information Age is here and that old idea has outlived its usefulness.”

Remarked President of the United States: “The pressure of the 21st century has forced us to rethink our relationship with education and the need to empower our students with the knowledge and skills they need to succeed in an ever-changing world.”

Any school child can now find more information in five minutes on Wikipedia than faculty teach in an entire college course.
Universities are no longer the 'keepers of knowledge'
Lecture: Where (old) information is transferred from the notebook of the professor to the notebook of the student, without passing through the brain of either.
Students are not “empty vessels” that we fill with knowledge
Neither knowledge nor wisdom can be “transferred” from the teacher or mentor.
'Information transfer' is not 'learning'!
The ‘old’ ‘C’ model:

(We do) **Content Coverage**

? ↓ ?

(We say we want) **Critical Thinking**
Failure of Behaviorist Teaching and Learning

MIT engineering graduates cannot answer basic questions from middle-school physical science.
Bloom’s Taxonomy of Learning (Cognitive Domains; 1984)

- Knowledge
- Understanding
- Application
- Analysis
- Synthesis
- Evaluation

Critical thinking:
- judge, evaluate, debate, recommend
- compose, invent
- outline, relate
- solve, manipulate
- compare, interpret
- define, describe
- define, describe
Bloom's Taxonomy of Learning (Cognitive Domains; 1984)

- **Knowledge**: define, describe
- **Understanding**: compare, interpret
- **Application**: outline, relate
- **Analysis**: solve, manipulate
- **Synthesis**: compose, invent
- **Evaluation**: judge, evaluate, debate, recommend

Levels:
- Critical thinking
- Content
- Information
Bloom’s Taxonomy of Learning
(Cognitive Domains; 1984)

- Knowledge
- Understanding
- Application
- Analysis
- Synthesis
- Evaluation

- Define, describe
- Compare, interpret
- Outline, relate
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- Judge, evaluate, debate, recommend
- Compose, invent

Content
Critical thinking
LEARNING
DISCONNECTS IN TEACHING & LEARNING

Too many courses concentrate on ‘coverage’.

1. We’ve trained students to expect such.

2. “All they have to do is parrot it back on the test, and then they forget it.” (Sarducci)

3. So, if you ask for different ‘learning’, they are lost or angry.
"They don’t teach you anything. They just give you stuff to read and lots of questions, and you have to teach yourself."
**DISCONNECTS IN TEACHING & LEARNING**

<table>
<thead>
<tr>
<th>Knowledge Theories (epistemology):</th>
<th>Learning Theories</th>
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<tr>
<td><strong>Realist</strong> - knowledge “exists” external to the learner</td>
<td><strong>Behaviorist</strong> - teachers possess and impart knowledge</td>
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<tr>
<td><strong>Constructive</strong> - knowledge is developed by the learner through experience</td>
<td><strong>Constructivist</strong> - knowledge is assembled by the learner through selection and organization of relevant data</td>
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‘Knowledge’ is constructed by students, not external to them (constructivism)
Working with students at Bloom’s ‘Knowledge’ level (actually, ‘information’ level) level does not help them ‘construct’ knowledge.

They are simply stenographers who don’t know where to file things.
Our job as teachers? Not to “impart knowledge”, but to help students learn to judge and use information to create meaningful constructs of knowledge.
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'Learning' is the construction process, not the construction product. Learning the process makes the student a 'life-long learner' able to tackle any future challenge.
‘Learning’ is the construction **process**, not the construction product. Learning the process makes the student a ‘life-long learner’ able to tackle any future challenge.

BUT, you must consider . . .
Nature of students . . .

Levels of Intellectual Development (Perry 1970)
Levels of Intellectual Development

B&W world; experts hold eternal truths (*Received Knowledge*)
OH GOOD, A TRUE OR FALSE TEST!

AT LAST, SOME CLARITY! EVERY SENTENCE IS EITHER PURE, SWEET TRUTH OR A VILE, CONTRESPIBLE LIE! ONE OR THE OTHER! NOTHING IN BETWEEN!
"I can't wait till I'm in the eighth grade and know all there is to know."
"I expect you all to be independent, innovative, critical thinkers who will do exactly as I say!"
JUST GO TO www.criticalthinking.com AND CLICK ON "ANSWERS"!
...AND IN MY VIEW, JEFFERSON'S DEFENSE OF THESE BASIC RIGHTS LACKED CONVICTION. OKAY, ANY DISCUSSION OF WHAT I'VE COVERED SO FAR?

SCRIBBLE! SCRIBBLE! SCRIBBLE!

SCRIBBLE!
OF COURSE NOT.
YOU'RE TOO BUSY
GETTING IT
ALL DOWN.
JEFFERSON WAS THE ANTICHRIST! DEMOCRACY IS FASCISM! BLACK IS WHITE! NIGHT IS DAY!

SCRIBBLE!
SCRIBBLE! SCRIBBLE!
SCRIBBLE!
Teaching is dead.

Boy, this course is really getting interesting.

You said it. I didn't know half this stuff.

'Doonesbury's Disease'
SILENCE IN THE CLASSROOM:
SOME THOUGHTS ABOUT TEACHING IN THE 1980s*

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[M]y own classroom experience suggests that there are profound deficiencies in the ability of many undergraduates to think logically and to employ analogical reasoning. This condition is closely associated with a dis-inclination and/or lack of ability to engage in critical thinking. Text is accepted without reflection, and authoritative status is granted without reservation. The provisional nature of opinion and of truth claims is not understood. If it is written down or presented by authority figure there is little disposition to entertain doubt (Gollin 1987, p. 3; emphasis in the text).
Advanced students can also be dualist . . .
The Challenge of Teaching
Levels of Intellectual Development

B&W world; experts hold eternal truths (Received Knowledge)

Dualistic (Perry)

Information

Knowledge

Understanding

Application

Analysis

Synthesis

Evaluation
Levels of Intellectual Development

- B&W world; experts hold eternal truths (Received Knowledge)
- Dualistic (Perry)
  - Subjective (Belenky)
    - Experts disagree; so maybe all opinions are valid
      - B&W world; experts hold eternal truths (Received Knowledge)
“Maybe it’s not a wrong answer—maybe it’s just a different answer.”
Don’t let facts interfere with your beliefs . . .
Levels of Intellectual Development

- Dualistic (Perry)
  - B&W world; experts hold eternal truths (Received Knowledge)

- Subjective (Belenky)
  - Experts disagree; so maybe all opinions are valid

- Procedural (Belenky)
  - Disciplines have critical standards, but learned methodology
"I'll be happy to give you innovative thinking. What are the guidelines?"
THEY ONLY TAUGHT ME HOW TO THINK OUTSIDE OF THE BOX. I'M NOT TRAINED FOR CIRCLES!!!
Students can use procedural knowledge to manipulate the system . . .
Students can use procedural knowledge to manipulate the system...
Levels of Intellectual Development

- Dualistic (Perry)
  - B&W world; experts hold eternal truths (Received Knowledge)

- Subjective (Belenky)
  - Experts disagree; so maybe all opinions are valid

- Procedural (Belenky)
  - Disciplines have critical standards, but learned methodology

- Constructed (Belenky)
  - Integration of knowledge learned from others with personal experience and reflection
Sometimes I lie awake at night, and I ask, “Is life a multiple choice test or is it a true or false test?”

Then a voice comes to me out of the dark, and says, “We hate to tell you this, but life is a thousand word essay.”

**Constructed knowledge**
“I still don’t have all the answers, but I’m beginning to ask the right questions.”

Constructed knowledge
Levels of Intellectual Development

- Constructed (Belenky)
- Procedural (Belenky)
- Subjective (Belenky)
- Dualistic (Perry)

Integration of knowledge learned from others with personal experience and reflection

Majority of college freshmen and sophomores (Belenkey et al. 1986)


The ‘Good Thinking’ Puzzle

Critical
Critical thinking is the disciplined mental activity of evaluating arguments or propositions and making judgments that can guide development of beliefs and taking action.

DEFINITION
(Paul and Elder 2005)
The 'Good Thinking' Puzzle

Critical

Creative
Bloom’s Taxonomy – Revised
(Krathwohl 2002)
Bloom’s Taxonomy - Re-revised (Murphy - 2009)

- Evaluation (critical thinking)
- Creation (creative thinking)

- Analysis
- Application
- Understanding
- Knowledge
- Information

'Deep' thinking
The 'Good Thinking' Puzzle

Critical

Creative

Reflective
Reflective Thinking

1. Links present to past experience

2. 'Knowledge' is constructed by, not external to, thinkers (constructivism)

3. Gives opportunity to modify knowledge base

4. Creates 'thread' of continuous learning
Meaningful ‘construction’ happens when students are challenged at higher levels of Bloom's.

Creation: creative thinking
Evaluation: critical thinking
Reflection: Reflective thinking

'Deep' thinking
The 'Good Thinking' Puzzle

Critical

Reflective

Creative

Metacognition
Metacognition

‘Thinking about thinking’

Share goals (and underlying theory) with students

- Perry’s scheme
- Critical, creative, and reflective thinking (Bloom’s)
- Problem-solving skills
An essential teaching component: Questions rather than answers
An essential teaching component: *Questions* rather than answers

Socrates
“When curiosity is absent, so is thinking.”

(Hill and McGinnis 2007)
Case Study Teaching and Learning

Case Studies: Real-life stories written with an educational mission (Garvin 2003)
'Reality' is constructed through narrative (Bruner 1991)

(Well-written) narrative (e.g., case) stimulates curiosity
Cases teach by asking students to analyze problematic situations. Cases do not give information as much as they ask students to evaluate actions and options, thus leading students to deeper thinking.
Case study learning is not easy for students --

“Sometimes frustrating because you won’t give us the answer.”

“More like real-life problems.”

“Showed there is no single right answer to complex problems.”

“More fun than lectures.”
Resources for the case-study teacher

http://ublib.buffalo.edu/libraries/projects/cases/case.html
Assessment of Case-Study Teaching and Learning
USDA Higher Education Challenge Grant
(At Virginia Tech)

4 courses, lecture model
Pre- and post-testing
• Watson-Glaser CT test
• Content analysis (essays)
Result = ‘normal’

Same courses, case model
Same testing
Result:
• 15-25% increases in ‘CT’
• No ‘knowledge’ difference
• Level of case model adoption affects results
Rekindle the dormant curiosity in your students, and they will surprise you!