

Free Learning and Control Learning

On the So-Called Failure of Constructivist,
Discovery, Problem-Based, Experiential, and
Inquiry-Based Teaching

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National Research Council Canada

SURF Education Days

Utrecht, the Netherlands, 13 November 2007

A. Free Learning (Connectivism)

Connectivism

- The theory that knowledge and learning can be described and explained using network principles

Two major aspects:

- ‘knowledge’ is to be organized in a certain way - ‘knowing’ is like ‘recognizing’, ie., pattern matching
- ‘learning’ is not to acquire a set of facts, but rather, to develop or ‘grow’ into a certain neural configuration

Connectivist Learning theory

- Based on principles of associationism
- Four major ways to learn:
 - Simple (Hebbian) associationism
 - Accidental association (by proximity)
 - Back-Propagation
 - Boltzmann learning

Connectivist Pedagogy

- To 'teach' is to model and demonstrate
- To 'learn' is to practice and reflect
- Both imply participation in what might be called 'an authentic community of practice'

Role of the teacher

- To practice one's work in an open manner; to work transparently
- To 'work' is to engage in a community
- To be openly reflective, eg., to write about the work

Role of the Learner

- To attach oneself to an authentic environment
 - Eg. A role-playing game
 - Eg. Electronic Performance Support
 - Eg. Community of Practice
- To observe and emulate successful practice
- To be 'reflective', ie., to engage in conversation about the practice

B. Control Learning (Instructivism)

‘Traditional’ Online Learning

- Learning Objects - content + pedagogy
- The ‘Learning Management System’

Three Loci of Control (Buntine Oration)

- Content Packaging
- Federated Search
- Learning Design

The Basis of Instructivism

- Kirschner, Sweller, Clark (2006) - Why Minimal Guidance During Instruction Does Not Work: An Analysis of the Failure of Constructivist, Discovery, Problem-Based, Experiential, and Inquiry-Based Teaching.

http://www.cogtech.usc.edu/publications/kirschner_Sweller_Clark.pdf

On the one side (they say)

- “On one side of this argument are those advocating the hypothesis that people learn best in an unguided or minimally guided environment, generally defined as one in which learners, rather than being presented with essential information, must discover or construct essential information for themselves”

On the other side (they say)

- On the other side are those suggesting that novice learners should be provided with direct instructional guidance on the concepts and procedures required by a particular discipline and should not be left to discover those procedures by themselves.

Aside...

- What is a 'novice learner'?
- There's a certain sense in this paper that a novice learner is 'anyone who has not already learned what needs to be taught'

‘Minimally Guided Learning Is...’

- discovery learning (Anthony 1973, Bruner 1961)
- problem-based learning (Barrows & Tamblyn 1980, Schmidt 1983)
- inquiry learning (Papert 1980, Rutherford 1964)
- experiential learning (Kolb & Fry 1975, Boud, Keogh & Walker 1895)
- constructivist (Jonassen 1991, Steffe & Gale 1995)

(say what now?)

Two Assumptions (they say)

1. Challenge students to solve "authentic" problems or acquire knowledge in information-rich settings
 - the assumption that having learners construct their own solutions leads to the most effective learning experience.
2. Assume that knowledge can best be acquired through experience based on the procedures of the discipline.

Their Argument:

- "Any instructional procedure that ignores the structures that constitute human cognitive architecture is not likely to be effective."
- "Minimally guided instruction appears to proceed with no reference to the characteristics of [human cognitive architecture]"
 - - characteristics of [human cognitive architecture]
= characteristics of working memory, long-term memory and the relations between them
- Thus, minimally guided instruction is unlikely to result in effective learning

The Credo (aka their Conclusion)

- after a half-century of advocacy of minimal guided learning, it appears there is no body of research supporting the technique
- - insofar as there is any evidence, "it almost uniformly supports direct, strong instructional guidance rather than constructivist-based minimal guidance"
- - not only is unguided instruction less effective, it may produce negative results

C. A Reality Check

- (aka, What, now?)

Their Argument is Internally Inconsistent

- They argue - The result is a series of recommendations educators find impossible to implement...
 - but then they say it's failing!
- They note - 'minimally guided instruction' is used in 50 medical schools
 - but the strongest criticism is that graduates 'recommend unnecessary procedures'

Their Conclusion is Not Plausible

1. We know that the methods work - large body of research
 - Hmelo-Silver, Duncan, and Chinn - cite numerous studies
http://www.cogtech.usc.edu/publications/hmelo_ep07.pdf
2. More to the point - we know people learn without guidance
 - Numerous examples on the internet - including the internet itself
 - 'Hole in the Wall Gang'
http://news.bbc.co.uk/1/hi/world/south_asia/4498511.stm

3. Even more to the point, we know people do not learn without practice

- Their account amounts to ‘leaning by being told’
- But we know people need to learn in open-ended practical situations - examples abound!
 - Deanna Kuhn - “we can hope to impart only an arbitrary smattering of what there is to know”
http://www.cogtech.usc.edu/publications/kuhn_ep_07.pdf
 - Fernette and Brock Eide - “who would you rather have for a doctor - one who practiced medicine better or one who knew more answers on a pencil-and-paper test?”
<http://eideneurolearningblog.blogspot.com/2006/10/why-we-still-need-teachers.html>

Their Argument is a Straw Man

- Inquiry learning, problem-based learning are not examples of ‘minimally guided instruction’
 - They are based on ‘scaffolding’
 - Direct instruction provided on a ‘need to know’ or ‘just-in-time’ basis

Hmelo-Silver, Duncan, and Chinn

http://www.cogtech.usc.edu/publications/hmelo_ep07.pdf

Their Argument is a False Dilemma

- They offer a choice between:
 - ‘minimally guided instruction’ and
 - ‘strong instruction’
- But these aren’t the choices
 - ‘Touring Rome’ example
 - When proposing ‘strong instruction’, it begs the question, *who instructs?*

Their Argument is a Straw Man (2)

- People who are 'minimally instructed' are not cast adrift...
- Miles Berry: "One of the main problems with the authors' argument is, to my mind at least, their failure to acknowledge much by way of a social dimension to learning ..."

<http://elgg.net/mberry/weblog/124841.html>

D. The Theory of Knowledge

The Polemic... Their Explanation

- Post-Sputnik curriculum reforms:
 - toward the assumption that knowledge can best or only be learned through experience that is based on the **procedures of the discipline**
 - has led to unguided practical or project work, rejection of instruction based "on the **facts, laws, principles, and theories** that make up a discipline's content"

Process and Content

- However "it may be an error to assume that the pedagogical content of the learning experience is identical to the methods and processes (ie., the epistemology) of the discipline being studied..."
- "... and a mistake to assume that instruction should exclusively focus on application."

The Scientific Method (1)

- According to them...
- Experiential learning at Work - Kolb 1971, Kolb & Fry 1975
- Process:
 - i. person carries out action, sees effect
 - ii. understand those effects, to anticipate what would follow
 - iii. understand the general principle

The Scientific Method (2)

- According to them...
- Two major components of PBL:
 - a) explicit teaching of problem-solving strategies in the form of the HD-Method (Barrows & Tamblyn 1980)
 - b) teaching of basic content in the context of a specific case or instance

The Generalization Problem

- They argue:
- Patel and Groen - the HD method may not be the most appropriate way to solve problems
- Patel, Groen, Norman: when you teach basic science in a clinical setting, students have difficulty separating it from the particular clinical problems into which it has been integrated (ie., students generalize badly)

Real Science...

- Is not the HD Method
- HD - was developed by Hempel (1950s) and is the hallmark of Logical Positivism
- Almost immediately refuted by Popper
- Numerous others: Kuhn, Lakatos, Lauden, Feyerabend

The Scientific Image

- Science is a community process (Kuhn)
- The object is scientific *explanation* and not inductive argument
- Criteria for explanation are ‘theory based’... ‘theory-laden data’ ... eg. simplicity, parsimony, testability...
- Explanations depend on expectations (van Fraassen)

E. The Cognitive Load Argument

Long and Short Term Memory

- concerned with the manner in how our cognitive structures are organized
 - based on Atkison & Shiffrin 1968:
 - sensory, short-term (STM) and long-term memory (LTM)
- - sensory memory not relevant here
- - relations between STM and LTM are critical to the argument

Long Term Memory

- The nature of LTM (according to thm):
 - "our LTM incorporates a massive knowledge base"
 - "we are skillful in an area because our long-term memory contains huge amounts of information concerning the area"
- > evidence: DeGroot 1965 work on chess expertise - experts better able to reproduce board configurations
- > experts derive their skill by (a) drawing on LTM (b) selecting and applying best procedure

The Ultimate Aim of Instruction (?)

- Their argument, continued:
 - the architecture of LTM provides us with the "ultimate justification for instruction"
 - "The aim of all instruction is to alter long-term memory"
 - "If nothing has been changed in LTM, nothing has been learned"

Working Memory

- Working Memory (STM): the cognitive structure in which conscious processing occurs
- Two well-known characteristics:
 1. Limited duration and capacity
 - Peterson and Peterson 1959 - information is lost in 30 seconds
 2. Restricted to a small number of elements
 - Miller 1956 - working memory restricted to 7 elements

The Prestige

(That is, where it all comes together)

They argue:

- Most learners can construct knowledge
 - no evidence that when given partial information that this ability *improves*
 - indeed, the reverse appears to be true
- Learners must construct a representation
 - complete information will result in a more accurate representation.
- Thus, constructivism does not lead to a prescriptive instructional design theory.

It's All In The Search

The putative 'worked example effect':

- problem-solving search "overburdens limited working memory resources to be used for activities that are unrelated to learning"
- By contrast, studying a worked example reduced memory load
 - because no search is required
 - attention is directed to learning "the essential relations between problem-solving moves"

But...

- Problem solving doesn't work that way...
- There isn't a 'search' - indeed, 'search-based' cognitive theory explains human reasoning very badly (eg. Stephen Koslyn, image rotation studies)
- Cognition is based on a process of *pattern recognition* - a *network phenomenon*

Experts and Schemata

They even seem to recognize this in their paper:

- "Experts use schema-based pattern recognition to determine the cause of a patient's illness."
 - Elstein 1994 - "knowledge organization and schema acquisition are more important for the development of expertise than the use of particular methods of problem solving."
 - "cognitive research has shown that to achieve expertise in a domain, learners must acquire the necessary schemata..."

But What is a Schemata?

- What do they think a schemata (aka schema, representation, archetype, frame, etc., etc.) is?
- We know what they think:
“the facts, laws, principles, and theories that make up a discipline's content”
- But this is simply an incorrect understanding of ‘science’ and ‘knowledge’

They Ought to Know Better...

- Bloom's Taxonomy
 - Cognitive: mental skills (Knowledge)
 - Affective: growth in feelings or emotional areas (Attitude)
 - Psychomotor: manual or physical skills (Skills)

<http://www.nwlink.com/~donclark/hrd/bloom.html>
- Personal Knowledge (Polanyi)
 - Knowing 'that' vs 'knowing 'how'
 - Like "riding a bicycle"
 - This knowledge is *ineffable*

Knowing a discipline

- /s knowing the practice of a discipline
- There is indeed even no *sense* to be made of saying it is knowing the 'facts' of a discipline
- Kuhn:
 - Knowing how to solve the problems
 - Knowing the language (jargon... theory of incommensurability)
 - Lakoff, etc. - frames - which inform the nature of observation itself - we learn to see by taking part in the conversation

Read/Write Web

- Judy O'Connell, two major aspects:
 - new literacies that are almost all social skills
 - the ability to read, write, and interact across a range of platforms.

<http://heyjude.wordpress.com/2007/08/29/literacy-and-web-20/>

- Andrew Churches's revision of the verb lists in Bloom's taxonomy

<http://www.edsupport.cc/mguhlin/media/bdtmindmap.png>

The Pedagogy

- Is based in personal learning - the acquisition of capacities and aptitudes rather than laws and facts
- What you really need to learn
<http://www.downes.ca/post/38502>
- The Semantic Principle
 - Autonomy, diversity, openness, interaction
- Conditions for personal learning
 - Relevance, Interaction, Usability<http://video.google.com/videoplay?docid=-5431152345344515009&hl=en>

Thank You

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<http://www.downes.ca>