Teaching, Learning, Innovation

Fostering Deep and Flexible Learning

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Today's Mantra: Making Things Better

Mechatronics Program

Anticipation Guide

Directions: Rank the following instructional interventions with respect to which has the greatest impact on student learning (1 = most, 3 = least)

.24 • Use of computer technology in class
        (Timmerman & Kruepke, 2006)

.50 • Use of Inquiry-based teaching methods
        (Furtak, Seidel, Iverson, & Briggs, 2012)

.73 • Provision of performance feedback to students
        (Haddie, 2008)
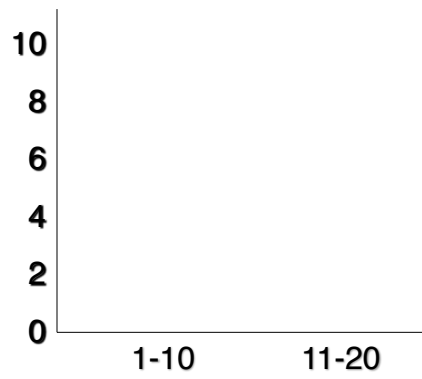
effect size: 0.2 = small; 0.5 = medium; 0.8 = large
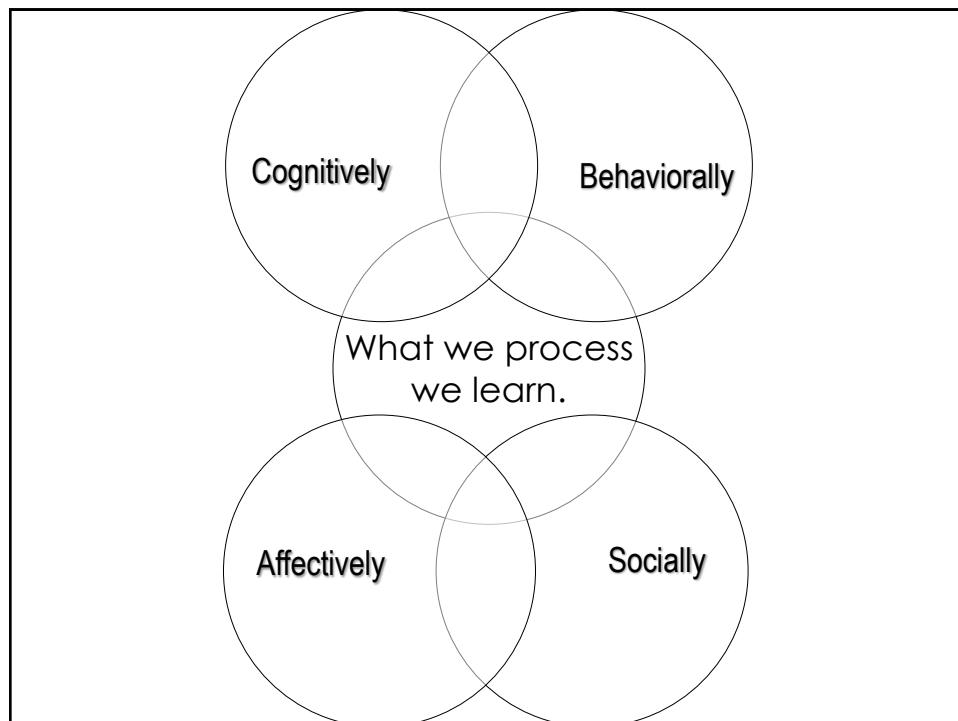
Perspective ->

Learning First (Part I)

Activity #1

	1-10	11-20
10		
8		
6		
4		
2		
0		

Activity #1

- Meaningful Learning
- Elaborative Learning
- Imagery
- Self-Generation
- Self-Reference Effect
- Encoding Specificity
  - State-dependent
  - Context-dependent
  - Transfer-Appropriate Processing

Processing

Cognitively

Behaviorally

What we process we learn.

Affectively

Socially

7 Principles for Developing Deep & Flexible Knowledge

1. Learning through practice at retrieval

2. Learning through varied tasks

3. Learning for varied purposes

4. Learning at the principle level

5. Learning awareness & control (metacognition)

6. Learning embedded in prior knowledge & experience

7. Learning in response to developmental feedback

(Engle, 2006; Halpern & Hakel, 2003; Mariano, Doolittle, & Hicks, 2009; Wagner, 2006)

25-Word Summaries

• Opportunity to engage in critical thinking and extract the essential meaning from a reading, lecture, video, movie, activity, or experience

• Summarize the meaning clearly and concisely, based on student's understanding, in 25 words.

• The summarizing (processing) is more important than the summary (product).

Barr, R., & Tagg, J. (1995, Nov/Dec). *From teaching to learning: A new paradigm for undergraduate education.* Change, 13-25.

Colleges provide instruction, but should produce learning. Students and teachers should co-produce knowledge. Coherent education creates flexible, adaptable, interesting people. This shift will change everything. [25 words]

The first two sentences of the summary do a nice job of addressing essential elements of the article; the second two sentences seem to lose the focus. The first sentence is an explicit central theme, while the second sentence is more implicit. Given that you have identified two themes in the two sentences, how could you combine the two sentences? Often combining such sentences will result in the use of fewer words and allow you to increase the interrelationship between the various ideas (thus increasing their meaning!).

The third sentence isn't really a central focus. The authors focus on student learning more than creating interesting people. The final sentence is more descriptive; that said, if you have the words to spare, the idea is important to the authors.
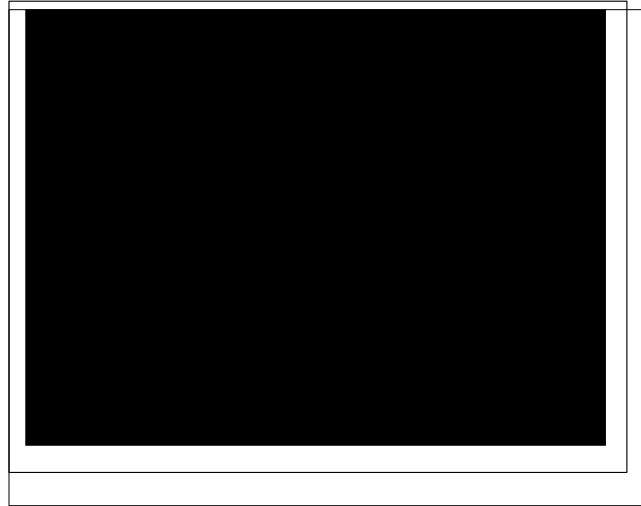
25-Word Summaries

- Think critically and extract the essential meaning
- Summarize the meaning clearly and concisely

1. Learning through practice at retrieval
2. Learning through varied tasks
3. Learning for varied purposes
4. Learning at the principle level
5. Learning awareness & control (metacognition)
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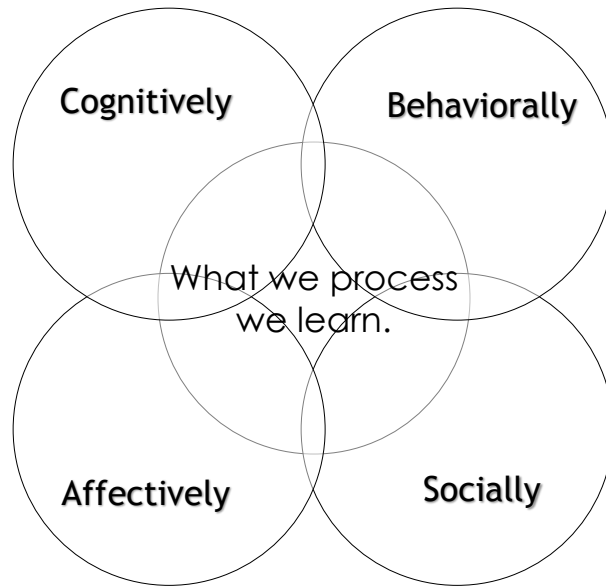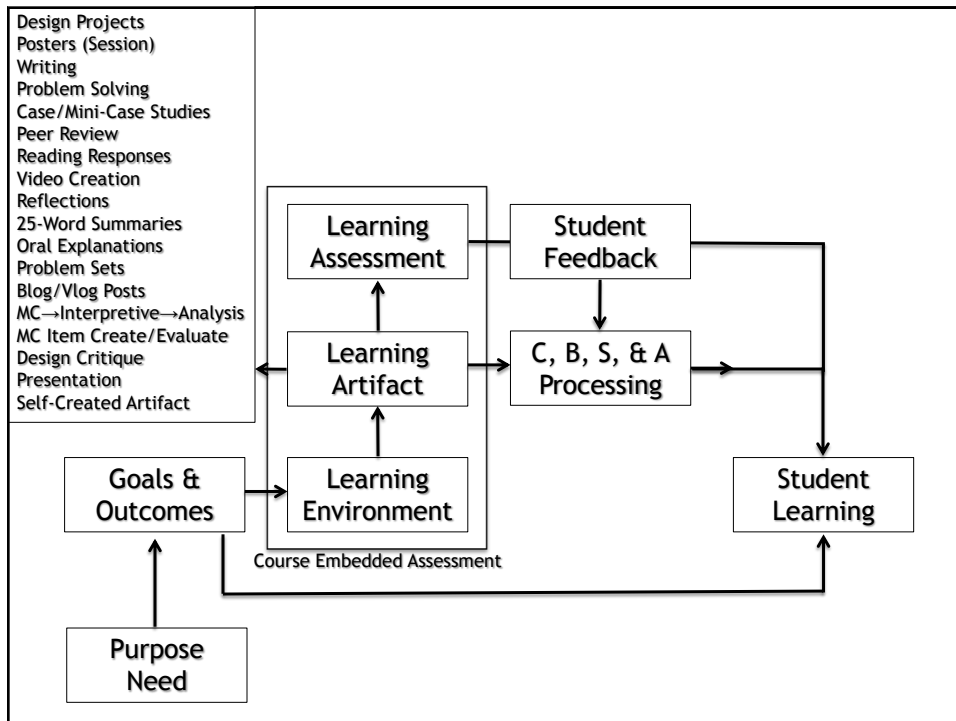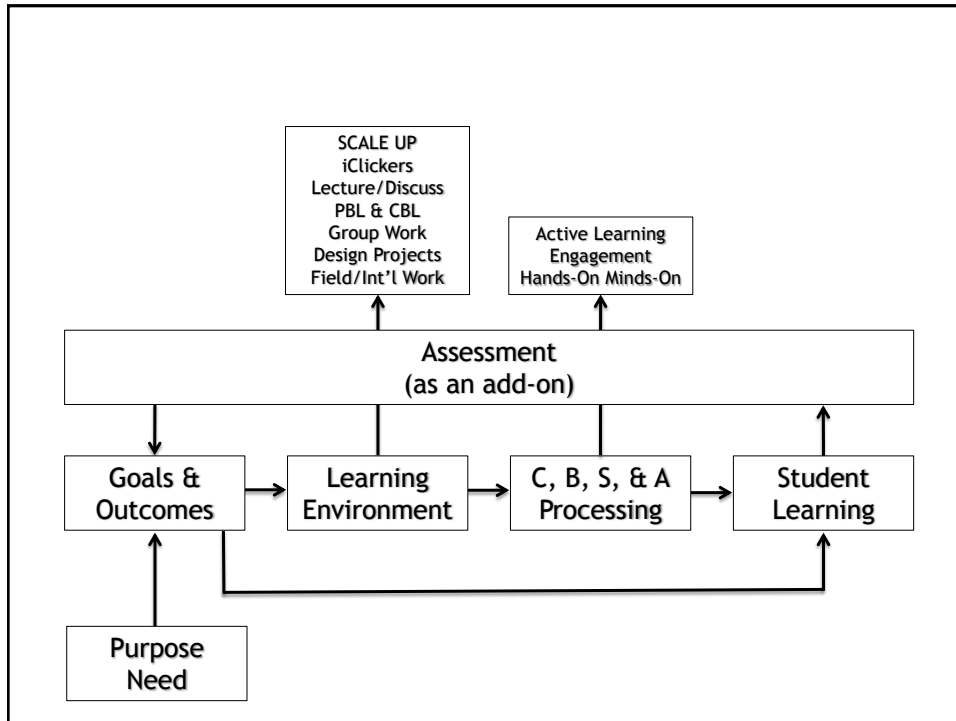7. Learning in response to developmental feedback

Design of Instruction

German ->

The Need for Clarity

Learning is not by magic, it's by design.

Cognitively

Behaviorally

What we process we learn.

Affectively

Socially

Diagram 1:

SCALE UP
iClickers
Lecture/Discuss
PBL & CBL
Group Work
Design Projects
Field/Int'l Work

Active Learning
Engagement
Hands-On Minds-On

Assessment
(as an add-on)

Goals &
Outcomes → Learning
Environment → C, B, S, & A
Processing → Student
Learning

Purpose
Need

Diagram 2:

Design Projects
Posters (Session)
Writing
Problem Solving
Case/Mini-Case Studies
Peer Review
Reading Responses
Video Creation
Reflections
25-Word Summaries
Oral Explanations
Problem Sets
Blog/Vlog Posts
MC→Interpretive→Analysis
MC Item Create/Evaluate
Design Critique
Presentation
Self-Created Artifact

Learning
Assessment

Student
Feedback

Learning
Artifact

C, B, S, & A
Processing

Goals &
Outcomes

Learning
Environment

Student
Learning

Course Embedded Assessment

Purpose
Need

Oral Explanations

- Opportunity to (a) clarify, communicate, and make tangible their understanding of various ideas, concepts, and procedures, and (b) to apply this understanding to a problem or situation of choice.

- Explain key ideas, concepts, and procedures from class in a 10-min video (no notes, no post-processing)

- The explaining (processing) is more important than the video (product).
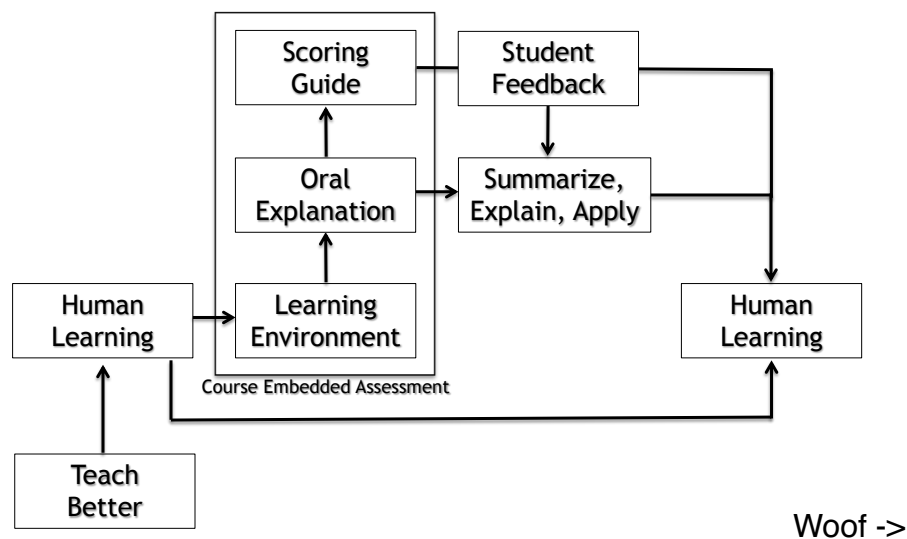
Explanation ->

Oral Explanations

Oral Explanations

- Clarify and communicate their understanding
- Explain key ideas and concepts in a 10-min video

1. Learning through practice at retrieval
2. Learning through varied tasks
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Learning is not by magic, it's by design.

Mental Break

Innovation and Teaching & Learning

What Do We Mean by Innovation?

- Innovation is the action required to create new ideas, processes, or products which when implemented lead to positive effective change. (Marc Wilson, Molina Labs)
- Creation is creating new value. Value is the key word, stressing the difference between innovation and invention (implementation).
- New ideas & implementation..It's not enough just to have a good idea. Only when you *act*, when you *implement*, do you truly innovate. (Tom Kelly, IDEO, *The Art of Innovation*, 2001, *The Ten Faces of Innovation*, 2005)

What Do We Mean by Innovation?

Three Attributes of Innovation

Create New • Implement • Positive Outcome

Innovation is *not* magical, mystical, or metaphysical.
Innovation is effortful.

1-12 of 70,977 results for **Books** : "innovation"

Thomas Edison — Phonograph, Light Bulb, etc.
Shirley Jackson — Physicist RPI President
Wright Brothers — Aviation Pioneers
Grace Hopper — First Compiler for Programming
Marie Curie — Research Method Po, Ra, & U

INNOVATORS

Programs — Mechatronics Manufacturing & Innovation
Technologies — Justin Miller One Button Studio
Partnerships — ORAU-RSCC Geospatial Cntr for Acad Ex
Strategies — Mitzi Vernon FORM: Line-Plane-Solid
Environments — Grant Funding Ambulance Simulator

RSCC — PSU — RSCC — UK — RSCC

Thomas Edison — Phonograph, Light Bulb, etc.
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Two Framing Concepts & One Quick Caution
1. Innovation occurs at different levels of scale – local to global.

2. Innovation is determined by the user, not the innovator.

RSCC — PSU — RSCC — UK — RSCC

To Innovate: 8 Principles

Making Things Better

Making Things Better

1. Solve a Problem

What's Your Problem?
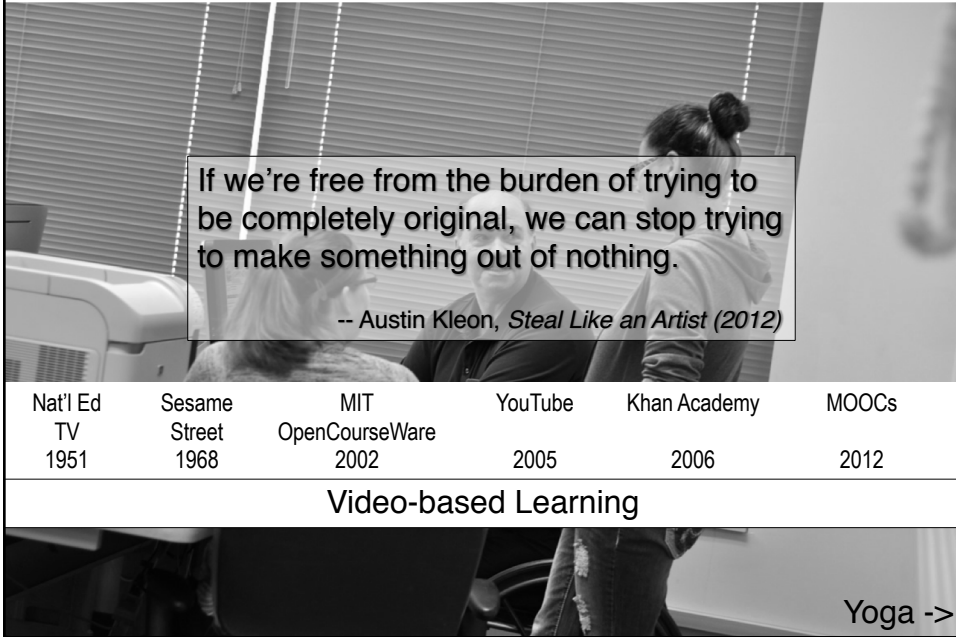
Constructivism and Education

How do I get students to *read*?	1999	MC Quizzes
	2000	MC Quizzes
	2001	na
	2002	1-Page Papers
	2003	1-Page Papers
	2004	1-Page Papers
	2005	na
	2006	MC Quizzes
	2007	MC Quizzes
How do I get students to *think*?	2012	25-Word Summaries
	2013	25-Word Summaries
	2014	25-Word Summaries
	2015	25-Word Summaries

Mac ->

> If we're free from the burden of trying to be completely original, we can stop trying to make something out of nothing.
>
> -- Austin Kleon, *Steal Like an Artist (2012)*

Nat'l Ed TV	Sesame Street	MIT OpenCourseWare	YouTube	Khan Academy	MOOCs
1951	1968	2002	2005	2006	2012

Video-based Learning

Yoga ->

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2. Build On Others

Making Things Better

3. Work Hard, Don't Wait for the Aha!

Innovavered.

A **TED2005** Talk – James Watson

Making Things Better

4. Solve It, then Solve It

Planning   Doing

Problematize It | Solve It | Resource It | Solve It | Implement It

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5. I'm Stuck! Walk Away.

Fixation → Take a Break → ↑ Problem Solving
↓
Incubation

↓   ↓
Unconscious Processing   Forgetting Fixation
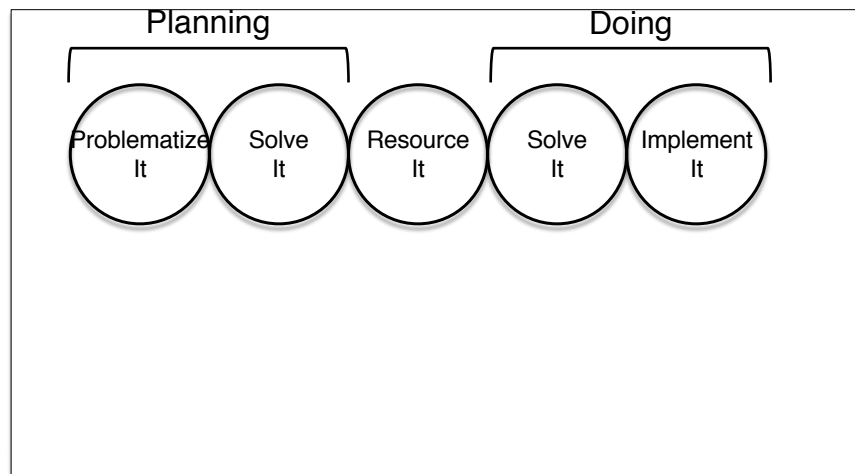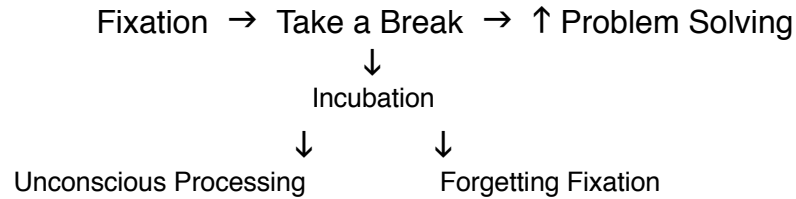
Low Load Mental Activity
- Breaks work better for divergent tasks, than convergent tasks
- More preparation before a break → ↑ problem solving
- A longer break → ↑ problem solving

(Gilhooly, et al., 2014; Kohn & Smith, 2009; Segal, 2004; Sio & Ormerod, 2009, 2014)

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6. Don't Wait, Do It

Do it, fix it, try it.
-- Peters & Waterman
In Search of Excellence (1982)

Don't worry, be crappy.
-- Guy Kawasaki, ex-Apple
TEDxBerkeley (2014)

Cult of the Imperfect

Give them the third-best to go on with;
the second best comes too late,
and the best never comes
-- Robert Watson-Watt, Air Ministry, UK

A **TEDxKC** Talk – Diana Kander

Marshmallow ->

A **TEDxKC** Talk – Diana Kander
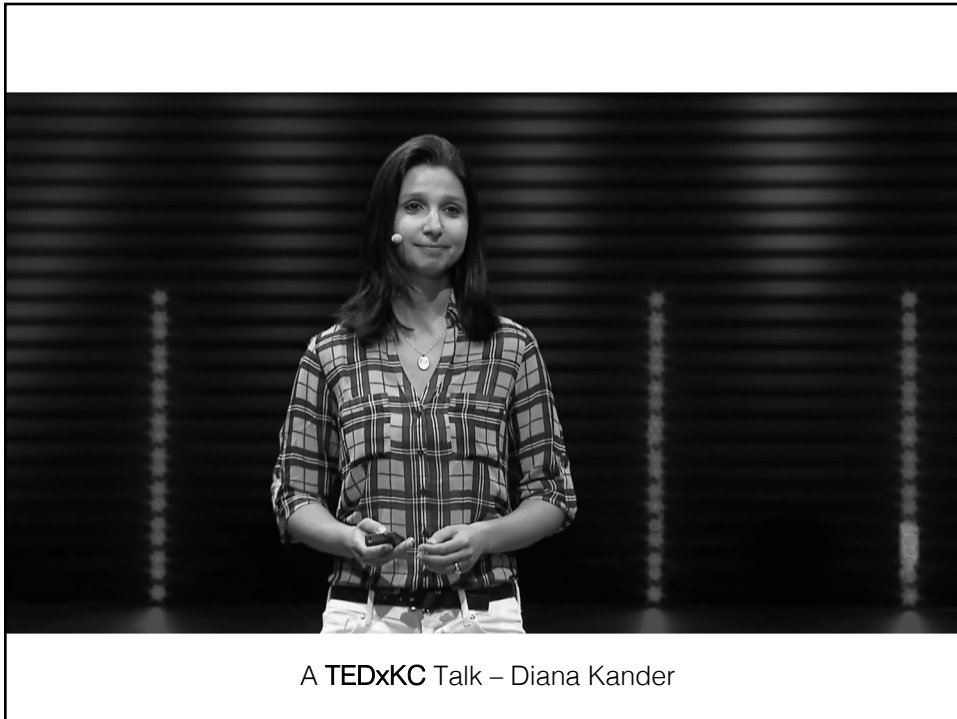
| Making Things Better

7. Limited Shelf Life

Innovative → Innovative → Innovative →

Useful →

iPod ->

Making Things Better

8. Focus on Progress

Innovation is about making things better,
not making things perfect.

Good is the enemy of great. (Voltaire)

Great lives with paralysis.
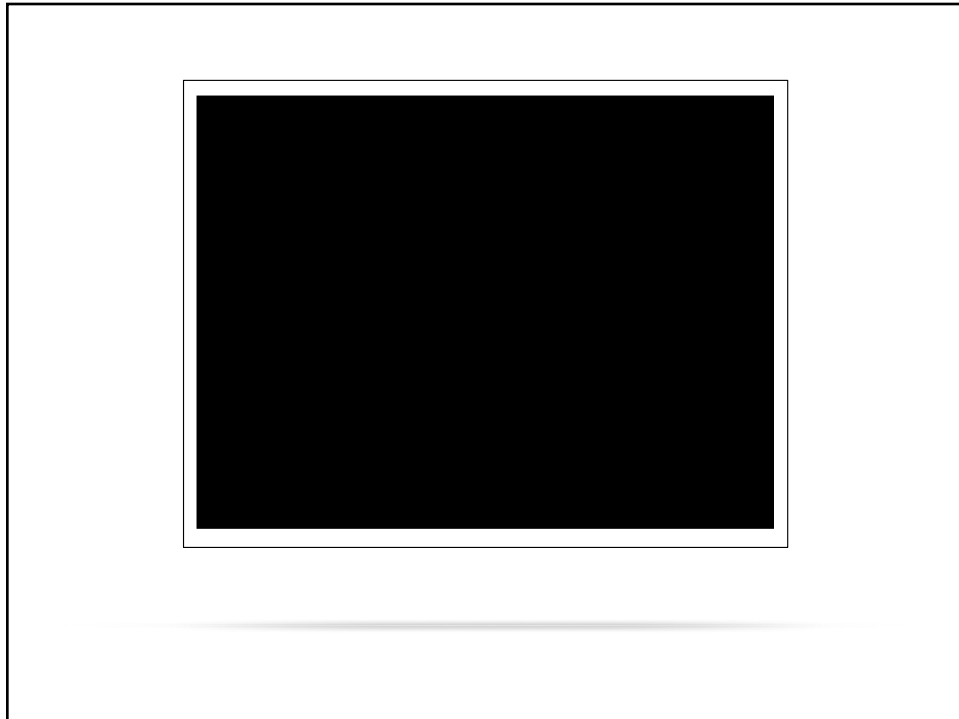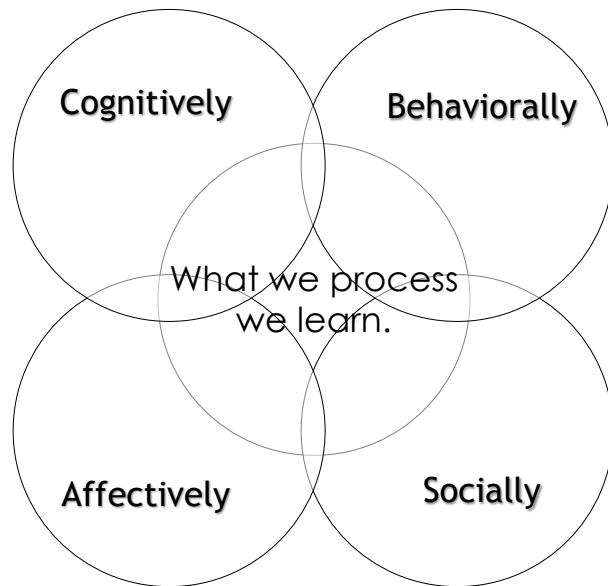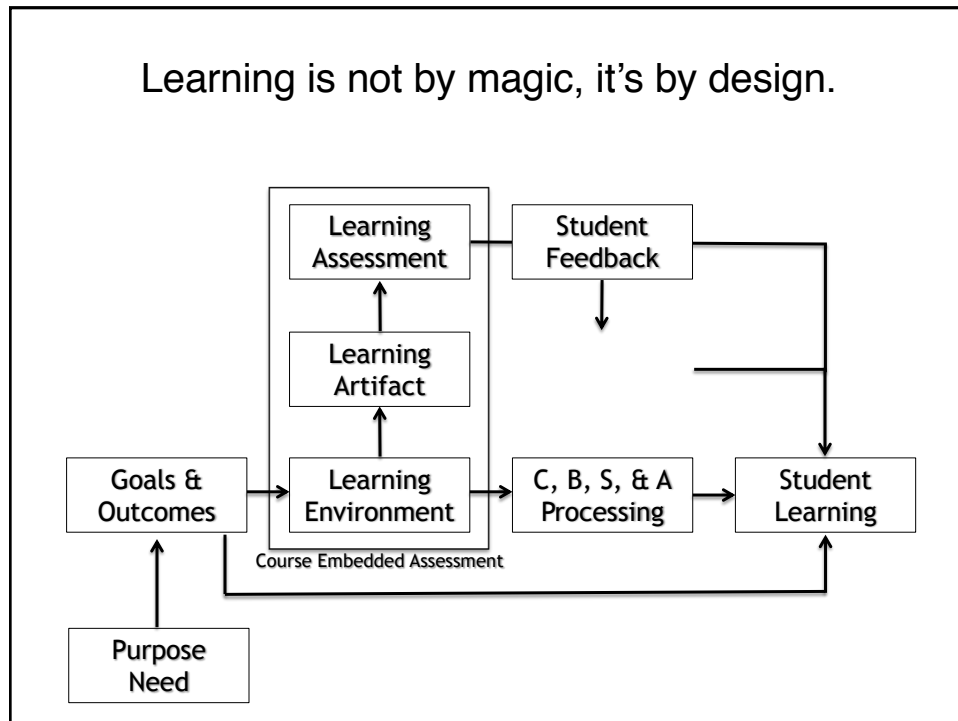
Conclusion

Cognitively

Behaviorally

What we process
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Affectively

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                    ┌──────────────┐  ┌──────────────┐
                    │   Learning   │  │   Student    │
                    │  Assessment  │  │   Feedback   │
                    └──────▲───────┘  └──────┬───────┘
                           │                 │
                    ┌──────┴───────┐         │
                    │   Learning   │         │
                    │   Artifact   │         │
                    └──────▲───────┘         │
   ┌──────────┐     ┌──────┴───────┐  ┌──────────────┐  ┌──────────────┐
   │ Goals &  │──▶  │   Learning   │─▶│ C, B, S, & A │─▶│   Student    │
   │ Outcomes │     │ Environment  │  │  Processing  │  │   Learning   │
   └──────────┘     └──────────────┘  └──────────────┘  └──────────────┘
        ▲            Course Embedded Assessment
        │
   ┌──────────┐
   │ Purpose  │
   │   Need   │
   └──────────┘
```

To innovate
is to make things better.

1. Solve a Problem
2. Build on Others
3. Work Hard, Don't Aha!
4. I'm Stuck! Walk Away
5. Solve It, then Solve It
6. Don't Wait, Do It
7. Limited Shelf Life
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