Design and Implementation of Interactive Learning – Part 1

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SDSM&T Faculty Workshop August 22, 2019

Session Layout

BIG IDEAS (Enduring Outcomes)
- How Learning Works
- Streamlined Course Design
- Alignment of Outcomes, Assessment and Instruction
- Interactive Learning

Neuroscience of Learning (How people learn)
- Key Elements
- Implications
- Processes that Support Learning
- Conditions/Limitations for Learning

Streamlined Course Design
- Alignment of Outcomes, Assessment and Instruction
- Course Concept Map

Assessment Overview
- Types of assessment
- Writing learning objectives
- Mapping objectives on a taxonomy exercise

Interactive (Cooperative) Learning
- Description & Rationale
- Cooperative Learning
  - Key Concepts
  - Types of Cooperative Learning
- Informal Cooperative Learning planning exercise

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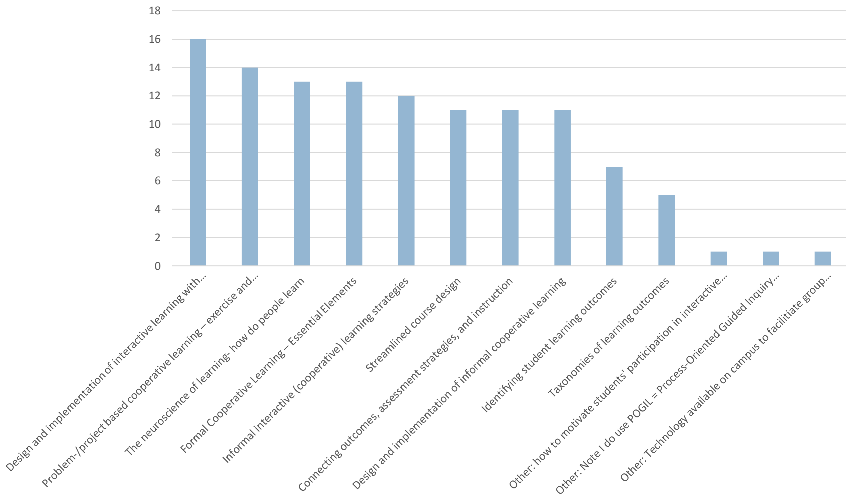
Pre-workshop Survey



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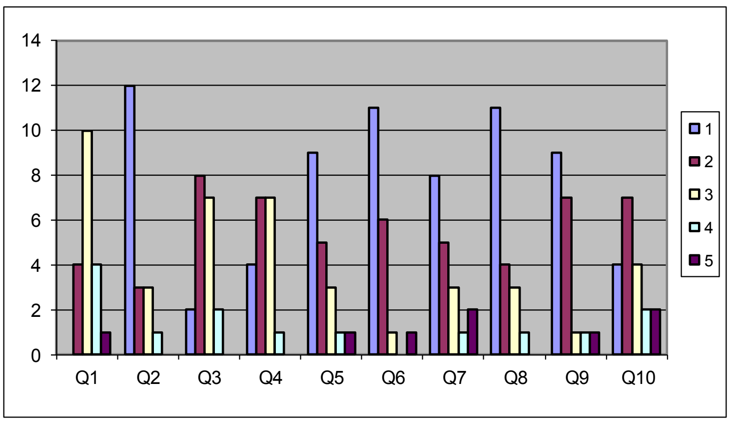
MOT 8221 – Spring 2019 Background Survey



PM	Q1	3.1	IE/OR	Q6	1.6
PMI/PMBOK	Q2	1.6	ModSym	Q7	2.2
KM	Q3	2.5	CAS	Q8	1.7
Agile	Q4	2.3	Lean Startup	Q9	1.8
EngSys	Q5	1.9	6 Sigma	Q10	2.5

N = 19/21

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It is strange that we expect students to learn, yet seldom teach them anything about learning. We expect students to solve problems, yet seldom teaching them anything about problem solving. And, similarly, we sometimes require students to remember A considerable body of material, yet seldom teach them the art of memory. **It is time we made up for this lack…**

D.A. Norman. 1980. Cognitive engineering and education. In D.T. Tuma and F. Reif (Eds.), *Problem solving and education: Issues in teaching and research. Erlbaum, pp. 97-107.*

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Big Ideas (Enduring Outcomes)

- **Neuroscience of Learning (How People Learn)**
- Streamlined Course Design
- Alignment of Outcomes, Assessment and Instruction
- Interactive Learning

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The Neuroscience of Learning

- Key Concepts: This is your Brain. . .
- Processes that Support Learning
- Conditions/Limitations for Learning
- Implications

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This is your brain. . .

- Brain cells are called **neurons**.
- You are born with at least 100 billion neurons.
- **Dendrites** (fibers) grow out of the neurons when you listen to/write about/talk about/ practice something, that is, when you are learning something.

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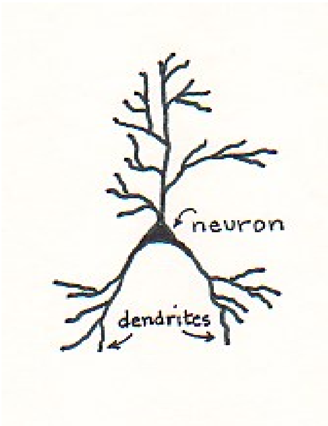
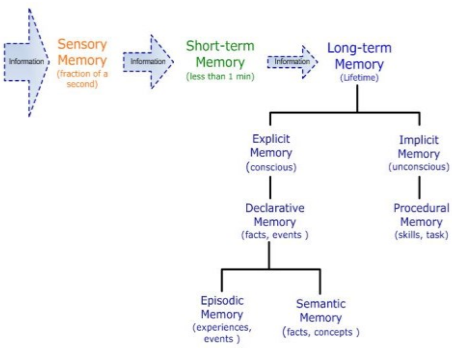
This is your brain. . .



- Neurons know how to grow dendrites, just like a stomach knows how to digest food.
- **Learning = Growth of dendrites.**
- New dendrites take time to grow because it takes a lot of practice for them to grow.

Memory



Types of Memory:

-Working, short-term memory

-Long-term memory: Explicit and Implicit

- Declarative
- Procedural
- Episodic
- Sematic

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Processes that Support Learning

- Processes
  - Metacognition
  - Executive Functioning
  - Self-Regulation
- Key Questions on Processes
  - How do we define the processes?
  - How do we use the processes to orchestrate learning?

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Conditions for Learning

- Motivation
  - Influences and Barriers
- Conditions for Learning
  - Physical
  - Cognitive
  - Emotional
  - Collaboration

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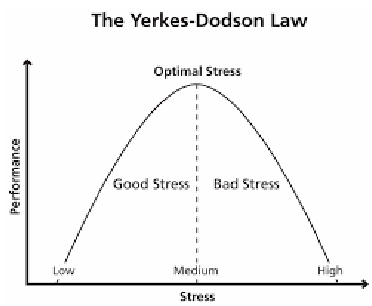
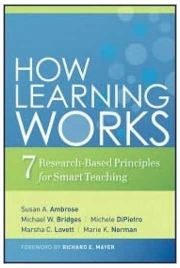
Limitations

- Cognitive Load
- Learning Barriers
  - Content
  - Incentive
  - Social
- Stress



Implications

- Culture and Context of Learning in the Classroom
  - Environment
  - Asset v. Deficit Model
- Instructional Approaches
  - Individual learning differences
  - Problem-based; Project-based
  - Interactive (Collaborative)
  - Assessment



1. Students prior knowledge can help or hinder learning
2. How students organize knowledge influences how they learn and apply what they know
3. Students' motivation determines, directs, and sustains what they do to learn
4. To develop mastery, students must acquire component skills, practice integrating them, and know when to apply what they have learned
5. Goal-directed practice coupled with targeted feedback enhances the quality of students' learning
6. Students' current level of development interacts with the social, emotional, and intellectual climate of the course to impact learning
7. To become self-directed learners, students must learn to monitor and adjust their approach to learning

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Streamlined Course Design

Streamlined Course Design is a guided process that is based on the engineering design process.

The end product is a course where what is learned, how that learning is measured, and the learning environment are all aligned.

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Common Instructional Design Approach

Choose Text

Identify Chapters Covered

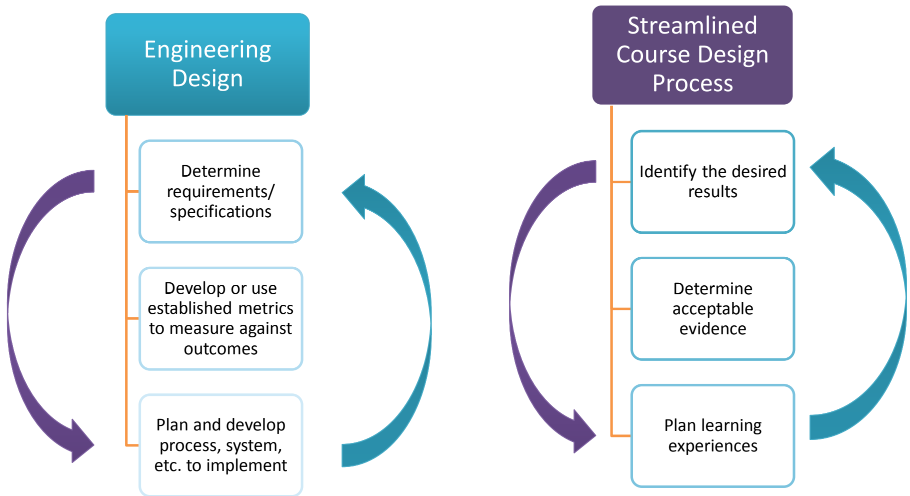
Develop Lectures

Create Exams

Why Streamline?

- Aligned courses — students are learning what "matters" and you have evidence about their learning
- Increased student learning — about the things that matter
- Increased satisfaction by instructors and students about their experience in the course

The Engineering Design Process vs. Streamlined Course Design Process



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Curricular Priorities: What are they?

First – how do you want your students to be different when they leave the class? What should they know, be able to do, care about?

Second – how can you rank what you listed in #1 as most important?

Wiggins and McTighe called these "curricular priorities"

- Enduring outcomes – enduring long after the course is over
- Important to know – Knowledge, Skills, and Attitudes(KSA) needed to arrive at the enduring outcomes
- Good to be familiar with – good if they can recognize, but nothing vital

Note these are not necessarily written as LEARNING OBJECTIVES (that is a separate step).

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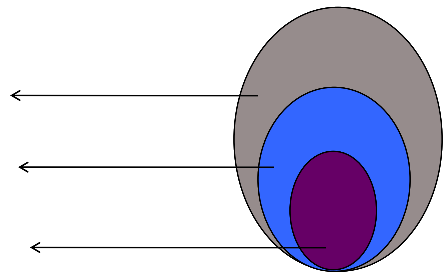
Curricular Priorities

Categorize outcomes into three levels

Good to be familiar with

Important to know

Enduring *outcomes*



From Wiggins and McTighe

How to Determine Curricular Priorities

Big ideas:

- What lies at the heart of the discipline?
- What do professionals/experts do?

Essential questions:

- What questions do you want your students to ask as they learn the material?

What are the *guiding concepts* and how do those concepts *relate* to one another?

- A graphic like a concept map is one way to discover relationships

Curricular Priorities Worksheet

1. List curricular priorities of the course you plan to (re)design (~ 2 min)
   1. Enduring outcomes
   2. Important to know outcomes
   3. Good to be familiar with outcomes
2. Share and discuss curricular priorities with a neighbor (~5 min)

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Curricular Priorities Worksheet – Part 2

1. As a follow up, please consider creating a concept map of the course that includes enduring outcomes, important to know, and good to be familiar with items.

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What are concept maps and why use them?

What are concept maps?

- Concept maps are graphical tools for organizing and representing knowledge (http://cmap.ihmc.us).

Why use concept maps?

- They are a tool for helping you think about how the concepts in your target domain are connected.
- They help you discover what is most important – thus are useful for determining curricular priorities and for identifying difficult or threshold concepts.

Concept Maps Software Tools

FREE

Cmap Tools (http:// cmap.ihmc.us)

- Institute for Human &Machine Cognition
- Free downloadable program
- Site also has links to instructional videos on how to use Cmap

Commercial software with free trials

Inspiration

- http://www.inspiration.com/

Learning Objectives = the bridge between content and assessment

WHY?
- Learning objectives are the mechanism for making the learning MEASURABLE. So you CAN assess it!

What? Learning objectives are statements that are:
- **S**pecific
- **M**easurable (Describable)
- **A**ttainable
- **R**elevant
- **T**ime-bound

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Why assess?

Designer's perspective:
- Assessment is the measure YOU need to know if your design is working as you would like it to.
- Analogous to the measuring against the specs of a technical design.
  - Writing learning objective is like writing the specs.

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Why assess?

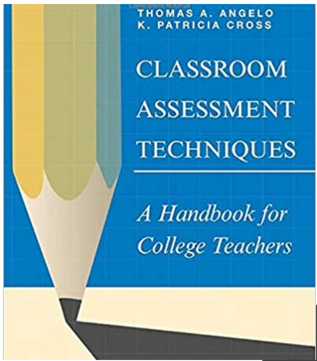
Learners' perspective
- How will LEARNERS know they learned the material?
- How will LEARNERS reflect on what they have practiced?
- How will LEARNERS be able to practice what they need to learn?

Assessment as:
- A form of learning
- A form of reflection
- A form of deliberate, distributed practice

Types of Assessment

1. **Diagnostic Assessment**
   Conducted at the beginning of an instructional unit, course, semester. . . to determine the present level of knowledge, skill, interest. . . of a student, group or class.
2. **Formative Assessment**
   Conducted periodically throughout the instructional unit. . .to monitor progress and provide feedback toward learning goals.
3. **Summative Assessment**
   Conducted at the end of an instructional unit or semester to judge the quality and quantity of student achievement and/or the success of the instructional unit.

Classroom Assessment Technique



Muddiest Point

Classroom Assessment Technique (CAT)

- What is the muddiest point in this morning's presentation for you?
  - Please answer on the index card provided.

Classroom Assessment Technique: High Return Low Investment

- The Muddiest Point
  - Remarkably efficient
  - High return
  - Low investment for the student (time and energy)
  - Provides information in which the students find least clear or most confusing

- Faculty
  - Always presented at the end of the lecture/class session
  - Provides immediate feedback on what areas need more clarification

Other CAT’s

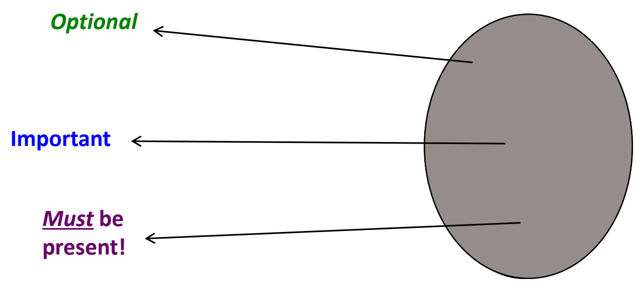
- *Background Knowledge Probe*: Prepare two open-ended questions
- *One-minute paper*: half sheet response
  - What was the most important thing you have learned thus far in the lecture/course/activity/reading
- *Focused List*: provide a word or phrase, students provide list of what they associate to be important.

Writing Learning Objectives

1. WHEN DO YOU WRITE LEARNING OBJECTIVES?
2. HOW DO YOU WRITE LEARNING OBJECTIVES?
3. EXAMPLES

When Do You Write Learning Objectives

Learning Objectives | Curricular Priorities



Constructing Learning Objectives
Using Verb-Noun Format

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Taxonomies of Learning Objectives

What is a taxonomy?

How do you use them?

Why are they useful?

When do you use them?

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Taxonomies of Learning Objectives

Bloom's taxonomy of educational objectives: Cognitive Domain (Bloom & Krathwohl, 1956)

A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives (Anderson & Krathwohl, 2001).

Taxonomy of significant learning (Fink, 2003)

Evaluating the quality of learning: The SOLO taxonomy (Biggs & Collis, 1982)

Facets of understanding (Wiggins & McTighe, 1998)

Anderson and Krathwohl taxonomy

AN UPDATED VERSION OF BLOOM'S TAXONOMY

Revised Bloom's Taxonomy

The Cognitive Process Dimension represents a continuum of increasing cognitive complexity—from lower order thinking skills to higher order thinking skills. Anderson and Krathwohl (2001) identify nineteen specific cognitive processes that further clarify the scope of the six categories (Table 2).

Table 2. The Cognitive Processes dimension — categories & cognitive processes and alternative names

lower order thinking skills → higher order thinking skills

remember	understand	apply	analyze	evaluate	create
recognizing • identifying recalling • retrieving	interpreting • clarifying • paraphrasing • representing • translating exemplifying • illustrating • instantiating classifying • categorizing • subsuming summarizing • abstracting • generalizing inferring • concluding • extrapolating • interpolating • predicting comparing • contrasting • mapping • matching explaining • constructing models	executing • carrying out implementing • using	differentiating • discriminating • distinguishing • focusing • selecting organizing • finding coherence • integrating • outlining • parsing • structuring attributing • deconstructing	checking • coordinating • detecting • monitoring • testing critiquing • judging	generating • hypothesizing planning • designing producing • constructing

(Table 2 adapted from Anderson and Krathwohl, 2001, pp. 67–68.)

http://www.celt.iastate.edu/wp-content/uploads/2015/09/RevisedBloomsHandout-1.pdf 48

Activity Part I (~3 Minutes): Write your Learning Objectives (LO)s

On your own, write LOs for your *enduring outcomes* first. If time allows, try to write one LO for an *important to know* piece of your curricular priorities

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Activity Part II (~5 Minutes) Discuss with your Neighbor

Share your learning objectives (LOs) with your breakout group. Do your LOs seem *SMART* and well-written to your peers?

Revised Bloom's Learning Taxonomy

The Knowledge Dimension classifies four types of knowledge that learners may be expected to acquire or construct—ranging from concrete to abstract (Table 1).

Table 1. The Knowledge Dimension – major types and subtypes

concrete knowledge →			abstract knowledge
factual	**conceptual**	**procedural**	**metacognitive***
knowledge of terminology knowledge of specific details and elements	knowledge of classifications and categories knowledge of principles and generalizations knowledge of theories, models, and structures	knowledge of subject-specific skills and algorithms knowledge of subject-specific techniques and methods knowledge of criteria for determining when to use appropriate procedures	strategic knowledge knowledge about cognitive tasks, including appropriate contextual and conditional knowledge self-knowledge

(Table 1 adapted from Anderson and Krathwohl, 2001, p. 46.)
*Metacognitive knowledge is a special case. In this model, "metacognitive knowledge is knowledge of [one's own] cognition and about oneself in relation to various subject matters . . . " (Anderson and Krathwohl, 2001, p. 44).

Iowa State University
Center for Excellence in Learning and Teaching

http://www.celt.iastate.edu/wp-content/uploads/2015/09/RevisedBloomsHandout-1.pdf

Revised Bloom's Learning Taxonomy

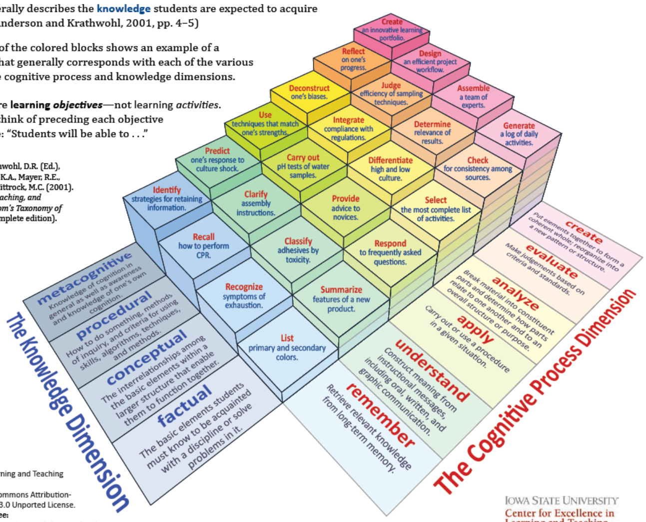
A statement of a **learning objective** contains a **verb** (an action) and an **object** (usually a noun).

- The **verb** generally refers to [actions associated with] the intended **cognitive process**.
- The **object** generally describes the **knowledge** students are expected to acquire or construct. (Anderson and Krathwohl, 2001, pp. 4–5)

In this model, each of the colored blocks shows an example of a learning objective that generally corresponds with each of the various combinations of the cognitive process and knowledge dimensions.

Remember: these are **learning *objectives***—not learning *activities*. It may be useful to think of preceding each objective with something like: "Students will be able to . . ."

*Anderson, L.W. (Ed.), Krathwohl, D.R. (Ed.), Airasian, P.W., Cruikshank, K.A., Mayer, R.E., Pintrich, P.R., Raths, J., & Wittrock, M.C. (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's Taxonomy of Educational Objectives* (Complete edition). New York: Longman.



Model created by: Rex Heer
Iowa State University
Center for Excellence in Learning and Teaching
Updated January, 2012

For additional resources, see:
www.celt.iastate.edu/teaching/RevisedBlooms1.html

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Center for Excellence in Learning and Teaching

http://www.celt.iastate.edu/wp-content/uploads/2015/09/RevisedBloomsHandout-1.pdf 54

Mapping Learning Objectives

Example from Ruth Wertz

Map of Week 5 Learning Objectives		Cognitive Process Dimension					
		1 Remember	2 Understand	3 Apply	4 Analyze	5 Evaluate	6 Create
Knowledge Dimension	A. Factual Knowledge	L2-GA					
	B. Conceptual Knowledge		L1-IK L3-IK				
	C. Procedural Knowledge						
	D. Metacognitive Knowledge			L4-EU L5-EU			

(Framework: Anderson & Krathwohl, 2001)

Content:

- [L1] Describe the meaning of the relationship between stress and strain.
- [L2] Define the modulus of elasticity, shear modulus, and Poisson's ratio
- [L3] Describe the physical meaning of effective stress.
- [L4] Compute total and effective vertical stresses under hydrostatic and seepage conditions.
- [L5] Estimate induced stresses at a discrete point or along a plane, due to an applied load.

Annotated Example: Map of Weekly Learning Objectives (Annotated Example).docx 55

Fink

TAXONOMY OF SIGNIFICANT LEARNING OUTCOMES

Dee Fink – Creating Significant Learning Experiences

A TAXONOMY OF SIGNIFICANT LEARNING

1. Foundational Knowledge

- "Understand and remember" learning

  For example: facts, terms, formulae, concepts, principles, etc.

2. Application

- Thinking: critical, creative, practical (problem-solving, decision-making)
- Other skills

  For example: communication, technology, foreign language
- Managing complex projects

3. Integration

- Making "connections" (i.e., finding similarities or interactions) . . .

  Among: ideas, subjects, people

4. Human Dimensions

- Learning about and changing one's SELF
- Understanding and interacting with OTHERS

5. Caring

- Identifying/changing one's feelings, interests, values

6. Learning How to Learn

- Becoming a better student
- Learning how to ask and answer questions
- Becoming a self-directed learner

Application of Fink Taxonomy

Joi Mondisa - Developing Self-identity, Confidence, and Community: The NLFN STEM Girls' Mentoring Program Curricular Project

Taxonomy Level	Learning Objective
Foundational Knowledge	Recall at least three specific STEM career opportunities ….(LO6)
Integration	
Human Dimension	Describe two personal strengths (LO3)
Caring	
Learning how to Learn	Feel comfortable working together with others and constructing meaning with others **(LO5)**
Application	Create and engage in making a Legos robot in a robotic competition. (**LO7)**

Learning Objectives and Taxonomies

Further Resources

- *What are learning objectives and how can we use them*? Appendix D of *How Learning Works* - http://firstliteracy.org/wp-content/uploads/2015/07/How-Learning-Works.pdf
- Two websites about (1) changes to Bloom's Taxonomy and (2) the revised Bloom's Taxonomy
  - https://thesecondprinciple.com/teaching-essentials/beyond-bloom-cognitive-taxonomy-revised/
  - http://www.celt.iastate.edu/wp-content/uploads/2015/09/RevisedBloomsHandout-1.pdf
  - http://www.celt.iastate.edu/teaching/effective-teaching-practices/revised-blooms-taxonomy/revised-blooms-taxonomy-flash-version
- Fink's Taxonomy – Self Directed Guide
  - https://www.deefinkandassociates.com/GuidetoCourseDesignAug05.pdf

Aligning instruction with curricular priorities

Essential Questions

Are there useful ways to categorize different kinds of “active” or more student-centered teaching strategies?

How does one decide which kind of activity to use?

Framework for looking at "active" learning

~~ACTIVE~~ ATTENTIONAL	CONSTRUCTIVE	INTERACTIVE
Doing something ~~physically~~ Paying Attention	Producing outputs that go beyond presented information	Dialoguing substantively on the same topic, and not ignoring a partner's contribution
Engaging activities	Self-construction	Guided-construction
Attending processes	Creation processes	Joint creation processes

ICAP framework, Michelene T.H. Chi

Chi, M.T.H. (2009). Active-Constructive-Interactive: A conceptual framework for differentiating learning activities. *Topics in Cognitive Science, 1*, 73-105

"Attentional" strategies

Attention is the gateway to learning

However, many of us live in a state of continuous partial attention

Strategies to help your student pay attention are important.

Examples:

- Assigning observation roles while watching a live demonstration or video
- Asking students to repeat what another student has said
- Providing handouts with "fill in the blank" sections

Constructive activities

Research on learning has shown that we learn new information by connecting new information to what we already know (this is called "Constructivism")

Constructive activities help your students make that bridge between new and previous knowledge

Examples:

- Providing an example of a concept or theory
- Explaining something in one's own words
- Converting written or numerical information into a diagram or graph

From Constructive Learning to Interactive Learning

Gaining students' attention and engaging them in constructive learning activities is more effective than when students are passive; however, it's not the best we know how to do.

Interactive learning is most effective and can bring about the highest learning gains.

However, interactive learning is also the most time-intensive (for instructors and learners). Use it when you need it most (with the most important and difficult concepts).

So… look at your curricular priorities. Those that are the most important (enduring outcomes and important to know) are worth the "investment" in constructive and interactive activities.

Question: Your Experiences with Interactive Learning

What was your experience **as an undergraduate student** with interactive learning?

- First time you heard the term in a class setting *or* the first time you were asked to work with others in a class setting
- What did the instructor ask you to do?
- What rationale did the instructor provide?

Karl's Experience

First Teaching Experience – Third-year course in metallurgical reactions – thermodynamics and kinetics

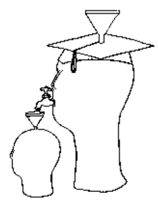
Lila M. Smith

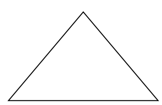
Karl's Quandary

Practice – Third-year course in metallurgical reactions – thermodynamics and kinetics

Theory – ?

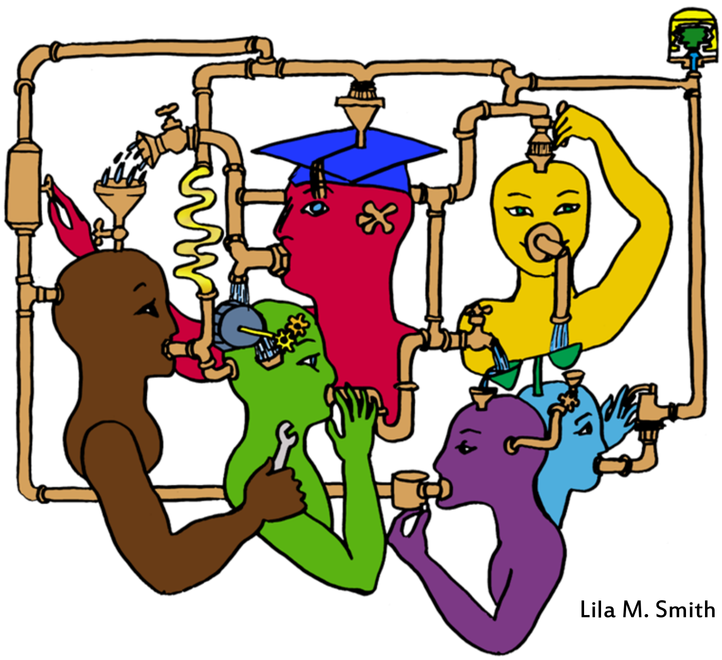
Research – ?





University of Minnesota College of Education Social, Psychological and Philosophical Foundations of Education

- Statistics, Measurement, Research Methodology
- Assessment and Evaluation
- Learning and Cognitive Psychology
- Knowledge Acquisition, Artificial Intelligence, Expert Systems
- Development Theories
- Motivation Theories
- Social psychology of learning – student – student interaction



Lila M. Smith

Cooperative Learning: An Evidence-Based Practice for Interactive Learning

Cooperative learning is instruction that involves people working in teams to accomplish a common goal, under conditions that involve both *positive interdependence* (all members must cooperate to complete the task) and *individual and group accountability* (each member is accountable for the complete final outcome).

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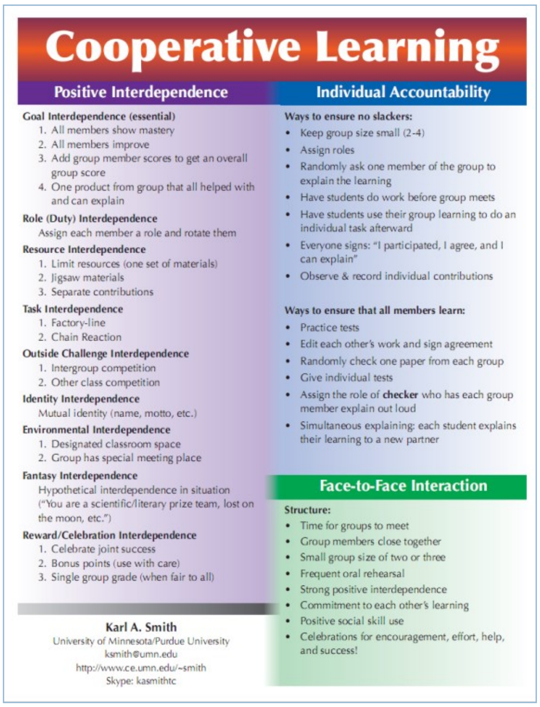

Cooperative Learning

Positive Interdependence

Goal Interdependence (essential)
1. All members show mastery
2. All members improve
3. Add group member scores to get an overall group score
4. One product from group that all helped with and can explain

Role (Duty) Interdependence
Assign each member a role and rotate them

Resource Interdependence
1. Limit resources (one set of materials)
2. Jigsaw materials
3. Separate contributions

Task Interdependence
1. Factory-line
2. Chain Reaction

Outside Challenge Interdependence
1. Intergroup competition
2. Other class competition

Identity Interdependence
Mutual identity (name, motto, etc.)

Environmental Interdependence
1. Designated classroom space
2. Group has special meeting place

Fantasy Interdependence
Hypothetical interdependence in situation ("You are a scientific/literary prize team, lost on the moon, etc.")

Reward/Celebration Interdependence
1. Celebrate joint success
2. Bonus points (use with care)
3. Single group grade (when fair to all)

Individual Accountability

Ways to ensure no slackers:
- Keep group size small (2-4)
- Assign roles
- Randomly ask one member of the group to explain the learning
- Have students do work before group meets
- Have students use their group learning to do an individual task afterward
- Everyone signs: "I participated, I agree, and I can explain"
- Observe & record individual contributions

Ways to ensure that all members learn:
- Practice tests
- Edit each other's work and sign agreement
- Randomly check one paper from each group
- Give individual tests
- Assign the role of **checker** who has each group member explain out loud
- Simultaneous explaining: each student explains their learning to a new partner

Face-to-Face Interaction

Structure:
- Time for groups to meet
- Group members close together
- Small group size of two or three
- Frequent oral rehearsal
- Strong positive interdependence
- Commitment to each other's learning
- Positive social skill use
- Celebrations for encouragement, effort, help, and success!

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Key Concepts:

- **Positive Interdependence**
- **Individual and Group Accountability**
- Face-to-Face Promotive Interaction
- Teamwork Skills
- Group Processing

http://personal.cege.umn.edu/~smith/docs/Smith-CL%20Handout%2008.pdf

Cooperative Learning Introduced to Engineering – 1981

Smith, K.A., Johnson, D.W. and Johnson, R.T., 1981. The use of cooperative learning groups in engineering education. In L.P. Grayson and J.M. Biedenbach (Eds.), *Proceedings Eleventh Annual Frontiers in Education Conference*, Rapid City, SD, Washington: IEEE/ASEE, 26-32.


Structuring Learning Goals
To Meet the Goals of
Engineering Education

Karl A. Smith,
David W. Johnson, and Roger T. Johnson
University of Minnesota

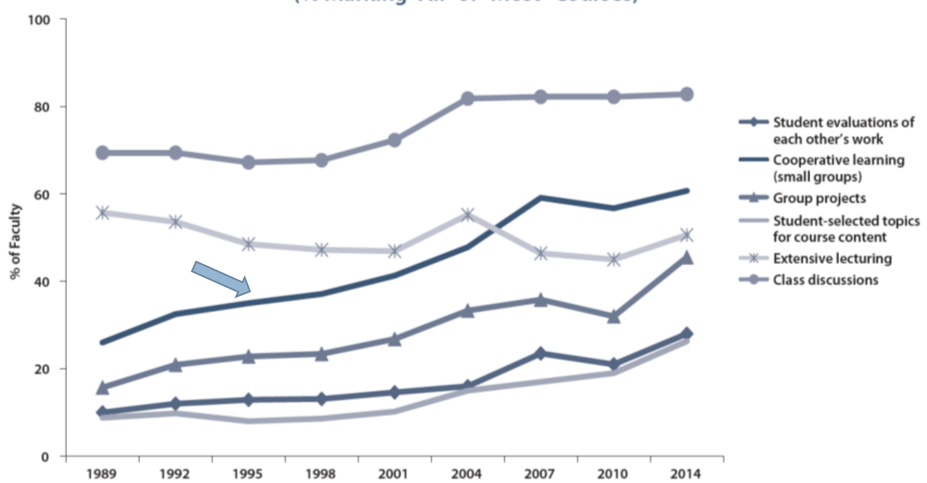
Goals of Engineering Education

Needs of Engineering Graduates

http://personal.cege.umn.edu/~smith/docs/Smith-Pedagogies_of_Engagement.pdf

Undergraduate Teaching Faculty: The 2013–2014 HERI Faculty Survey

Figure 2. Changes in Faculty Teaching Practices, 1989 to 2014
(% Marking "All" or "Most" Courses)



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http://heri.ucla.edu/monographs/HERI-FAC2014-monograph.pdf

Undergraduate Teaching Faculty, 2011*

Methods Used in "All" or "Most"	STEM women	STEM men	All other women	All other men
Cooperative learning	60%	41%	72%	53%
Group projects	36%	27%	38%	29%
Grading on a curve	17%	31%	10%	16%
Student inquiry	43%	33%	54%	47%
Extensive lecturing	50%	70%	29%	44%

*Undergraduate Teaching Faculty. National Norms for the 2010-2011 HERI Faculty Survey, www.heri.ucla.edu/index.php.

Why Emphasize Cooperative Learning?

Student learning and retention

Essential **transferrable skill** development

Key to **innovation**

High priority for **Employers**

Cooperative Learning Research Support

Johnson, D.W., Johnson, R.T., & Smith, K.A. 1998. Cooperative learning returns to college: What evidence is there that it works? *Change*, *30* (4), 26-35.*

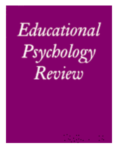
- Over 300 Experimental Studies
- First study conducted in 1924
- High Generalizability
- Multiple Outcomes

Outcomes

1. Achievement and retention
2. Critical thinking and higher-level reasoning
3. Differentiated views of others
4. Accurate understanding of others' perspectives
5. Liking for classmates and teacher
6. Liking for subject areas
7. Teamwork skills

*[CLReturnstoCollege.pdf]

January 2005

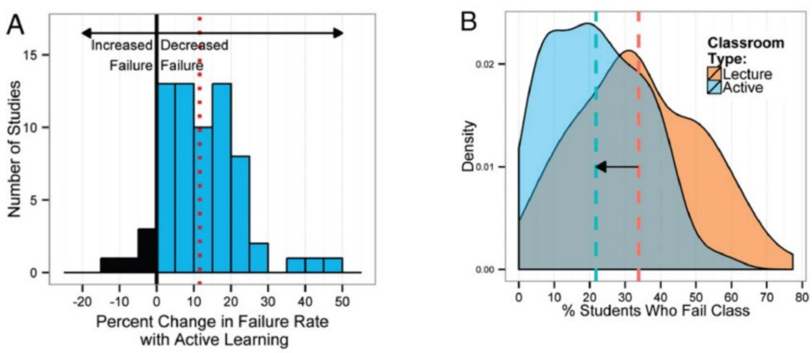


March 2007

25 (3&4) 2014

Engaged Pedagogies = Reduced Failure Rates

Evidence-based research on learning indicates that when students are actively involved in their education they are more successful and less likely to fail. A new PNAS report by Freeman et al., shows a significant decrease of failure rate in active learning classroom compared to traditional lecture



Freeman, Scott; Eddy, Sarah L.; McDonough, Miles; Smith, Michelle K.; Okoroafor, Nnadozie; Jordt, Hannah; Wenderoth, Mary Pat; Active learning increases student performance in science, engineering, and mathematics, 2014, Proc. Natl. Acad. Sci.

Observational study of over 2000 classes – most common behaviors:

- Faculty
  - Lecturing
  - Writing in real time
  - Posing nonrhetorical questions
  - Following-up on questions
  - Answering student questions
  - Clicker questions
- Students
  - Listening to instructor
  - Answering instructor questions
  - Asking questions

http://science.sciencemag.org/content/sci/359/6383/1468.full.pdf

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Pedagogies of Engagement

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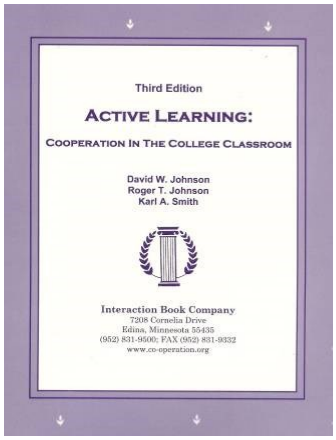
Cooperation in the College Classroom

- **Informal** Cooperative Learning Groups
- **Formal** Cooperative Learning Groups
- Cooperative **Base** Groups

Notes: Cooperative Learning Handout [Smith-CL-College-Notes-817.pdf]



First edition 1991.

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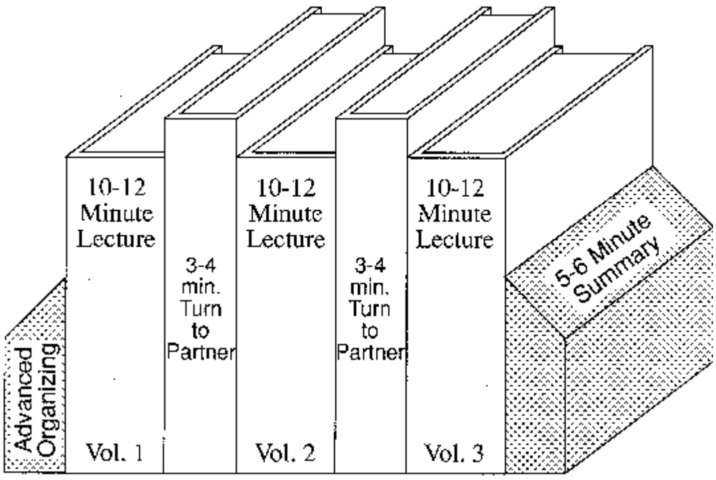
Book Ends on a Class Session



Smith, K.A. 2000. Going deeper: Formal small-group learning in large classes. Energizing large classes: From small groups to learning communities. *New Directions for Teaching and Learning*, 2000, 81, 25-46. [NDTL81Ch3GoingDeeper.pdf]

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Book Ends on a Class Session

1. Advance Organizer
2. Formulate-Share-Listen-Create (Turn-to-partner) — *repeated every 10-12 minutes*
3. Session Summary (Minute Paper)
   1. What was the most useful or meaningful thing you learned during this session?
   2. What question(s) remain uppermost in your mind as we end this session?
   3. What was the "muddiest" point in this session?

1 Advance Organizer

"The most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly."

David Ausubel - Educational psychology: A cognitive approach, 1968.

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2 Formulate-Share-Listen-Create

Informal Cooperative Learning Group
Introductory Pair Discussion of a

FOCUS QUESTION

1. Formulate your response to the question **individually**
2. Share your answer with a partner
3. Listen carefully to your partner's answer
4. Work together to Create a new answer through discussion

95

2 Focus Question Examples

- Give an example
- Describe an application…
- Explain in your own words…
- Paraphrase the idea
- Support the following statement…

96

Activity: Developing a "Book Ends on a Class Session" Plan

Total Activity Time: ~15 minutes

Part 1: Individual Exercise (~5 minutes)

Part 2: Small Group Discussion (~10 minutes)

Part 3: Lightning Talk Report Out (if time)

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Informal Cooperative Learning Planning Form

Description of the Class Session: ____________________

1. **Your Name, Department, and Course Title:** ____________________
2. **Session Topic:** ____________________
3. **Objectives** (Major Understandings Students Need to Have At The End Of The Session):
   a. ____________________
   b. ____________________
4. **List the Enduring or Important to Know Outcome that this activity is targeting.**
   ____
5. **Time Needed:** ____________________
6. **Method for Assigning Students to Pairs Or Triads:** ____________________
7. **Method for Changing Partners Quickly:** ____________________
8. **Materials** (such as slides or handouts listing the questions to be discussed and describing the **formulate, share, listen, create** procedure):
   ____

Advanced Organizer Question(s)

Questions should be aimed at promoting **advance organizing** of what the students know about the topic to be presented and **establishing expectations** as to what the session will address.

1. ____________________
2. ____________________
3. ____________________

1

Cognitive Rehearsal Questions

List the specific questions to be asked every 10 or 15 minutes to ensure that participants understand and process the information being presented. Instruct students to use the **formulate, share, listen, and create** procedure.

1. ____________________
2. ____________________
3. ____________________
4. ____________________

Monitor by systematically observing each pair. Intervene when it is necessary. Collect data for whole class processing. Students' explanations to each other provide a window into their minds that allows you to see what they do and do not understand. Monitoring also provides an opportunity for you to get to know your students better.

Summary Question(s)

Give an ending discussion task and require students to come to consensus, write down the pair or triad's answer(s), sign the paper, and hand it in. Signatures indicate that students agree with the answer, can explain it, and guarantee that their partner(s) can explain it. The questions could (a) ask for a summary, elaboration, or extension of the material presented or (b) precue the next class session.

1. ____________________
2. ____________________

Celebrate Students' Hard Work

Provide a close to the activity by asking students to acknowledge their partner, for example by (1) thanking them or (2) mentioning one thing their partner did that helped them learn.

1. ____________________
2. ____________________

2

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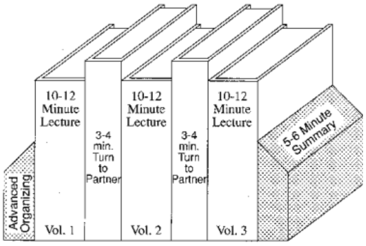
Activity Part I (5 Minutes)
Sketch Plan

1. List Session Topic*
2. Learning Objective (for an Enduring Outcome)*
3. List Activity*
4. **Write 2 – 3 "focus" questions.**



*Use the same information here as you did for the earlier activities.

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Activity Part II (5 Minutes)
Discuss with your Neighbor

Share your plan and focus questions with your neighbor.

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Activity Part III - Lightning Talk Report Out

Share the key takeaways from your small group discussion on your plans. Were there any similarities with plans or questions?

Informal Cooperative Learning Groups

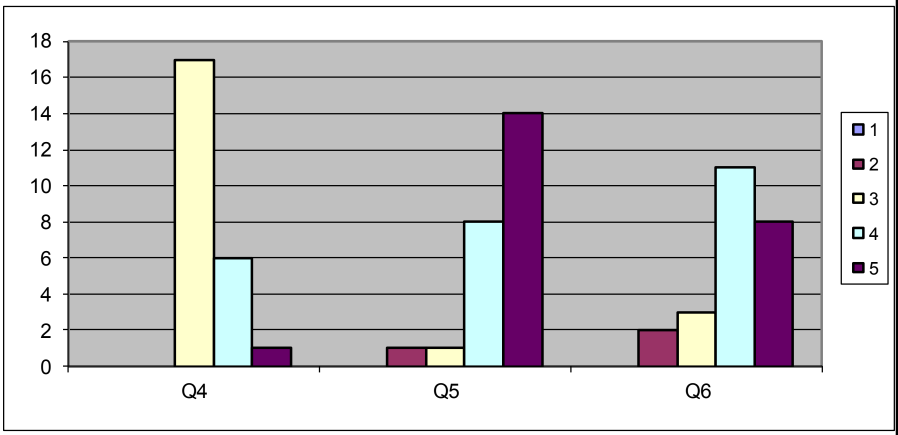
- Can be used at any time
- Can be short term and ad hoc
- May be used to break up a long lecture
- **Provides an opportunity for students to process material they have been listening to (Cognitive Rehearsal)**
- Are especially effective in large lectures and one-time events (e.g., guest presentation)
- Include "book ends" procedure
- Are not as effective as Formal Cooperative Learning or Cooperative Base Groups

Session Summary (Minute Paper)

Reflect on the session

1. Most interesting, valuable, useful thing you learned.
2. Things that helped you learn.
3. Question, comments, suggestions.
4. Pace: Too slow 1 2 3 4 5 Too fast
5. Relevance: Little 1 2 3 4 5 Lots
6. Instructional Format: Ugh 1 2 3 4 5 Ah

SDSM&T – Session 1 (8/22/19)



Q4 – Pace: Too slow 1 . . . . 5 Too fast (3.3)
Q5 – Relevance: Little 1 . . . 5 Lots (4.5)
Q6 – Format: Ugh 1 . . . 5 Ah (4.0)