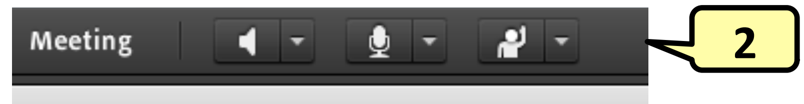
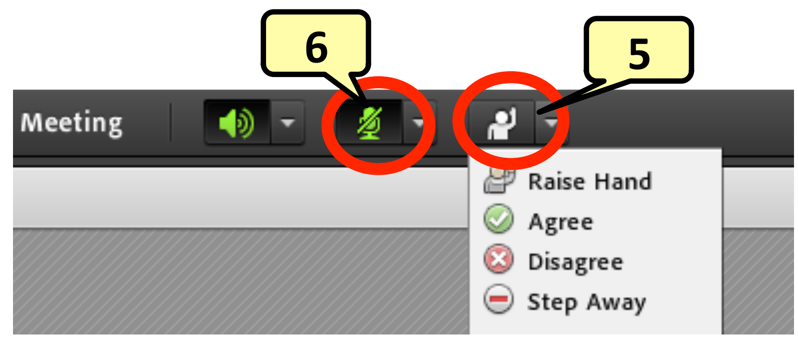
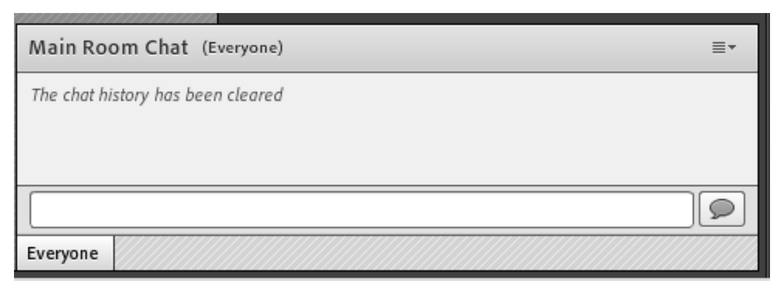
Welcome! As you enter the room, please…

1. Plug in your headset (if available).
2. Familiarize yourself with the **top bar** on the screen
3. Make sure your **speakers and mic are enabled** (the icons on the top bar should be **highlighted in green**).
4. Run the **audio setup wizard** (this option is available from the “Meeting” menu on the left right of the screen).
5. Once you have run the wizard, “**raise your hand**” by clicking on the icon available on the top bar. This will indicate hosts you are ready to test your mic.
6. After testing your mic, **mute yourself** by clicking on the mic icon on the top bar (this will help to avoid background noise).

Note: Feel free to use the chat at any time!







Record the Session

Mechanics VCP Session 2
April 11, 2013

STUDENT MOTIVATION AND LEARNING TAXONOMIES

Agenda:

(i) Objectives for today's session
(ii) Review of your feedback from Session 1
(iii) Structuring learning to mesh with student motivation
(iv) Learning taxonomies
(v) Assignments for Session 3 (18 April 2013)

Session 2 Learning Objectives

Ed

- **At the end of this session, participants will be able to:**
  - ***discuss*** **how expectancy and value contribute to student motivation**
  - ***design*** **a classroom environment that encourages student motivation**
  - ***explain*** **the cognitive and knowledge dimensions of the revised Bloom's taxonomy**
  - ***apply*** **the ideas in the taxonomy to** ***create*** **both learning outcomes and learning activities that target specific locations in the cognitive-knowledge matrix**

TUES Workshops

Brian

- **Individual workshops, which will last for two hours, will focus on:**

*****Developing an understanding of the NSF TUES Program**

*****Incorporating effective strategies into an educational proposal**
*****Defining project goals, expected outcomes, and evaluation questions**
*****Working with an evaluator to develop a project evaluation plan**
*****Addressing NSF's broader impacts expectations in a project**
*****Designing a project for impact and transportability**

- **http://ehrweb01.aaas.org/stem-iwbw/workshops/**

Blog Posts

Brian

- **Holding office hours in different places**
- **Collaborative Learning Techniques**
- **Request for statistics on enrollment, passing, withdrawal, pass with D**
- **Assessment methods- quiz asking them to write a question or two**
- **Creating a positive classroom environment depends some on class size**

Introductions

Brian

C Y Kuo

Arizona State University-
Polytechnic Campus

Ken Manning

SUNY Adirondack

Matthew Jensen

Florida Institute of
Technology

Joan Dannenhoffer

How Learning Works*

Brian

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 student' 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 approaches to learning**

*Ambrose, Bridges, DiPietro, Lovett, and Norman, *How Learning Works* (2010)

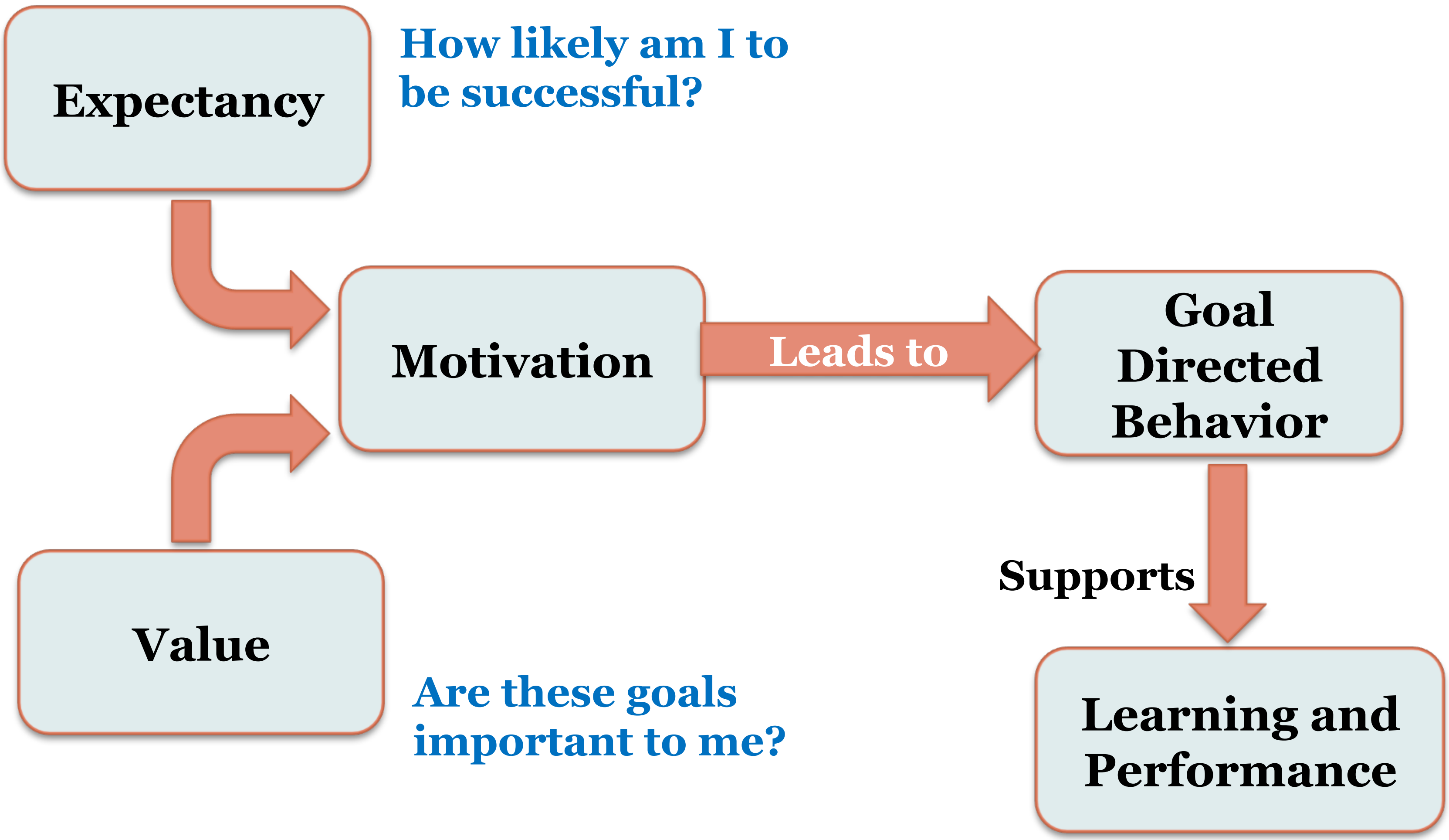
Motivation and Learning

Brian

- **Motivation is described as *a state that energizes, directs and sustains behavior***
- **Personal investment that an individual has in reaching a desired state or outcome**
- **Motivation enhances cognitive processing**
- **Motivation leads to goal-directed behavior**

Value and Expectancy

Brian



From "How Learning Works"

Sample Behaviors

Brian

Mastery Oriented Students
Main interest is in learning the skill/content
Willing to take on difficult tasks beyond present capability
Views mistakes as learning opportunities

Performance Oriented Students
Main interest is in appearing competent or better than others regardless of level achieved
Sticks to tasks that are familiar, known quantities
Views mistakes as evidence of lack of competence and therefore to be avoided

Two types

Performance approach

Performance avoidance

Effects of Environment on Motivation

Brian

Student's Efficacy is	Environment is NOT Supportive		Environment is Supportive	
	DON'T SEE Value	SEE Value	DON'T SEE Value	SEE Value
LOW	Rejecting	Hopeless	Rejecting	Fragile
HIGH	Evading	Defiant	Evading	Motivated

From How Learning Works

Increasing Student Motivation*

Brian

- **Choose knowledge and skills that are worth learning**
  - **Assign authentic, real-world tasks**
- **Provide appropriate level of challenge (Zone of Proximal Development)**
- **Make the classroom a safe place to take the risks involved in learning by the way you treat students' attempts to learn**
- **Encourage the building of a community of learners in your class, where everyone supports others' attempt to learn**
- **Give the learners some choices in what and how they learn**
- **Be a good model of a mastery-oriented learner**
- **Give students an opportunity to reflect**
- **Accept the fact that yours is not the only or even the most important venue in which your students function**

Svinicki, M. D., (2005). *Student goal orientation, motivation, and learning*. (Idea Paper #41). Manhattan, KS, The IDEA Center.

Breakout Rooms

Brian

- **What have you done in your class that you think motivates students?**

- **In breakout rooms, come up with a list of things you do to motivate students**
- **1^{st} person on breakout room list is recorder (take notes on the whiteboard)**
- **4^{th} person on list will report out**

Introductions

Ed

Mazen Tabbara

Lebanese American University

Carisa Ramming

Oklahoma State University

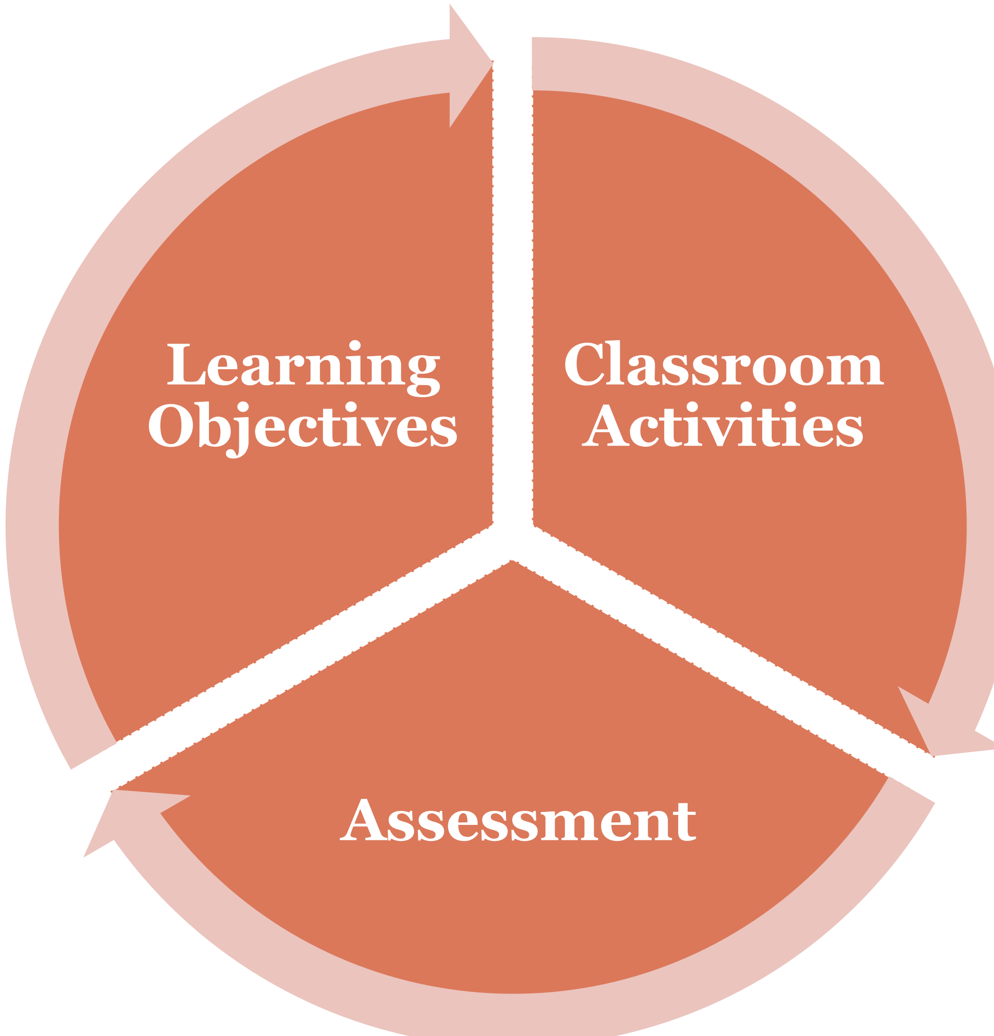
Steve Kirstukas

Central Connecticut State University

Himangshu S. Das

Course Alignment

Ed



Learning Taxonomies

Ed

- It is helpful to consider many of the HLW principles, as a whole, in a unified expression of what we ask students to do and what actions we take to promote learning
- One way to view this set of actions is via a *learning taxonomy*
- The best-known is Bloom's taxonomy (updated in 2001), which we will talk about in depth in Session 2 (April 11)
- For now, simply consider…

Taxonomies

Ed

- **Principle 4: to develop mastery, students must *acquire* component skills, practice *integrating* them, and *know when* to apply what they have learned**
  - **"acquire" component skills**
  - **"integrate" them**
  - **"know" when to apply them**

- **These verbs describe different levels of cognitive engagement, as we will see next time** *http://www.celt.iastate.edu/pdfs-docs/teaching/RevisedBloomsHandout.pdf*

A Model Using (Revised) Bloom

Ed

A Model of Learning Objectives

based on

A Taxonomy for Learning, Teaching, and Assessing:
A Revision of Bloom's Taxonomy of Educational Objectives

Among other modifications, Anderson and Krathwohl's (2001) revision of the original Bloom's taxonomy (Bloom & Krathwohl, 1956) redefines the cognitive domain as the intersection of the Cognitive Process Dimension and the Knowledge Dimension. This document offers a three-dimensional representation of the revised taxonomy of the cognitive domain.

Although the Cognitive Process and Knowledge dimensions are represented as hierarchical steps, the distinctions between categories are not always clear-cut. For example, all procedural knowledge is not necessarily more abstract than all conceptual knowledge; and an objective that involves analyzing or evaluating may require thinking skills that are no less complex than one that involves creating. It is generally understood, nonetheless, that lower order thinking skills are subsumed by, and provide the foundation for higher order thinking skills.

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

The Cognitive Dimension

Ed

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

The Matrix

Ed

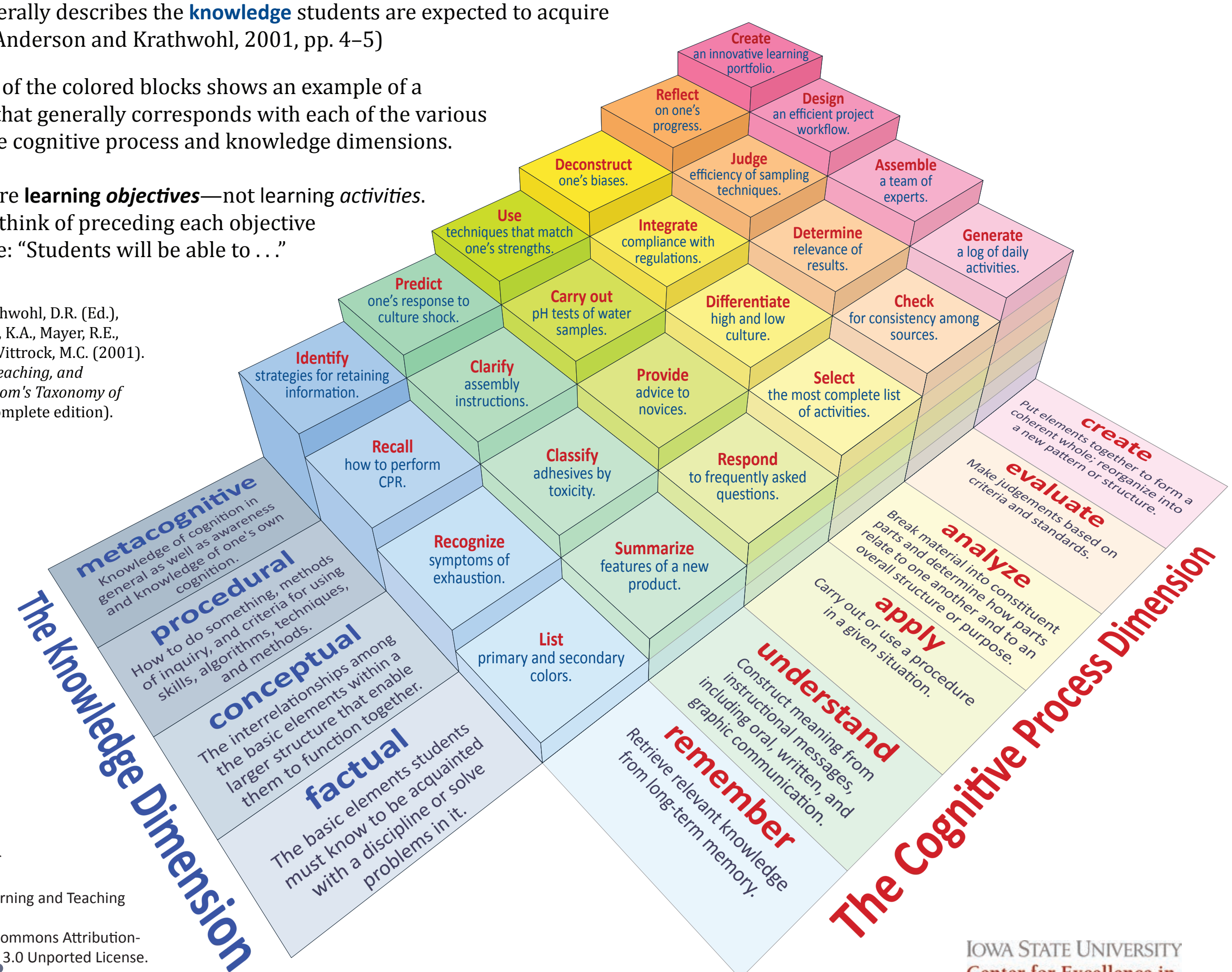
A statement of a **learning objective** contains a **verb** (an action) and an **object** (usually a noun).

- 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

Iowa State University
Center for Excellence in Learning and Teaching

Example Learning Objectives

Ed

Statics
EGR 207
SUNY Adirondack

Student Learning Outcomes

Upon successful completion of this course, student will be able to:

1. illustrate concentrated forces and distributed loads in mechanical systems or structures with vector models in two and three dimensions;
2. determine moments of forces about points and lines or axes in 3-D space;
3. resolve a complex three-dimensional force system into a resultant force and moment;
4. draw a free body diagram showing internal, external, and gravitational forces on a structure or element of a structure;
5. apply the basic equations of statics to determine unknown forces and/or reactions, and/or internal forces and moments in a statically determinate structure, machine, or element in three dimensions;
6. determine the centroid of an arbitrary area, line, or composite area or line through integration or the aid of standard tables for known geometric shapes;
7. determine the second moment of area for an arbitrary area or composite area through integration or the use of standard tables for geometric shapes; and
8. apply the parallel axis theorem to determine the second moment of area for arbitrary and composite areas about a specified axis.

Ken Manning

Another Example

Ed

Rick Hill

1. Employ vectors and calculus to **describe** and **predict** the planar motion of particles and rigid bodies (translation and rotation).

2. **Apply** kinematic principles to **describe** and **predict** the planar motion of a system of connected particles and rigid bodies including pinned, rolling, and sliding connections (translation and rotation).

3. **Produce** free-body diagrams for particles, rigid bodies, and systems of rigid bodies along with their components.

4. **Apply** Newton's laws of motion to **relate** forces obtained from free-body diagrams and accelerations from kinematics to **derive** the equations of motion for particles and rigid bodies in planar motion.

5. **Generate** simplified models and dynamic equations of motion for connected mechanical systems including rigid links, rigid inextensible cords, sliding and rolling contact conditions, springs and masses, and be able to **critique** the limitations and appropriateness of these models.

6. **Apply** work and energy principles to **analyze** and **predict** the motion of particles and rigid bodies in 2-D.

7. **Apply** impulse and momentum principles to **analyze** and **predict** the motion of particles and rigid bodies in 2-D.

8. **Differentiate** between approaches and **explain** why a particular approach (Newton's laws, work-energy, impulse-momentum) was employed in solving a given problem.

9. **Obtain** numerical results for the dynamic equations of motion employing algebraic manipulation, solution of differential equations, or computational

General Discussion of Objectives and Verb Choice

Ed

- **it's hard to assess "understanding", it's much easier to measure performance on specific tasks**
- **you can choose verbs from different areas in the matrix to serve different purposes**
- **verb choice is powerful because it clearly sets expectations for students**
  - **do they need to be able to *recall* something?**
  - ***apply* something?**
  - ***integrate* something with something else?**

Breakout: Apply Bloom to *Activities*

Ed

- **Let's think about how you can use the idea of the cognitive and knowledge dimensions to *create learning activities***
- **Instructions: in your breakout room**
  - **Set the timer for 15 minutes**
  - **Pick a topic from statics or dynamics, then collaboratively create a *progression of learning activities* that start on the lower tiers of the matrix, and end on the higher tiers**
  - **2nd person on the list takes notes**
  - **3rd person on the list reports out to the group**

For Session 3 (April 18, 2013)

Ed

- **Update your user profile (with a picture!)**
- **Review article in Atrium folder**
  - **Bransford, et al., "Creating High Quality Learning Environments" (Session 3 folder)**
- **Connect with our community on the blog**
- **Based upon the Bransford article (especially pp. 184-189):**
  - **Reflect on the reading**
  - **Spend no more than 30 minutes redesigning a specific, important lesson you teach to improve the alignment of assessment, objectives, and strategies**
  - **Upload a document explaining your redesign to the folder:**

    Mechanics VCP Session 3>Redesigns