

# What do you want them to learn today?

## WRITING LEARNING GOALS TO DRIVE INSTRUCTION & ASSESSMENT

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### RESOURCES

1. **Learning goals resource page**, with tipsheets and examples:  
[http://www.cwsei.ubc.ca/resources/learn\\_goals.htm](http://www.cwsei.ubc.ca/resources/learn_goals.htm)
2. **Clicker resource page** with videos, question banks, and more:  
<http://STEMclickers.colorado.edu>
3. **Handouts** will be at [blog.sciencegeekgirl.com](http://blog.sciencegeekgirl.com)



### Suggested Reading:

1. Handelsman, Miller & Pfund, 2007, *Scientific Teaching*. New York: WH Freeman & Co.
2. Smith & Perkins, 2010, At the end of my course students should be able to... *Microbiology Australia*, March. (linked within Learning Goals resource page)
3. Angelo & Cross, 1993, *Learner-Centered Assessment on College Campuses*, Needham Heights, MA: Allyn & Bacon

# EXERCISE #1: The Frustrated Student



I am a sophomore majoring in physics. I was thinking I might go to graduate school to do research and become a professor, or maybe apply for an industrial internship. I usually get As in my courses, only a few B's so far in college. I totally breezed through high school, it was so easy.

This semester, I enrolled in Modern Physics. I approach this class like most others: I attend lecture (have only missed two), read the textbook (usually before class), and turn in the homework if it's going to be graded. Prof. Lopez is great; he's really well organized and follows the book closely. The homework has been helpful for learning the terms and information.

The first midterm exam in this course was NOT what I expected. None of the questions were multiple choice. We had to write out short (and sometimes LONG) answers. I barely finished it in the 2-hour exam period. Plus, three of the questions tested us on things we had never learned and skipped stuff we had covered in class. For example, we learned about delta functions, and it wasn't even on the test. But there was this question asking us which observations from the photoelectric effect are inconsistent with a particle theory of light. How am I supposed to know about that? I got a 55 on that test. What a crock! Forget physics, it's not for me.

Adapted from Handelsman, Miller & Pfund, 2007

# Learning goals

- **Definition**: What students should be able to do after completing a course
- **Requirement**: Must be measurable  
⇒ *assessment and goals tightly linked*
  - ✓ Your goals should reflect what you value in the student learning process
  - ✓ Often, students never know what your goals are!

## **Three levels:**

Course scale (5-10 per course) ⊙ Topic-scale (2-5 per topic) ⊙  
Class-scale (2-3 per class period)

# Examples

## Human Genetics for non-majors

Course-level learning goal	Specific learning goal
<p><b>Content:</b> Demonstrate how meiosis leads to diversity in the next generation</p> <p><b>Skills:</b> Become better problem solvers</p>	<p>Predict the probability of generating sperm and egg cells with specific chromosomal makeup, and explain how these cells are produced</p>

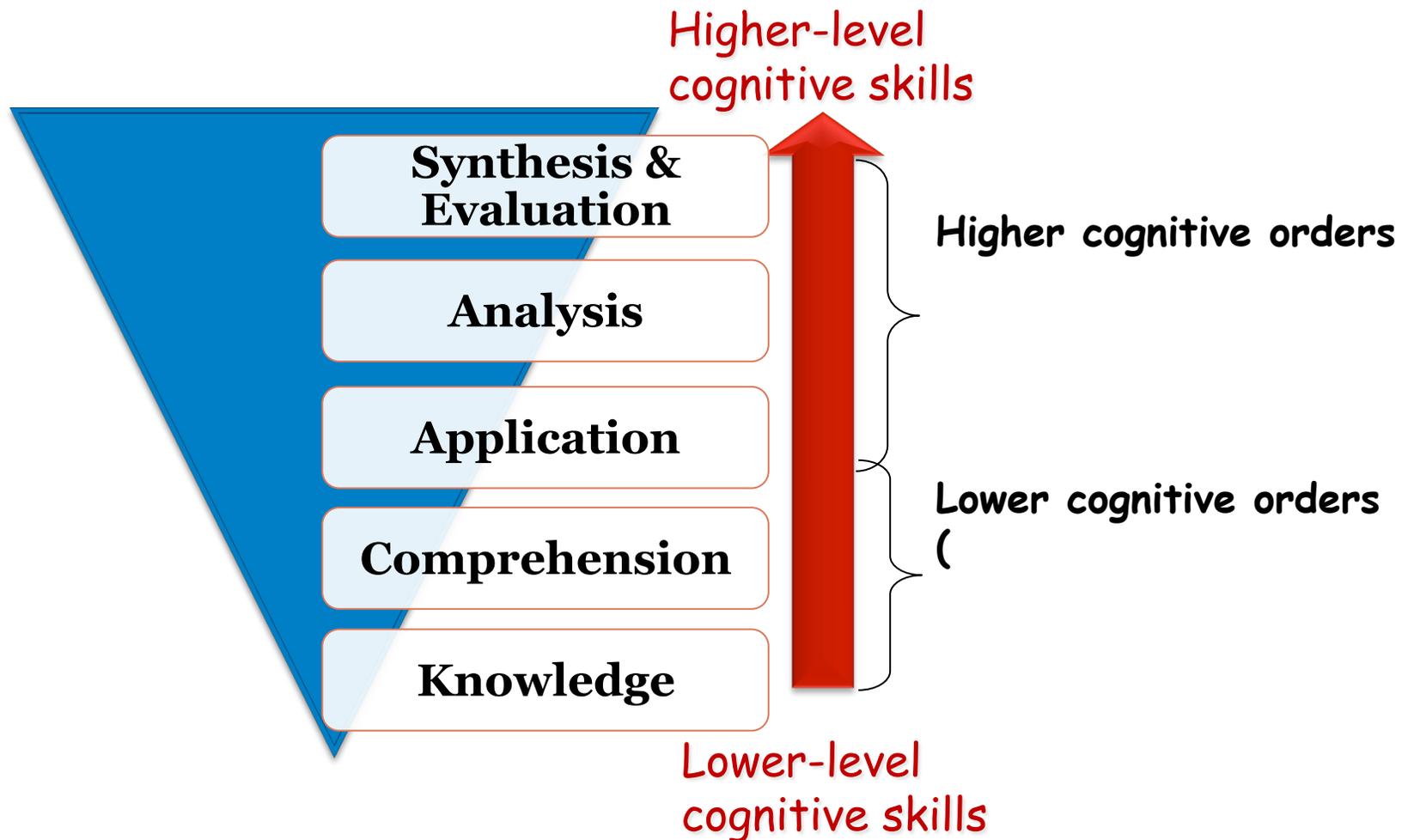
## Intro Astronomy

Course-level learning goal	Class-scale learning goal
<p><b>Content:</b> Explain the role of natural forces in the universe</p> <p><b>Skills:</b> Interpret simulations and data</p>	<p>Analyze the phases of the moon by using computer simulations and constructing a model.</p>

# Levels of knowledge

## Bloom's Taxonomy, 1956

*What level of understanding do you want them to gain?*



# EXERCISE #2: Three Little Pigs



## **Rating the cognitive level of learning goals based on Bloom's Taxonomy**

Below is a summary of The Three Little Pigs. The following is a list of specific learning goals your teacher might present you with. Please give each goal a level from Bloom's Taxonomy.

### **The Three Little Pigs**

A wolf looking for food finds three pigs, each one having their own home made of straw, sticks and finally, bricks. The wolf knocks on each door, threatening to blow their house down. The pigs with the straw and sticks fall victim to the wolf's threat. The homeless pigs take refuge in the third pig's house and the wolf is not able to blow the brick house down. The wolf comes down the chimney, and is caught in a pot of boiling water placed there by the third little pig.

Level	Learning Goal
	<b>Compare and contrast the motivations of the wolf and the pigs.</b>
	<b>Predict which of the three pigs would rate highest on an IQ test (if you had been able to give it at the beginning of the story).</b>
	<b>Describe the main characters in the story, and their roles.</b>
	<b>Imagine what social constraints might be influencing your feelings as you read this story. (Did you feel sorry for the wolf? Why or why not?)</b>
	<b>Justify why the third little pig should not be prosecuted for boiling the wolf.</b>

Summary adapted from <http://answers.yahoo.com/question/index?qid=20110114204002AAWEjAI>

# Types of Knowledge / Learning Goals

## FACTS:

Terminology, information, details

## CONCEPTS

Classifications, categories, principles, models, reasoning.  
Analyze, explain, and predict the world around you

## PROCEDURES:

Skills, techniques, methods, problem-solving  
Thinking like a scientist: Use alternative representations, compare and contrast, strategize, justify, design an experiment, create a graph.

## METACOGNITIVE

Self-awareness about what helps you learn; studying & learning strategies.

## AFFECTIVE (attitudes & beliefs):

Appreciate, enjoy, value. Recognize that the behavior of the world around you is not magical and mysterious, but rather can be understood and predicted using certain fundamental principles.)

# EXERCISE #3: Exam Dissection



<b>Question #</b>	<b>Type of knowledge</b> (facts, concepts, procedures, metacognitive, beliefs)	<b>(Optional) Bloom's Level?</b>

## Bloom's Taxonomy Verbs for Writing Learning Objectives – Page 1

### Lower Order Skills

<b>I. Remember (Knowledge)</b> (shallow processing: drawing out factual answers, testing recall and recognition)	<b>II. Understand (Comprehension)</b> (translating, interpreting and extrapolating)	<b>III. Apply</b> (Knowing when to apply; why to apply; and recognizing patterns of transfer to new situations)
arrange choose describe define find identify label list locate match memorize name order omit recite recognize relate recall reproduce select state	classify describe defend demonstrate distinguish explain express extend give example identify illustrate indicate interrelate interpret infer locate match paraphrase represent restate rewrite select show summarize tell translate	apply calculate classify construct complete choose dramatize employ explain generalize illustrate interpret manipulate organize operate paint practice prepare produce select show sketch solve translate use

## Bloom's Taxonomy Verbs for Writing Learning Objectives – Page 2 Higher Order Skills

<b>IV. Analyze</b> <b>(breaking down into parts, forms)</b>	<b>V. Evaluate</b> <b>(according to some set of criteria, and state why)</b>	<b>VI. Create (Synthesis)</b> <b>(combining elements into a pattern not clearly there before)</b>
analyze appraise calculate categorize classify compare contrast discriminate differentiate distinguish examine experiment identify infer investigate point out question select separate subdivide survey test	appraise argue assess choose compare criticize critique decide debate defend determine discuss estimate evaluate judge justify predict prioritize rate recommend select support value weigh	arrange assemble collect choose combine compose construct create design develop do formulate hypothesize invent make make up originate organize prepare plan produce propose role play tell write

## Check-list for creating **class-scale** learning goals:

- ✓ Is goal expressed in terms of **what the student will achieve** or be able to do?
- ✓ Is the **Bloom's level** of the goal aligned with your actual expectations?
- ✓ Is the goal **well-defined**? Is it clear how you would measure achievement?
- ✓ Do chosen verbs have a **clear** meaning?
- ✓ Is **terminology familiar**/common? If not, is the terminology a goal?
- ✓ Is it **relevant and useful** to students? (e.g. connected to their everyday life OR does it represent a useful application of the ideas).

# What are some assessment methods?

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## **FORMATIVE, IN-CLASS**

- ✓ Concept Tests / Clickers
- ✓ Minute Papers
- ✓ Just in Time Teaching
- ✓ Listening to student discussion in class
- ✓ Weekly / Daily Surveys
- ✓ White-boarding activities
- ✓ In-class work / Tutorials
- ✓ Case studies
- ✓ Ranking / ordering tasks
- ✓ Think-pair-share.
- ✓ Student-designed reading assessments

## **FORMATIVE, OUT OF CLASS**

- ✓ Homework
- ✓ Discussion boards

## **SUMMATIVE EVALUATION**

- ✓ Quizzes
- ✓ Exams
- ✓ Oral presentations
- ✓ Poster symposia

## **SUMMATIVE FEEDBACK**

- ✓ Conceptual surveys
- ✓ Attitude surveys

# Take-home exercise: Alignment



<b>Learning goal</b> (where are you going?) <i>From previous activity</i>	<b>Likely student prior knowledge/ misconceptions</b> (Where are you at?)	<b>Example learning activity = formative assessment</b> (How are you going to get there?)	<b>Summative / formative assessment question</b> (Are we there yet?) <i>From exam or write a new one</i>

# Take-home exercise: Grading



I attended a workshop about assessment, and the main thing I learned is that I'm supposed to assess students before class so I can target what the students need to know. So, I created a series of pre-class quizzes for the students, but most students don't do them because they are not graded. However, I don't have the time to grade 320 of these each week – much less the other 16 assessments the workshop suggested. I'll just go back to trusting my gut to know how well the students are doing.

## Key questions to guide discussion:

- ✓What issues might be contributing to this situation?
- ✓What is this professor's definition of "assessment"?
- ✓Other than grades, what strategies could motivate the students to participate in the assessment?
- ✓What suggestions do you have for the professor?
- ✓Have you faced a similar challenge?

Adapted from Handelsman, Miller & Pfund, 2007

# ACTION PLAN



Which tools, strategies or resources from today's workshop will be most helpful to you in teaching this semester or in the near future?

Think of your last few lectures. What topics have you struggled to teach?

List two colleagues who could help you brainstorm ways to address this struggle using learning goals and assessment tools:

- 1.
- 2.

Next time you teach, try one of the strategies that you and your colleague identify. How will you know if the strategy is successful? What will you observe or measure?