Learning Goals & Objectives for Computational Physics

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Adapted (by Danny) from SEI Learning Goals Workshops at CU Boulder
Adapted (by Larry) for today’s shorter session
Learning goals for this session

You will be able to:

• Appreciate the value of developing learning goals

• Develop and communicate your learning goals clearly for your course as a whole, and for a particular topic

• Recognize the value of aligning assessments with goals

• Begin writing learning goals specific to computation
**Teacher Centered Approach**

- Identify topics to "cover" in the course
- Create the syllabus and lecture slides
- Write exam questions

  - What topics do *I* need to teach my students?
  - When will *I* teach the topics? How will *I* give them the information?
  - How will *I* know that students learned the material *I* covered?

**Learner Centered Approach**

- Identify learning goals/objectives
- Decide on assessments
- Create activities and syllabus

  - How will my *students* be different?
  - What evidence will *students* provide that they have changed?
  - What do *students* need to achieve those goals?
Backward Design

What should students know or be able to do by the end of the course/session?

What evidence will convince you that they got there?

How will you help them get there?
Terminology

• **Learning goal:** Broad description of what students will understand and learn: often COURSE LEVEL (usually 5-10 per course)

• **Learning objective:** specific, action-oriented description of what students will be able to do: often CLASS LEVEL (usually 2-5 per topic)

This is not just a list of the syllabus topics, but statements of what students can do as a result of learning about the topic.
Example of Learning Goal vs. Learning Objective

<table>
<thead>
<tr>
<th>Course learning goals</th>
<th>Topic-level learning objective</th>
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| Students will understand the basic concepts of probability and random variables | Students will be able to:  
  • Explain probability in terms of long-term relative frequencies  
  • Find probabilities of single and complementary events  
  • Calculate the mean and variant of a discrete random variable          |
Do your goals represent “enduring understandings”?

Wiggins and McTighe, 1998
Check-list for refining topic-scale learning objectives:

- Is goal expressed in terms of *what the student will achieve* or be able to do?

- 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 itself a goal?

- Does the goal *align* with course-scale goals?

- Do your goals cover a range of types of knowledge?

- Is it relevant and useful to students?
Communicate your learning goals

Students appreciate knowing the explicit expectations of them.

It helps them focus their effort.
How well did you achieve today’s learning goals?

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INITIAL TRY
MAY NOT PRODUCE
DESIRED OUTCOME
Computation Implementation Space (CIS)

- Using available simulations.
- Producing Pseudocode.
- Modifying working programs.
- Writing code from scratch.
- Modifying minimally working programs.

- with computational instruction happening in the classroom/laboratory or in a flipped classroom model (online videos or tutorials).

Lecture
Homework
Laboratory
Exams
Midterm or Final project
Questions/Comments?

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