OPEN ACCESS Freely available online

CourseSource

Essay

Learning Frameworks Aid Goal-oriented Course Design

Nicola C. Barber

1210 University of Oregon, Eugene, OR 97403-1210

Abstract

As a new instructor it can be hard to know where to begin. Thankfully, *CourseSource's* learning frameworks (https://www.coursesource.org/courses) shaped my approach to teaching as a first year instructor. The frameworks, which include learning goals and objectives written by members of several life science professional societies, are set up to facilitate goal-oriented instructional design. They allowed me to start designing my courses from well-considered learning goals and objectives, rather than a long list of topics or chapters in a book. I also aligned assessments and instructional activities to these goals and objectives that target both content knowledge and skills. This goal-oriented approach gave me confidence as a new instructor, empowered my use of active learning, and provided my students a clear understanding of how to succeed.

Citation: Barber, N.C. 2018. Learning Frameworks Aid Goal-oriented Course Design. *CourseSource.* https://doi.org/10.24918/cs.2018.12

Editor: Michelle Smith, Cornell University

Received: 09/06/2018; **Accepted:** 09/11/2018; **Published:** 09/28/2018

Conflict of Interest and Funding Statement: The author does not have a financial, personal, or professional conflict of interest related to this work.

***Correspondence to:** 1210 University of Oregon, Eugene, OR 97403-1210 USA, Email: nbarber@uoregon.edu

As I prepared my first teaching assignment, I was both grateful and intimidated when I was given a large textbook and years of past syllabi, instructional materials, and slide decks. I had a tremendous amount of content to put into context, for myself and for my students. As researchers we become specialists, but are frequently called upon to teach topics broader than our area of specialization. Aspects of my first course topic, developmental biology, were outside my comfort zone. Designing a course for the first time, I knew I needed to begin with the end in sight. What goals would I help my students achieve? I had gained instructional design experience as a postdoc in science education, but I was hardly prepared for the breakneck pace and pressures of undergraduate teaching. For guidance, I turned to *CourseSource's* developmental biology learning framework (https://www.coursesource.org/courses/developmental-biology). The society-approved learning goals and sample learning objectives shaped my course design and approach to teaching.

It is considered best practice in instructional design to begin by developing learning goals to which all other instructional elements will align (1,2). Learning objectives break learning goals down into measurable outcomes that describe what students can do. For example, one Society for Developmental Biology Learning goal is for students to understand "How do organisms maintain gamete populations?" and the relevant learning objectives include compare and contrast spermatogenesis and oogenesis, and draw and compare the functions of meiosis and mitosis. Assessments are then developed to determine if students have met objectives and provide feedback on progress toward goals. Lastly, instructional strategies and activities are designed to support student learning so that they may demonstrate on assessments that they have met objectives. This so-called "backward" design is really anything but backward. As instructors, we need to know where we are going if we hope to get there. Furthermore, although it can be easy to get caught up in exciting science topics and activities, research has demonstrated that goal-aligned, student-centered instruction maximizes student learning (1,3,4).

Rather than devise all new learning goals for my course, I turned to *CourseSource* and the extensive work of my colleagues. *CourseSource* has partnered with a number of professional societies to create learning frameworks for biology courses in their field (https://www.coursesource.org/courses). For example, members of the Society of Developmental Biology created the developmental biology learning framework (https://www.coursesource.org/courses/developmental-biology). Having these resources vetted by specialists in the field inspired confidence, especially in areas that were outside my specialty.

CourseSource learning frameworks are set up as a table, and beside learning goals and sample learning objectives are aligned, peer-reviewed, evidence-based teaching resources. This organization is particularly helpful for making goal-oriented instructional design decisions, and developing a sense of how experts connect the big ideas in a field. Rather than focus on a list of topics to cover, the developmental biology learning framework allowed me to take a big picture view of what I wanted my students to understand and be able to do.

The developmental biology learning framework gave me a great starting place and kept me goal-oriented, even though I did not use every learning goal and I added and adapted some of the learning objectives. I considered the verbs of the learning objectives to focus instructional decisions on both

competencies and content. If I expected students to be able to compare and contrast phenomena, how would I know they could do it, and how could I give them practice with both the skill and the content? It is easy to slip into the habit of explaining exciting science, instead of building students competencies in a subject area. To demonstrate understanding, my students needed to master both content and associated skills so I made sure I was teaching both.

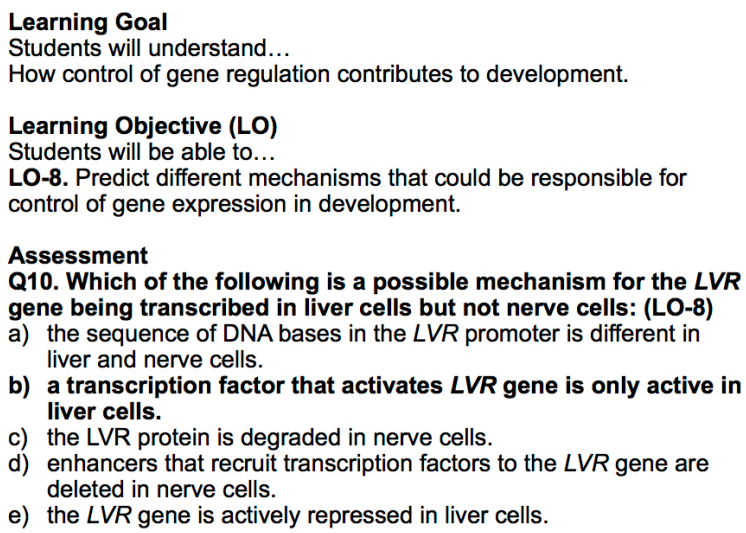
I designed my assessments and learning activities to align to my goals and learning objectives. Although I set out all the learning goals and objectives prior to the start of the quarter, I continued to develop specific assessments and activities as the course unfolded. I made a point to consider assessments before activities, and drew from CourseSource and other available activities where I could. This alignment kept me focused as an instructor, but also allowed me to be transparent with my students about my approach. Many of my students expected a lecture-heavy course and were surprised to be asked to actively participate in class. Explicitly pointing to how both learning activities and assessments aligned with course learning objectives empowered my use of active learning, and helped students understand what we were working toward and how to succeed in the course. For example, midterm exam keys pointed out the learning objectives assessed in each question to help students study for the final (Figure 1).

Anecdotally, students reported this transparency about the course design was helpful. One former student told me later that my course design changed his study habits, and that the learning objectives helped him focus on practicing skills and integrating content. Of course, I faced inevitable unforeseen challenges that first quarter, but I was grateful to have a solid foundation and well-considered goals to orient my efforts.

For new instructors or those looking to make course changes, I recommend looking to the *CourseSource* learning frameworks (https://www.coursesource.org/courses) to facilitate course design and find goal-aligned teaching resources. For seasoned instructors, please consider submitting articles about activities that are aligned to learning goals to fill gaps in the frameworks. Teaching can be labor-intensive and isolated work, but when it comes to instructional design we do not need to start from scratch or do it alone. *CourseSource* is a powerful collaborative platform to build a repository of peer-reviewed educative materials, and promote a student-centered, goal-oriented approach to science education. It is an invaluable resource, and when I started preparing for my next course I knew where to begin.

REFERENCES

1. Handelsman J, Miller S, Pfund C. 2006. Scientific Teaching. New York, NY: W.H. Freeman.
2. Wiggins G, McTighe J. 1998. Understanding by Design. Alexandria, VA: Association for Supervision and Curriculum Development.
3. Simon B, Taylor J. 2009. What is the value of course-specific learning goals? J Coll Sci Teach 39.
4. Smith MK, Perkins KK. 2010. At the end of my course, students should be able to...": the benefits of creating and using effective learning goals. Microbiol Aust 31:35-37.



Learning Goal
Students will understand…
How control of gene regulation contributes to development.

Learning Objective (LO)
Students will be able to…
LO-8. Predict different mechanisms that could be responsible for control of gene expression in development.

Assessment
Q10. Which of the following is a possible mechanism for the *LVR* gene being transcribed in liver cells but not nerve cells: (LO-8)
a) the sequence of DNA bases in the *LVR* promoter is different in liver and nerve cells.
b) a transcription factor that activates *LVR* gene is only active in liver cells.
c) the LVR protein is degraded in nerve cells.
d) enhancers that recruit transcription factors to the *LVR* gene are deleted in nerve cells.
e) the *LVR* gene is actively repressed in liver cells.

Figure 1. An example assessment item from a midterm exam aligns to a learning objective and learning goal. The answer key for the midterm exam indicates the relevant numbered learning objective (LO-8), to guide student studying.