

An Online Introductory Biology Syllabus for Transformative Learning

Mark E. Walvoord, Assistant Director, STLR, University of Central Oklahoma; Instructor, Biology, University of Oklahoma



ABSTRACT:

I sought to apply Transformative Learning theories to rebuild an online, non-majors Biology course. The goals were to modify course learning outcomes, activities, and power dynamics based on the following learning theories: Transformative Experiences (Teaching for Transformative Experiences in Science model), Mezirowian Transformative Learning theory, Fink's Taxonomy of Significant Learning, Brookfield's Critical Reflection theory, and the University of Central Oklahoma's Student Transformative Learning Record (STLR) framework. To begin this course transformation, I modified my existing syllabus, annotating it to describe the theoretical underpinnings and reasons behind the course design, description, and activities. My hope is that this annotated syllabus will engender discussion about applying Transformative Learning frameworks to other courses.

INTRODUCTION:

Transformative Learning (TL) is an adult learning theory that seeks to describe and analyze the perspective-expanding experiences that positively change both individuals and societies. One commonality between the several descriptions of this theory is the importance of learners having memorable experiences, either epochal or incremental ones, on which they can reflect and dialogue (e.g., Brookfield, 2005; Dirkx, Mezirow, & Cranton, 2006; Habermas 1972). Faculty and staff have the important role of being facilitators of this process with our students.

Biology education may be a rich field in which to implement transformative learning pedagogies, leading to more well-rounded, employable, critical thinking, and academically successful students. The biological sciences involve experiential learning (e.g., laboratory courses, field work, independent research projects), hypothesis-testing, critical thinking, controversial topics (e.g., evolution, climate change, endangered species legislation), relevant topics (e.g., cancer, reproduction, hormones), and especially for non-majors, the possibility of addressing their fixed identity mindset as a "non-science people." These can act as disorienting dilemmas on which students can critically reflect and dialogue.

The additions of the following to biology courses may promote TL:

1. The inclusion of big-picture course objectives, along with activities to help achieve these;
2. Built-in opportunities for students to critically reflect on and dialogue about their experiences and potential shifts in their perspectives (e.g., journaling, Scharmann & Butler, 2015). This shift may be evidenced by student's integrating ideas into their "real world" (Pugh, Bergstrom, Heddy, & Krob, 2017; Wong, Pugh, & The Deweyan Ideas Group, 2001); and
3. Assessing student transformative growth, as is done through UCO's Student Transformative Learning Record (2019; Table 1) based on the American Association of Colleges and Universities' VALUE rubrics (<https://www.aacu.org/value>).


This poster proposes a design for a non-majors, online, introductory biology course that integrates transformative learning theory. Walvoord (2018) applied a TL setup to biology laboratory courses broadly, but here I seek to include the Teaching for Transformative Experiences in Science (TTES; Wong, et al., 2001) model, Transformative Experiences (TE; Heddy & Pugh, 2015), Fink's Taxonomy of Learning (Fink, 2013), and Mezirowian TL theory (Mezirow, 2000) across a semester-long course. To describe this setup, I've included an annotated syllabus to point out the places where these theories integrate with the course structure.

Table 1. UCO STLR rubric for assessing student growth in "Health & Wellness"

TRANSFORMATION	INTEGRATION	EXPOSURE
<ul style="list-style-type: none">•The student personifies a holistic view of health and wellness (physical, spiritual, emotional, intellectual, environmental, financial, occupational, and social) and can articulate its meaning to others;•Student demonstrates commitment to care of self and/or others; and/or•The student exhibits behaviors that demonstrate a change in perspective in fostering and sustaining a healthy community and natural environment.	<ul style="list-style-type: none">•The student exhibits an understanding of concepts for health and well-being and has begun to integrate at least one of the eight dimensions of wellness into their overall health and well-being;•Student participates in activities that demonstrate life balance, wellness, and maintenance of a healthy lifestyle; and/or•The student can determine the need for change to improve their own health and wellness and/or the well-being of their community and natural environment.	<ul style="list-style-type: none">•The student has a basic awareness and understanding of at least one of the eight dimensions of wellness (physical, spiritual, emotional, intellectual, environmental, financial, occupational, and social);•Student is aware of the importance of activities that foster health and wellness, but may have minimally incorporated behaviors into personal lifestyle; and/or•Student has had a basic introduction to issues around the community and their natural environment.

ANNOTATED SYLLABUS:

Biology 1003: Contemporary Issues in Biology



Mark Walvoord
walvoord@ou.edu
(405) 974-5589
Office hours by appointment (video conference)

Including the personal dimension (Fink) and personal examples of both "experiential value" and "modelling re-seeing" from the TTES model.

Students start thinking about their own perception (TE), and it explicitly states that we are seeking to transform perspectives (TL) beyond the content.

"Journey with you" implies more student-centered environment, not "the power is at the lectern" setup (Brookfield, 2005).

Outcomes are explicit, so students know what to work towards and what is expected of them, preventing anxiety.

Learning Outcomes 2-5 imply or directly state content applicability to students' outside lives (TE).

Students develop their own learning outcomes (Week 1 activity) to make the course more student-centered and display shared power (Brookfield).

Beyond Disciplinary perspectives are explicitly stated again as goals (TL), and space is left for their own "beyond the classroom" goals to be added (learner-centered environment).

TL explicitly stated, but this time explained, complete with mention of experiences, critical reflection, dialogue, and perspective shift (TL).

I admit it...I love biology. My happy place is standing in a primary rainforest in Washington state or NE Madagascar staring in awe at the biodiversity around me. When I see something biological in nature, I am curious about why it's there, how it reproduces, what its fossil ancestors were like, if it is endangered, what eats it, or how its nervous system works.

As a non-biology-major, you might have a different experience and perception of biology. This course aims to expand and transform your perspectives about biology, and about its applicability to help us understand and solve contemporary issues in society. I'm excited to be on this journey together with you this semester.

Learning Outcomes for this course

At the end of this course, you should be able to:

- Proficiently evaluate the validity of scientific claims
- Ask scientific questions and outline what it would take to answer them
- Find and use resources related to biology
- Understand the biological basis of several contemporary issues (e.g. cancer, climate change, genetically modified organisms, biofuels, antibiotic resistance)
- Clearly communicate biological principles to non-biologists

And, you will have expanded your perspective in one or more of the following areas:

- The value of science in explaining observable phenomena
- Appreciation for and wonder at the biological world
- Your identity as a scientifically-literate citizen
- Confidence to evaluate and help solve societal issues related to biology
- Other perspectives that you identify through ongoing reflection on course activities

We'll accomplish these goals through a transformative learning*, online course** setup.

*What is Transformative Learning (TL)? TL is an adult learning theory that helps explain how we observe and experience phenomena that might not match with our prior assumptions or beliefs. These "disorienting dilemmas" can either be ignored or critically reflected upon through soul-searching, dialogue with peers/instructor, and further observation. The result may be an expansion of our assumptions or perspectives on that topic, perhaps even to the point of a complete (lasting) transformation in worldview, belief, attitude, identity, and/or behavior.

**This is a fully online course, so your comfort with technology is important to your success. Note that *online* does not mean: easier, self-paced, nor individualistic. Learning takes time, so just as with all courses, plan on about 2-3 hours of work per credit hour per week outside of the 3 hours of "class time" (so, ~10 hours/week). Using technology does allow us some extra flexibility in deadlines (you can work up to 2 weeks in advance!), collaboration (discussion board, web conferencing, etc.), and access to online resources.

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Implication that the student will not be able to just "remain anonymous." Even though online, the class will involve lots of interaction.

This textbook was chosen because it applies biology content to real-world issues and topics. This helps the student apply these concepts to their own lives (TE). Topics are introduced with a human connection (e.g., scientist's study area) to give human dimension (Fink); some may cause disorienting dilemmas (TL).

There is some structure, since this is an introductory course, but there is also room for some student choice. That way, the power structure is shared and the content may be more relevant and interesting to them (Brookfield).

Attention-grabbing chapter topics that are issues-based to connect to student's lives (TE).

Final week title is clear that it will be spent reflecting on the semester (TL).

Resources needed for this course

1. Reliable internet connection
2. Up-to-date computer hardware and software to access online tools
 - a. Internet browser (e.g. Chrome, Firefox, Safari)
 - b. Canvas, <http://canvas.ou.edu>
 - c. Zoom web conferencing, <https://zoom.us/j/8991983256>
 - d. eBook and InQuizitive software, <https://digital.wwnorton.com/>, see below
3. *Biology Now with Physiology*, 2nd Ed., W.W. Norton (eBook with InQuizitive access), ISBN: 978-0-393-66401-0

Timeline and Topics:

Schedules for the first and last weeks of the semester are set by the instructor. For the other weeks, we will follow the structure below, with some of the specific chapters and content selected by you, the students in the course.

Introduction

Week 1	Orientation, pre-surveys, goal setting, and the nature of science (Ch 1)	
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Unit 1: Life's Building Blocks

Weeks 2-3	Two to be chosen from the following [Ingredients for Life (Ch 2)] [Engineering Life (Ch 3)] [Cells and Biofuels (Ch 4)] [Plastics Toxic to Cells (Ch 5)]
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Unit 2: Genetics

Weeks 4-6	Three to be chosen from the following [Dog Days of Science (Ch 6)] [Deadly Inheritance (Ch 7)] [Killer Spinach Genes (Ch 8)] [Tobacco's New Leaf (Ch 9)]
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Unit 3: Evolution

Weeks 7-10	Four to be chosen from the following [Whale Fossil Hunting (Ch 10)] [Battling Resistance (Ch 11)] [Adaptations & Species (Ch 12)] [The First Bird (Ch 13)] [Neanderthal Sex (Ch 14)]
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Unit 4: Physiology

Weeks 11-12	Two to be chosen from the following [Baby Bust (Ch 19)] [The Sunshine Vitamin (Ch 20)] [Body Rebuilding (Ch 21)] [Testing the Iceman (Ch 22)] [Amber Waves of Grain (Ch 23)]
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Unit 5: Ecology

Weeks 13-15	Three to be chosen from the following [Amazon on Fire (Ch 15)] [China's One-Child Policy (Ch 16)] [Communities of Wolves & Trees (Ch 17)] [Ecosystems (Ch 18)]
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Reflections

Week 16	Conclusions, post-survey, final projects due
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Each week starts with students doing some critical reflection to explain their initial thoughts (assumptions, perceptions, perspectives) on the topic. This gives a baseline from which to assess growth weekly or over the semester (STLR). These are video posts, to help an online class feel more personal. Points are self-declared to build trust between instructor & students (Brookfield).

These cover multiple levels of Bloom's Taxonomy and offer adaptive learning technology, using game theory.

These assignments help students apply each chapter's content, and begin to see how knowing that content will help them outside of class (TE). E.g., students track macromolecule (food/vitamin) intake and compare to the U.S. Department of Health recommendations; or, they record and analyze data about lizard length (online simulation), helping them understand what scientists do to help with identity formation as a scientifically literate citizen (TL).

These both help the students reflect on their own growth and provide data (quant and qual) about student conceptual understanding AND shifts in perception, identity, application of content, and perspective (TE/TL) to assess beyond-subject growth (STLR).

These bookend the weeks (began with "starting assumptions"), and allow reflection on the week, or connections between weeks TE/TL. These are not collected, allowing students to be more honest and open in their reflection. Participation points are self-declared, building trust between instructor and students.

Collaboration across the semester provides both a disorienting dilemma (compromise, planning, communication) and work-ready skills (TL). The setup allows more connections between content each week, and connection between content and application to larger worldwide issues (TE). Also, students choose the product type, so it is student-centered and a creative opportunity.

An explanation of both the traditional grade assessments and this different kind of assessment of growth are included. This again sets up the expectations that students won't just learn content, but will have expanded perceptions (TE) and perspectives (TL). TL growth will be assessed from evidence displayed in surveys, videos, and discussion board responses, to match to STLR-like rubric for each 4-5 TL tenets listed on page 1.

Types of Assignments:

- **Starting Assumptions** video posts: This assignment is to get you to express some of your opinions or thoughts about each subject before you really dig deeply into it. You will record a 1-minute or longer video to post to our discussion board, answering one or more of the prompts that I provide each week. You will need to respond to the *Starting Assumptions* posts of at least two other students. You'll watch their entire video, then type up substantive responses of 50 or more words each. Points are self-declared. (30 minutes/week)
- **InQuizitive**: Each week you'll be assigned an InQuizitive activity, which is like a quiz about that week's textbook chapter(s). The questions ask you to remember, apply, or analyze information from your textbook (*Biology Now*), chapter-by-chapter. It is an online quizzing system from our textbook publisher, W.W. Norton, but think of it more like a game than a quiz. Questions are engaging, you can work on them until you understand the content (i.e., get 100%), and you can see your performance compared to the rest of the class. This assignment type is auto-graded. (2 hours/week)
- **Time on Task** assignments: These assignments will differ for each chapter, but all of them will have the same purpose: to encourage you to apply your understanding of that week's content. This may be through a creative writing project, making a concept map, critiquing a documentary, or populating an MS Excel sheet with some data that you collected then discuss. Your instructor will manually grade these using a provided rubric. (3 hours/week)
- **Surveys**: Online surveys will consist of pre- and post-concept inventories, pre- and post-surveys of your perspectives on various biology topics, and a course evaluation. These count towards participation points for the course. (~2 hours total)
- **Weekly Journaling**: Your instructor will provide 3-6 reflective prompts for you to consider as you write week-ending journal entries. (30 minutes/week)
- **Collaborative Project**: You will work with two other students to "adopt" a threatened or endangered organism, and put together a "product" that teaches about the biology of this organism (some physiological aspect, adaptations, phylogeny, its place in the ecosystem), hypothesizes selective breeding or genetic engineering projects to help it, and then gives a more realistic plan for its recovery. This project can include flyers, a self-made video, a report, a webpage, and/or other outputs. This is manually graded using a provided rubric and peer input. (~40 hours total)

Measurement of Learning:

Your growth in **understanding of biological content** will be assessed through your:

- weekly assignments: Starting Assumptions videos, InQuizitives, and Time on Task (50%);
- participation in surveys and weekly journaling (15%); and
- collaborative semester project (35%).

I will measure your **expansion of perspectives** (transformative learning growth) through your writing, video posts, analysis of written/video reflections, and comparison of survey data.

Resources:

Beyond the internet, your peers, and my office hours, OU provides some other resources to help you succeed in your studies. Please take advantage of these FREE resources.

- Library: [OU Libraries, libraries.ou.edu/](http://libraries.libraries.ou.edu/)
- Tutoring: [OU Tutoring, uc.ou.edu/action](http://writingcenter.ou.edu/) and [OU Writing Center, writingcenter.ou.edu](http://writingcenter.ou.edu/)
- Technical Assistance: [OU IT Service Desk, http://itsnorman.ou.edu/contact/](http://itsnorman.ou.edu/contact/)
- Improving Study Skills: [OU Student Success, http://studentsuccess.ou.edu/](http://studentsuccess.ou.edu/)

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Page 4 includes university policy statements (accommodation, religious holidays, etc.)

APPLYING TRANSFORMATIVE LEARNING TO YOUR CLASS or LAB:

Using Backwards Design principles

1. Identify beyond-course content skills students should gain in your class/lab. Your institution may already have a set of these.
2. Describe what evidence you could see in a student who had mastered those skills, have intermediate mastery, or a beginning understanding. Put this into a rubric (e.g., in your LMS).
3. Create or modify course/lab activities to meet those goals; perhaps by including surprising or upsetting activities along with chances for critical reflection and dialogue.
4. Explain to students in your syllabus and towards the start of the semester:
 - a) what Transformative Learning is;
 - b) course outcomes;
 - c) what they'll submit for evidence of achieving those outcomes;
 - d) some incentive (e.g., future job skills; highest achieving student will receive a free lunch; etc.)

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