November 2017

Full Issue: Journal on Empowering Teaching Excellence, Volume 1, Issue 2

USU Center for Innovative Design and Instruction
Utah State University

Follow this and additional works at: http://digitalcommons.usu.edu/jete

Part of the Higher Education and Teaching Commons

Recommended Citation
Available at: http://digitalcommons.usu.edu/jete/vol1/iss2/2

This Article is brought to you for free and open access by the Journals at DigitalCommons@USU. It has been accepted for inclusion in Journal on Empowering Teaching Excellence by an authorized administrator of DigitalCommons@USU. For more information, please contact dylan.burns@usu.edu.
The Journal on Empowering Teaching Excellence is a bi-annual publication released in March and October. We accept articles and multimedia submissions from higher education professionals who have practical, experience-based insights to share with their peers. We value material that is up-to-date, proven, and easy to implement in today’s teaching environments.

JETE is a publication from the Center for Innovative Design and Instruction, and Academic and Instructional Services at Utah State University. It is produced in connection with the Empowering Teaching Excellence faculty development program.

To submit, please visit http://digitalcommons.usu.edu/cgi/submit.cgi?context=jete

Copyright © 2017 by Utah State University

Academic and Instructional Services
Utah State University
5105 Old Main Hill
Logan, UT 84322

Editorial Board

Editor-in-Chief

Mike Christiansen, Associate Professor
College of Science, Department of Chemistry and Biochemistry, Utah State University, Logan UT

Associate Editors

Neal Legler, Director
Center for Innovative Design and Instruction, AIS, Utah State University, Logan UT

Travis Thurston, Senior Instructional Designer
Center for Innovative Design and Instruction, AIS, Utah State University, Logan UT

Editorial Board - ETE Faculty Committee and Executive Committee

Erin Anderson, Instructional Designer
Center for Innovative Design and Instruction, AIS, Utah State University, Logan UT

Mark Brunson, Professor
Quinney College of Natural Resources, Environment and Society Department, Utah State University, Logan UT

Roslynn Brain, Professor
Quinney College of Natural Resources, Environment and Society Department, Moab, UT

Rich Etchberger, Vice Provost
Office of the Executive Vice President and Provost, Utah State University, Moab UT

Harrison Kleiner, Senior Lecturer
College of Humanities and Social Sciences, Languages, Philosophy, and Communication Studies Department, Utah State University, Logan UT
Becki Lawver, Assistant Professor
College of Agriculture and Applied Sciences, School of Applied Sciences, Technology and Education, Utah State University, Logan UT

John Louviere, Executive Director
Academic and Instructional Services, Utah State University, Logan UT

Ed Reeve, Interim Vice Provost
Office of the Executive Vice President and Provost, Utah State University, Logan UT

Melissa Scheaffer, Senior Lecturer
College of Engineering, Department of Engineering Education, Utah State University, Logan UT

Robert Wagner, Vice President
Academic and Instructional Services, Utah State University, Logan UT

Brad Watson, Director
Price Campus Academics & Student Success, Utah State University Eastern, Price UT
# Table of Contents

## About This Issue

*Michael Christiansen* .................................................................................................................. 1

## Mnemonic Mechanisms for Making Memories

*Thayne Sweeten* ............................................................................................................................. 4

## Learn, Apply, Share: Combining Student Learning and Community Engagement

*D avid Law, Sheree Meyer, Latrishia Fall, Kim Labrum, and Rachel Arocho* ......................... 11

## Stalled at the Gate: Addressing Student Failure in a “Gateway” Course

*Susan Neel* ........................................................................................................................................ 24

## Apathy and Concern over the Future Habitability of Earth: An Introductory College Assignment of Forecasting CO₂ in the Earth’s Atmosphere

*Benjamin Burger* ............................................................................................................................ 35

## Engagement Across the Miles: Using Videoconferencing with Small Groups in Synchronous Distance Courses

*Amy Piotrowski and Marla Robertson* ............................................................................................ 46

## Promoting Critical Thinking in General Biology Courses: The Case of the White Widow Spider

*Joseph Wilson* ............................................................................................................................... 53

## Reflections on Thirty Years of Teaching for Utah State University Distance Education

*John Barton* ......................................................................................................................................... 62
A Welcome and an Invitation

We enthusiastically welcome you to the second issue of the Journal on Empowering Teaching Excellence: a peer-reviewed, biannual, cross-disciplinary publication that runs in concert with Utah State University’s Empowering Teaching Excellence (ETE) faculty development program.

Despite our journal being helmed by USU, we welcome submissions from any postsecondary institution and discipline. Our objective is to provide a peer-reviewed forum for contributors to publish impactful classroom innovations, where readers can encounter new data, ideas, and methods to facilitate positive and poignant changes to their individual curricula. Above all, we hope to encourage, catalyze, and energize faculty of any experience level to become the best educators they possibly can.

Scope and Theme

Some academic teaching journals focus on large sample size analytics, often drawn from traditional university classrooms with hundreds of student participants. Such approaches are essential for making conclusions with broad statistical significance. However, they may inadvertently ignore advances made in small classrooms, where size limitations sometimes allow for only narrower statistical inferences. This consequently prevents published dissemination of potentially groundbreaking and positive small-class developments.

We accordingly aim for a broader scope in this journal, targeting educational innovations in classrooms of all sizes and in any discipline. Officially, our focus
extends to “higher education professionals who engage in the design and practice of instruction, [which] includes tenure and non-tenure track faculty who teach, instructional designers, graduate teaching assistants, graduate instructors, and others” (USU Academic and Instructional Services, n.d.). This purview extends to student engagement; teaching and learning evaluation; instructional design strategies; content, resources, and tools; and technology review and implementation.

Thus, despite showcasing diverse practices across various disciplines, one unifying thread of this issue is the theme of best teaching practices in small rural classrooms, often with nontraditional students. From Barton’s Reflections paper (2017) to Wilson’s techniques on promoting critical thinking (2017); from Neel’s work on addressing student failure in gateway courses (2017), to Piotrowski and Robinson’s live videoconference-teaching to multiple geographically-dispersed locations (2017); all the articles herein represent innovations to small, rural university classrooms: an area in which USU faculty stand as stalwart pioneers (Christiansen et al., 2017).

We again welcome you to this second issue of the Journal on Empowering Teaching Excellence and anticipate that within its pages, you will encounter a wellspring of ideas, innovations, strategies, and techniques that will hopefully encourage, inspire, and invigorate you to reach even greater heights as a teaching professional.

References


Mnemonic Mechanisms for Making Memories

By Thayne Sweeten, Ph.D.
Utah State University

Abstract

In many classes, students are faced with the daunting task of remembering a lot of terms or structures in a relatively short period of time. Though there is much to memorize, students may not be aware of the many mnemonic mechanisms that can help them make quick and lasting memories. This article describes three such mechanisms: word associations, visual images, and stories. Examples of how these mechanisms can be applied, either individually or in combination, are provided in the context of teaching human anatomy. Whether used by teachers or students, these mechanisms can be incorporated into a class, providing fun and effective ways to both teach and learn.

Introduction

Taking a university course on human anatomy can be like drinking from a fire hydrant. In a few short months, students are expected to regurgitate the names of almost every bone in the body, along with the names of the bumps, cracks, and holes found in these bones. Next, they are expected to learn the names of muscles, along with their various origins, insertions, and actions. They also must remember the names of important nerves and their innervations, along with major blood vessels of the body, including the organs that each vessel serves. The lists of structures and parts to memorize goes on and on, filling nearly 200 pages of lecture notes! For many of us that struggle with memory, drinking from this hydrant is a daunting undertaking, threatening drowning in an overwhelming flow of information.

Many subjects and courses are rich in terms or structures that students must memorize. Although students are given long lists of material to memorize, provided
tools or mechanisms to help remember these new materials are often lacking. The pedagogical approach often consists of the teacher introducing material and expecting the students to take it home to study, presumably to cement into their minds with repetition. Multiple exposures to material is an effective way to learn, but it is not very efficient in memory-laden classes, especially to busy students with multiple demands on their time. Such an approach may soon become tedious, leading to exhaustion and poor academic performance.

Alternative methods are available to assist with memorization. Books have been written on the subject, drawing on an abundance of scientific literature (Klemm, 2012). Many of these mechanisms are based on the concept of linking something that one already knows to new information that one is trying to learn, analogous to using a bridge that has already been built to cross a river instead of making a new one. These techniques incorporate imagination, visualization, and creativity, which in turn, can make learning enjoyable. Do they work? An extensive history of research supports their effectiveness in a wide variety of individuals and conditions (Lewinsohn et al., 1977; Hill et al., 1991; Susana, 2017). My anecdotal experience, along with feedback from many students, is consistent with this research. In fact, these types of mnemonic techniques work so well that they are the primary mechanism used by memory champions at international memory competitions (Zogaj, 2012). The purpose of this article is to increase awareness of these concepts and to provide original examples of some of these techniques for use in instruction.

There are many “memory mechanisms” that have been described (Rupp, 1998; Vaughn, 2007). For the purpose of this paper, I will describe three techniques that can be used individually or in combination: word associations, visual images, and stories. These can serve as teaching and learning tools, not only in an anatomy class, but also in any class that requires some memorization, or even in daily living.

**Word Associations**

Anatomists have developed technical terms for parts and regions of the body. In the case of the armpit, it is formally known as the axilla and is part of the axillary region, the area of the upper chest surrounding the armpit. How can we use what we already know to memorize the new term “axillary region”? Many students have heard of or even used Axe deodorant, so we can build on this and other knowledge about the
armpit, by saying we use axe deodorant in the ill-smelling hairy armpit. Students know about Axe deodorant, they know that the armpit can smell ill, and they know that it is hairy. When we put the underlined terms together we get axillary. This may seem a little complicated at first, but it can be a very fun and effective way to learn.

Another, perhaps simpler, example involves the anatomy of a neuron. A neuron has a single extension that leaves the cell body to send electrical signals to other cells. This structure is called an axon. Bundles of axons make up nerves. Looking at the word axon, what can we take, which we already know from that word, to help us remember its name? How about we use axe again and say that if we put an axe on the axon we could keep a neuron from sending a signal. As a point of emphasis, and to improve retention, we would show a picture of a neuron with its axon and then use an animation of an axe coming down on the axon to cut it (Figure 1).

---

Figure 1: A picture of an axe on a neuron can help students remember the term axon.

**Visual Images**

Visual images connected to word associations can be a powerful way to reinforce memories. This may be due to the fact that visual memories have been shown to be superior to auditory memories (Rigney & Lutz, 1976; Brady et al., 2008). Perhaps this
is intuitive for those of us who remember peoples’ faces much easier than their names. Therefore, an image of an axe chopping an axon, or a stick of Axe deodorant in someone’s ill-smelling armpit, can be used to reinforce word associations or auditory cues. However, not all visual images have the same memory impact. For example, while at an amusement park recently, I saw a young couple walk by with large, purple, spiked Mohawk hairdos. Unlike the other people at the park, these individuals have readily stayed in my memory. Why? Because they were atypical, so they stood out. Images that remain in our minds the best are those that stick out as unique, different, or unusual (McDaniel, 1986). Unique visual images can be useful tools to help remember anatomy. For instance, one part of the body that anatomy students must memorize is the popliteal fossa: the shallow indentation found on the backside of the knee. Using our word association technique, we can dissect popliteal into two words: “pop” and “little,” as little sounds much like “lital,” the last part of popliteal. Now we have two familiar words that can be linked to the new word. To bring this all together in an image, we can show a picture of a person in a difficult yoga pose balancing a pop that is little in the back of her knee (Figure 2).

![Figure 2: A picture of a person in a difficult yoga pose balancing a “pop” that is “little” in the back of her knee to remember popliteal fossa.](image)
Not all words or terms lend themselves well to word associations, and it is best not to “reach” too far in making associations or they can become confusing. However, if even 10% to 20% of terms in a class lend themselves to simple word associations, this can be a useful and enjoyable way to reduce memory burden.

**Incorporation of Story**

Stories, along with either real or imagined visual images, can also be effective tools to help with making memories, especially if there is sequential information to retain. In anatomy classes around the world, one sequence of structures that students cannot avoid learning is the twelve cranial nerves and their functions. Learning these nerves can be a challenging task, but the task is eased with stories. For instance, one of the first things that I do when teaching the cranial nerves is show the students a cartoon. The cartoon is a Looney Tunes clip of Wile E. Coyote and the Road Runner that I remember from Saturday morning cartoons of my youth, and conveniently, it is now available on the internet. In the clip, Wile E. paints a road leading to a painting of a fake tunnel on a rock wall with the hopes of luring the Road Runner to run into the wall. The Road Runner falls for the bait and takes off full speed down the road toward the “tunnel.” Miraculously, when he reaches the painted tunnel, he runs right through it. Wile E. is dismayed and attempts to also give the tunnel a try. He steps back to get a good run at it, his nose out front, and approaches the tunnel with legs spinning. He is not so fortunate. He hits the cliff head-on and falls backward. The Road Runner then dashes back through the tunnel, running over Wile E. and leaving him flat on his back in a daze. The clip ends. At this point, I ask the students what part of Wile E. hit the cliff first. “His nose,” they reply. “What hit next?” I ask. They respond, “His eyes.” I then explain that the last thing that happened to Wile E. was that he was left lying on his back with his eyes spinning in circles. By remembering this clip, students can more easily recall the first three cranial nerves. The first cranial nerve corresponds to the structure that hit first, his nose. It is associated with smell and is called the “olfactory” nerve, enabling us to smell things like an **old factory**. Second, Wile E.’s eyes hit the wall. The second cranial nerve is the optic nerve, used for sight. The third cranial nerve is the oculomotor nerve, which innervates many of the muscles of the eye, “**motoring**” the oculi to spin in circles and focus near-and-far, just like Wile E.’s eyes did after his unfortunate event.
Additional stories can be useful in helping students remember cranial nerve IV and subsequent nerves. Cranial nerve IV is called the trochlear nerve. This nerve helps with moving the eye down and to the side. The story that helps me remember the fourth cranial nerve is the tale of the Three Billy Goats Gruff. In this story, three Billy goats want to cross a bridge spanning a deep gorge, but they are stopped by a troll guarding the bridge. The smallest goat attempts to cross first. After being stopped by the hungry troll, the little goat convinces the troll to spare him and eat his bigger brother who is soon to cross. The troll, who appreciates the concept of super-sizing a meal, agrees with this plan of sibling betrayal and waits for the “Big Mac.” Of course, the same scenario plays out with the Second Billy goat. Eventually, the super hungry troll waits for the approach of the third and largest Billy goat, only to be disappointed by the fact that the oldest goat also has an extra-large set of horns that sends the poor troll falling to his demise. Students have likely heard this classic tale, but they are unaware that there was a fourth Billy Goat. The Fourth Billy Goat appears at the end of the story following the fall of the troll. While crossing the bridge, he looks to the side and down and exclaims, “The troll is clear.” Of course, the fourth goat was using his fourth cranial nerve, the trochlear nerve, to look sideways and down at the fallen troll. We have now learned the name, number, and function of the fourth cranial nerve, all while listening to a fairy tale.

I like to continue this story by asking, “Why did the goats want to get to the other side of the bridge?” Because they wanted to try the gem-like grass. The fifth cranial nerve is called the trigeminal nerve, and it innervates the muscle used for chewing things like grass. Imagine these goats chewing/trying this gem-like grass in a peaceful green field on the other side of the bridge. As they chew the tall grass, it rubs against and tickles their faces. Cranial nerve V also enables sensation of stimuli on the face, allowing one to feel the temperature and touch of cool grass, etc., on the face, like what is happening to these goats as they chew.

The adventures can continue for our goats and for us as we utilize word associations, visual images, and stories to help remember the lists of life. What will happen next is only limited by our imaginations. Perhaps our feeding goats will use their abducens nerves to move their eyes laterally just in time to see the six hungry pirates who want to abduct them. My experience, consistent with Brahler & Walker’s (2008), has shown that these are fun and effective techniques to enhance memory and aid student success, especially in memory-intensive courses where content flows quickly.
References


TED. (2012). Idriz Zogaj: How to become a memory master [Video file], Retrieved from https://www.youtube.com/watch?v=9ebJlcZMx3c


Learn, Apply, Share: Combining Student Learning and Community Engagement

By David Law, Ph.D., Sheree Meyer, Latrisba Fall, Kim Labrum
Utah State University
Rachel Arocho
The Ohio State University

Abstract

This paper describes how an upper division Family Life Education course was redesigned using the personal teaching philosophy of Learn, Apply, Share. This philosophy provides the framework for meaningful learning to occur at three levels. The Learn portion of the philosophy focuses on an experiential learning project, based on andragogy principles, that prepared students enrolled in the course to be family life educators. The Apply portion describes how student research assistants on the project used their experiences to prepare for professional positions in academia or other helping professions. This paper concludes by describing how students and the research assistants Share and evaluate what they have learned by offering a marriage enrichment workshop to couples from the community seeking to improve or strengthen their relationships.

Introduction

I believe the quality of interpersonal family relationships is a strong contributing factor to overall well-being (Jimenez-Iglesias et al., 2015). I was fortunate to grow up in a family where affection and kindness were shown naturally, and I assumed that all families felt safe and worked like mine. When I was twelve years old, I had an experience outside of my own home that exposed me for the first time to an ugly, even abusive, side of family life. I still remember the look of anguish on my friend’s face as he helplessly watched those he loved hurt each other. That moment planted a
In this article, written with my undergraduate (and now also graduate) research assistants, my team and I detail how we have designed and adapted an upper-division undergraduate course in the Human Development and Family Studies Department (formerly called Family, Consumer, and Human Development), HDFS 5540: Family Life Education Methods. The redesigned course has been offered in this format every spring since 2012. The purpose of the course is to prepare students to practice family life education (FLE) skillfully and effectively. I spend the first half of the semester teaching students the basics of FLE – what it is, what it is not, and best practices in offering it. During this time, students design a session for a marital enrichment workshop. In the second half of the semester, students deliver this workshop to community couples under my supervision. The students are given the opportunity to evaluate their effort and learn from this hands-on experience. In addition to serving as the final project of the university course, the workshop is also a research opportunity. Together with my research assistants, we assess the couples’ experiences and outcomes from the workshop through appropriate data collection and analytic methods.

My students and I describe how my teaching philosophy of Learn, Apply, Share has framed how I teach this course and how we have used this experience to create learning opportunities for students enrolled in the course, my research assistants, and couples from the community at large. Students enrolled in the course and my research assistants have used this experience as an opportunity to apply knowledge gained in the classroom to solve real problems (Wurdinger & Carlson, 2009). This type of “outside the classroom” learning is especially important as the public increasingly clamors for graduates of higher education to be competent in their field (Faculty Innovation Center, 2017).
I first describe how I came to consider principles of adult learning in the redesign of this course. Then, we address each portion of my teaching philosophy in turn. To address the Learn portion of my philosophy, we focus on the students enrolled in the course by briefly discussing the students’ rating of their own learning (these results are further discussed in Law and colleagues (n.d.)). To address the second point of my philosophy, Apply, the student coauthors of this paper describe how working with me on this course and workshop has helped prepare them for professional positions in family life education, academia, and other helping professions. Lastly, we address the Share portion of my philosophy by briefly touching on the community couples’ experiences with the workshop; more detail on their outcomes can be found in Arocho and colleagues (n.d.).

A Unique Opportunity

I have been teaching HDFS 5540, Family Life Education Methods, since 2001. Although I consistently received higher-than-average student evaluations, after seven years the course began to feel stagnant to me. This stagnation motivated me to begin a serious inquiry about changes I could make that would result in deeper and more meaningful student learning. As I considered changes to HDFS 5540, I found three resources particularly helpful.

The first resource was How Learning Works: 7 Research-Based Principles for Smart Teaching (Ambrose et al., 2010), which all Utah State University teachers were encouraged to read at the time. In particular, I found principles four and five helpful. Principle four states “To develop mastery, students must acquire component skills, practice integrating them, and know when to apply what they have learned” (p. 5). Principle five is “Goal-directed practice coupled with targeted feedback enhances the quality of students’ learning” (p. 5). After reading How Learning Works, I was convinced that I needed to give my HDFS 5540 students opportunities to practice developing and delivering family life education with plenty of feedback from me. Realizing that my students needed opportunities to practice, I decided to look into experiential learning as my second resource.

Experiential learning has gained popularity in higher education because it gives students authentic opportunities to apply what they are learning. Often this application comes from activities outside the classroom (Wurdinger & Carlson, 2009).
Under the guidance and facilitation of the teacher, experiential learning activities move students from a theoretical understanding to a broader, more applied understanding (Sullivan & Rosin, 2008). Well-designed experiential learning activities task students to solve problems in unfamiliar situations. It is within this process that students learn what they do and do not know, and then how to learn about the things they do not know. It is through this reflective process that students become self-directed learners (Ambrose et. al., 2010).

As I dug deeper into why experiential learning had such widespread support on college campuses, I was exposed to the term andragogy, a more precise word than pedagogy when it comes to considering the needs of adult learners. Pedagogy has its roots in the art and science of teaching children (Pappas, 2013) and continues to be influenced by human development theorists, particularly Jean Piaget's cognitive theory and Lev Vygotsky’s cultural theory (Constructivism, n.d.). Although we often use pedagogy to denote the learning of all ages, andragogy is a better fit for college students, as it focuses on adult learners. Andragogy is most linked to well-known American educator Malcolm Shepherd Knowles, who conceptualized four principles of learning especially pertinent to adults (Kearsley, as cited in Pappas, 2013).

I decided to explicitly address each of Knowles’ four principles throughout the course of the semester. The first principle is that “Adults need to be involved in the planning and evaluation of their instruction” (Kearsley, as cited in Pappas, 2013). Although given an outline for the content of their workshop session, in my redesigned course students have been granted autonomy to structure their session and activities to their unique ideas and strengths (though I give final approval of each session once the students have presented me with their organized and thoughtful manual). The second principle is, “Experience (including mistakes) provides the basis for learning activities” (Kearsley, as cited in Pappas, 2013). Throughout the semester, the students receive feedback in many forms and from multiple sources, including themselves, each other, the participating couples, the research assistants, and me. This feedback is offered in both graded and ungraded evaluations. The third principle, “Adults are most interested in learning subjects that have immediate relevance and impact to their job or personal life” (Kearsley, as cited in Pappas, 2013), is easily addressed by the subject matter of the course. Many of the students can apply the material from the workshop to their own lives as family members, partners, or spouses, as well as to their future careers in helping or service fields. Finally, Knowles’ fourth principle, “Adult learning is problem-centered rather than content-oriented,” (Kearsley, as cited
in Pappas, 2013), is addressed by the overall design of the course. Instead of being given hypothetical cases and clinical explanations, students are tasked with designing and delivering content to real people who want and need this enrichment opportunity.

As my understanding of Ambrose’s seven principles, experiential learning, and andragogy deepened, I developed a vision of how I could use the *Learn* and *Apply* portion of my teaching philosophy to also create a meaningful opportunity to implement the *Share* component. My HDFS 5540 class would be based on effective learning principles for adult learners and framed by my teaching philosophy; the experiential learning opportunity granted to the students would also provide a chance to share relationship enrichment with the community. I began incorporating these resources and principles into my teaching immediately, but it was not until 2012 that I was able to fully implement my vision of what HDFS 5540 could be. That year, we held the first workshop for community couples. Much has changed since then, described in the *Apply* section below, but the basic principles of the workshop have remained true to my core philosophy.

**Learn**

We assessed the students’ perception of their experience and learning from their end-of-semester evaluations between the years 2012 and 2017, which were conducted anonymously online through the overall university evaluation system. Students consistently rated their satisfaction with the course above other courses in the same discipline and across the university. In feedback left in these evaluations, students commented on the value of the course to their future career and mentioned that they were glad for the chance to apply the knowledge they had gained over the years in their degree program to a real experience. For a more in-depth description of what the students did to prepare for the workshop and the collection of data to assess student learning, see Law et al. (n.d.).

**Apply**

Student research assistants (generally HDFS undergraduate majors at the time they began working with me, though a few had graduated from their undergraduate programs) have been involved in the course redesign, workshop design, and research
since 2012. The research assistants’ main focus was designing the workshop to best meet the needs of the participating community couples. I have often asked them to apply what they have learned from their previous coursework to interpret the experiences we have had and make changes as needed to make the workshop as helpful as possible. There have been various adjustments made over the years to each aspect of the workshop and research design, described in turn below. This *Apply* section is written from the research assistants’ perspectives, namely the coauthors of this paper, and describes how they were able to apply their learning to each aspect of the workshop and research design, as well as how working on that particular aspect helped prepare them for later experiences.

**Overall Workshop**

Although the basic principles of the workshop remained the same between 2012 and 2017, we made a number of significant changes to the workshop format to better serve the needs of the couples and help the experience be more effective.

**Timing**

In the first year of the course’s redesign, we held the workshop over two Saturdays one week apart. Couples struggled to return to the second Saturday session, so in the second year, we decided to make it a two-day workshop held over one weekend. However, we realized that offering multiple sessions in the all-day format, whether spread over one weekend or two, seemed to overwhelm the couples. Thus, in 2015 we changed the workshop to 90-minute sessions one night a week for six weeks. This change was fruitful: couples could concentrate on one topic for longer, had time between sessions to process and practice the skills, and in general seemed more willing and excited to attend. In this format, some participants even said they wanted the workshop to be longer – up to six months in some cases!

**Room and enrollment size**

Considering room and enrollment size, we learned that bigger is not always better. For instance, in the three most recent years (2015-2017, which were the most similar in design), the room and group size played a role in the success of the workshop. The 2015 workshop was held in a small classroom with seven couples, and the couples sat at tables arranged in a circle around the room. It felt intimate, and the couples seemed to connect with each other and with the facilitators on a personal level. In contrast,
in 2016 we moved to a larger, state-of-the-art classroom and enrolled ten couples in the workshop. Couples were seated at tables arranged in a large square. This workshop proved to be challenging, and we had a hard time creating the “magic” of the year before and felt that the couples were less connected. This was likely due to both technological difficulties and the sheer number of people involved in every conversation. In 2017, we moved the workshop to the smallest room yet and limited enrollment to seven couples. The couples sat around one table and the setting was more intimate. This was a very successful workshop and, once again, the group atmosphere was energetic and engaging.

**Offering meals**

In the early years of the workshop, funding was limited, and we were only able to offer refreshments (water, soda, and snacks) to the participants. In 2015, we were granted internal funding support, which allowed us to begin serving the couples a catered dinner prior to the workshop each week along with snacks during the session. We believe this meal made the workshop more comfortable and gave the group a warmer atmosphere. A 2015 participant even spoke in a post-workshop video of how the workshop felt like a “date night” and something they could look forward to for fun with their spouse.

**Session content**

As the format has evolved, so has the workshop content and session organization. In the early years, as many as eight sessions were offered (depending on the number of students enrolled in the course), and they were based loosely on the book *The Seven Principles for Making Marriage Work* (Gottman & Silver, 1999). However, we eventually reduced the workshop to six sessions and realized that couples desired more varied topics in the workshop – specifically, some mentioned wanting more discussion of sexual intimacy. Thus, we began including information from the book *His Needs Her Needs: Building an Affair-proof Marriage* (Harley, 2011) in the sessions. Since 2015, we have had a consistent outline of content on which the student facilitators base their sessions, and this format has seemed to be both interesting and useful to the couple participants (see Arocho et al. (n.d.) for specific topics of each session).

Through these changes in the overall workshop format, the student research assistants have been given the opportunity to see the logistics of program planning come to life. These details, such as time of day or choosing to offer refreshments or
full meals, made significant differences in the retention and enjoyment of the participating couples, but decisions were not based on things we had learned from classes or textbooks. Instead, we witnessed participants’ reactions and moods and were given the chance to discuss these details with participants and with each other, leading to the changes documented here. Without these hands-on, behind-the-scenes glimpses into program planning and management, we would not have such knowledge of the minutia of program development. Because of these experiences, we are able to jump into future program development with eyes wide open to how much the little details matter.

**Group Process**

In addition to helping with workshop organization, we have had the opportunity to sit in on the sessions and even occasionally facilitate workshop content. This has given us the opportunity to witness firsthand the power of group process (an important component of family life education when offered in workshop formats like this – see Darling et al., 2014). Being able to see the workshop in progress, and hear from the couples, has given us a learning experience like no other. In the words of a student who worked on the workshop for three years (second author), “Applying the knowledge that we gleaned during the time spent listening to lectures, reading, and discussing family life education is where the real ‘sink into your bones’ learning began.” Despite hearing repeatedly about the importance and nature of group process in previous classwork, clarity came after we had the chance to witness what we had been taught in action by applying it to the couples participating in the workshop. After each session of the workshop, the research team would process how it went. This debriefing became a highlight of each workshop night. It was through these conversations that we learned what content and group process seemed to be well-received by the couple participants and what areas could be improved upon. In these back-and-forth exchanges each member of the research team was invited to fully express their opinions in a non-judgmental environment, which made us feel that we actually had an impact on the workshop experience and outcomes.

**Research Design and Data Quality**

As mentioned previously, this course redesign and the resulting workshop were not only for the students’ benefit, but also for the couples who participated. Thus, we
needed to document couples’ outcomes in a systematic way. The opportunity to
design and participate in the research protocol, from measure selection to data
analyses and beyond, gave us the chance to apply our budding research skills, and it
prepared those of us who have gone on to graduate school for advanced research
training.

**Measures**

We knew from the beginning that we needed to measure changes in participants’
thinking and behavior following the workshop, but our approach had to be refined
over the years. In the first few years, we wrote assessments meant to identify changes
in the specific behaviors and cognitions addressed in the workshop curriculum.
However, we quickly realized that the workshop had the potential to help couples
improve in more than just their recollection of specific principles. Thus, we started
assessing participants on measures that ranged from marital satisfaction to sexual
intimacy. Over the years, as we have learned more about research and measurement,
we have continued to refine assessments by adding or removing questions or whole
measures. In 2015-2017, we narrowed our methods to a specific set of proven
assessments and maintained a consistent research protocol, including three
measurement points (pre-workshop, post-workshop, and six-month post-workshop
follow-up). See Arocho et al. (n.d.) for the list of measures used and the reasoning
behind their inclusion.

**Data collection**

While choosing appropriate and validated measures, we have also had to refine
our method of collecting data from the couples. Early on, we began collecting data
online using *Qualtrics* survey software instead of paper surveys for the main
assessment points (though weekly satisfaction surveys were collected with paper and
pencil at the end of each workshop for ease and speed). Although generally user-
friendly, over the years we have learned to more fully utilize the features of this
software while still making the measures convenient and easy to answer. Because the
assessments are online, we have been able to solicit responses by emailing each
participant individually with a link to the assessments, a method that has been well-
received by participants.
Encouraging responses

In general, we have found personal contact to be the key to encouraging completion in all waves. In addition, we realized in 2015 that we could encourage more timely responses to the post-workshop assessment by allowing participants to complete the assessment on laptops at the workshop site before leaving the final session. However, we noticed a higher incidence of missing data, especially for sensitive questions, in the post-assessment than in other waves. We believed this may have stemmed from both members of the couples sitting next to each other and feeling uncomfortable answering these questions within sight of their spouse. In the following years, we separated the spouses on opposite sides of the tables to allow each member of the couple to have privacy to respond while still collecting these measures in a timely manner. Overall, we have had excellent assessment rates – of the 21 couples to complete the workshop between 2015 and 2017, at least one member of each couple has completed all assessment points (although the 2017 follow-up has yet to be collected), which we attribute to the personalized nature of the experience and the research assistants’ efforts to follow up with participants.

The process of developing the research protocol and managing the resulting data has been especially important to the research assistants who have gone on to attain graduate education. The fourth author of this manuscript, who was in-person during the early years of the workshop and is now involved remotely while pursuing a doctoral degree, credits this experience with giving her firsthand knowledge of the challenges and rewards of collecting prevention and intervention data. “Having the opportunity to design and implement, and to see the results of a workshop and research effort like this, gave me the opportunity to dive head-first into research and determine if I wanted to pursue this type of work.”

Grant Writing, Funding, and Presentations

In addition to workshop facilitation and research design, the research assistants have also been highly involved in successfully securing university funding to pay for workshop materials and food, internships, and research conference travel to present material from this course and workshop at local, state, and national conferences, including the Uintah Basin Research Conference, the Utah State University Fall Undergraduate Research Symposium, the Teaching Family Science Conference, and the meeting of the National Council on Family Relations. The experience writing
grant applications has been important in the students’ training, and in the coming years we plan to apply for external grants to continue growing this project.

**Share**

Finally, I return to my teaching philosophy to highlight the Share function of this workshop. Having lived and served in rural communities for much of my life, I am acutely aware that couples living in rural areas are often underserved in their relationship needs and marriage enrichment education. This is in large part due to rural communities often having fewer resources for mental health services or therapy, let alone educational and enrichment activities, as compared to larger urban areas (Openshaw et al., 2012). I realized that this class could serve dual purposes: benefit the students through experiential learning, but also provide a much-needed workshop to the rural communities in which the students were already living.

Although the students enrolled in HDFS 5540 class were registered at campuses and learning centers around the state, the workshop was offered via interactive videoconferencing to couples residing in one rural community (we experimented with offering the workshop to multiple sites in the first year, but decided it was important to group process for the couples to be together in-person, even if the student facilitators were scattered throughout the state). The couples were recruited from the community with flyers, radio ads, social media, and word of mouth. Couples completed pre-workshop, post-workshop, and six-month follow-up assessments, so we could better understand their experiences with the workshop.

In the 2015-2017 years (the most consistently measured), couples reported small but significant improvements in satisfaction (2015 only), communication patterns, commitment, and emotional intimacy (changes in sexual satisfaction were positive, but not significant). Although these changes were not maintained statistically to the six-month follow-up assessment, effect sizes suggested that couples still showed slight improvement in these areas. For more detail on the procedures, statistical methods, and results ascertained from the couples, please see Arocho et al. (n.d). Overall, we believe that this experience was successful in reaching an underserved population, thus addressing the Share piece of my teaching philosophy by giving the students the opportunity to reach the local community with useful and meaningful information.
Conclusion

As I reflect back on the past six years of this redesigned course, I feel satisfied that I am being true to my teaching philosophy of Learn, Apply, Share. Using well-researched principles on adult learning, I believe I am providing a rich environment for learning to take place with the students who enroll in the class, the research assistants, and community members. While I am pleased with the learning that has occurred with my students enrolled in the course and the community couples subscribing to the marriage workshop, my research assistants’ learning brings me the most professional satisfaction. Over the years, we have spent countless hours constructing this experience to make it the most helpful to students and community members. As evidenced by these research assistants being coauthors of this paper and continuing to work with me as their paths have taken them to further education and professional careers, they have moved in my mind from student mentees to valued colleagues.

Overall, this course and the associated workshop have given me the opportunity to apply my teaching philosophy in a meaningful way while also allowing me to be true to my mission to help students and the community develop healthy, satisfying family relationships.

References


Stalled at the Gate: Addressing Student Failure in a “Gateway” Course

By Susan Rhoads Neel, Ph.D.
Utah State University

Abstract

This article is a case study of how student data can guide instructors in course redesign. A significant percentage of students enrolled in an American Civilization course did not successfully complete the course. An examination of ACT scores, GPAs, grades in math and English composition, reading tests, and assignment completion rates indicated that two key obstacles to student success were a lack of student engagement and a disparity between student reading capabilities and the required instructional materials. Following a change in the topical focus of the course, the addition of active-learning projects, and supplemental aids to the textbook, course completion increased.

Several years ago, as I looked out across the classroom of students taking their seats for the first day of HIST 1700, I noticed some familiar faces. They’d been here before. Having failed the course previously, they were back for another crack at earning the credits needed to graduate or transfer. American Civilization (HIST 1700) fulfilled humanities requirements for the associate’s degree at the College of Eastern Utah, where I taught at the time.¹ But, more critically, HIST 1700 was one of only two courses regularly taught at the college that provided students with state-mandated American Institutions credits. Like math and English composition, HIST 1700 is a “gateway” course, and that is why nearly all students seeking a degree at CEU landed

¹ Utah State University merged with the College of Eastern Utah in July 2010 to form Utah State University Eastern, which is now part of USU’s regional campus system.
in my classroom. Every semester, many students successfully completed the course. But quite a few failed or withdrew. Twenty-six percent of the students who enrolled in the course ended up “stalled at the gate,” forced to repeat the class, or try their luck in another AMI course. This essay describes my effort to diagnose why so many students were not succeeding in HIST 1700 and to devise ways of getting more of them through the gateway.

Higher education is increasingly data-driven. Institutions now collect and use vast amounts of data about student characteristics and behavior to manage recruiting and enrollment, schedule facilities and human resources, organize degree and course offerings, and track student completion. Until recently, such data have been utilized largely to guide institutional or program-level decisions. For example, the Center for Community College Student Engagement’s massive data sets, drawn from tens of thousands of students across the country, have been used by a number of institutions to implement a variety of student engagement and retention programs, including accelerated and self-paced developmental courses, first-year experiences and learning communities, and structured academic pathways. Utilizing student data at the classroom level to design and teach individual courses is not yet a common practice, although that is beginning to change (Stewart, 2017), with projects such as the Civitas Explore platform and Instructure’s Student Insight Engine, both of which are now being piloted at USU. In trying to understand the failure-to-complete problem in HIST 1700, I had access to very limited data. But the data I did have was central to gaining insight into student performance and to imagining new pedagogical strategies for success.

Failure-to-complete rates in “gateway” courses are a serious concern in open-enrollment institutions like the former College of Eastern Utah, where many students arrive with low college readiness skills. In 2010, 22% of all grades at CEU were D or F grades. At Utah State University, only 12% of grades in undergraduate courses fell in this range. Remediation, as most higher education scholars agree, can be problematic. It is expensive for institutions to provide college preparatory courses, which are also costly for students, who find themselves forced to spend time and money on classes that do not produce credits toward graduation. The problem was

\[\text{2 USU Eastern remains an open-enrollment institution offering mostly associate’s degrees and technical certificates, although upper division coursework is available through the USU regional campus system.}\]
particularly pronounced at CEU because high D-F rates in courses such as MATH 1030 (42%), ENGL 1010 (22%), and HIST 1700 (26%) contrasted sharply with exceedingly high grades in almost all other courses. In 17% of the courses offered at CEU from 2008-2010, all students received a grade of an A; in 42% of the courses, more than half of the final grades were As. The impact of this grade disparity between required “gateway” courses and other classes on student expectations and satisfaction is unknown; but at an institution facing a dramatic decline in enrollment (as CEU was in 2010) a serious look at grade distribution and failure-to-complete rates seemed warranted.

It was in this context that I set out to determine why so many students were not succeeding in HIST 1700. At my request, the CEU administration provided data on the 495 students who had taken the sections of 1700 I taught between 2008 and 2010. The provided data included overall GPAs for each student at the time they took HIST 1700, their ACT scores (when available), and their grades in ENGL 1010 and whichever math course they had taken. From my own course grade books, I compiled assignment completion rates and assessment scores for all students as they progressed through the 16-week course. In addition to examining these data, I conducted CLOZE reading tests in the spring 2010 sections of the course (82 students took the test) and ran a Flesch-Kincaid analysis on 148 student essays.

Although I had no data on the age, race, class, or ethnicity of the students enrolled in HIST 1700, casual observation suggested that they were representative of CEU’s student body, which was (and is still today) overwhelmingly white and young. In 2010, 82% of CEUs students enrolled at the Price campus were white. Unlike many open-enrollment community colleges, CEU enrolled mostly traditional-age students, with 75% being under the age of 25 and a significant number (through Utah’s concurrent

---

3 By contrast, in only 1% of the undergraduate courses offered at USU were all grades “A.”

4 As an open-enrollment institution, CEU did not at that time require students to submit ACT scores so not all students enrolled in HIST 1700 had taken the exam. Today all students in Utah are required to take either the ACT or SAT.

5 The CEU campus in Blanding served a majority Native American population (57%), but those students took HIST 1700 offered by faculty on that campus.
enrollment program) being under the age of 18. By contrast, 17% of CEU’s students were over the age of 30, which meant that each section of HIST 1700 had a few nontraditional students intermixed with a large group of very young students. Thirty-five percent of the students at CEU had Pell Grants, suggesting that a significant number of students in HIST 1700 came from economically distressed homes. Fifty-two percent of the students in HIST 1700 were women, a reflection of the fact that CEU was one of only two USHE institutions that enrolled more women than men.

The students enrolled in HIST 1700 had basic college skill levels consistent with expectations at an open-enrollment community college. The average ACT composite score for students at CEU in 2009 was 20, and this was true for the students in HIST 1700. The average reading score was 21. The ACT’s 2009 College Readiness Benchmark score for predicting a 75% chance of earning a grade of C or higher in college social science courses was 21 on the reading test. Sixty-three percent of the students enrolled in HIST 1700 met or exceeded this benchmark. This would suggest a reasonable expectation that a significant number of students enrolled in HIST 1700 should have been able to pass, and indeed they did. But success in the course did not clearly correlate with ACT scores. Students who received an A in the course all had ACT scores at or above the readiness benchmark of 21. But some students whose ACT scores met the benchmark failed the class, and others who did not meet the benchmark received B and C grades. Although ACT scores were not predictive of individual student success, I found it valuable to know that the students in my course generally had modest college-level skills—particularly in reading—and that a significant number (36%) scored well below what the ACT identified as college ready, having reading scores that ranged from 12 to 19.

This fact was supported by the CLOZE tests I administered to 82 students during the spring of 2010. The results of these tests indicated that students in HIST 1700 had an average eighth-grade reading level, with a number of them ranking at the sixth-grade level, and none scoring above the 12th grade level. On the Flesch-Kincaid scale, the written work submitted by students was also, on average, at the eighth-grade level.

---

6 Because Price’s only high school is located one block from the CEU campus, most concurrent enrollment students attended the same classes as regular enrollment college students. Twenty-one percent of students at CEU in 2010 were concurrent enrollment.

7 System-wide, USHE institutions serve equal numbers of men and women; only CEU and Snow College enrolled more women in 2010 (59% and 54%, respectively).
Only one essay reached the 12th grade level, while 18 were written at or below the sixth-grade level. The textbook used in the course was written at the 12th grade level on the Flesch-Kincaid scale, which is standard for commercial, college-level history textbooks. These results helped explain the anecdotal evidence I had from conversations with students and course evaluations that many students were struggling with the textbook. My experience through nearly 20 years of teaching the U. S. history survey is that students rarely “like” a textbook. Clearly, the problem in HIST 1700 went beyond the usual student displeasure with assigned reading.

A disconnect between the textbook and student skill levels may have been one factor in the high failure rate in the course. But data on overall GPAs for the students in HIST 1700 and on their success rates in other “gateway” courses suggested that I needed to take a deeper look. The average college GPA for students at the time they took HIST 1700 was 2.68. A breakdown of GPAs clearly correlated with success in the course—those students who received an A in the course had, on average, much higher GPAs (3.5) than those who failed (average GPA of 1.7). Of the students who received failing grades in HIST 1700, 13% also failed ENGL 1010, and 29% failed MATH 1030 or MATH 1050. All of this seemed to indicate there was a cohort of poorly performing students, whose failure extended beyond the specific conditions or content of HIST 1700.

Did these failing students have any identifiable characteristics or behaviors that might help explain their failure to thrive? The data available to me limited any conclusions about class, age, or race beyond the broad ones mentioned above, but my course grade books revealed two important characteristics. First, a majority (55%) of the students who failed HIST 1700 were men. Conversely, women accounted for 60% of the A grades in the course. This seems consistent with recent scholarship on the declining success of men in college (Levin, 2006; Lopez & Gonzalez-Barrera; 2015; Nolan, 2015; Voyer, 2014).

The second distinguishing characteristic of those who failed HIST 1700 was the lack of what I call “work discipline.” Students who failed did so because they simply did not complete the required coursework. Students were required to complete a variety of tasks in the course, including a group project with a classroom presentation,

---

8 It should be noted that not all students had completed a math or English course by the time they took HIST 1700.
short weekly research and writing projects, exams, and a final essay paper. There was a total of 22 graded activities divided across four course units. Students earning an A in the course consistently completed 98%-100% of the graded tasks during each unit. Students earning an F completed, on average, fewer than half of the graded tasks, with the completion rate declining during each unit. Failing students completed 73% of the tasks during the first unit, but only 42% during the final unit. No student who completed all 22 tasks failed the course. Among the students who failed the course, the average grade for the work they did submit was a D+ (D- on exams and C on assignments). If these students had completed a greater percentage of the course requirements, many would have been able to pass.

On the basis of the analysis described above, I began to consider what possible changes to the course’s content, structure, and pedagogy might help improve student success. Two issues in particular seemed most amenable to remediation: the lack of student engagement and the disparity between reading skill and the level of instructional materials. To address the issue of instructional materials, I decided to supplement the textbook with a set of additional tools designed to assist students in accessing and digesting the material. I rejected the idea of adopting a textbook written at a lower reading level because those texts, designed for the middle-school market, did not have content suitable for a college-level course. I prepared a series of illustrated study guides for each chapter of the textbook that included a graphical outline of the content and highlighted key vocabulary, names, and events.

One advantage of these study guides was that individual students could utilize them according to their own needs. Some students might rely on the study guides heavily, while others might not need them at all. Separately, some students might find the guides most helpful early in the semester, but as the semester progressed, might develop the ability to read chapters without as much support from the guides. All study guides were posted on a course website so students could access them at any time. I took the further step of editing the publisher-provided test bank to rephrase

---

9 I surveyed 15 history textbooks published for the college and high school markets; all had text written at the 12th grade reading level. Only books intended for the middle-school market had lower reading level texts.

10 I maintained independent websites for all courses, rather than using CEU’s Learning Management System (LMS), which was limited in its capacity at that time. With USU’s adoption of Canvas, I now employ that platform for all course materials.
question language and vocabulary to a reading level that seemed more accessible. I did the same for all of my lectures and course instructional materials, giving particular attention to providing more time in my classroom presentations to define vocabulary, as well as to explain the meanings of words and concepts that I now realized were not as commonly understood as I had once assumed.

Finally, I added a simple statement in my course introduction explaining that students should expect to encounter new words and concepts over the semester. I told students that the textbook is a tough read, but that there are tools to help. I also encouraged them that persistence and patience will pay off. In Student Engagement Techniques, Elizabeth Barkley (2009) notes that student failure is most acute when there is a disconnect between expectations and skill levels. By adjusting expectations to a realistic level, along with reassurances that help is available at any time they feel the need for it, I believe students of reading level are better prepared to use the textbook.

Addressing the issue of student engagement proved more difficult than adopting strategies to help students bridge the gap between reading capacities and instructional materials. The failure of so many students to do the work required in the course seemed likely due, in part, to factors beyond the content and organization of this specific class. Educational scholars and boots-on-the-ground instructors are all too aware that a myriad of circumstances, from personal psychology to socio-cultural conditions, influence the performance of college students. As instructors, we all appreciate the need to address individual student problems humanely and realistically. But a 26% failure-to-complete rate struck me as requiring more than the usual complement of flexible due dates, make-up assignments, and extra credit projects. Were there any changes to the course content and instructional approaches that could help improve student engagement?

A detailed discussion of the various pedagogical changes I considered are beyond the scope of this brief essay, but the two principal ones that I adopted were a switch in the thematic focus of the course and replacing the weekly and groups assignments with three active-learning projects. For most general education courses, there is ongoing discussion within professional disciplines about how best to teach basic surveys. This is true in history. Some historians prefer a broad chronological overview, providing a brief look at the main events in the long expanse of U. S. history. In recent years, many historians have adopted a thematic approach, choosing to focus on specific issues, such as social history. This choice is for topical depth,
rather than comprehensive chronological coverage. I decided to reorganize HIST 1700 from a chronological approach to a topical one, focusing the entire course on the changing concept of freedom through four key episodes from the eighteenth through twentieth centuries. A strong theme that is as relevant today as in the past, coupled with an in-depth look at several of the most dramatic eras in American history, seemed more likely to capture the attention of students than 16 weeks of “this happened, and then this happened.” This choice is, frankly, a trade-off—much that is important in U. S. history goes unmentioned in the course, but the hope is that what is covered is compelling and will better sustain student interest.

The second pedagogical change I made was to introduce two role-playing activities and a multimedia research and essay project. In one assignment, for example, students were tasked to be either a Northerner or Southerner during the Civil War and to compose a series of imaginary letters describing their experiences. In another, students took a virtual tour of New York City during the Gilded Age and wrote an essay describing what immigrants might have seen when they arrived in the city. These assignments replaced the short weekly essays and group projects previously required, thus significantly reducing the number of graded assignments. These three assignments were organized around separate websites, which provide students all the needed information, documents, and instructions. The websites were designed to be visually stimulating and to allow students to interact with materials according to their own schedules. These assignments were made available to students at the beginning of the semester. Although there were specified due dates for each assignment, students had many weeks in which to prepare and complete the projects.

As I began to implement these changes, an even larger transformation took place. In July of 2010, Utah State University took over the College of Eastern Utah. The institution, renamed Utah State University Eastern, continued to operate as an open-enrollment institution, primarily offering associates degrees and technical certificates, but integrating its curriculum with USU’s main and regional campus system. USU Eastern no longer offered HIST 1700, replacing it with USU 1300. As the sole instructor for USU 1300 at USU Eastern, I taught the course exactly like the former HIST 1700, using the same curriculum and textbook, but with the changes in assignments and study guides I devised following the analysis described above. In the

---

11 The four episodes are the American Revolution, the Civil War, the industrial revolution, and the civil rights movement.
years since the merger, 351 students have taken my sections of USU 1300. It is possible, therefore, to make some assessment of the impact my analysis and reorganization has had.

The data show a very different grade curve from the previous, pre-merger record.

The biggest change has been a shift of the curve from C to B. The percentage of students receiving an A in the course has remained the same (13.3% and 13.6%). Significantly, the percentage of students failing the course has declined from 23% to 16%; the decline in D grades has been more modest, from 10% to 8%. This is heartening, but it is worth noting that failure is still directly related to a lack of engagement: as before, no student who completed all the requirements failed the course. My changes seem to have been most helpful in slightly improving the grade of C students. This improvement is largely the result of scores on the active-learning assignments. Exam grades have not significantly improved (the average remains a C, increasing from 72% to 76%), despite the addition of the textbook study guides.

The shift in the grade curve for HIST 1700/USU 1300 needs to be placed in the context of a development that had nothing to do with the changes to the course that I implemented. In the years since Utah State assumed control of the old College of Eastern Utah, enrollments have continued to decline. As a reflection of this decline in the USU Eastern student population, enrollment in my sections of USU 1300 has also dropped. Prior to the merger, enrollment in HIST 1700 averaged 99 students per semester. Post-merger enrollment in USU 1300 has averaged only 41 USU Eastern students per semester. However, since the merger, the course has been open to students throughout the USU system via IVC, and these non-USU Eastern students now account for 18% of the course enrollment. I do not have access to the same kind of data that I did for the pre-merger students, but USHE data for the general USU population suggests that these students are likely to have higher ACT scores. At this time, there appears to be no significant difference in the performance of the two student populations in USU 1300, but the sample size is too small to draw any significant conclusions.

As of this writing, the USU history department has decided to reinstate HIST 1700. Beginning with fall semester 2017, USU 1300 will no longer be offered at USU

---

12 USU Eastern enrollment in Fall 2010 was 2,634; enrollment Spring 2017 was 1,593.
Eastern. My HIST 1700 course format will remain much the same: a thematic approach, four-unit structure with assessment based on active-learning projects, final essay, and four exams. One significant change will be the introduction of a new format for the textbook. Although the course will use the same textbook as in the past, it will now be available to students in digital format through Canvas. Inclusive Access, as this format is termed, makes the textbook available as individual chapters (the instructor can select which chapters to provide in whatever order) from the first day of the semester. Students pay for access to the textbook as a course fee at the time of registration (the fee is returned if a student drops the course by the university’s established class drop schedule). The cost to students is significantly lower than a print version. Coupling access to the textbook with registration ensures that all students have the textbook from the beginning of the semester. In addition, Inclusive Access comes with a publisher-provided online self-quizzing tool called InQuisitive and online chapter guides. These tools, which are much more sophisticated and interactive, will replace the ones I designed.

With all the required course materials, including the textbook and active-learning assignments, now available through Canvas, I will have access to a wider range of data on student engagement in the course. I am now also using a cloud-based polling app (REEF from iClicker) that should provide additional data on student attendance and participation. Although I can offer no clear or conclusive data to demonstrate that the changes I implemented resulted in improved student success, I am convinced that the exercise has been worthwhile. Utilizing data to diagnose specific problems in student performance has greatly enhanced my understanding of the challenges I face as an instructor, and I believe I am better equipped to meet those challenges. As I continue to tinker with the course over the coming semesters, I look forward to applying new sources of data to enhance my teaching.

References


Stewart, Courtney (2017) Learning Analytics: Shifting from theory to practice. *Journal on Empowering Teaching Excellence, 1*(1). doi:10.15142/T3G63W Available at: https://digitalcommons.usu.edu/jete/vol1/iss1/1

Apathy and Concern over the Future Habitability of Earth: An Introductory College Assignment of Forecasting CO₂ in the Earth’s Atmosphere

By Benjamin Burger, Ph.D.
Utah State University

Abstract

Non-science, first year regional undergraduate students from rural Utah communities participated in an online introductory geology course and were asked to forecast the rise of CO₂ in the Earth’s atmosphere. The majority of students predicted catastrophic rise to 5,000-ppm sometime over the next 3,100 years, resulting in an atmosphere nearly uninhabitable to human life. However, the level of concern the students exhibited in their answers was not directly proportional with their timing in their forecasted rise of CO₂. This study showcases the importance of presenting students with actual data and using data to develop student forecasted models. It also illustrates the challenge in environmental science with the cognitive issue of temporal discounting, in which the consequences of these future predictions tend to be viewed apathetically due to the long durations in which they play out.

Introduction

On April 14th, 1970 at 3:07 Coordinated Universal Time and 200,000 miles from Earth, three men wedged in the outbound Apollo 13 spacecraft heard an explosion (NASA, 2009). A moment later astronaut Jack Swigert transmitted a message to Earth, “Houston, we’ve had a problem here.” One of the oxygen tanks onboard the
Service Module had exploded, which also ripped a hole in a second oxygen tank and cut power to the spacecraft. Realizing the seriousness of the situation, the crew quickly scrambled into the Lunar Module. The spacecraft was too far from Earth to turn around; instead, the crew would have to navigate the spacecraft around the far side of the moon and swing it back to Earth, if they hoped to return alive. The Lunar Module now served as a life raft strapped to a sinking ship (the Service Module). The improvised life raft was not designed to hold a crew of three people for the four-day journey home. Oxygen was conserved by powering down the spacecraft. Water was conserved by shutting off the cooling system, and drinking became rationed to just a few ounces a day. There remained an additional worry: the buildup of CO₂ in the space capsule.

At high concentrations, CO₂ (carbon dioxide) causes asphyxia, in which the blood cannot be replenished with fresh oxygen. In the Earth’s atmosphere, there is a balance of 20.9% oxygen, 79% nitrogen, and a tiny fraction of carbon dioxide, usually measured in parts-per-million. With each outbreath, the crew expelled air with about 5% carbon dioxide. This carbon dioxide would accumulate in the lunar module over the four-day journey and result in death by hypercarbia: the buildup of carbon dioxide in the blood. The crew had to determine how long the air would remain breathable in the capsule.

Although the biosphere is much more complex than a sealed space capsule, the Earth finds itself in a similar predicament to that of the Apollo 13 crew. Its resources are stretched to provide food, water, and air to over 7 billion people. In similar fashion as the air in the Apollo 13 space-capsule, the Earth’s entire atmosphere is also changing with a dramatic rise in levels of carbon dioxide, which have been building up in the Earth’s atmosphere during the last century, along with a rapidly growing population (Newell and Marcus, 1987). The amount of carbon dioxide in the atmosphere today (408 ppm) is by far the highest it has been in over 800,000 years (Lüthi et al. 2008) and has not reached this high of a level since 4.5 million years ago (Pagani et al. 2010). How long will the air remain breathable?
Methods

The students in my introductory science class at Utah State University were asked the same question that faced the crew of the Apollo 13, but applied to the entire Earth. How long will Earth’s atmosphere remain breathable, given the recent historical increases in carbon dioxide?

The students face this challenging question after completing a three-chapter module on the Earth’s atmosphere, as part of an online introductory physical science course at Utah State University Uintah Basin Campus. The course is an Earth Systems class for non-science majors, utilizing Skinner & Murck’s 2011 textbook, entitled “The Blue Planet: An Introduction to Earth System Science” 3rd edition. The students taking the class are non-science majors, with a range of degree programs with education and business dominate fields of study.

The students are directed to the Earth System Research Laboratory, Global Monitoring Division website (ESRL, 2017) run by the National Oceanic & Atmospheric Administration, which currently maintains the long-term carbon dioxide monitoring station on top of Mauna Loa in Hawaii.

The students are asked to use the available data to make a prediction of when (years after present) the values of carbon dioxide will reach 5,000 parts per million (ppm). The 5,000-ppm amount was chosen because it is the amount that the Occupational Health Guideline for Carbon Dioxide (1978) lists as requiring workplace ventilation. Although fifty times this amount is fatal to humans (Gill et al. 2002) within a few seconds, a value of 5,000 ppm at the Mauna Loa observatory would indicate that values elsewhere on the planet would be significantly higher, and such high values would be detrimental to long-term human health on the planet\(^\text{13}\). Other than the data, students are not given any step-wise procedures, and it is up to them to devise a forecast and defend their own procedures for their answer. The

\(^{13}\) Current understanding of historical levels of carbon dioxide in the atmosphere, using the Ginkgo stomata on fossil leaves proxy method, indicate previous ranges in Earth’s last 100-million-year history from 176 to 2,285 ppm (Barclay & Wing, 2016). While this method is less sensitive to detecting values above 800 ppm, a value of 5,000 ppm would be unprecedented over the last 100 million years and would lead not only to catastrophic climate change, but mass extinction.
project is developed within the framework of constructivism theory in education, in which learning is the active creation of knowledge from personal experiences. There is a significant body of research about the merits of constructivism theory, and in particular, problem-based learning (Hoover, 1996; Mayer, 1996). Inquiry-based learning has become widely accepted in the teaching of science (Rakow, 1986). One of the biggest criticisms of constructivism theory is whether questions or problems given are defined well enough for the student to actually answer (Land, 2000). This project does not have a definitive answer, but facilitates back-and-forth discussion of the assignment, and the students at this point should have the prior knowledge to present a reasonable forecast.

At this juncture in the semester, students have already been introduced to some of the basic principles of climate and weather. However, the project does not directly address climate change. While climate change can be discussed in the students’ forecasted answer, it is the change in Earth’s atmospheric composition that is of concern in this assignment. Climate change is covered in the class, but focused on after this assignment and after the students have mastered an understanding of the composition of the Earth’s atmosphere.

Student answers over the five semesters I’ve introduced this assignment have some bearing on the challenges facing today’s environmental education. In particular, how does apathy and concern play against better knowledge of the available data? Additionally, how concerned or apathetic are students who forecast a sooner, rather than later, date in the assignment? When first introduced, I predicted that student responses would reflect their forecasted date, such that students who predicted earlier dates would be the most concerned about rising CO₂.

Students were also asked a series of follow-up essay questions:

1. What assumptions did you have to make to come up with this estimate?
2. How confident are you in your answer?
3. What tools or thought processes did you use to come up with your answer?
4. Did this knowledge increase or decrease your concern about increasing levels of CO₂ in the atmosphere?
Results

Responses from 130 students forecasted different rates of increasing CO$_2$ concentration in the atmosphere from five semesters taught between 2014-2017. Figure 1 shows the histogram of responses. Only 10 percent of the students (n=13) forecasted that levels of CO$_2$ would either never reach that level, or reach it after 10,000 years. However, the majority of students (90%) forecasted a 5,000-ppm level within the next 10,000 years, and 84% forecasted a 5,000-ppm level within the next 3,100 years. Hence 90% (117/130) of students predicted catastrophic levels of CO$_2$ in the future.$^{14}$

![Figure 1: Graph of student responses from 130 introductory geology students enrolled in the class from 2014 to 2017.](image)

Answers from two of the essay questions on student confidence, as well as increased or decreased concern based on new knowledge, were quantified by the instructor using a five-point Likert scale for the final three semesters, based on

$^{14}$ If interested there are a number of published carbon dioxide models that give differing predictions of forecasted CO$_2$ levels. Using the more linear Chambers (2017) equation yields an answer of 550 years in the future that CO$_2$ levels with reach the 5,000-ppm mark, while the exponential equations of Bourne (2009) equation yield an answer of 166 years in the future. My own forecast suggests between 413 (which assumes 1 ppm rate increase every 25 years) to 1,531 years (assuming rates remain held at 3 ppm per year). These predictions are within the ranges of those given by students at Utah State University.
student essays (n=90). The levels of concern that students expressed in these essays were scored based on their essay answer as: 1) not concerned; 2) somewhat concerned; 3) concerned; 4) concerned and we should take action; 5) gravely concerned and/or frightened by numbers. These scores were open-coded based on the student’s response, rather than directly scored by the student.

Regression plots show no strong correlation between students’ forecasted rise in CO₂ in the atmosphere and their own confidence or concern about rising CO₂ in the future (Fig. 2, top). In other words, the level of the students’ concern or apathy in their own calculations of rising CO₂ in the atmosphere does not correspond greatly to their own forecasts. Students who predicted a slow rise of CO₂ in the atmosphere were equally concerned as those who predicted an extremely fast rise of CO₂ in the atmosphere. There is a slight shift in the mean value of the predictions, as a function of this scale, if students with predictions longer than 10,000 years are removed. With this change, those who showed the greatest concern manifest slightly shorter predictions than those with the least concern (Fig. 2, bottom).

Figure 2: Graph of 90 student essay responses scored to a 1-5 Likert scale, with 5 high and 1 low, showing the level of student confidence in their prediction, as well as the level of the student's concern resulting from their prediction. Black lines indicate the mean student prediction in each category (calculated after removing student answers longer than 10,000 years in the future).
Discussion of Student Forecasts of Rising CO₂

Overall, most of the students (90% or 117/130 students) predicted catastrophic levels of CO₂ in the future within the next 10,000 years. Students were not given any analytical procedures to solve this problem and were required to devise their own procedures to justify their answers. Overall, student forecasts can be grouped into three major approaches. The first is a simple linear extrapolation, often done by drawing a line on a graph or using a given rate for the most recent year, or average rate over the last decade. The second is more complex and uses an exponential curve to either plot data on a spreadsheet or calculate a formula from the different rates as they increase each year. The third involves a more conceptual approach, including in calculations like societal changes in the near future, the availability of fossil fuel resources, and possible government regulations on CO₂ emissions. Most students answer this question through a simple linear approach, which tends to result in a slower rate of increase when compared to exponential forecasts. The physicist educator Albert Bartlett spent his career documenting the well-known educational phenomenon in which students have difficulty understanding exponential growth in forecasting the future (Bartlett, 1978). This seems to have played out in our exercise, with most forecasts tending to be linear.

While not necessarily comparable, surveys on climate change indicate that rural communities in Utah tend to feel less concern than other regions of the country. For example, independent surveys by Howe et al. (2015) and Marlon et al. (2016) found that only 67% of rural Utah respondents indicated that CO₂ should be regulated as a pollutant, compared to a national average of 74% (Howe et al. 2015; Marlon et al. 2016). Differences between students in this class and general survey results are likely related to several factors. One of them is that students were shown actual data and asked to formulate a model to predict changes over time, whereas general surveys just asked a single question without introducing or showing data to support or refute the claim. Studies where survey participants are introduced to the scientific consensus on atmospheric change show an increased acceptance compared to those that are not (Van der Linden et al. 2017). The results demonstrate that when students are given data and are required to use it to extrapolate or forecast, they tend to come to a consensus that CO₂ levels in the atmosphere are rising at alarming levels. Helping students to critically analyze such data and draw rational conclusions from them are an important part of environmental education.
Discussion of Student Concern or Apathy

Results from this study demonstrate that even when students forecasted a very quick rise in CO₂ levels, they were not necessarily correspondently alarmed or worried about this rise. In reading through the student essays, common themes for this disconnection become apparent.

First, a segment of the apathetic students voiced some relief that their forecasted answer would not happen within their own lifespan. Indeed, the threshold of this apathy is around the length of a single human life of 75 years. Once students calculated that this threshold would not occur in their own lifetimes, they tended to be more apathetic in interpreting their results. This is likely related to a well-known phenomenon in human cognition called temporal discounting (Hershfield, 2011). It is one of the reasons people have trouble planning for retirement. This phenomenon is a result of how the human brain views future events and disproportionately worries about more immediate or current crises. It is closely related to how delayed monetary rewards are devalued from immediate awards (Green et al. 1997). The greater an event’s distance in the future, the more disconnected from it people tend to feel. If this extends beyond their own lifespans, they are much more disengaged. A much smaller segment of the apathetic students voiced a religious belief that the human species would be saved through a miracle or divine intervention, and an equally similar segment voiced that science and new technology would reduce CO₂, thereby giving humanity time to devise a solution.

It is important to note that 79% of the students had some level of concern about the rise of CO₂, and that these more apathetic students represent a minority. However, only 6% of students were gravely or highly concerned about rising CO₂, even after completing the assignment.

One possible way to prevent temporal discounting in environmental studies would be with a follow-up assignment in which students imagine what the world would look like when CO₂ levels reach these high levels in the atmosphere. Some research, such as that by Hershfield (2011), has shown that by viewing aged augmented self-portraits, subjects tended to have less temporal discounting when it comes to saving for retirement in old age. A follow-up assignment, in which students plan out what the world would look like and how human lives would be impacted (such as respiration required for traveling outdoors and CO₂ scrubbers in most
homes) could serve as an interesting future study to see what impact it might have on attitudes regarding rising CO₂ concentrations in the atmosphere.

**Conclusion**

Challenges abound on how to deal with the changing atmosphere, energy resources, population growth, and ensuring that the earth remains a habitable place for humans far into the future.

With the aid of mission control, the crew of Apollo 13 solved the problem of the rising CO₂ in the air of the Lunar Module as it returned to Earth. Using plastic bags, cardboard, and tape, the crew managed to attach lithium hydroxide canisters from the Service Module inside the Lunar Module. These lithium hydroxide canisters scrubbed the rising CO₂ in the air in the spacecraft enough to get them home to Earth safely.

As it voyages through space, Earth has a grave problem, similar to that of the damaged Apollo 13 space capsule. Rising CO₂ in the atmosphere will present a clear danger to future generations. If we are to survive as a species, we will need to find a solution in the decades to come. As educators, we also need to teach rising generations of students the importance of understanding the available data and using them to forecast the future. We must also be aware of the temporal discounting in monitoring the low level of concern among the general public.

**References**


Engagement Across the Miles: Using Videoconferencing with Small Groups in Synchronous Distance Courses

By Amy Piotrowski, Ph.D. and Marla Robertson, Ph.D.
Utah State University

Abstract

This article presents suggestions for conducting small-group work in synchronous distance courses taught using Interactive Videoconferencing (IVC) systems. One challenge of teaching over an IVC system is getting students involved in class activities. The authors share how they have used a videoconferencing tool to break up IVC classes into small groups for discussion activities and get peer feedback on written work. These activities engage students in applying what they are learning and in constructing knowledge through discussion with their peers.

Introduction

Classroom dialogue is a powerful component of effective pedagogy (Howe & Abeden, 2013), especially as a way to encourage active student engagement and higher-order learning (Pahmer, Groschner, & Seidel, 2015). As university professors tasked with teaching our content through synchronous distance courses over Interactive Video Conferencing (IVC) systems, finding ways to incorporate effective classroom dialogue has been challenging. We know from previous research that dialogue that allows students to communicate through multiple modes, media and genre (listening, speaking, reading, writing, viewing, representing) is a critical piece of learning (Ritchart, Church, & Morrison, 2011; Tharp & Gallimore, 1988; Vygotsky,
Therefore, providing opportunities for all student voices to be heard and valued, particularly students who may be attending class alone in a remote location, is an important part of our work (Freire, 2000; Vygotsky, 1978).

Challenges of Engagement in IVC Courses

Previous research shows that teaching over an IVC system presents challenges for instructors as they seek to engage students in class activities. Fitzgibbon (2003) found that some students “took advantage” of not being in the same place as the instructor to behave inappropriately and off-task (p. 31). Stone and Saulino (1997) concluded that the less the professor lectured and the more students shared their thoughts, the higher students rated the course. Sweeten (2016) presented students’ self-reported beliefs that they are more likely to ask questions and feel they learn more in face-to-face classes over IVC classes. These prior studies suggest that the need to find ways to get students connected and actively participating with their peers in learning activities becomes even more important when students and instructor are not together in the same location.

We believe an important part of effective teaching is building a classroom community of practice (Lave & Wenger, 1991; Wenger, 1998). Building classroom community is challenging, even in face-to-face environments. This can be especially difficult in an IVC environment where we teach students attending from up to nine different sites at a time. However, one way to build classroom community is to incorporate effective classroom discourse practices that integrate facilitation by the instructor and listening and engaging in discussions by the students (Lloyd, Kolodziej, & Brashears, 2016).

Using Small-Group Videoconferencing in IVC Courses

We use Cisco Meeting Application, or CMA, a videoconferencing tool embedded in our university’s Learning Management System, Canvas. (This tool was known as Acano before Fall 2017.) Before the semester begins, we ask our IVC system administrator to set up the CMA groups. We typically ask for enough groups
so that each group is limited to three or four individuals. Once the groups are set up, we get a link for each group. We can then set up a page in Canvas with links, so all a student has to do to join the CMA discussion is to click on the link associated with their group. The instructor can easily join in each group’s discussion by using the links. This allows the instructor to go from group to group monitoring discussion, just as an instructor could walk around a face-to-face classroom to check in with each group as they meet. Students in each CMA group also have the ability to take turns leading the discussion and to share screens with the group. Many other videoconferencing tools have features similar to CMA, so we anticipate our tips will be broadly applicable to educators using any variety of similar applications in their classrooms.

Tips for Engaging Students in Small Groups via Videoconferencing

We have used CMA groups in a variety of ways in our classes. One approach is to have students discuss assigned readings for the course as a way to engage everyone in the conversation. Thus, students know that they will be accountable for their assigned readings and will get more opportunities to speak than in a large whole-class discussion. Research shows that using reading, writing, and discussion in collaborative student groups aids learners in understanding the material and improves student achievement (Johnson, Johnson, & Holubec, 1994; Marzano, Pickering, & Pollock, 2001). Here are some tips for conducting discussions of reading assignments:

1. Have students prepare for discussion by writing something to bring with them to class. We have our students write a Reading Response before class meetings. These Reading Responses include listing 8 to 10 important points from the reading, a comment on why what they learned from the reading is important, how they might apply what they read, and two questions they have after reading. During small-group discussions, students share their questions with the rest of the group, which allows student inquiry to drive the discussion. We typically give groups 15 minutes to meet.

2. Check in with each group. Students like getting to talk to their instructor in a smaller setting. They can share what the group is discussing and ask the instructor questions.
3. Once small-group discussions have finished, have each group share an important point from their discussion with the rest of the class. We have each group pick a spokesperson who will speak for the group during this whole-class discussion.

A variation of this type of discussion is for students to post a reading response on a discussion board prior to class with questions to ask the class. CMA could then be used to respond to group members’ questions in class.

Another possible discussion activity is called a jigsaw. A jigsaw discussion is a way to have more readings available for students or to “learn content that has been broken into chunks” (Silver, Strong & Perini, 2007, p. 187). In this case, students are not assigned to read all of the readings, but are assigned to only read parts. They learn about the highlights from other members of their class. In this case, CMA would be used two different times for the discussion: first, for the expert group and second, for the jigsaw group. Here are the steps to conducting a jigsaw discussion:

1. Students are assigned to read one of a group of readings. For this example, we will say that there are four readings. Each student will be assigned to a group and will read that group’s assigned article before the next class meeting. Students will be expected to come to class with notes about their reading.
2. When students come to class, all students who read the same reading would get together and discuss the most salient points of the reading via a discussion link. So, all 1’s would be in one group, all 2’s would be in a group, etc. This is often called the expert group. Students in these groups would take notes on the major points they want to share with their classmates, based on the discussion.
3. Next, the groups rearrange, with one person per assigned reading in a group. For our example, each group would then be made up of a 1, 2, 3, and 4 student. The experts on each reading would then share the major points of their article with their new group and discuss the commonalities or differences between the readings.

Another way we have used CMA groups is as a way for students to provide peer feedback on writing assignments. As Kirby and Crovitz (2013) say, “Writers need readers—a community for praise, suggestions, feedback, and responses” (201). Students could get peer feedback on a variety of assignments, including essays, research papers, and lab reports. Students can get on CMA either in pairs or small
groups. They can read aloud their writing, share it via email or a discussion board with their group, or they can use CMA’s screen-sharing feature to show their work to their group. Here are some tips for conducting a peer feedback activity:

1. Provide guidelines for what kind of feedback students should provide to their peers. You can even have students tell their groupmates what they would like feedback on.
2. Provide enough time for each individual to get feedback on their writing. You may want to set a timer for when groups should move on to the next person’s work.
3. To encourage helpful and constructive feedback, you can have students evaluate the feedback they get from their peers. You could make this evaluation of their peers a grade. We have also seen instructors offer extra-credit points or some other reward to students whose feedback is rated most helpful by their peers.

Students can also get peer feedback on other class assignments. For example, our students create lesson plans that they can share with the group to get feedback on improving the lesson plan before they submit it for grading. Alternatively, students can do their lesson with the other members of the group, as the students.

**Conclusion**

While we don’t have student evaluation data to analyze at this time, our students have told us how they appreciate the opportunity to interact with their peers. Students have said that they especially appreciate getting to know peers at other sites whom they may not get to meet face-to-face. Our experiences suggest that using videoconferencing with small groups can build a community of learners in distance courses and help students engage with course content through discussions.

Videoconferencing in small groups can be used for a variety of class activities, particularly discussion and peer feedback activities. Tools such as CMA can enable teachers of IVC courses to do many of the kinds of activities that can be done in face-to-face settings. By making IVC classes more interactive and getting more student participation, instructors can move away from lectures and toward activities that allow
students to apply what they are learning and construct knowledge through interactions with their peers.

**References**


Promoting Critical Thinking in General Biology Courses: The Case of the White Widow Spider

By Joseph S. Wilson, Ph.D.
Utah State University

Abstract

It is generally accepted that critical thinking is an important, and likely essential, component of success in college and beyond. Despite the nearly universal acceptance of the importance of critical thinking, only a low percentage of students in the U.S. can demonstrate critical thinking proficiency on standardized exams. This phenomenon may result from instructors using a reductionist view of critical thinking and focusing on learning processes rather than on evaluation of intellectual resources. In general biology courses, I use non-threatening, active-learning, group activities to promote critical thinking. For example, students are presented with an email from a member of the community and asked to formulate a response using the internet as their resource. I have found that using this non-threatening activity near the start of the semester promotes students’ acquisition of critical thinking skills and allows me to present assignments focusing on more controversial topics that require critical thinking later in the semester.

Introduction

The past 30 years have initiated a renaissance of sorts in the concept of critical thinking in U.S. education. This new focus on developing critical thinking, particularly in science courses, has come about partially through the efforts of various national science organizations (e.g., American Association for the Advancement of Science, 1989; National Research Council, 1995; National Science Foundation, 1996), and has resulted in a dramatic increase in published literature about critical thinking in science education. For example, a Google Scholar search of papers that include the phrase

In addition to policymakers and science organizations, college professors also consider critical thinking to be one of the most important indicators of student learning. In fact, an Association of American Colleges and Universities (AACU) report found that 93% of higher education faculty members considered critical thinking to be essential, and 87% of undergraduate students felt that their college experience helped them develop the ability to think creatively and analytically (AACU, 2005). Unfortunately, despite the nearly universal acceptance of the importance of critical thinking, the same AACU report found that only 6% of undergraduate seniors were able to demonstrate critical thinking proficiency based on standardized assessments (AACU, 2005).

While there are numerous definitions of what critical thinking is (Quitadomo and Kurtz, 2007), most center around the idea that critical thinkers are able to solve problems and make decisions based on reasoning and logic in a self-regulated way. The disconnect between recognizing the importance of critical thinking and actually seeing the development of critical thinking skills in our students could be the result of problems with the conceptions of how to teach critical thinking (Bailin, 2002). Critical thinking is often taught in terms of processes or skills, so that if students follow a specific process, they will have critically analyzed a problem (Bailin, 2002). An example of this can be found in the reductionist way we often teach the scientific method, which generally follows a flowchart from observations and questions, to hypothesis, then prediction, followed by experiment, analysis of data, and conclusion. The problem with this is, if we simply focus on the process, it is possible that students can participate in the process but fail to be critical in their thinking (Bailin, 2002; Van Gelder, 2005). Rather than focus on teaching the process and skills, critical thinking can be taught by focusing on understanding and analyzing intellectual resources (Bailin et al., 1999; Bailin, 2002).

**Critical Thinking in Science Courses**

Critical thinking can and should be taught in every discipline and at all education levels, but there is a growing concern over the performance of U.S. students in their performance in science, technology, engineering, and math (STEM) fields, relative to
other industrialized countries (Freeman et al., 2014b). At many institutions, STEM courses can have among the largest class sizes and are taught primarily through lecture-based instruction, yet recent research shows that active-learning can dramatically increase student performance over lecture-based instruction (Freeman et al., 2014a).

Most college majors require their students to take a life sciences class as part of their general education, and many students fulfill this requirement by taking a general biology course. While memorizing facts, figures, and processes is a necessary part of learning general biology, on its own, memorizing does not promote critical thinking.

Today, many of the facts that educated people once carried around in their heads are now accessible on the smartphones that nearly all incoming freshman carries in their pockets. With the increased accessibility of facts, why have our students’ critical thinking abilities remained relatively low? Perhaps it is because the ability to wade through the overwhelming abundance of facts available to students with the click of a button takes a more analytical way of thinking; it requires readers to be hyper-vigilant about what information they accept as fact and demands that they question the logic behind the answers to their internet searches.

We can tell students that they need to become critical thinkers until we are blue in the face, but until they experience actual critical thinking, the concept will likely not stick. Studies have shown that community-based inquiry methods that incorporate aspects of research can increase students’ abilities to think critically (e.g., Quitadomo et al., 2008). In this paper, I will discuss how we can teach critical thinking in general biology classes through the implementation of simple, active-learning, group-based research activities that focus on answering the types of questions college professors regularly get in their inboxes.

Background

As a biologist, I get asked a variety of science-based questions, ranging from what critter my students found in their basement to what the difference is between fast and slow twitch muscles. Many times, I do not know the answer off the top of my head, yet I am generally able to use the internet to find the answers to the questions I receive. So, why are professors often able to answer people’s questions by searching
the internet, when the questioners themselves are not? Do professors have access to different information than non-scientists? Of course, the answer is no. The information is the same, but the ability to critically evaluate that information might be different.

It may be true that one major difference between a scientist and a college freshman is that the scientist has memorized more facts, figures, and processes than the student. But knowing these facts and figures alone is not generally what gives scientists the answers we seek. Instead, scientists have learned to critically navigate the internet to find answers in which we can be confident. As instructors, then, how can we help students learn these skills through guided experiences?

Many instructors successfully promote critical thinking by giving their students what they consider critical challenges, in which students are assigned a problem to solve or are asked to evaluate an idea (Bailin, 2002). In college classes, these critical challenges are often based on current hot-button ideas or arguments (i.e., ways to combat global warming, or is nuclear power a desirable energy source?). While these topics can provide lively classroom discussions and can promote critical thinking, many students come to class with preconceived notions about the controversial topic, which can cloud their judgment and hinder their critical-thinking exercise.

Below, I describe some activities I use to teach students to critically evaluate the information they find on the internet, by having them answer questions that biologists are regularly asked. Generally, I begin the semester with non-threatening exercises, such as the case of the white widow spider. As the semester progresses and students become more comfortable with critically evaluating information, I move on to more controversial topics; for example: “Are fats healthy?” “Is nuclear energy safe?” or “Is climate change real?”

The Case of the White Widow Spider

Near the beginning of the semester in my general biology class, I have a discussion with my students about the different types of scientific inquiry and how we have more resources available to us than all previous generations of scientists. To illustrate this point, I often ask someone to look up a particular scientific fact, something like, “What are the stages of the cell cycle?” or, “What organelle makes proteins?” I then
point out that when I was a freshman, I had to look up this information in my biology book rather than simply on my phone. I then discuss with my students that in our class we will be memorizing facts and learning about biological processes, but I want them to be able to think critically about the subjects we are learning, and I want them to be able to apply this material to their lives.

At this point, I split the students into groups (depending on the class size, generally groups of three to six students) and present them with the following email:

Dear biology department,

My name is [Jane Doe] and I have a question about a spider I recently found at my house near my kitchen window. I wasn’t sure exactly who to contact so I’m sending this email to the biology department contact email address I found online in hopes it will reach someone that can help me.

As I mentioned I recently found a spider in my kitchen that matches the description I found online of the white widow spider. I have small children and I am really concerned since I have never seen a spider like this before. I was hoping you could give me some information.

Thank you.

I tell the students that this is a real email I received while working at the University of Nevada, Reno and that it was sent by someone living in the Reno area. I then let the students know that their assignment is to write a response to this person. I encourage students to use any resources they have, including their textbook, online resources, and past experience.

As the groups are researching and formulating their responses, I walk among the groups, ask questions, and provide some guidance. I generally give my students 10 to 15 minutes to research and develop an answer. Once students are finished, we go over some of their responses as a class and discuss how they found their information. In large classes you can simply select a few groups to discuss their results. I then walk them through the process I went through in order to respond to this email.
Generally, the first thing students do to answer the question is to search “white widow spider” on the internet. The first website to come up using this search is a Wikipedia page about white widow spiders (*Latrodectus pallidus*). This short Wikipedia page tells about the range of the spider (it is found in North Africa, the Middle East, and Central Asia), the description of the spider, and its medical significance. It is toxic, and a bite can be fatal to children or the weak (“*Latrodectus pallidus*”, n.d.). At this point in their search, students need to think critically about this information: What is the likelihood that the white widow spider, which is native to the Middle East, was in a homeowner’s kitchen in Nevada?

From here, students often go in a variety of directions, sometimes looking up spiders found in Nevada and sometimes focusing on the dangerous aspects of white widow spider bites. Sometimes student groups decide that while it is unlikely this is a white widow spider, the best thing to recommend is to kill it, just in case.

In my own quest to answer this question, I did the same thing my students did: I searched “white widow spider” on the internet, which led me to the Wikipedia page. Realizing it is very unlikely that the spider in Reno was the white widow spider, I assumed the home owner thought the spider looked similar to a black widow but with lighter coloration. I then used Wikipedia to find the taxonomic family to which the white widow belongs (Theridiidae). Next, assuming that most of the spiders in that family look similar to the widow spiders, I did an image search for Theridiidae and looked for light-colored species. Through this process, I concluded that the homeowner from Reno likely had a common cobweb spider or a tangleweb spider, both of which are harmless.

**Are Fats Healthy?**

Finding answers to questions on the internet can be challenging, as suggested websites might differ, depending on how you phrase your question. Another activity I use to teach my students to be critical consumers of information requires students to visit various websites that offer different points of view and asks them to critically evaluate the information they find.

After discussing organic compounds, including carbohydrates, oils and fats, and proteins, I split my students into groups and assign each group a topic to research on
the internet. Research topics include: “Are fats healthy?” “Are carbohydrates healthy?” and, “Is a high-protein diet healthy?” I then direct student groups to use the internet to answer their assigned question. I specifically tell each group to find at least two websites that suggest their organic compound (fats, carbohydrates, or proteins) is healthy, and at least two websites that suggest it is not healthy.

As student groups research their topics (for about 15 min), I walk among groups asking questions and providing feedback. Groups are then asked to present their findings to the class (as well as turn in a sheet of paper with their findings). In addition to presenting their view of whether or not their particular organic compound is healthy, I ask groups to share their source websites and tell us if they trust the site or not, and why.

Follow Up

Because critical thinking can be difficult (Gelder, 2005), students will likely not get the hang of it after a single activity, or even after multiple activities. I suggest regularly incorporating activities like those mentioned above throughout the semester. Like any skill, critical thinking takes practice, and students often need to be guided through the process (Gelder, 2005). I have found that by presenting students with a non-threatening critical challenge near the beginning of the semester, like the ones described above, they become used to the process of critically assessing internet-based information. This enables me to delve into more controversial topics later in the semester with less resistance from the students than I have experienced in the past.

In order to help coach students as they practice critical thinking, it is important to let them discuss some of the challenges and successes they had during the activities. Rather than discuss these directly after the activity, I suggest waiting until the following class period to find out what the students liked and disliked about the activity. I have found it is useful to ask two questions: 1) What was something you liked about [the activity]? and 2) What is one way [the activity] could be improved? I often include these questions at the end of quizzes or exams, or even ask them as online surveys. Asking what they like and how it could be improved allows students to meditate on their successes and failures and often results in beneficial suggestions that improve future implementations of similar activities.
Conclusion

Active-learning activities such as “the case of the white widow spider” or “are fats healthy?” can help students learn to critically evaluate information (Zohar et al., 1994), particularly information they read online. I find that presenting students with non-threatening case studies at the beginning of the semester can train them to critically evaluate ideas. It also allows me to introduce more controversial topics later in the semester with less student resistance. Activities like those presented here, or variations of them, can be used in small or large classes and can positively influence students’ critical thinking abilities.

References


Reflections on Thirty Years of Teaching for Utah State University Distance Education

By John Barton
Utah State University

Abstract

In this brief essay, author John D. Barton, Principal Lecturer, History, Utah State University Uintah Basin Regional Campus muses on teaching excellence and student engagement. His sources are largely his personal reflections of thirty years teaching and storied examples and quotes from former students. He defends the use of lecture and discussion as primary pedagogical tools, insists that concern and love for students is paramount, and gives five specific guidelines to become a master teacher and mentor of students.

_Credo: We are all students—learners in search of ever-greater truths—first to understand, then impart._ – John D. Barton, Principal Lecturer, Department of History.

I began teaching for Utah State University at the Uintah Basin Education Center (UBEC) fall quarter 1988. Since that time I have taught over 300 sections of upper and lower division history and Student Success Seminars. I have taught courses utilizing every delivery method offered by USU Distance Education from the 1980s to the present, including face-to-face, concurrent enrollment, dedicated telephone line audio only, slow scan (with 30 second screen renewal) Com-Net, Micro-Wave Broadcast, print-based independent study, and currently Interactive Video Conference (IVC) and Canvas supported Online. For distance education courses prior to the change from quarters to semesters, I often taught a five-credit course one evening per week in a single marathon session of 5:30 to 10:00 pm. Over the years, I
have learned (largely through trial-and-error) many things that work well in teaching pedagogies and support for students. I had to learn how to engage and maintain student interest or they would leave or fall asleep! There was no teaching support offered by the University. Good teaching was merely expected. Currently, there is a rapidly expanding body of published research on teaching excellence for college-level instructors. And while I am not an expert on all the latest trends, there seems to be some constant factors that set great teachers apart, regardless of subject matter, technology, or delivery. While pondering what has been successful for me, as well as observing many colleagues over the years, there are a few overarching points that stand out above detailed pedagogy, classroom techniques, or technological assistance. These include enthusiasm for the topic and student engagement using a lecture format, genuine love for the students, and specific practices that narrow the distance between instructor and student.

There are many differing opinions on the best pedagogical practices. Most of the current trends include an ever-increasing antipathy toward the lecture; yet I love to lecture, and most of my students enjoy hearing my lectures. Why, especially when many academics may suggest that lecturing is not a best practice, do I strongly defend a lecture-based class? First, I do not advocate that all instructors use a lecture format for their classes. Second, some professors lectures are unfortunately so boring that students tune out and dread coming to class. If you choose to lecture, be enthusiastic! There is overwhelming evidence that anything delivered with genuine enthusiasm and passion becomes contagious. Great lecturers master their material. They do not read lectures from lecture slides or lecture notes in a monotone delivery. Notes and presentations are fine for reminders of detail and to impose organization on the lecture, but the lecture needs to have a spontaneous feeling of being fresh and exciting, even if it is a lecture you have delivered dozens of times. New instructors will become more and more proficient at mastering both their materials and presentation with each course they teach. After 30 years and thousands of lectures on American History, I am still excited about the material. My secret? I don’t teach history – I teach students!

It still excites me to see students gain interest and become engaged and even passionate about the material. When students communicate little interest in history, I try to energize them by making history (or any other topic) relevant. Unless connections are made to the past, history is of little interest, and honestly, of little value. We are who we are because of history. In every lecture, I point out connections
between the past and my students’ lives. Note the student connections to the subject in the following emails from online students for Utah History:

**Hey Mr. Barton,** I just wanted to share a little interesting fact that came to my attention as I was reading the Massacre at Mountain Meadows book. John Urie who is mentioned in the book is my great-great grandfather (sic) (Name Withheld, personal communication, Spring 2017).

**Hello professor,** … I really enjoy this class it’s personal to me because on my mother’s side I am Blackfoot Indian and on my father’s side I had a great deal to do with the pioneers and the Mormons, my great-grandfather was Ephraim Hanks, so it’s pretty cool to learn this history (sic) (Name withheld, personal communication, Fall 2015).

I encourage spontaneous discussion within my lecture. I want my students to ask questions, make comments, point out connections to them personally, and to our current time and situations. I prefer spontaneous discussions over set discussion times. Following these conversations, I then continue with the lecture and move to the next point that spurs a new discussion. To teach/lecture in this manner, one must know the material, be flexible, and have the a primary goal of gaining student interactions and interest rather than just “getting through the lecture.”

My lectures consist of a string of interconnected stories that advance a theme of history. History is made compelling and memorable by interconnected stories of the past, coupled with interpretations of why it is relevant and important. Stories are powerful. We relate to, remember, and understand stories. They endure the passing of generations. Perhaps history lends itself to this approach more than many other disciplines, but each subject—even math and science—has its stories, and students need to become engaged with those stories to help them internalize and become invested in the material.

Great teachers not only have a passion for the subject they teach, but they also have a genuine concern—even a love—for their students. In today’s jaded world, using the word *love* in an academic essay might be considered misplaced, quaint, or even inappropriate. It is not! Those who decide to enter academia to make a lot of money, find an easy job, have summers off, or primarily to accommodate family schedules, are setting up themselves—as well as their future students—for disappointment. If teachers do not love their students, they fail at the most important academic
responsible: to inspire students’ understanding, to make the world in which we live relevant, and to then advance that understanding to ever greater heights and applications. Genuine love will impact how you interact with students on every level. To love your students means to give them the best of yourself: every time, every setting, every delivery system, every class period. Show love for the students, even the challenging ones, by listening with compassion. Love them enough to call them on their foolish or discursive comments or attitudes. Challenge them to learn and grow. You will not be able to connect with them all, but if you show concern for them and their success, they generally know/feel it and respond positively. Constantly and honestly appraise your classes, delivery, and course reviews. Put your assignments and syllabi together not for what is easiest for you, but for what will best enhance student learning and engagement. Seek genuine criticism about your teaching; be humble enough to change.

Demand respect from your students for yourself, the class, the course material, and the institution. No concern is unworthy of attention. Insist that students elevate their level of understanding, their critical thinking, and their analysis—not only to earn a good grade, but to become a quality person. Help them make the connections between the classroom and their world. Treat all students with respect: even hard and challenging students, including those who ask a question you recently answered. Listen to them. Demand the same from them. Insist they respect and be polite to each other. It is fine, even desirable, to disagree in academics, but not to be disagreeable. Be fair and reasonable in your procedures and policies. Listen to and respect students’ concerns, mishaps, and genuine emergencies.

As a cautionary example, some years ago, during finals week, a USU graduate student was admitted to the hospital and placed in the ICU for what the physicians feared was a pending heart attack. In the ICU, he could not make or take phone calls. Upon release from the hospital, the student’s first concern and phone call was to the professor whose exam he had missed. Hearing of the situation, the professor said there was nothing he could do; the exam had been missed. The student was not allowed to make up or take the final exam! With a 97% average in the class to that point, he failed the course! This kind of attitude and unwillingness to work with a student should have no place in academics or in life.

Learning should impart reverence and respect. Never assume that you know everything or that a student cannot know something about the subject that you do
not. Humbly learn wherever you find truth. If students ask questions for which you do not know the answer, tell them you don’t know, but you will find out! If they point out an error you make, be humble enough to not only accept it, but thank them! The proud cannot learn, for they already know all.

I strongly believe in roles and responsibilities. As a class instructor, my role and responsibilities are different from those of the students, but neither is more important than the other. Regardless of my degrees, research, publications, papers read at conferences, awards, grants, or recognitions, can I be a teacher without my students?

The third part of this essay will advance some absolutes for successful teaching:

1. Impart expectations and instructions with clarity. Students fear misunderstanding the instructions and expectations. They seek reassurance. Reduce as much of that stress as possible. In every class I introduce myself and my passion for the topic, the course itself, and my expectation for their success. Using Canvas (USU’s Course Management System) to manage my courses, I supply detailed written and recorded audio/visual instructions for each assignment. Some students are better audio learners than visual, and vice-versa. By offering both written and audio/visual instructions, student angst over assignments, as well as questions about how to proceed, have significantly diminished. Most students do their work confidently, knowing they are doing it correctly. I created and recorded a slide presentation writing tutorial that specifically details how I expect students to write and footnote in my classes. I make them review it and then take an open-note quiz on it to reinforce the details. This helps me to grade papers and explain the grades assigned. I also find great success and frequent positive student feedback by recording an audio/visual response for every student on each major assignment.

2. Never destroy a student’s dreams. A good teacher inspires his/her students to reach for the stars. At times, a good teacher has to help students gain understanding of what it takes to achieve their dreams and goals, but never crush or even hint that those dreams are unattainable.

3. Give positive feedback on every assignment, despite how poor it may be, by finding something good to say. Couch your negative comments as helpful criticisms in language that is kind, supportive, and encouraging.
4. Understand that there is really no such thing as teaching—only learning. A good teacher strives to create an environment that enables a student to learn. Learning occurs when students pull information into their brains, rather than when the instructor attempts to push it there!

5. Teach beyond the classroom. Great teachers inspire and prepare their students for success in life.

When I accepted the invitation to write an essay on my teaching practices and experience, I feared some might think that I perceive myself a master teacher who reaches and motivates all my students. I yearn for that to be the case, but it is far from the truth. I often fail to connect with my students. I lament every poor grade I give, knowing that I failed to communicate and motivate that student to succeed in my class. I recently received the worst student evaluations of my career. It was a new course, and I thought my selection of materials and assignments was engaging, even creative. The students were brutal in their evaluations and comments. I was hurt, angry, and frustrated. But after wallowing a bit, I began to carefully review and change my upcoming syllabus for the same course to address their genuine criticisms. When I hear stories of how a teacher impacted the life of a student, it reminds me of why I teach, and why, after decades of practice, I still aspire to become better: to become a master teacher. I hope readers of these rambling thoughts find gems of truth worthy of consideration and, perhaps, of implementation.

References