Meta-Learning: Teaching Students How to Learn Builds Success for Life

Stephen Carroll
Santa Clara University

What would you do if I told you that spending 15 to 45 minutes per week teaching students how to learn the materials you teach can increase their content learning by 10–25%? What if I added that your students would gain this knowledge faster, spend less time doing it, and retain it far longer (at least five years past graduation)? What if I further told you that your students would make the honor roll at four times the normal rate, join national honors societies at three times the normal rate, and be over two-and-a-half more likely to assume leadership positions on campus and in their communities? Interested?

I have long argued (see NTLF, V26N2) that one of the most important reasons why college students aren’t as successful as they should be is that we don’t teach them how to learn. In the past two decades, we have learned a great deal about how the human brain works, including how we learn, yet this research has not been widely applied to higher education. Faculty development conferences have, over the same period of time, increasingly focused on evidence-based teaching, and in the past few years, workshops on brain-based teaching and learning have proliferated. Yet, to date, there has been no large-scale research into the effects on learning such teaching could have. The outcomes listed in the first paragraph were the results of a three-year experiment conducted by my colleague Andrea Pappas and me that might be considered a kind of precursor to such a study. Our numbers were small—only about 80 students—but the results were very consistent across the three years.

Our experiment involved a course that linked a section of Critical Thinking and Writing (CTW—in English, taught by Carroll) with a section of Cultures and Ideas (C&I—in Art History, taught by Pappas). Both are two-quarter-long, required Core Curriculum courses, and first-year students were randomly assigned to these classes during orientation, though the algorithm attempted to fill each class with members of the same Residential Learning Community (RLC). Our experimental intervention consisted of spending up to 60% of class time during the first two weeks of class teaching students how to learn, with smaller...
of class time later in the quarter as new learning tasks were introduced. We compared data from three classes before our intervention against three classes that included the interventions and saw striking improvements in learning across the board, including the results listed above.

Our experiment with teaching meta-learning (learning to learn) included both course-level and lesson-level interventions, and incorporated current research from neurobiology, cognitive science, learning theory, and theories of human development. Course-level interventions aimed to teach students how to learn, using a six-part model derived from our research and current best teaching practices. Lesson-level interventions were derived from the same model, but focused on teaching students how to do the kinds of learning required by the tasks we were asking students to do, e.g., taking quizzes, taking notes, writing papers, and working in teams.

**Motivation**

The model begins with **motivation that engages students**, because if students don’t care, they won’t learn. Passive learning is an oxymoron; students must pay attention for their neurons to create the new connections (synapses) that physically embody learning. Positive engagement also produces eustress and more enjoyable (especially in ways that make learning easier and more enjoyable) learning, thereby making it easier and more fun.

At the heart of eustress is the same neurobiology of the essential elements of learning: acquisition, retention, and transfer—the ART of learning. Our lessons on acquisition highlight three simple principles: learning is making connections, learning changes the brain (neural plasticity), and desirable difficulty drives growth. The section on retention focuses on the central roles of emotions and repetition (practice) in learning. Asking students to practice divergent thinking, analogical thinking, and changing frames of reference helps them understand and practice transfer. In this stage, we also teach students Bloom’s Taxonomy for the cognitive domain, Kolb’s learning cycle (including Zull’s extensions), and Perry’s scheme of intellectual development. Here, we purposefully help students better understand the architecture and processes of their learning so that they can change their learning practices in ways that will align them with the biological realities and phenomenological processes of learning, thereby making it easier and more fun.

**Redefining Learning**

Part two redefines learning away from memorization and transient acquisition of knowledge and skills and toward habit formation and the affective changes (curiosity, confidence, etc.) that produce it. Getting students to analyze their existing methods of self-directed learning (e.g., learning to drive, to play a sport or musical instrument, to use a new phone) shifts their goals from performance on tests to durable changes in their thinking, feeling, and behavior. Their analysis also uncovers that the best ways to create such deep durable learning are repeated low-stakes testing and distributed practice. Thus, as students shift their understanding of learning, they not only discover that they already use best practices, they also internalize that real learning is ongoing, purposeful, and durable.

**How Learning Works**

The third part focuses on **how learning works**. We start with basic neurobiology of the essential elements of learning: acquisition, retention, and transfer—the ART of learning. Our lessons on acquisition highlight three simple principles: learning is making connections, learning changes the brain (neural plasticity), and desirable difficulty drives growth. The section on retention focuses on the central roles of emotions and repetition (practice) in learning. Asking students to practice divergent thinking, analogical thinking, and changing frames of reference helps them understand and practice transfer. In this stage, we also teach students Bloom’s Taxonomy for the cognitive domain, Kolb’s learning cycle (including Zull’s extensions), and Perry’s scheme of intellectual development. Here, we purposefully help students better understand the architecture and processes of their learning so that they can change their learning practices in ways that will align them with the biological realities and phenomenological processes of learning, thereby making it easier and more fun.
Editor's Note:

Structurally, one might say this issue of NTLF has good bookends. Part two of Stephen Carroll’s examination of “meta-learning” offers a very positive look at the benefits—even the necessity—of teaching students how to learn at the same time one is teaching them particular content. Anyone who’s read much about what we should be doing in college has heard this many times, but Carroll, through some limited but encouraging research data, shows the immediate benefits of taking on this challenge.

The issue concludes with Marilla Svinicki’s clear-eyed look in her AD REM... column at the breadth and depth of this challenge. Her focus looks less outward toward the students and their lives as back upon ours as faculty and the levels of awareness and new reflective pedagogical skills we’ll need to meet it.

The articles lying between these bookends explore ways of meeting this large, overarching challenge.

Who among us hasn’t come out of a reverie of thinking about teaching in some idealistic way only to encounter the cold water of practical reality with all its shortages of resources, its thickets of bureaucracy? Few, I imagine. Readers who’ve followed Mike Rogers’s TECHPED columns know that Mike approaches even such vexing situations with imagination and patience. If the evidence shows that retaining students in STEM disciplines depends on involving them in research early on but doing that demands resources in short supply, Mike will find a way to find resources. This time he turns to “citizen research,” “crowd-sourcing,” community involvement, and themes not only academically instructive and illustrative, but of importance to the wider world. I like publishing Mike Rogers because his careful, patient, intelligent approach to solving big institutional problems seems to me a kind of model that would do a lot of good if more widely emulated.

Patty Payette and Brian Barnes continue their CRITICAL THINKING series with a look at “truthiness,” the Stephen Colbert neologism for thinking something must be true because it feels right to you. Learning to look twice (for evidence) and question several times (for the authority) all those things that feel right lies at the heart of all critical thinking.

The Kentucky trio, Charlie Sweet, Hal Blythe, and Rusty Carpenter, offer part two of their advocacy of “design thinking” in this issue’s CREATIVITY CAFÉ column. In a sense, all three of these columns circle around the central activities of “meta-learning.” “Design thinking,” for example, has much in common both with the “systems thinking” Mike Rogers discusses in TECHPED and with aspects of critical thinking explored by Payette and Barnes. Learning to learn and be effective in the world involves all of these at some point or another. “Design thinking” seems very American, a hands-on, thinking-sleeves-rolled-up descendent of William James’s and John Dewey’s pragmatism. Indeed, it’s interesting to note that pragmatism began to enjoy a revival among philosophers in the 1970s just about the same time that faculty development began to find its sea legs.

Promoting any of these ideas, making them work in educational settings, depends first on connecting with students, and students—despite our tendency (and our need) to think of them in general terms—remain individuals. Connecting with them very often demands individuation. Office hours provide one setting for meeting students one-on-one, but offices also impose latent ideas and feelings about power and authority that may work against connecting with students in productive ways. Fiona Rawle, guest columnist in SPEAKING FROM EXPERIENCE, outlines a way of meeting with students while walking on campus. Her idea underscores a point made throughout this issue: Often it’s good to get outside.

—James Rhem

Strategies and Tactics

The fourth part, strategies and tactics, explores the effects of exercise, nutrition and hydration, sleep, and various cycles (attention cycles, study cycles, sleep cycles) on learning. We also examine other physiological factors that influence learning, including stress, alcohol, caffeine, and drugs—illegal and prescription, so students can make informed choices about lifestyle in relation to learning performance. We’ve experimented with using smells as memory aids, and we’ve debunked many common misperceptions about ideal learning spaces. In this part, students broaden their conceptions of learning and explore the deep interconnections between learning and the routines of everyday life.

High-Performance Learning

Part five lasts the entire two quarters because it focuses on developing a practice of high-performance learning. We use anonymous diagnostics to provide our students with reports on their habits related to the elements of learning listed above, and we develop classroom practices that require regular reflection on students’ learning inside the classroom and out so that they get used to monitoring, analyzing, and improving their own learning practices. We use jigsaws, group tests, and other activities that leverage the power of community to amplify and widen these routines by making students responsible not just to themselves, but to their groupmates and classmates.

Maintenance

Finally, the sixth part is maintenance, which amounts, in practice, to teaching students a theory of change. Developing and maintaining any new habit takes time, persistence, and emotional resilience. When students understand the patterns of the change process, they cope better with predictable challenges—slow initial progress, backsliding, etc.—and become more confident and persistent in their learning practices.
Course-level meta-learning instruction happens mostly at the beginning of our course so that students start developing effective learning practices from day one. But because most students have been trained throughout their lives to use passive approaches to learning, they have developed counterproductive habits in relation to nearly all the specific tasks they are asked to do in college: taking notes, reading, taking quizzes and tests, working in groups, doing research, writing papers, analyzing facts, creating new solutions, discussing ideas, reviewing peers’ work, etc. Therefore, we teach students how to do each new kind of task immediately prior to the task they are performing that task for the first time. This helps students break bad habits more quickly, and succeed more rapidly because it aligns what they are trying to do with what we want them to do, and students—not being mind-readers—progress more rapidly when they know exactly what we expect from them.

Some people may object that teaching students how to perform each kind of task you want them to do is cheating. In fact, it helps instructors more accurately assess the degree to which students have learned course content because it tends to equalize study skills, test-taking skills, and other independent variables unrelated to content knowledge that would otherwise distort the data collected by assessment mechanisms. In other words, without meta-learning, test scores may reflect learning skills more than content acquisition. Others may resist taking time away from teaching content, but our results consistently show that spending class time teaching meta-learning (up to 20% of total class time) results in students learning 10–25% more content knowledge.

I have omitted many details about the meta-learning instruction we developed, both because there isn’t room in such a short piece and because in some sense, those details are unimportant. You will have different ways of teaching your students how to learn what you want them to learn. Future research will reveal better techniques for teaching meta-learning. What matters is that we spend time teaching students how to learn in general and how to perform the specific types of learning tasks we expect of them. Doing so dramatically increases their learning and their success across multiple dimensions of their lives, including leadership and extracurricular activities as well as academics. It makes them more effective, more efficient, more self-directed learners. And most of all, it prepares them for success in the 21st century, when rapid changes in the workplace, the environment, in communication and in personal relationships will confer a huge advantage on people who know how to learn rapidly and effectively. I’ve heard that gaining such an advantage is why some people attend college.

**References**

Some excellent resources for developing a learning-focused teaching practice include *The New Science of Learning* by Terry Doyle and Todd Zakrajsek; *Teach Students How to Learn* by Sandra McGuire; and *Teaching for Learning*, by Claire Howell Major, Michael S. Harris, and Todd Zakrajsek.

**CONTACT:**

Stephen Carroll  
Director - Professional Writing Program  
Santa Clara University  
500 El Camino Real  
Santa Clara, CA 95053-0280  
E-mail: scarroll@scu.edu

---

**TECHPED**

**The Three R’s: Retention, Research, Resources**

Michael L. Rodgers  
Southeast Missouri State University

The meeting of the university’s president and provost with STEM faculty had long been scheduled, but the recent and unexpected announcement of severe cuts in the state appropriation threatened to deflect attention from the meeting’s intended topic: a major new initiative to improve retention across the institution. The atmosphere was tense as the president outlined options for meeting the shortfall: a hiring freeze, tuition increases, and a restructuring of employee health insurance benefits featuring major increases in deductibles and copays.

The president, unwilling to postpone the retention initiative, stated that boosting retention offered a measure of relief, as the additional retained students would continue to pay tuition that would otherwise be lost to the institution. Mention was made of retention plans developed at multiple levels. However, the paucity of available resources guaranteed that few of the plans’ proposals would be meaningfully enacted.

Heads nodded in agreement when one faculty member asserted that “research is clear that the best way to retain students in STEM is to involve them early in real, meaningful research projects.” On its face, the assertion appeared to be a helpful suggestion to realize retention goals, but in reality it was a reminder of a long-standing grievance: faculty receive no additional compensation or teaching load adjustment for involving students in research, despite the presence of credit-bearing research courses in both the undergraduate and graduate catalogs. It is certain that faculty will see no favorable alteration to the policy during a sudden and severe budget crisis.

**Concentrating Resources for Research**

Involving students directly in meaningful research is typically a very individualized and resource-intensive proposition. Because traditional research groups tend to be smaller than classes, opportunities to leverage time and resources are limited. Especially in STEM, but also in many other disciplines, good research requires far more than content knowledge and methodology: careful attention must be paid to safety, responsible moral and ethical practice, environmental regulations, and training on specialized equipment. Lack of close
become a departmentwide task, themes may allow orientation to research, similarities in research ally orient new students to ongoing amounts of faculty time to individu-

human need. Instead of using large

manifestly important in terms of

in the degree program because the

students in meaningful research without expending the same level of individualized attention tradi-

upper-division undergraduates and graduate students?

One approach, albeit a technology-op-
tional one, might be to take a “systems thinking” approach to course and degree program organiza-
tion. The idea is to extend courses and programs beyond a body of content toward a body of content with a purpose. In chemistry, for example, the American Chemical Society’s mission statement, “[t]o advance the broader chemistry enterprise and its practitioners for the benefit of Earth and its peo-
ple,” could form the basis for a re-
design of a department’s research activities into content discovery and application to address real human problems. If a department redesigned its research to focus on themes associated with, say, water quality, student interest in research may be awakened earlier in the degree program because the work is conceptually accessible and manifestly important in terms of human need. Instead of using large amounts of faculty time to individually orient new students to ongoing research, similarities in research themes may allow orientation to become a departmentwide task,

An experiment that may expand student research participation is to incorporate “citizen science” projects into entry-level research experiences. Citizen science has been around for a long time, shows up in many disciplines, and need not use much technology. One of the oldest citizen science projects is the Audubon Christmas Bird Count, in which citizens who are not necessarily professional ornithologists conduct a census of birds according to a set of observ-
ing, record-keeping, and reporting rules. Volunteer participants are actively engaged in the creation of new knowledge about the nation’s birds, and they gain insight into how and why the research is performed. Not insignificantly, volunteers become invested in a community of practice, rather like those created by systems thinking. And, as is common with many citi-

Leveraged Research

Systems thinking may offer some efficiencies in terms of faculty time and other resources, but its best feature is its ability to connect a discipline to specific human needs and/or environmental issues. In systems thinking, students study a discipline—and do research— not as an end in itself, but as the means to an end. But even with efficiencies, research can be a very resource-hungry enterprise. How might departments and faculty with very limited resources serve students who come to research out of a desire to do something meaningful?

Vol. 26, No. 4 2017
projects similar to those described above? The citizen science project would supply an element of intrinsic worth, and a well-designed structure in which the research would be performed and reported. A faculty member could use his/her discipline knowledge to select projects for which students might volunteer. Projects could be selected to align with research done in the department, thus initiating students to subsequent research. The faculty member could add value to the experience by deploying writing assignments in which students explain their projects, reflect on their participation, or demonstrate how the citizen science project was foundational to research available to students within the department. Having local faculty members function as intermediaries between students and the citizen science projects should help maintain student ties to the institution, and put the project into perspective in the discipline. In any event, placing beginning students in citizen science projects with some local oversight promises to bring introductory research experiences to many students with a minimal additional load on faculty.

Research in Online Courses

Online courses and dual-credit courses are increasingly under pressure to demonstrate that they are equivalent (or at least comparable) to face-to-face courses. For many courses, this increasingly involves the use of research projects even at the freshman and sophomore levels. Citizen science projects may offer access to research by online students who are unable to physically appear in a research lab to carry out a traditional project.

In a Faculty-Poor Environment

Budget pressures and changing markets are driving institutions away from old staffing models built around tenured and tenure-track faculty that perform distinct teaching and research functions. Partly to ameliorate the pressures of teaching ever-larger classes, textbook publishers and many others have developed online homework systems, interactive video, and many other technology-enabled systems to automate teaching functions. Perhaps an experiment to improve STEM retention through research grounded in citizen science projects is really an attempt to reduce pressures on faculty through an automation of introductory student research. The test will be to demonstrate that students can do meaningful and personally satisfying research without large additional commitments from faculty.

Endnotes:

Much research supports this assertion, both for general populations and specific identity groups. For an example of the latter, see http://www.cur.org/assets/17/Viera.pdf. https://goo.gl/29uDI.

See, for example, “Systems Thinking To Re-imagine Chemistry”, https://goo.gl/3ft5b0. https://goo.gl/b2UUI.


CONTACT:

Michael L. Rodgers, PhD
Director, Advanced Placement Teacher Development & Professor of Chemistry
One University Plaza
Cape Girardeau, MO 63701
E-mail: mrogers@semo.edu

SPEAKING FROM EXPERIENCE

Thinking Outside the Office

Fiona Rawle
Department of Biology
University of Toronto Mississauga

I teach several undergraduate science courses (with enrollment ranging from 24 to 1,000 students), and for each course I schedule about 2–3 office hours every week, plus midterm prep sessions, as well as final exam reviews. This translates to more than 108 hours in total (which is more than 6,480 minutes), all spent sitting in my office meeting with students, and if they don’t show up, then waiting for them to come. Sometimes my office hours are fulfilling and productive, and I think the students benefit—they can contain golden teaching opportunities that strengthen the relationship between professor and student. However, at other times, they can feel rushed when there is a long line of students waiting to be seen, or they can seem impersonal (such as when students come solely to request grade increases). Now with online office hours or other types of virtual office hours, they can feel even more impersonal.

I was trying to think of ways in which I could make my office hours more effective in terms of connecting with students and having meaningful discussions. I noticed that some students often seemed intimidated in my office, and sometimes avoided making eye contact. I decided to hold walking office hours, where we walk on trails around campus. Being a parent, I noticed that my kids are sometimes more willing to talk about difficult subjects when they are in the car and aren’t making direct eye contact. I thought perhaps the same would be true of my students, as it is difficult to make direct eye contact when walking on trails. It became clear to me that walking office hours, although I’m not advising that they should act as a replacement for traditional office hours, are an excellent supplement. I’d like to explain why.

How it works: I suggest you post walking office hours at the start of the term, and send email reminders the day before. Also, post a map of the route and where students can join the route. I find it works best to have a ~15-minute circular route, and to pass by the “pick-up point” multiple times in case

Thinking Outside the Office

Fiona Rawle
Department of Biology
University of Toronto Mississauga

I teach several undergraduate science courses (with enrollment ranging from 24 to 1,000 students), and for each course I schedule about 2–3 office hours every week, plus midterm prep sessions, as well as final exam reviews. This translates to more than 108 hours in total (which is more than 6,480 minutes), all spent sitting in my office meeting with students, and if they don’t show up, then waiting for them to come. Sometimes my office hours are fulfilling and productive, and I think the students benefit—they can contain golden teaching opportunities that strengthen the relationship between professor and student. However, at other times, they can feel rushed when there is a long line of students waiting to be seen, or they can seem impersonal (such as when students come solely to request grade increases). Now with online office hours or other types of virtual office hours, they can feel even more impersonal.

I was trying to think of ways in which I could make my office hours more effective in terms of connecting with students and having meaningful discussions. I noticed that some students often seemed intimidated in my office, and sometimes avoided making eye contact. I decided to hold walking office hours, where we walk on trails around campus. Being a parent, I noticed that my kids are sometimes more willing to talk about difficult subjects when they are in the car and aren’t making direct eye contact. I thought perhaps the same would be true of my students, as it is difficult to make direct eye contact when walking on trails. It became clear to me that walking office hours, although I’m not advising that they should act as a replacement for traditional office hours, are an excellent supplement. I’d like to explain why.

How it works: I suggest you post walking office hours at the start of the term, and send email reminders the day before. Also, post a map of the route and where students can join the route. I find it works best to have a ~15-minute circular route, and to pass by the “pick-up point” multiple times in case
students want to join your office hours at different time points. (For example, students could join at 10:00, 10:15, or 10:30.) The “pick-up point” should be a central hub, such as near the library or the main instructional building. The students can also walk in the opposite direction of the route in order to intercept you. This is another reason to have the route and direction posted clearly on the course management website. I have found that these walking office hours work well for both bigger (15+) and smaller (~4) groups. For the bigger groups, someone walks in twos, and I go through the middle, dropping back now and then, making sure I walk beside everyone for a bit. The bonus of this approach is that students start to talk to one another. With traditional office hours, when students were outside of my office, they would usually be rather quiet, or listening intently to the person in my office (I asked why they did this, and they told me that it was because they didn’t want to miss out on any advice). It’s also important to check the weather the morning of walking office hours, and email out cancellations as necessary. I don’t routinely offer walking office hours in winter terms, as I live in a part of North America that can be freezing and covered in snow during winter.

Benefits: From a professor’s perspective, I immediately saw a benefit in terms of the types of conversations I was having with my students, and the walking office hours definitely led to more meaningful discussions. Importantly, I felt that on these walks, I was able to be a better listener to my students as I didn’t have the distractions (such as a computer, phone or hallway noise) that I may have had in my office. Also, from a personal perspective, I saw an improvement in my own mood and well-being through being more active in the outdoors with less time spent sitting at my desk. There have been many recent medical reports on how “sitting is the new smoking,” and the fact that these walking office hours have me walking on campus at least three times a week is a significant health benefit. My anecdotal impression for students is that they enjoy the extra one-on-one (or close-to-one-on-one) time. There has also been more meaningful discussion about career opportunities or research placements, or history of the subject we are talking about, and several students have applied for research positions because of these walks. At the end of the term, students have sought me out to tell me how much they appreciated the walks.

Interestingly, I found that students would come to traditional office hours and walking office hours for different reasons. The walking office hour students asked questions about my research, my experience as a student, sought out advice for personal matters, or just wanted to chat about current events. During my walking office hours, students would rarely ask questions about test or exam marks or even about course content.

I feel strongly that students should steer office hour discussions, but some may not be comfortable doing that. I found that many more students would drive the conversations during walks than traditional office hours. The walks give the students the opportunity to “warm up” to the conversation or talk (or not talk) as we walk before asking a difficult question. I recognize that the Walking Office Hour format may select for students that are more outgoing or are more interested in “deeper” conversations; however, it’s important to note that I wouldn’t have had these same types of conversa-

Considerations: I was always aware of any mobility-challenged students that may have wanted to attend these walks, and I had a back-up route that followed sidewalks on campus in case any of these students attended. You need to consider your route carefully regardless, and a lot will depend on whether or not your campus is in an urban or rural environment. It is also important to consult your department regarding legal and insurance considerations.

These walking office hours were in addition to my traditional office hours, and thus were additional calendar items that I had to schedule. However, given that they resulted in me and my students connecting with each other, being in the outdoors, getting some exercise, engaging in meaningful conversation, and learning more about each other, I feel they were worth it. After all, the point of office hours isn’t really to be in your office.

CONTACT:
Fiona Rawle, PhD
Associate Professor,
Teaching Stream, Dept. of Biology
University of Toronto Mississauga
3359 Mississauga Road
Mississauga, ON L5L 1C6
CANADA
E-mail: fiona.rawle@utoronto.ca

CRITICAL THINKING

Combatting the ‘Truthiness’ Tendencies

Patty Payette and Brian Barnes
University of Louisville

Helping students identify and grapple with flaws and a bias in their thinking processes is the aim of critical thinking. Often these stem from a “good feeling.” To
contend with their own “truthy” tendencies by explicitly introducing the concept of fallacious thinking and use the classroom and our own teaching as a low-risk springboard for helping to identify and address common errors in thinking. We discuss a sample of common fallacies fostered by an over-reliance on truthiness—jumping on the bandwagon, egocentrism, socio-centrism, and error blindness—in order to help students stop feeling their way to truth and start critically engaging with evidence.

**Questioning the Bandwagon**

Truthiness can lead us astray, because, if we hear others say it, or we hear it on the news, it seems acceptable to us. Often, we adopt it unquestioningly. The characteristic of credulity, rarely discussed but always in play, is an important contributor to the bandwagon’s fallacious effect. We fall prey to the bandwagon fallacy when we believe as truth something being pushed by the mainstream or popularly considered to be true; we substitute the collective understanding—as vague or as unsupported as it may be—in place of our own.

Wikipedia, as a crowd-sourced repository of knowledge, might be subject to some kind of bandwagon effect. How do we know that Wikipedia isn’t merely a convenient digital bandwagon that serves up truthy information about the world, like an encyclopedic echo chamber? Does its credibility in our minds rest primarily on its accessibility, ubiquity, and popularity with thousands of users, contributors, and readers?

Initially skeptical of Wikipedia as a reliable source of information for learners, historian Alexandra McIntyre’s research led her to conclude that Wikipedia’s entries are generally accurate; its open-source platform means that egregious inaccuracies get corrected quickly. McIntyre also discovered this open-source, real-time nature of Wikipedia makes it a ripe opportunity to foster students’ awareness of the slippery nature of historical “truth,” how knowledge gets created, and the role interpretation plays in telling and retelling history (McIntyre, 2010). Some of the modes in which she has students engage with Wikipedia to develop their critical thinking skills can be easily adopted by other instructors. These include having students compare a Wikipedia article with relevant print sources and explore where and why inconsistencies might appear. She advises teachers to choose a controversial topic that invites engagement and then have students trace how controversies play out in Wikipedia, asking them to make connections to the world around them, discover how “truth” gets created, and consider “how people think about what they think, rather than to simply look at facts” (McIntyre, 2010, p. 6).

**Examining Our Built-In Biases**

Egocentrism is another fallacy that feeds our truthiness tendencies. Egocentrism is believing something is true as a result of our own lived experience, through our own way of knowing; it is uncritical and not based in a process of rational judgment. Truthiness can feel good because it feeds our egocentric beliefs; truthiness dovetails wonderfully with the worldview we already possess. It doesn’t challenge or threaten us. We feel good about being right, thus lulling ourselves into truthy, intellectual self-satisfaction. As long as nothing bad comes from our inability to effectively adjust to changes, nothing challenges truthiness.

Another common form of non-rational bias is sociocentrism (Paul & Elder, 2014). Many of our students are not aware of the extent to which they have unquestioningly internalized the normative prejudices of their society and culture. They have absorbed sociocentric
Teachers can teach students to identify and correct their own error blindness by helping them test and question what they know about a topic or issue by asking themselves “what am I missing?” Schulz purports that helping thinkers actively attend to counter-evidence engages them in locating their intellectual blind spots (2010). A strategy for engaging students in this type of exploration and expansive thinking comes from teaching colleagues at Fort Lewis College (Kraus, Sears, & Burke, 2013). They gave their students controversial topics such as medical marijuana, whether vaccines can cause autism, ghost photos, racial profiling, dog breed bans, and the possibility of psychic powers. Teachers asked students to work through each topic with the following seven questions:

- What am I asked to believe or accept?
- What evidence is available to support this claim?
- What alternative ways are there to interpret the evidence?
- Rate the evidence/alternatives on a scale of 0–10 based on validity/strength.
- What assumptions to biases came up when doing the above steps?
- What additional evidence would help us evaluate the alternatives?
- What conclusions are most reasonable or likely?

The Fort Lewis College faculty posit that these intellectual steps help students move from certainty through discomfort to another level of knowing. You might adapt this assignment by choosing a topic in your own field as the focus for the exploration, by scaffolding this process across several class sessions, or by adapting the assignment to the context and goals of your course.

Truthiness feels good, because it provides a quick, thought-free source of certainty. It’s a misleading certainty, however. Acknowledging doubts, resolving contradictions in our reasoning, and challenging our familiar thinking patterns are all essential elements for intellectual growth and are core to critical thinking processes. Teachers should strive to help their students cultivate these characteristics for lifelong learning.

**References**


National Public Radio. 2016, November 2. “‘Late Show’ host says he has finally found his post-Colbert Report voice.” Retrieved from https://goo.gl/qFIhOS.


**CONTACT:**

Patty Payette: patty.payette@louisville.edu

Brian Barnes: logician@hyrusa.com

---

**CREATIVITY CAFÉ**

**Why Design Thinking Should Matter to Higher Education, Part II**

Charlie Sweet, Hal Blythe, and Rusty Carpenter

Eastern Kentucky University

Wylant (2008) establishes an excellent definition of our subject in saying “design can be thought of as a professionalized version of the creative process and
significant in the achievement of innovation” (p. 12). In Part I (NTLF, V26N2), we defined design thinking, explained its process, discussed the personality profile of a design thinker, and differentiated the concept from its close relative, creative thinking. We also pointed out that while design thinking seems to have become part of secondary education, higher education has been slow to embrace it. This time, we’d like to show how the concept can be transferred up one rung of the education ladder.

**K–12 Research Into Design Thinking**

According to Lammi and Becker (2013), “there are multiple K–12 programs and curricula that purport to teach engineering design” (p. 56). Apedoe, Reynolds, Ellefsen, and Schunn (2008) have written about bringing engineering design into high school classrooms. Brophy, Klein, Portsmore, and Rogers (2008); Sadler, Coyle, and Schwartz (2000); and Svensson and Ingerman (2010) have all discovered that the greater the relationship of designing to real life, the greater the student interest. Carroll, Goldman, Britos, Koh, Royalty, and Hornstein (2010) studied the role of design thinking in a middle school classroom, finding it not only an alternative to the simplistic No Child Left Behind requirements but that it “fosters the ability to imagine without boundaries and constraints” as well as helping “students become empowered agents in their own learning who possess both the tools and the confidence to change the world” (p. 52). Faust and Howland (2013) record how they used Stanford’s d.school (The Hasso Plattner Institute of Design) practice of design thinking in order to create a curriculum for the Burke School, an independent K–8, concluding, “Design thinking is a structured process in which students, working in teams, learn to flexibly shift among critical and creative thinking strategies to solve authentic problems in any discipline” (p. 29). And in an effective real-life application of the principle, the nonprofit Tools at Schools facilitates relationships between specific businesses and particular schools (tools-at-schools.com).

**Postsecondary Education Applications**

For the most part, design thinking in colleges seems reserved for engineering departments. Back in 1992, Buchanan claimed, “We have seen design grow from a trade activity to a segmented profession to a field for technical research and to what now should be recognized as a new liberal art of technological culture” (p. 5), even noting four areas where design is explored by those who do not think of themselves as designers:

1. “the design of symbolic and visual communications”
2. “the design of material objects”
3. “the design of activities and organized services”
4. “the design of complex systems or environments for living, working, playing and learning” (pp. 9–10).

Most recently, David Kelley, head of Stanford’s d.school, and John Hennessy, the university’s president, as Miller (2015) says, “see design thinking as something valuable for all undergraduates, not only those interested in design or engineering” (B7). Dym, Agogino, Eris, Frey, and Leifer (2005) offer other reasons for including one major model of design thinking, project-based learning, in first-year to graduate curricula: “available research suggests that these kinds of courses appear to improve retention, student satisfaction, diversity, and student learning” (p. 114).

**Our Experience with Design Thinking**

Normally in this column we make very few references to our experiences and research. In the absence of scholarship on the application of design thinking in higher education, however, we would like to offer some personal examples for consideration relative to the seven principles discussed in our previous column.

Design thinking revolves around a collaborative group. In our case, the three of us have formed an executive committee. For that committee to succeed, it had to have regularity and discipline. We meet every Tuesday from 8:00 a.m. to 9:15—fall, spring, and summer terms—and have for the past seven years.

Design thinking begins with an understanding of the human element, which in our case is mostly our students. Years ago, we asked our Institutional Research unit to supply us with the relevant National Survey of Student Engagement (NSSE) data on our students, and we met quite often with the vice president for student affairs about regional and national trends. In fact, as all fields of communication begin with a strong sense of audience, we asked Jim (who has since moved on to the presidency of a large New England institution) to provide the opening fall presentation on the characteristics of our university’s student body for our center for teaching and learning (CTL).

Design thinking needs ideation to create both products and processes. In order to provide an incubator for the next generation of teachers, we settled on an experimental classroom that we labeled LEAF (Learning Environment for Academia’s Future). By collaborating with the university’s IT department, Building & Grounds, the College of Education, and the Department of Communication,
we researched the ideal classroom, repurposed an unused bowling alley on campus, developed a new pedagogical model we called the Mentor from the Middle, supported the instruction with the latest technology, and created a methodology for observing and assessing instructors. The LEAF classroom was a low-res prototype for what eventually became the Noel Studio for Academic Creativity, a state-of-the-art facility serving both our students and faculty.

Some Implementations

Design thinking was instrumental in developing a new campus minor. When SACS (our accreditors) demanded we inaugurate a value-added education piece across campus they called the QEP (Quality Enhancement Program), we were on the group that proposed our university “will graduate informed critical and creative thinkers who communicate effectively.” To help accomplish this goal, we set up a universitywide course in critical thinking, and later we added the minor in applied creative thinking. For the minor, we had to develop a six-course sequence. Additionally, for our Introduction to Applied Creative Thinking (CRE 101), we could find no textbook, so we wrote the Introduction to Applied Creative Thinking (2012), then created Teaching Applied Creative Thinking (2013) for CRE 301.

Design thinking led to a statewide pedagogical conference. Years ago, our state held an annual conference wherein each of the eight major institutions plus the independents and community college system kicked in about a third of the funding and the state’s Council on Postsecondary Education supplied the other two-thirds. Unfortunately, the funding dried up and the conference died. We ideated on a replacement that we could run in our new Noel Studio and came up with the Pedagogicon, an annual one-day conference in late May that is now three years old and attracting conferees from across the country.

Design thinking helped us with faculty development. We took over New Faculty Orientation, created a Teaching & Learning Innovations Series, advised and ran our chief academic officer’s Provost Speaker’s Series, and developed a spring event for faculty and student research we called Scholars Week. As a result, we had an organized program of milestone events that fed into a new comprehensive faculty development program we helped organize.

A related and major problem design thinking helped solve focused on how to reach faculty with professional development. Aside from our milestone events, we realized that roundtables, workshops, and speakers were still reaching at best 10% of the faculty. As our executive committee ruminated, we brainstormed out the old saying about Muhammad and the mountain. For this collaborative effort, we consulted with relevant colleagues across campus, resulting in the creation of DEEP (Developing Excellence in Eastern’s Professors), a fully online program that takes faculty members through four stages of development and leads to certification in a number of areas (e.g., metacognition, critical thinking, flipping the classroom).

Conclusion

Importantly, in almost every one of these “creations,” we began with a prototype that we knew wasn’t quite finished, or in the language of Saturday Night Live, “not ready for prime time.” However, we were willing to take a risk because we had the creative confidence in the idea in the first place, and in the second we were willing to assess our product and keep on reshaping it for the better. Our experience with design thinking has certainly been positive. Not only has it allowed us to develop a number of valuable initiatives on campus, but it has also allowed us to foster greater involvement by colleagues from a variety of disciplines. We certainly believe design thinking can be a valuable academic tool.

References


CONTACT:

Charlie Sweet
E-mail: charlie.sweet@eku.edu
Schools of the Future: Are WE Ready?

Marilla Svinicki
University of Texas at Austin

Last week, I streamed a really interesting PBS Nova episode exploring the school of the future ("School of the Future," shown on September 14) as seen by cognitive and developmental psychologists. I can say that the points made were really key ones, but they pulled me up short when the implications for teaching became painfully obvious. Are we ready to provide the kind of teaching support that this new learning requires?

But first what did the program assert that got me thinking? Drawing on a great deal of the best research on learning, the show focused on how research suggests we need to support student learning and instructor teaching for the future of schools. Here’s a CliffsNotes of the highlights.

**Preschool**—Students at this level need to be taught basic skills that support learning, such as paying attention, then paying attention for an extended time, focusing on one activity, listening and following directions, and cooperating with others.

**Elementary school**—Here the focus of research is on the students’ need to feel safe, especially for those students whose home lives or neighborhoods are not peaceful and nurturing. Building the school as a community and designing activities that allow students to try new things and be recognized when they do are ways to make school safe and the students appreciated.

**Middle school**—For middle school, the show focused on giving the students the skills and attitudes that will help them persist in the harder type of learning seen at this phase of education. So here the teachers focus on encouraging a growth mindset (a belief that they can improve) and on drawing on grit (ability to continue in the face of difficulty), two very prominent areas in research on learning.

**High school**—The research on learning in high school focuses more on their need for culturally relevant things to learn. At this age, students want to be and work with their group to solve real problems.

Perhaps you are saying to yourself, “What does this have to do with me? I teach college level.” Here’s the conundrum. You’ll notice that none of the above focused on content expertise. This is because, as one of the experts said, “Our kids are going to have to work with knowledge that hasn’t been discovered yet on technologies that haven’t been invented yet” (Linda Darling-Hammond). What she suggests is that we have to help them learn skills and attitudes that will keep them learning even when the world has changed beyond what we can imagine.

We are proficient teachers and scholars, but are we ready for the different roles we’ll need? Now we need to be learning analysts, developmental experts, teachers who can follow a student’s thinking even when it gets into areas we’re not so sure about, teachers who can ask just the right question or make just the right observation to trigger the student’s thinking. I’ve been worrying about this since I watched that show. I believe that these teaching skills are not always learned along with our expert knowledge.

Why do I think that? Because there is another stream of research on knowing that implies that expertise follows something of an inverted-U-shape course. At first, we know very little and can only answer really straightforward questions that lie on the surface of the knowledge. As we become more knowledgeable about a field, we begin to see the structure of a field enough to make reasonable guesses based on less information when a student asks a slightly off-center question. But when we become real experts (as most of us have), we come to a place where the basics become so automatic that we don’t even see them anymore. Are we going to be capable of answering those basic questions and providing the guidance those students need when our expert content knowledge is no longer relevant and new things quickly overwhelm us? Do we know what to ask, how to ask, what to say, at just the right time and level? Are we ready for the challenge? Some are, some are not, and some don’t even see it coming.

**CONTACT:**
Marilla D. Svinicki, PhD
E-mail: msvinicki@utexas.edu

---

**Editorial Advisory Board**

**Cynthia G. Desrochers**, Professor
Michael D. Eisner College of Education
California State University, Northridge

**Pat Hutchings**, Vice President
The Carnegie Foundation for the Advancement of Teaching

**Wilbert McKeachie**, Professor of Psychology, Emeritus
University of Michigan

**Mary-Ann Winkelmas**, University of Nevada, Las Vegas

**Edward Neal**, Professional Consultant
Leadership & Policy Studies

**Laura Rendón**, Professor & Chair
Department of Educational Leadership & Policy Studies
Iowa State University

**Elizabeth O’Connor Chandler**, Director, Center for Teaching & Learning
The University of Chicago

**Mark Stoner**, Professor of Communication Studies
California State University, Sacramento

**Marilla Svinicki**, Professor of Psychology
University of Texas at Austin