SECTION ONE

Coping with Plagiarism

By Wayne Stauffer

SOURCE: https://www.insidehighered.com/views/2017/11/30/strategies-minimizing-plagiarism-essay

As long as students put off doing writing assignments until almost too late, do not study the course material as well as they should, have low confidence in their academic abilities, settle for doing less than their best in their schoolwork and just don't feel like putting out the effort and instead grub for grades, there will be plagiarism.

In other words, we professors cannot eliminate it entirely, no matter how hard we try to design the perfect assignment or develop/find the ultimate originality-checking software or online testing environment. Students' desire to cheat cannot be planned out of our assignments, because it is outside the curriculum. We design our course work under a basic assumption: people who want to learn will be willing to do what we ask them to do to learn it. When that cooperation is not present, learning breaks down.

We can only take several steps to minimize plagiarism. We can make cheating more labor-intensive or costly than the effort involved. We can also try to make the assignments so interesting that students want to explore the subject as deeply as we want them to or so unusual that a response doesn't already exist out there. Yet hard as we work to make the assignment one on which students don't want to bother plagiarizing, someone will always try to take the shortcut.

An analogy occurred to me: speeding. We have traffic speed limits to regulate automobile traffic flow, mainly for safety reasons, and we have penalties for ignoring those limits. We all understand why the limits are there, and most of us agree to them, but some people still exceed the limits anyway. Fortunately, the bad consequences for others (accidents and deaths) are a comparatively small percentage when we ignore the limits. But when we know the police are there, most of us follow the law most of the time. It seems to me that students also know that we want them to do their own work and understand our rationale for why we do not want them to plagiarize. But if they think they can get away with it, some try.

Discussions of the different software solutions often go into the details of how they work and how effective they are at detecting, but such discussions seem off the mark -- they are the mechanism by which the cheating happens, not its motivation. We have to explain the value of doing one's own work and that one must actually absorb the information for any real learning to occur.

Tactics we can take to reduce plagiarism include:

- Discussing forms of plagiarism and examples from outside academe -- and the penalties that violators paid.

- Talking with students about the intellectual laziness inherent in plagiarism and how true learning takes work. Part of this can include how we develop thinking and work habits that do not include cheating.
- Setting up assignments so that no one assignment will fail a student for the course. That can take off some of the pressure to get a really high score on that one assignment that assures a passing grade.
- Developing the kind of assignment that makes it more time-consuming to try to find an answer online than to just write it oneself.
- Designating specific points to cover. We can spend time working out the instructions for the assignment to get what we want from students. We can ask specific questions to get students to provide proof that they read our course materials.
- Changing up the assignments every few semesters. This can make previous "banks" of assignments irrelevant.
- Limiting students to only certain sources or give them only specific sources to use.
- Making students do the assignment in person -- and requiring that it be handwritten, no devices needed.
- Assigning a heavier weight on process over product by checking drafts and work along the way to the final product.
- Getting to know students' ways of expressing themselves. Collecting short samples of their writing in person to compare with writing in the longer pieces can give an idea of their writing style. It can also reassure students that we know their ideas and understand their perspective on the subject.
- Modeling proper research and citation form for students. Sharing with students some of our efforts at writing for publication and how we go about exploring the field of study.

Not all of these are needed, but using several of them in combination can keep students guessing as to whether it is worth their effort to cheat.

We also have to clearly indicate the penalty for plagiarizing and enforce it. After a few instances of catching and penalizing students, the word will get out that we mean it, and over time, fewer instances will occur. (Just like those pesky speeding tickets.)

I use an originality checker. I do not make plagiarism accusations on the basis of a hunch or a gut feeling. When it gives a positive result for plagiarism, I send that report back to the student as my proof with the failing grade on it. My institution gives professors latitude to handle incidents. As long as it is in the syllabus and clearly communicated, the professor is in the right. Of course, the other half of this is whether the students have read the policy in its numerous locations. As long as the professor has provided ample warning, the student is responsible.

Besides changing our tactics, we need to adjust our emotional response. As I read articles in *Inside Higher Ed* and other publications and interact with colleagues who have caught students, the emotional timbre of the conversation is growing more intense. With millennials not identifying as "adult" until their 30s, sometimes part of it is that adolescent defiance that teenagers have: "I'll show you." Colleagues have told me of extensive email exchanges and in-person confrontations with students about what are or are not plagiarized passages. We, the professionals in the room, have to defuse that. Sometimes the more we make of it, the more we inadvertently throw down the gauntlet as a challenge to students.

We have to set the tone for the interaction a good deal lower. I understand the frustration: after umpteen different disclaimers on the penalty from us, students still cheat. We also have dealt with it over the many years of our careers, and students still cheat. But we have to control that frustration and go for the teachable moment: no, the student is not a bad person; yes, the student believes they have a good reason for the action; no, I will not allow a second try; no, I will not "make an exception this time"; yes, the penalty stands. Almost every time, the student does not plagiarize for me after that. But I also understand that is no guarantee that they won't try again in a subsequent class for another professor.

I do not advocate simply shrugging our shoulders, acquiescing to the inevitable and dropping the whole activity. Students need to learn solid research processes, valid sources and proper documentation formatting. They only learn so much in a multiple-choice quiz. Doing the project is the way to learn.

All of what I've said is relative, not absolute. Notice my use of qualifiers: "reduce," "fewer" and "minimize." The technology makes plagiarism faster and sometimes harder to detect. A recent article described a paraphrasing software that, ahem, "adjusts" the phrasing into a more student-sounding expression. I understand that the originality checkers are not perfect, but they signal students that I am paying attention.

Sometimes a student will pull one over on the old professor. This does not mean I have failed and the student won. It means the student was exceptionally clever. You win most and lose some, but eventually the cheaters who get one past me will get what is coming to them when they get caught by another professor. The penalty for that instance might be more severe than mine was. What goes around, comes around. And the remainder who have not plagiarized often find that they have actually learned something by doing their own work.

SECTION TWO

Teaching and Learning: Lost in a Buzzword Wasteland

Stephen L. Chew William J. Cerbin December 5, 2017

SOURCE: https://www.insidehighered.com/views/2017/12/05/need-theory-learning-opinion

Having a theory of how people learn would allow teachers to plan pedagogy more effectively and examine all factors relevant to learning.

Few professions are "revolutionized" with such frequency as teaching -- and with such minimal impact on actual practices. As veteran teachers, we've seen many teaching practices and technological advances that promise to transform (or disrupt) education, including programmed instruction, clicker questions, discovery learning and on and on. They follow a similar pattern: initial excitement with reports of strikingly positive results, followed by the growth of doubts and negative results, leading to a mixed picture of success and failure, and then descending into inconsequentiality or practice by only a limited number of adherents.

Are we being cynical? If we were to synthesize current trends in pedagogy, we would conclude that the best teaching practice is: high impact, student centered, engaging, hands-on, just-in-time, technology enhanced, flipped, blended, hybrid, transformational, cooperative, collaborative, reflective, authentic, situated, guided, integrative, supplemental, reciprocal, gamified, experiential, adaptive, disruptive and active. It is also brain based, peer based, inquiry based, group based, team based, project based, case based, community based, discovery based, competency based, evidence based, mastery based, research based, service based, problem based and data driven, not to mention massive, open and online.

In other words, teaching and learning are lost in a buzzword wasteland. "Cutting-edge" pedagogy changes often but results in little actual progress in terms of promoting student learning. There has been an explosion of pedagogical research in the last 20 years, but it has yet to translate into widespread, substantive innovations in teaching practices. As a result, many teachers simply ignore teaching trends.

How did teaching get this way? More important, what can be done to move teaching forward?

The problem stems from viewing innovations as magic bullets that will work for everyone. Indeed, the focus on innovations diverts attention from the everyday reality of education: teaching and learning are complex and hard. They are complex and hard because we don't know the exact conditions in which student learning will occur. How people learn depends on multiple interacting factors that defy any one-size-fits-all solution. Yet we keep trying to find a simple solution to this complicated problem.

We pursue simplistic solutions to teaching for a number of reasons. In his book *Visible Learning*, John Hattie provided a major empirical one. After synthesizing more than 800 meta-analyses of different factors affecting learning, he concluded that virtually all learning innovations work, noting that one only needs a pulse and a belief that an intervention will work, and it likely will. Teachers become excited when they try something different and students notice and respond to it. The problem is that the effects are transient; they fade as the shiny new pedagogy becomes routine.

The fundamental theoretical reason for our pursuit of simplistic answers is the lack of a comprehensive, empirically validated model of how students learn. Such a theory will be complex, stipulating all the elements that contribute to learning and specifying principles of how these elements interact with each other. Such principles could guide the design, implementation and assessment of effective pedagogy across different situations.

Without such a theory, teachers must make their own assumptions about how students learn. Unfortunately, many teachers base their pedagogy on simplistic ideas, untested intuitions and faulty assumptions. The lack of a validated model leads to a profusion of different teaching methods based on various assumptions. Fads emerge (or re-emerge in an altered form). Teachers with different assumptions often talk past one another, and people outside teaching believe they are qualified to "fix" teaching.

How do we break out of this unproductive cycle and move teaching forward? The solution is to develop a comprehensive theory of how people learn. A good theory would guide both research and practice by organizing existing pedagogical knowledge, allowing it to accumulate and advance. Teachers could use such a theory to guide the development and assessment of effective pedagogies. Researchers could use the theory to guide progressively more advanced and germane research.

To be effective, any pedagogy must mesh with what we know about how the mind learns and thinks. Cognitive research shows the mind is good at some aspects of learning and limited in others. We know conditions and strategies that can enhance learning and ones that hinder it. If a teaching strategy doesn't leverage the strengths and compensate for the weaknesses of the human cognitive system, it will fail. For example, digital textbooks with embedded links for students to explore can help learning by providing a richer encoding, but they can also cause distractions in attention that hurt learning.

Historically, we have used global theories of development and learning, such as Jean Piaget and John Dewey, but those theories are too broad to be of use in specific teaching situations. What's more, our understanding of learning has advanced considerably. At the other end of the spectrum, cognitive psychologists have discovered individual, specific factors that aid learning, such as retrieval practice and interleaving, but those single elements often do not easily translate into the complex context of the classroom.

What would such a theory of student learning look like? Looking only at cognitive factors, research has identified multiple factors that interact to influence student learning. They include:

- Mental mind-set: how students view their ability to learn through their own efforts influences their willingness to take on challenges and their perseverance.
- Prior knowledge: the more students know about a subject, the easier it is for them to learn more about that subject.
- Misconceptions: misconceptions are common in any field and remarkably resistant to correction.
- Ineffective learning strategies: students often prefer the least effective study strategies for long-term learning.
- Transfer of learning: students often fail to generalize learning beyond the immediate classroom context.
- Selective attention: students overestimate their ability to learn while multitasking or in the face of distractions
- Constraints of mental effort and working memory: students can concentrate and consider only a limited amount of information.
- Metacognition and self-regulation: students are often overconfident in their level of understanding, and this misconception influences their study habits.
- Fear and mistrust: students who believe that their teachers want them to succeed and design assignments that will help them succeed will work harder and persevere longer than students who see their teachers as indifferent or trying to "weed them out."

This extensive list of factors makes clear why effective teaching is so difficult to achieve. Any valid theory of student learning has to address all these issues.

For example, a teacher may try to help students by correcting their poor learning strategies, but if the problem is with misconceptions and prior knowledge, the approach will be unsuccessful. Moreover, all these factors interact and influence each other. Greater prior knowledge, for example, reduces the mental effort required to learn new information.

The most important consequence of this interaction is that it means there is no single best way to teach across all situations. A valid theory of learning would have to capture this complex interaction.

Having a theory of how people learn would allow teachers to plan pedagogy more effectively and to examine all factors relevant to learning. Note that these are only the cognitive factors and do not even address social or other important aspects. Developing such a theory will require the collaboration of researchers who understand the mind, educators who understand the classroom context and teachers who must put the pedagogy into practice. Many fields contribute to teaching, and it will take a concerted, multidisciplinary effort to develop a valid theory.

Ideally, the people leading this effort will have mastery in their field, in pedagogical research and in teaching that addresses all the cognitive challenges to achieve student learning. Most disciplines have an organization dedicated to conducting pedagogical research on teaching that field effectively. The members of these organizations are likely to have the closest combination of expertise needed to move teaching forward. These organizations could also bring researchers and practitioners together to focus on research that examines cognitive challenges in authentic educational settings.

It may seem counterintuitive to argue that in order to achieve practical improvements in teaching, we need to develop a theory, but that is exactly what is needed to transform teaching into a coherent set of effective practices. Currently, faculty development consists of presenting teaching techniques with no theoretical framework, as if procedure equals pedagogy. As a result, techniques are interpreted and enacted in a wide variety of ways. Grounding practice in an accepted theory would bring much needed clarity to the definition of terms.

Educational buzzwords often encompass ill-defined categories of practices and mean different things to different people. Take "active learning," a term that has been in circulation at least 25 years. It seems to include all instructional practices except lecturing and is used interchangeably with other equally ambiguous terms such as "hands-on learning."

If our analysis is correct, we are approaching the development and assessment of pedagogy all wrong. Instead of judging pedagogies to be good or bad, we should be asking, "In what situation is this pedagogy appropriate to use?" and "What kind of learning is likely to result?" We are not arguing that all pedagogies are equal. Some pedagogies are more widely applicable and more likely to succeed than others. But all pedagogies have their limitations.

We should not be looking for the single best teaching method. What works for one section of a class may not work in another. We need theory-driven pedagogy to achieve desired goals. To develop such a theory would be huge undertaking, but it would certainly beat wandering aimlessly in a buzzword wasteland.

------Comments

In the Weeds Laura Gibbs

The million dollar question is how do we know what our deficits in teaching are? If it is difficult to access what is 'best practice' then how do I know what deficits to fill? I'd be guessing relative to pedagogy (only rarely does a content knowledge misconception or error occur and is easily recognized and fixed). Also from some of the links provided above - best practice usually involves more assignments, assessments, feedback, and etc. to students. I agree with this absolutely. Students do better with more work and more feedback. Motivation is higher. Also students themselves favor assignments and feedback directly from the instructor.

This puts best practice mostly out of my reach (200+ students/semester, 0 TAs, assessments are long form). Computer aided grading, multiple choice assessments are cold. Computer grading while speedier than by hand has other expected and unexpected time sinks; feedback and partial credit are limited.

Frankly, rolling out a new, unproven item always worries me because if it goes wrong I will get an avalanche of complaints, bear responsibility for poor student outcomes, and bear responsibility for not preparing 200 students with prerequisite information for upcoming coursework. The course schedule is prescribed and tight; there is no more than one 'free' lecture per semester and usually every lecture is required to complete the course coverage.

I would wish that 'best practices' would also have a nuance and pragmatism to address various varieties of classrooms. Mostly what I read in articles and comments, I conclude must be for upper level seminar courses because of the impossibility of executing this or that plan with a large number of students with no extra man power. No one it seems wants to touch a large lecture section with a ten foot pole.

------David K. Hurst
I am a management practitioner turned educator and as I read this piece I felt I could substitute 'management' for 'teaching' without any loss of meaning. We have the same problems. I don't agree with the proposed solution however. There will never be a comprehensive, empirically validated theory of how organizations function and grow. This is a rationalist myth from the 1950s when it was thought that management could be made into a social science in the mold of economics. The positivist framework works well within broad limits in the world of objects, but not in the world of people. We need an ecological approach. Here context matters, history matters and stories matter. Management is a practice, an art, a craft and a little bit of science.

We need different philosophical roots. Neo-pragmatic philosopher Richard Rorty put it well:
"Pragmatism, by contrast (with positivism), does not erect Science as an idol to fill the space once held by God. It

views science as one genre of literature – or, put the other way around, literature and the arts as inquiries, on the same footing as scientific inquiries. Thus it sees ethics as neither more "relative" or "subjective" than scientific theory, nor as needing to be made "scientific". Physics is a way of trying to cope with various bits of the universe; ethics is a matter of trying to cope with other bits. Mathematics helps physics do its job; literature and the arts helps ethics do its. Some of these inquiries come up with propositions, some with narratives, some with paintings. The question of what proposition to assert, which pictures to look at, what narratives to listen to and comment on and retell, are all questions about what will help us get what we want (or about what we should want)…" (Consequences of Pragmatism)

------withnailandi

The theory of student learning you outline is at the base of every composition program for which I've ever worked. Grad school pedagogy courses and practicums were saturated with comprehensive theories of knowledge-building, scaffolding, etc. Same with training of profs in remedial English, ESL, special ed, and so on.
Perhaps you might interview some folks in those fields before generalizing. Yes, education is saturated with jargon and buzzwords, but no one is more apt to roll their eyes at it than actual educators.
The buzzwords are mostly the province (and bread and butter) of administrators, college PR offices, and politicians.

SECTION THREE

Applying the Science of Learning: Using the Principles of Cognitive Psychology to Enhance Teaching and Learning

Diane F. Halpern

SOURCE: http://www.au.af.mil/au/awc/awcgate/congress/halpern.htm

Thank you for inviting me to join you in your deliberations about ways to apply principles from the science of learning to enhance teaching and learning. I am delighted and honored to be here. Unfortunately, you gave me an almost impossible assignment—in about five minutes, I am supposed to provide a useful summary of what we know about human learning and cognition with suggestions for future research. In the short time allocated, I plan to share some of my excitement about advancements in the learning sciences with you and suggest some ways to translate our knowledge of human cognition into meaningful school reform with the hope that you will continue to explore the findings and ideas at some later time.

My academic area is cognitive psychology. Cognitive psychology is the empirical branch of psychology that deals with questions about how people think, learn, and remember. Cognitive psychologists study how people acquire, utilize, organize, and retrieve information. We study topics like memory, decision making, problem

identification and solving, critical thinking, and reasoning. It is clear that a successful pedagogy that can serve as a basis for the enhancement of learning will have to incorporate ideas about the way in which learners organize knowledge and internally represent it, and the way these representations change and resist change when new information is encountered. Despite all of the gains that we have made in understanding what happens when people learn, most teachers "have gained relatively little from cognitive psychology" (Donald Schoen, The Reflective Practitioner, 1983). It seems that even cognitive psychologists apply very little of what they know about their academic discipline to their teaching. The gap between empirically validated theory and practice is wide. This idea first came to me as I sat through a deadly dull three-hour lecture on the shortness of the human attention span.

Here are a few examples of cognitive principles that should be guiding our design of learning activities:

1. What and how much gets learned in any situation depends heavily on prior knowledge and experience. Psychologists use the term "construction of knowledge" because each learner builds meaning using what is already known. For example, in an explanation of this principle in "How People Learn," we are told about a fish who learns about the dry world from a bird. When the bird describes beings who can walk upright and breathe air, the fish imagines fish-looking people walking on their tails, with both gills surrounded with water and lungs filled with air. The comprehension process is similar to that used when children learn that the world is round; they replace their pancake-shaped view of the earth with a ball that has been cut in half, so that we can walk on the flat cut surface without falling off. In other words, the best predictor of what is learned from at the completion of a lesson, course, or program of study is what the learner thinks and knows at the start of the lesson, course, or program of study.

2. We maintain mental models (beliefs) for a wide variety of complex phenomena including those we encounter in the physical world (e.g., moving objects) and social world (e.g., stereotypes about members of groups) because, for the most part, they make sense to us. Our models of the world "work," and thus are difficult to change. Individuals beliefs about the world are organized into mental models that make sense and "work"--that is, do a reasonably good job in their day-to-day life.

Consider this: In a random telephone survey conducted by the Public Opinion Laboratory at Northern Illinois, 21% of the over 2000 adults who responded to the survey believe that the sun resolves around the earth, and an additional 7% did not know which revolves around which. Didn't most of these adults learn somewhere that for over 400 years the scientific community unanimously determined that the earth revolves around the sun? Although we cannot be sure, I would guess that most of these adults learned this fact, but never altered their mental models of planetary motion because their everyday observations don't support it. We see the sun "moving" across the sky as morning turns into night. The earth-centric view of the universe makes sense according to the naive model that is easily constructed and tested and confirmed on a daily basis. In order to change an individual's mental model, we need to design instruction so that the errors in naive models are exposed and the benefits of the new model are obvious. Cognitive psychologists and others have diagnostic assessment models that provide information about each learner's understanding, and based on the way learners respond to questions designed to probe their understanding, teachers can redirect learning activities that correct these errors.

3. Learning is influenced by our students' and our own epistemologies (theories about learning). Academic motivation is related to beliefs about learning.

Many students believe that they cannot "do math," or understand science, or write poetry, or succeed in some other academic discipline. When you ask them about this belief, you find that what they really are saying is that they believe that learning should be easy, but when they learn in these disciplines, it is effortful. What they don't know is that learning and remembering involve multiple, interdependent processes. Some types of learning occur implicitly, that is without conscious awareness. Other types of learning are very easy, and other types of learning are effortful, perhaps even painful and aversive, such as learning the names of the facial nerves or how to "do" long division. It is only after they invest in the hard work of learning that additional learning in these fields becomes easy and more automatic. There is no single set of learning principles that will always work. If I were learning how to ride a unicycle, I would need to practice on a unicycle, no amount of expert explanation would substitute for my getting on the unicycle and pedaling; but I do not have to experience different events in history in order to "know"

them. The best way to learn and recall something will depend, in part, on what it is you want to learn and recall as well as what you already know.

4. Experience alone is a poor teacher. There are countless examples where what we learn from experience is, in fact, systematically wrong. For example, most jurists believe that they can tell from a person's demeanor whether she or he is telling the truth. In fact, they cannot. Therapists believe that a particular intervention has worked when a client improves after that intervention; of course, if most clients enter therapy at times of crisis, then improvement is likely no matter what intervention is taken because of the ubiquitous effect of regression to the mean. If a client does not improve, then therapists reason that he or she was too sick to benefit from the good treatment. There are countless examples of this sort of erroneous thinking, where our beliefs about the world are maintained and strengthened despite the fact that they are wrong. We end up with great confidence in our erroneous beliefs.

This is important because there is a popular belief that all learning and learning assessments should be "authentic"--a term that I don't particularly like. I'd settle for phony learning if what was learned met the tests of long-term retention, retrieval when needed, and flexible recall and use of the information that was learned so it can be used creatively—regardless of how it was learned. Authentic situations are often not optimal for good learning. What is missing from most authentic situations and from most real-life situations is systematic and corrective feedback about the consequences of various actions. When jurists have many experiences where they believe that they can tell if someone is lying and they receive feedback as to whether or not the individual is lying, they can learn that they are not good judges of truth telling. In real life, the systematic feedback is usually missing, so they continue to believe that they are good at the task of identifying liars when, in fact, they are not. Similarly, in the absence of reliable and regular feedback, we tend to believe that our interpretations of social events are accurate or the reasoning behind a political belief system is valid when it may not be.

Let me quickly list a few more examples of ways that can be applying cognitive principles to our teaching and learning.

- Virtually all science courses, especially at the introductory level, involve a lecture portion where a lone teacher mostly talks (and writes on the board) and learners take notes—a satisfactory arrangement for learning if the desired outcome is to produce learners who can repeat or recognize the information presented, but one of the worst arrangements for the promotion of in-depth understanding. In this example, the problem is that both the faculty and students believe that achieving a high score on a recognition test (i.e., multiple choice exam in which the questions tap lower level cognitive processes) or a test that requires only repetition of course material is evidence of "good learning." Unfortunately, it is possible for students to achieve a high score on tests like these and not be able to recognize that a concept applies in a slightly altered context or be able to apply a concept at some time in the future.
- Laboratory exercises are mostly "canned," requiring very little original thought by the learners and few surprises for anyone, thus bearing little resemblance to the cognitive processes needed in real research laboratories. The more creative aspects of research, including the generation of a genuine question and the multiple decision points encountered in the research process are invisible to students in most laboratory courses, especially at the introductory level, where the vast majority of college students complete their formal science education. It is impossible to estimate the number of potential scientists and scientifically informed citizens who are lost at this level because they fail to see any excitement in research, but there are many reasons to believe that it is a large number.
- Asking learners to recall some information leads to selective "forgetting" for other related information that they were not asked to recall. Thus, the act of remembering strengthens some memory traces and weakens others, a fact that should influence how we test students. Few college faculty are aware of this effect and inadvertently are creating learning activities that actually cause forgetting for information that want students to retain. When students are tested frequently, they receive higher scores than students who are tested

infrequently, thus creating the impression that frequent testing is a sound educational practice. Conscientious professors will often use frequent testing because they believe that the high scores achieved on these tests show that frequent testing is a sound educational practice. But, frequent testing also leads to overconfidence in learners who erroneously believe that their long-term retention for the information will be better than it actually is, a belief that should lead them to put less time and effort into studying the material for future recall This is another example where the short-term benefits of an educational practice masks the long-term detriments associated with it.

Teaching for Transfer

The sole reason why we have schools and universities, that is formal settings designed for learning activities is that we expect that learning will transfer. Information learned in one context can transfer to a different context, but we need to teach in ways that encourage transfer. Because of my interest in and commitment to helping students improve their ability to think critically, this is one topic about which I have very strong feelings. The purpose of formal education is transfer. We teach students how to write and think well in the belief that they will use these skills when they are not in school. The truth is sometimes they do and sometimes they don't.

Let's consider a simple concept like correlation. Most students who have taken courses in the social and behavioral sciences or statistics can tell you that a correlation between two variables does not necessarily mean that one caused the change in the other. Most students who have had course work on this topic can compute a correlation coefficient for a set of data and provide examples of positive and negatively correlated variables. They can explain the oft-cited example that as the number of churches increases in a city so does the number of prostitutes, but that this relationship doesn't mean that the increase in number of churches caused the increase in number of prostitutes. But what happens when they are sitting at their kitchen table and read in the newspaper about a study that found that students who attended preschool were better readers by the end of first grade? Many of these same students don't recognize the likelihood that attending preschool did not necessarily cause the first graders to be better readers. But our students can be taught to recognize and apply concepts, like correlational reasoning, that are learned in school in real world settings.

The frequent use of real-life examples will help students to recognize these principles when they encounter them out of school, especially when a wide variety of examples are used and informative feedback is provided. There is a strong research base that supports this statement. Of course, a teacher who returns to the same topic with real life examples throughout the semester will "cover" less material than one who goes on to another topic as soon as her students can compute the correlation coefficient and explain that correlation is not cause. We need to give more thought to what we want students to know and be able to do when they finish our courses.

With some consideration of what sort of information students will need to know and in what settings, principles to enhance transfer and retrieval can be incorporated into every learning activity.

Assessing Learning Outcomes

We need assessments of learning that are consistent with their intended use. Assessment is a term with multiple meanings. Assessment designed to provide feedback that will improve teaching and learning is different from assessment for the purpose of certifying a level of knowledge or skill for the learner, which is also different from assessment for the purpose of evaluating the instructor or the instructor's system or state. I believe that much of the heated debate over assessment would be resolved if those involved in the debate realized that they are often talking about assessment for different purposes and the type of assessment needs to match its intended use.

Research Needed

We need research that can "scale up," by that I mean research designs for large and diverse groups of learners, multiple researchers and teachers, with at least a quasi-randomized design that will allow stronger causal inferences than most educational research designs. Educational research needs to be funded for longer periods of time so that long-term retention and transfer can be assessed. Long-term retention and transfer are the reasons for education, but we cannot determine the effectiveness of any educational application or intervention if the funding runs out before the students leap the many educational gaps, where increasing numbers are unable to bridge from high school to postsecondary school and from school to work.

We need to invest in dissemination projects with as much care and planning as we put into the research itself. There need to be rewards for good educational practices along with positive outcomes for researchers and teachers who are willing to take risks, even when the knowledge gained from those risks is that some method did not work as hoped.

There are, of course, numerous other examples that I could have used to make my point that knowledge of how people learn, think, and remember should at the heart of educational reform. I am happy to provide suggested readings for anyone who would like to learn more or check my conclusion that, with appropriate instruction, we can improve how people learn, remember, and think.

In closing, I'd like to add that enhancing student learning is the most important task we face as a society. Work place and citizenship skills are more complex that ever before; a thinking, educated citizenry is our best hope for the future. We can do a better job of educating our country's most precious commodity--smart, educated adults who can cope with and chart the direction of the change. The rate at which knowledge has been growing is exponential and the most valued asset of any society in the coming decades is a knowledgeable, thinking citizenry--human capital is our wisest investment. More than ever, we need to prepare students to learn efficiently and to think critically, so that the United States can remain competitive and cooperative in the 21st century.

References

An annotated reference list and numerous related documents can be found at http://asl.csusb.edu

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