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The Tribalism of Teaching and Learning

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Abstract

Scholarly research focusing on teaching and learning has experienced extraordinary growth in the last 20 years. Although this is generally good news for the profession of teaching, a troubling form of tribalism has emerged that inhibits the advancement of teaching practice. In this essay, we trace the development of scholarly inquiry into teaching and learning and the emergence of different "tribes" within the movement, each with its own outlets, goals, and methods. Finally, we discuss how these tribes can bridge their differences and work together to advance teaching effectiveness.

Keywords

scholarship of teaching and learning, learning sciences

Psychology has a long history of studying learning and educational processes, dating back at least to John Dewey, William James, and E. L. Thorndike. In recent years, psychological research on educational issues has come under the multidisciplinary umbrella of the "learning sciences." Sawyer (2006) stated that the "The goal of the learning sciences is to better understand the cognitive and social processes that result in the most effective learning, and to use this knowledge to redesign classrooms and other learning environment so that people learn more deeply and more effectively" (p. xi). Research in this field typically argues for the application of cognitive theory to educational settings (e.g., Bransford, Brown, & Cocking, 2000; Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013).

The scholarship of teaching and learning (SoTL) comes primarily from the field of higher education. The approach was conceptualized by Boyer (1997) and put into practice by others, particularly Shulman (2004). Shulman wrote, "For a scholarship of teaching, we need scholarship that makes our work public and thus susceptible to critique. It then becomes community property, available for others to build upon" (p. 43). Thus, teaching becomes a subject of scholarly inquiry akin to any complex problem area that researchers might investigate. SoTL requires meaningful inquiry into teaching that is publicly documented, shared, critiqued, and upon which others can build. SoTL research focuses primarily on evaluating pedagogical methods such as service learning (e.g., Conway, Amel, & Gerwien, 2009) or using concept maps to enhance student learning (Berry & Chew, 2008). This journal, *Teaching of Psychology* has been at the forefront of promoting such research, devoting an entire issue to SoTL in 2008 (Smith & Buskist, 2008).

There is certainly overlap between the two approaches. Both fields are concerned with improving teaching and learning through scholarly inquiry. Both wish to replace untested assumptions and intuition as the basis of teaching practice with research-based principles. Both focus on learning as the critical indicator of teaching effectiveness and move beyond the simplistic equating of teaching with presenting information. The two areas should complement each other and create a synergy that advances teaching and learning, yet that is often not the case. The two fields have become tribes with their own methods, often not collaborating with each other.

The distinction is reinforced by terminology. SoTL researchers tend to talk about pedagogical concepts such as engagement, active learning, and critical thinking that have no exact parallel in learning sciences. The meaning of these terms is somewhat malleable and lacks theoretical precision. Learning science researchers talk about attention and deep processing as precise constructs operationalized for research purposes, but often not operationalized for use in pedagogical practice.

Learning sciences and SoTL also differ in their approach to research. Learning researchers tend to be methodical and systematic, never wanting to go beyond the data. Teachers are pragmatic because they have to develop pedagogy in the absence of complete knowledge about how their students learn. Thus, they often base their pedagogy on intuition, informal observations from their own experience, and beliefs that have no overt empirical foundation. SoTL research is used to assess the impact of this contextually developed pedagogy. Note that we are not saying that all teachers' informal beliefs and intuitions are wrong. Expert teachers are effective because they

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have a deep, perhaps implicit, understanding of how students learn, and their understanding is probably more advanced than the current state of learning science. We are saying that their knowledge is likely composed of a mix of correct and incorrect information, and there is not an empirical basis to determine which of the beliefs are correct and which are not.

The Learning Sciences Approach

Research in learning sciences tends to be driven by theory and basic research from cognitive psychology and related fields. Studies often argue for the application of findings from areas such as attention, working memory, levels of processing, testing effects, and cognitive load to teaching practice and student learning strategies. These studies tend to be relatively well controlled, ranging from laboratory studies to rather constrained classroom demonstrations of the potential utility of specific interventions in specific contexts with particular material. The research is also typically limited in scope, focusing on learning single topics over relatively short time periods. The result is often recommendations about concepts or practices that teachers and students should either employ or avoid (e.g., Dunlosky et al., 2013).

This research, though certainly valuable, has the limitation that the results may not translate into the full context of teaching. Research conducted in a controlled classroom context may still not apply to the full pedagogical context. For example, Gurung, Daniel, and Landrum (2012) sampled students at multiple and diverse institutions and measured a set of key variables thought to be related to student learning based on prior research. They then administered a standard quiz and related the study variables to both the quiz scores and the self-reported learning. First, the variables predicted only 26% of the variance of actual quiz scores and 36% of self-reported learning. Furthermore, whereas some variables identified by research in learning sciences were correlated with quiz scores, others were not. For example, surface or shallow processing was significantly negatively correlated with quiz score, but deep processing was uncorrelated.

Why might variables found to be strongly related to learning based on controlled research predict so little of the quiz variance in a full pedagogical context? We propose that it is because the pedagogical context is a complex interaction of multiple factors, including the topic, the state of knowledge of the student, the mental mind-set of the student, the study strategies employed by the student, the pedagogical strategies employed by the teacher, the characteristics of the teacher, and the assessment method (Chew et al., 2009; Daniel & Poole, 2009). Researchers in learning sciences often act as if successful teaching practice is like putting together a jigsaw puzzle. If we can identify the bigger, more complex pieces of the puzzle, the easier it will be to find the smaller remaining pieces. We suggest that successful teaching practice is more like finding the volume of a block (or any polyhedron). If we are told that one side measures 10 cm, that is clearly an important piece of information, but we are not much closer to deriving the volume of the block. There remain too many unknown degrees of freedom. To take an analogy from physics, the difference between learning sciences and teaching practice is akin to the difference between knowing the laws of thermodynamics and being able to predict the weather. The two are clearly related, but one does not easily translate into the other.

This view has several implications. First, it means that the impact of any learning variable will vary according to the pedagogical context. In some situations, it will be critical, some irrelevant, and perhaps in some counterproductive. Any learning variable has boundary conditions, and what works for one class may not work for another. There is no single best way to study or teach and there are many ways to learn. Second, the value of a learning variable is measured not just by its impact in one situation, but its application across a range of relevant situations. Third, teachers must determine ways to utilize learning variables effectively for their particular situations. Daniel (2012) argued that learning science can be the source of *promising principles* of learning that must then be designed for application and adapted by instructors before realizing their pedagogical potential. Much like the discovery of active chemical ingredients is merely the first step in developing effective drugs, understanding the basic principles of learning is only the beginning of the development of effective pedagogical interventions.

Evidence for interaction among learning variables is common. For example, students alter their study strategies according to the type of test, which influences their test performance (Abd-El-Fattah, 2011; Ross, Green, Salisbury-Glennon, & Tollefson, 2006). Deeper, more desirable study strategies are correlated with student perceptions of the quality of the course (Richardson, 2005). Hardin (2007) found that the use of PowerPoint enhanced the teaching of one instructor but detracted from another's. To truly develop usable knowledge for practice, the field needs to move beyond simple main effects toward an understanding of the complex interactions that occur in typical teaching and learning contexts.

SoTL research can help learning scientists to translate promising principles into effective pedagogical practices, or at least outline the boundary conditions in which a principle is useful and describing the kind of learning that results.

The SoTL Approach

SoTL research typically studies learning within a full pedagogical context, thus avoiding the pitfalls of generalization. However, SoTL research is still subject to methodological shortcomings. First, SoTL research is often not based on, or mapped to, principles of learning. New pedagogical methods are developed and promoted without an understanding of how they are supposed to activate fundamental learning processes. There is no empirical framework to guide the development, refinement, and extension of SoTL findings. For example, Daniel and Broida (2004) presented findings that properly configured online, pre-lecture quizzing encouraged better exam scores. They recommended certain parameters that make such quizzing effective. However, they did not investigate the source of the effect. Do online quizzes work by encouraging reading when it would otherwise not be done, by spacing reading and exposure to the content, or via a version of a testing effect? Without systematically addressing the cause or causes of the effect, we are left with a recipe for successful intervention but no understanding of the systems supporting it. A similar argument can be made for context by material interactions. Are there certain contexts or learning materials that quizzing may have little or compromising effects with regard to learning?

There are literally thousands of published studies of pedagogical methods with little attempt to organize them into a meaningful theoretical framework. We are thus left with a rather crowded buffet of techniques without any theoretical framework to explain how they leverage basic cognitive or motivational systems in their target population. Thus, systematic investigation of the sort that would move science forward, or provide appropriately nuanced and flexible pedagogical practices, is thwarted.

Second, SoTL typically reports the success of particular methods in a particular context and within a particular level of a specific discipline (e.g., large section general psychology courses using multiple-choice exams). The strength of this model is a fairly specific target in which the technique may be effective. Some SoTL employs a more controlled lab setting (e.g., Daniel & Woody, 2013) that allows for a more direct focus on the technique, albeit decontextualized. While opting for more control, these studies do not often map the results to the cognitive or motivational constructs that learning science researchers articulate. Thus, we have the emergence of a hybrid that is neither: A mid-level of control for particular methods and a promising midpoint between traditional classroom-based SoTL and theory-focused learning science.

Third, it is not uncommon in SoTL research for studies to offer conclusions based upon a very simple experimental design: *something versus nothing*. In this model, an intervention is compared to no intervention (e.g., reading vs. no reading). While this may be able to demonstrate that the intervention does no harm (assuming significant results for the intervention), it does not offer a real test between competing pedagogical interventions (e.g., spaced reading vs. massed reading). Thus, the most appropriate comparison group is often the *demonstrated next best alternative*. In other words, does the intervention work better than something demonstrated to work better than nothing?

In the absence of a theoretical framework to guide the development of pedagogy, teaching practices become fad-driven, with one teaching fad being replaced by another. Teaching practice changes but does not progress and improve. The pedagogical literature is littered with methods and techniques that initially held great promise and caused great excitement but then faded into obscurity, replaced by the next big thing. Furthermore, teachers waste time investing in teaching approaches that have no basis in learning science and thus are useless or even counterproductive, such as learning styles (Pashler, McDaniel, Rohrer, & Bjork, 2009). Finally, ineffective teaching strategies can be developed based on misconceptions or distortions of research from learning sciences. Examples are easy to find, such as many claims about "brain-based education" (Geake, 2008; Goswami, 2006; Sylvan & Christodoulou, 2010). Another example is the move from physical textbooks to digital e-readers, which is not driven by any theoretical justification or empirical findings. In fact, the research indicates that the use of e-readers may slow learning (Daniel & Woody, 2013). In the same way, the development of Massive Open Online Courses is not being driven by any theoretical or empirical foundation of how people learn.

The learning sciences can help guide the development of effective teaching practices if properly understood by teachers. To be effective, any teaching method must be grounded in the cognitive architecture of the human mind. It must mesh with how students learn. If it fails to do so, the teaching method will fail; no matter how well intentioned.

A Call for Translational Research

The tension between research that is highly controlled but not ecologically valid versus research that is ecologically valid but not as well controlled is as old as Ebbinghaus and Bartlett (e.g., Banaji & Crowder, 1989; Ceci & Bronfenbrenner, 1991). What is needed to rectify this kind of tribalism is reciprocal collaboration between researchers (e.g., Klatzky, 1991), in this case between the learning sciences and SoTL. Each must recognize how the strengths of one approach can compensate for the weaknesses of the other, especially with regard to issues of control and complexity. We argue for translational scholarship that bridges the two areas. Translational research involves integrating basic principles of learning into pedagogical practices that teachers can use as well as a focus on issues derived from educational practice, not just theory. It also involves understanding how a pedagogical practice might work in terms of basic learning principles.

Below are three examples. The first is an example of successful translational research. The second is an example of a promising principle from learning sciences in which the translational research has yet to be done to develop it into pedagogical practice. The third is an example of how SoTL can inform the learning sciences and how translational research could benefit both approaches.

Formative assessment provides a good example of translational scholarship. Formative assessments are low stakes assessments designed to give both the student and the teacher a measure of the students' level of understanding of a concept. Examples include Think-Pair-Share activities, ConcepTests, and so-called clicker questions. Formative assessments have been shown to be an effective pedagogical practice across different teaching contexts (e.g., Mazur, 2009) and research exists to guide its use (e.g., Anthis, 2011). It is also grounded in the principles of learning science. In various forms, formative assessment can improve metacognitive awareness, provide feedback to students, give formative evaluation, improve concentration and engagement, and require self-testing. All of these factors have been shown to improve learning (Hattie, 2009).

Distributed practice or spacing is an example of a promising principle that has robust support in the learning science literature (Dunlosky et al., 2013). However, knowing this principle neither offers specific guidelines for teachers on how to implement this principle in their instruction nor informs students how to utilize this principle in their studies. There is the question of what the optimal spacing interval is for what content, for what level of prior knowledge of the student, and for how long of a study period? Furthermore, distributed practice is most effective for long-term recall. It will not be useful to students if their goal is not long-term recall. If their goal is passing today's test, then massed practice, or cramming, is superior to distributed practice for immediate recall. Finally, distributed practice assumes a constant amount of study time that is either massed or distributed. Such control over available study time may never be realized in the schedules of many students. These kinds of constraints or boundary conditions affect the utility and effectiveness of the principle. Translational research is needed to determine if and how the principle can be translated into pedagogical practice across contexts, content types, and students.

At the core of teaching is conceptual change, in which students reorganize their schematic knowledge to understand the world in a new, more sophisticated way. An example is how children move from an intuitive concept that the world is flat to the correct but counterintuitive concept that the world is spherical (Vosniadou & Brewer, 1992). Conceptual change is neither quick nor easy, and it typically involves not just learning an accurate concept, but discarding a long-held, intuitive misconception (Chew, 2005). A key question for learning is as follows: Under what conditions does conceptual change occur? Piaget described conceptual change as the process of accommodation, but he did not specify the conditions that bring it about. Teachers grapple with bringing about conceptual change in their students every day. It is likely that teachers have discovered much about conceptual change that would be helpful to learning scientists. This knowledge has yet to be captured from the experts and tested in controlled studies.

It is in this very process of moving from a promising principle to a pedagogical technique or pedagogical knowledge to principle of learning where we see the pitfalls of tribalism, as well as the promise of perspectival pluralism. Rather than arguing that the tribes should merge beneath a singular perspective, we believe that it is most productive to leverage the strengths of each perspective with the goal of translation and effective application on one hand, and the description of foundational learning processes (and their interactions) on the other. Thus, we view the perspectives as potentially complimentary. In the spacing example above, it would be quite natural for SoTL researchers to assess various iterations of spacing in multiple contexts.

Mayer (2010) has argued for such an approach by distinguishing between the *science of learning*, which is the study of how people learn, and the *science of instruction*, which is the study of how people help other people learn. We endorse the idea that research on teaching should span from the fundamental principles of learning to effective pedagogical practice and vise versa. But, we are not convinced that it requires defining a separate area of research. Rather, it requires an orientation within each perspective toward a kind of research that both translates basic learning research into pedagogical practice and translates the expertise and practice of expert teachers into basic learning principles. In this sense, either learning sciences or SoTL can, and should, engage in translational research. The links between scientist and clinician in the field of medicine, as well as the clearly defined process of translation from lab to market, provides a model of efficiency for the future evolution of a truly applicable science of learning. Just as the drug discovery process informs the translational and clinical trial process in medicine, collaborations such as these would promote a more efficient and meaningful move from promising principle to successful pedagogical strategy.

In this essay, we have described two "tribes" of pedagogical research. Each believes it is doing the difficult and necessary work to advance teaching. What is really needed is collaboration between the two groups as well as a structure for such collaboration (see, e.g., Daniel, 2012). Such translational research has the potential to truly advance pedagogical effectiveness and a more thorough model of human learning in context.

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