Recent Research in Science Teaching and Learning

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The *Current Insights* feature is designed to introduce life science educators and researchers to current articles of interest in other social science and education journals. In this installment, I highlight three diverse research studies out of psychology journals that address student study strategies, faculty change, and the influence of instructor style on the gap between perceived learning and actual learning.

STUDENT STUDY STRATEGIES

Chen, P., Chavez, O., Ong, D. C., & Gunderson, B. (2017). Strategic resource use for learning: A self-administered intervention that guides self-reflection on effective resource use enhances academic performance. *Psychological Science*, 28, 774–785. <https://doi.org/10.1177/0956797617696456>

Instructors can express frustration with students for not using the available resources to prepare for exams. Implicit in this frustration may be an assumption that students know how to select and use resources, yet many students may not engage in this kind of strategic thinking about exam preparation. In this study, Chen and colleagues test whether a short intervention, called the Strategic Resource Use intervention, can 1) encourage students to explicitly create a strategy for using course resources to study for their exams and 2) increase their exam performance.

The Strategic Resource Use intervention is quite simple. Students first read a short prompt describing how high achievers use resources strategically during exam preparation. They are then prompted to consider the types of exam questions they expect and to choose, from a list of the available class resources, the resources they wanted to use to maximize their learning for the exam. This list included practice exam questions, the textbook, discussing with peers, instructor office hours, and other resources available in a typical class. After completing this checklist students were then asked two open-ended questions on 1) why they thought each chosen resource would be helpful to them; and 2) when, where, and how they would study with the resources chosen. The intervention was deployed online 10 days before each exam, and students had 3 days to complete it. Students took 10–15 minutes to complete the intervention and earned extra-credit points for completing the activity.

This study was particularly well controlled. Two cohorts participated in the study in the same semester of two different years of the same class with the same instructor. Within each class, students were randomly assigned to either the treatment or control condition, and the instructor was blind to this assignment. In addition, researchers collected background and motivational measures from the students. They found no difference between the treatment and control groups across the following measures: high school grade point average (GPA), college GPA, desired grade, motivation to get that grade, and confidence that they could achieve that grade. In addition, because self-selection bias can occur when it comes to who completes extra-credit assignments, researchers analyzed their outcome data in two different ways: including all the students assigned to a condition whether they completed all the assignments or not and just including the students who completed all the assignments. Outcomes from the analyses of these two approaches were quite similar, although there was a dosage effect. Here, I will report only the results for students who completed all the assignments.

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Chen and colleagues found that the Strategic Resource Use intervention increased overall course grades by one-third of a letter grade relative to the control treatment. In addition, students who completed the intervention consistently performed significantly higher on all the exams except for exam 1. Students in the intervention group also reported significantly more self-reflection on their learning, and the more self-reflection they engaged in, the more useful they found the resources they used to study. One might predict that being exposed to the checklist might mean that students in the treatment group were simply using more resources to study than students in the control group, who did not see the checklist. However, students in the treatment group actually used fewer resources. This finding supports the main hypothesis of the paper: students in the intervention group used resources more strategically. Additional support comes from student responses to the open-ended questions. Writing about four study strategies seemed to be associated with increased course performance: tailoring choice of resources to study from to exam format; choosing resources based on their ability to increase understanding of content; setting when a resource will be used; and planning how to use that resource.

Thus, Chen and colleagues demonstrate through a well-controlled and well-designed experiment that instructors can reduce potential frustration by helping their students become more strategic in their studying through a short online intervention.

FACULTY CHANGE

Stupnisky, R. H., BrckaLorenz, A., Yuhas, B., & Guay, F. (2018). Faculty members' motivation for teaching and best practices: Testing a model based on self-determination theory across institution types. *Contemporary Educational Psychology*, 53, 15–26. <https://doi.org/10.1016/j.cedpsych.2018.01.004>

Although effective teaching practices are well documented, not all faculty employ them. Stupnisky and colleagues explore whether different types of motivation for teaching predict the use of best practices. Specifically, they apply Ryan and Deci's (2017) self-determination theory to this question. In this theory, motivation ranges from autonomous, which is similar to intrinsic motivation, wherein something is done for enjoyment and satisfaction, to external regulation, wherein something is done because of factors outside of the self, such as rewards and costs. To achieve the most optimal form of motivation, autonomous motivation, individuals must feel competent in their environment, relate to others, and experience a sense of choice. When these psychological needs are not met, individuals are more likely to be on the more external regulation end of the motivation spectrum. Based on this theory, Stupnisky and colleagues posit that faculty who have their needs for autonomy, relatedness, and competency met will feel more autonomous motivation for teaching, and that autonomous motivation in turn will be more likely to predict the use of best practices.

Researchers distributed a survey to faculty at 19 different universities and colleges across a range of institution types (doctoral-, master's-, and bachelor's-granting institutions; public and private [not for profit]) and disciplines. More than 1500 faculty replied to the survey (46% response rate). Faculty responded to items that addressed 1) the motivation faculty

experience for their teaching; 2) the extent to which their psychological needs are met at work; and 3) their use of four teaching best practices: instructional clarity, higher-order learning, reflective and integrative learning, and collaborative learning. Structural equation models were applied to theses to test whether the fulfillment of psychological needs predicted autonomous teaching motivation, and whether autonomous teaching motivation was more likely than external teaching motivation to predict use of best practices. Although researchers did find small differences in how motivation and psychological needs predicted the use of best practices between different institution types, I will only discuss the results pooled across institution types.

Autonomous (intrinsic) motivation had a positive and significant relationship with the use of all four best practices. External motivation was unrelated to the use of best practices. Thus, to most consistently promote the use of best practices in teaching, these results suggest it is better to focus on building autonomous motivation (enjoyment, satisfaction) for teaching rather than using external motivations (tenure and promotion, teaching awards, etc.). The authors acknowledge that not everyone may come to enjoy teaching, but they can begin to recognize its importance. Being motivated by the value of teaching is so close to autonomous motivation that working toward this will lead to equally strong change.

In addition, Stupnisky and colleagues found that fulfillment of autonomy, competence, and relatedness needs predicted an increase in autonomous motivation. There was no relationship between need fulfillment and external motivation. Thus, efforts to increase the use of best practices might include elements that fulfill these psychological needs. On the basis of these findings, the authors suggest possible elements of faculty development or change initiatives, including providing faculty with choice in course selection (autonomy), providing professional development and time to prepare their courses (competency), and facilitating a sense of community or connection between faculty and their students and colleagues (relatedness). Motivation frameworks, therefore, can be useful for considering the design of interventions and can help identify leverage points that promote the use of best teaching practices.

LECTURING STYLE AND STUDENT OVERCONFIDENCE

Toftness, A. R., Carpenter, S. K., Geller, J., Lauber, S., Johnson, M., & Armstrong, P. I. (2018). Instructor fluency leads to higher confidence in learning, but not better learning. *Metacognition and Learning*, 13(1), 1–14. <https://doi.org/10.1007/s11409-017-9175-0>

To study effectively, students need to accurately assess what they know and what they do not know. Unfortunately, many factors can influence a student's ability to do this. In this study, Toftness and colleagues explore the influence of "fluency." In this context, fluency is defined as how easy something appears to be to learn. Specifically, the authors focus on how the presentation style of a faculty member could influence students' ability to accurately self-assess their knowledge.

For this study, researchers focused exclusively on lecturing methodologies. They created two 31-minute videos on information theory in which an instructor said the same things, used the same visuals, and presented material at the same rate, but the style of delivery was different. In the fluency

treatment, the instructor was engaging: dynamic voice, hand gestures, movement, and dramatic pauses. In the disfluent condition, the instructor did not make eye contact and read the lecture notes in a monotone from behind a podium. Undergraduates ($n = 213$) recruited from a range of disciplines were assigned to watch one of these videos and complete both a posttest and a survey over the video content. Half these students took the posttest immediately after watching the video, and half took it a day after watching the video. All students took the survey immediately after watching the video. In the survey, students rated the effectiveness and communication ability of the speaker and answered questions concerning how well they believed they would perform on a test covering this material.

Regardless of when they took the exam, students believed that they learned more in the fluent instructor condition than in the disfluent condition. In experiment 1 (testing immediately after the video), students in the fluent condition predicted they would get 60% of the questions correct, whereas the disfluent students predicted 46%. Students also rated the fluent instructor as more effective. However, there was no significant

difference in actual learning between the two groups (scores: 56 [fluent] vs. 51% [disfluent]). The results followed a similar pattern for the students who took the test a day after watching the video: students in the fluent instructor condition thought they would get more questions correct than did students in the disfluent condition (66 vs. 50%), but in reality their learning was the same (48 vs. 45%).

Thus, students exposed to a fluent lecturer were overconfident in their learning: the gap between what they knew and what they thought they knew was significantly larger than in the disfluent condition. The authors elegantly describe an entertaining lecturer as creating an “illusion of learning,” because he or she makes learning the material look easier than it actually is. The researchers did not expand the study beyond lecturing, but one wonders whether an instructor using active-learning techniques could further reduce the gap between perceived learning and actual learning?

REFERENCE

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