

Current Insights

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ABSTRACT

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 recent studies from the fields of psychology and science, technology, engineering, and mathematics education that can inform life science education. The first characterizes how instructor beliefs about intelligence are communicated to students in the classroom. The second explores how instructor identity as a researcher may lead to different types of teaching identities. The third presents an alternative way to characterize students' success that is based in Latinx college student values.

HOW DO INSTRUCTOR BELIEFS ABOUT INTELLIGENCE GET COMMUNICATED TO STUDENTS?

Kroeper, K. M., Fried, A. C., & Murphy, M. C. (2022). Towards fostering growth mindset classrooms: Identifying teaching behaviors that signal instructors fixed and growth mindsets beliefs to students. *Social Psychology of Education*, 25, 371–398.

Decades of research have established the impact of students' beliefs about the malleability of their own intelligence on their motivation for and performance on tasks (Dweck and Yeager 2019). Recently, the role of instructor beliefs about intelligence on student outcomes has been highlighted. Instructor beliefs have been shown to relate to student motivation, belonging, persistence, and achievement (cf. Rattan *et al.*, 2018; Lacosse *et al.*, 2021). In this article, Kroeper and colleagues explore which instructor behaviors influence students' perceptions of instructor beliefs about intelligence in science, technology, engineering, and mathematics (STEM) courses.

Through four focus groups, 40 students identified a suite of instructor behaviors that they believed influenced their perceptions of their instructors' beliefs about intelligence. Researchers organized these behaviors into four clusters. The first cluster was "explicit messages about progress and success." Messages that encouraged beliefs in the malleability of intelligence included instructor statements about the potential of students to improve with time and providing specific strategies to support that growth. This could include self-disclosure by instructor about their own or other students' improvement. The second cluster of behaviors was "opportunities for practice or feedback." The presence of course features like peer review or instructor/teaching assistant (TA) review before final drafts were due or opportunities to submit revisions signaled the instructors thought students could get better and, thus, the malleability of intelligence. The third cluster of behaviors was related to "instructors' responses to poor performance." Acknowledging students' struggles, giving advice on how to improve, and reviewing common mistakes with the whole class all communicated a belief in the malleability of intelligence. In addition, grading schemes that allowed points for effort, participation, or asking questions also communicated this. The fourth cluster was "values instructors placed on student learning and development." Behaviors like valuing attendance and participation so that students can better learn the materials, replying to emailed questions quickly, and building supportive relationships with students supported students' perceptions that an instructor believed intelligence was malleable.

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In the second study, researchers developed a survey that measured common instructor behaviors from each of the four clusters. Using a sample of more than 700 students from across 44 STEM classes, they tested whether students' experiences with these behaviors predicted their perceptions of their instructors' beliefs about intelligence (after controlling for students' own personal beliefs). Researchers created composite scores from the items representing each of the four clusters of behaviors. They ran hierarchical linear models to test the relationships while accounting for the structure of their data set (i.e., students nested in classes). All four clusters were significantly related to students' perceptions of their instructors' beliefs about intelligence, which supports the hypothesis that these behaviors are being used by students to evaluate instructor beliefs. The strongest relationship was for the "explicit messages about progress and success" cluster. Researchers also looked at each instructor behavior individually, and not all behaviors were correlated with perceived instructor beliefs about intelligence. For example, of the three behaviors in the "opportunities for practice and feedback" cluster, only one, encouraging students to get instructor or TA feedback before turning in an assignment, was correlated with belief about instructor mindset.

In summary, this study connects concrete instructor behaviors to students' perceptions of their instructors' beliefs. Although not exhaustive, this study suggests specific interventions instructors can try to intentionally convey their beliefs about malleability of intelligence to their students and thus increase student motivation and performance. Replication of this study across other institutions as well as the collection of additional validity evidence for the survey is still needed.

INSTRUCTORS' PURPOSE FOR TEACHING: PRODUCING NEW RESEARCHERS OR INDEPENDENT LEARNERS?

Günter, K. P., Ahnesjö, I., & Gullberg, A. (2022). "I try to encourage my students to think, read, and talk science" intelligible identities in university teachers' figured worlds of higher education biology. *Journal of Research in Science Teaching*. Advanced online publication. <https://doi.org/10.1002/tea.21829>

Many factors influence a STEM instructor's beliefs and approaches to teaching, but one of the most personal and influential may be an instructor's own professional identity (Brownell and Tanner, 2012). Identity has the potential to influence instructors' goals for STEM teaching, their beliefs about the respective roles of teacher and student in the classroom, the content they teach, and the methods they use to teach it. Yet, viewing these beliefs as purely personal hides the structural influences of STEM training and culture (Brownell and Tanner, 2012; Avraamidou, 2020). In this study, Günter and colleagues turn to a unique data set to expand our understanding of current beliefs about STEM teaching: the teaching statements of STEM professionals applying for STEM positions.

This research took place in Sweden, where applications for faculty positions are public record. Günter and colleagues were able to collect the applications of those on the shortlist for 30 STEM faculty positions at a single university. There were 94 unique applicants for these positions. Teaching narratives are particularly revealing artifacts, because they are one of the few

places STEM professionals are asked to clearly articulate their purpose for teaching. Further, the people writing teaching narratives are aware that they are writing to a STEM audience and so may appeal to or intentionally challenge the perceived norms in STEM. In either case, they are revealing what they perceive these dominant norms to be (i.e., what is "good" STEM teaching?). Thus, these statements can reveal dominant narratives about STEM teaching. Researchers used a discourse analytic framework focusing on teacher beliefs, assumptions, and values as well as stories told to illustrate these in their teaching statements. Using these methods, Günter and colleagues found two dominant teaching identities across these teaching statements at this university: "Research Science Teacher" and "Facilitating Science Teacher."

What was most interesting about the Research Science Teacher were the shared assumptions that were communicated. For teachers in this category, the main goal of teaching was to create new scientists. The content they described choosing to teach and the skills they emphasized were targeted to the research career path. Thus, they saw transmission of both science and enthusiasm for science as the main goals of teaching. Interestingly, no one in this category explained what "good" science actually entails. It seemed to be assumed everyone shared the same idea. Beyond these two primary goals, teachers with this identity expressed responsibility for knowing more than students and acting as a researcher role model for students to emulate. Teaching was implied to be an altruistic act on the part of a person who was primarily a researcher. Teaching and graduate research mentoring were described as interconnected, requiring the same tools and methods. People with this identity seemed to see teaching as a skill that comes naturally from doing research: "A good and enthusiastic researcher will naturally be a good university teacher" (p. 12). Additional teaching training was rarely pursued by these individuals.

One important contrast between Research Science Teacher and Facilitating Science Teacher was that this second identity did not exclusively teach to recruit students to a researcher career path. This identity was more attuned to variation in student backgrounds and goals. Instructors with this identity expressed the desire to teach students to be independent learners. This core difference leads to more emphasis in the teaching statements on students being actively involved in their learning (rather than a focus on transmission), because independent learners needed to learn how to produce their own knowledge and should have agency to shape their experiences. This identity did not see teaching and mentoring as so tightly intertwined, because the goals for the two tasks were different, so these instructors tended to recognize the need for separate training in teaching.

Collectively, this study helps us better understand some common narratives about teaching and its purpose among STEM practitioners. Some interesting implications from this study were for relationships within STEM departments and faculty change. Instructors across these two identity profiles fundamentally believe the role of teaching was different: to produce researchers versus independent learners. If STEM practitioners believe the purpose of teaching is to produce researchers, then they may not easily recognize that faculty who are not researchers can have teaching expertise (because they

are not researcher role models). In addition, if being a good teacher comes naturally from being a good researcher, then these practitioners may not see the need for additional training in teaching and thus may not partake in learning about evidence-based practices. One strategy to address this might be to suggest evidence-based practices better reflect research tasks. For instance, evidence-based strategies like course-based undergraduate research experiences that are framed as more authentic to the research experience do seem to have enjoyed widespread adoption.

This study also raises many interesting questions. In their work at a single institution, researchers found only two dominant narratives among applicants selected for interviews for research positions. Would expanding the study to include multiple universities with diverse institutional cultures identify additional teaching identities? Similarly, what might examination of teaching statements from applicants not selected for interviews reveal? Might there be additional or a broader diversity of identities represented among this applicant pool? The authors conclude the article with a call to provide STEM practitioners space to consider the norms that they are enculturated into and that they embody in their teaching as a means of encouraging change. By making these norms visible, like in these teaching statements, instructors can challenge them and make their own choices.

DIVERSIFYING HOW STUDENT SUCCESS IS MEASURED

Langhout, R. D., Rosales, C. E., & Gordon, D. L., Jr. (2022). "Success" in the borderlands: Measuring success for underrepresented and misrepresented college students. *Journal of Diversity in Higher Education*. Advance online publication. <https://doi.org/10.1037/dhe0000444>

LSE and other education journals are full of articles measuring students' success, often in terms of course performance or career-focused outcomes like obtaining a job after graduation. However, although it is not often discussed, these measures are rooted in a particular cultural context (primarily in the ideas of white culture's emphasis on individual responsibility and individual gain). Langhout and colleagues argue that we need to expand definitions of success to include how students of color define success. Specifically, they focused on the development of a survey to measure student success using characteristics of success identified by Latinx undergraduates.

Researchers drew on some of the few studies that explored Latinx conceptions of student success. These studies are reviewed in the introduction and present a very different picture of success than a high grade point average (GPA) or getting a job after college. Latinx students often described navigating two or more conflicting cultural contexts. For example, some Latinx students attended predominantly white institutions with norms that can conflict with the norms of their family or home communities. Success for these students included navigating oppression in the college environment, using the consciousness they developed from being part of multiple communities to create change, and feeling whole despite straddling multiple contexts. Being "bold in the face of stigma" and "self-motivat[ing] in the face of low expectations" represented success (p. 4). In addition, some Latinx students

described their goals for education as more focused on helping their home communities than on individual gain. Maintaining relationships with and advancing their home communities while at college was also important for success.

Langhout and colleagues initially wrote 15 survey items based on these student characteristics of success. They shared items with experts in multiple areas, including psychometrics, educational equity, and student success, to collect initial face validity. They then used their instrument to survey students at a Hispanic-serving research institution to collect two additional measures of validity. They did not limit their study participants to Latinx students. Instead, they argued that these measures of success should make sense to students of color generally, because many of them straddle multiple cultural contexts. In addition, they argued from a practicality standpoint that institutions would not have the resources to only target Latinx students with their survey instruments. Instead, the instrument needed to work with everyone.

The factor structure of the survey was determined through iterative exploratory factor analyses run on half the collected sample. Once a factor structure was established, a confirmatory factor analysis was run on the other half of the sample. This statistical procedure provided validity evidence based on internal structure. To reach a stable workable solution, the authors removed negatively worded items and two items that did not statistically seem closely related to the other items. Ultimately, they ended up with a nine-item measure of success as characterized by Latinx students.

The final source of validity evidence was the relationship of their new measure of success to existing measures. The researchers hypothesized that their measure should be correlated with measures of student thriving (the presence of emotional and psychological wellness). The thriving measure they used had three dimensions: academic determination (motivation, self-efficacy, and effort toward school), social connectedness (feeling like they matter to others and are valued on campus), and diverse citizenship (desiring to interact with others different from oneself and believing one can make a difference in the world). They also collected two typical measures of success at school: high school GPA and composite Scholastic Aptitude Test (SAT) score. The researchers hypothesized that their measure of success would measure a different dimension of success from these typical measures and thus would not be correlated. This is exactly what they found. Their construct measuring Latinx definitions of success was correlated with the thriving subscales but not with GPA or SAT.

In conclusion, the researchers argued that colleges and universities need to broaden their definitions of success to include definitions beyond those based in white culture. The authors did not necessarily suggest that all institutions stop using traditional measures that focus on career-related outcomes, but that these measures be expanded to capture additional goals students may hold. In this study, they demonstrated that it is possible to create a survey instrument that can capture expanded definitions that include social justice goals. Further work with this scale beyond a single institution should be done to explore the generalizability of the measure.

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