Do introductory courses build scientists?

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Many future educators will leave college with only one or two introductory science classes. Those one or two intro courses can determine how they leave feeling about their scientific ability, directly shaping how they teach and inspire the next generation of students.

“That person who goes on to teach is going to have an impact on hundreds, if not thousands of children in their lifetime,” Anne Egger, a professor in the CWU Department of Geological Sciences and Department of Science and Mathematics Education at CWU, said. “It’s absolutely critical.”

Oftentimes, those same intro courses are weed-out courses, designed to either test students’ resolve or reduce enrollment in highly competitive majors. Leighanna Hinojosa, Director of Evaluation for the GEAR UP the METRO grant at the University of Oklahoma and a former Science Education Specialist in the Department of Science and Mathematics Education at CWU, asked: “Why are students feeling like they don’t belong in science, even when they’re equally capable?”

“We don’t want these spaces to be exclusionary and push students out. We want more people to enter with these diverse perspectives and to participate and collaborate.”

Hinojosa and Egger conducted research on the impact of changing STEM teaching practices and materials through the TIDeS Project, or Teaching with Investigation and Design in Science. Their most recent publication, in April 2026, Building students’ science identity in introductory undergraduate science courses, examines their data from the TIDeS Project. Their findings suggest that intro courses can build scientists, especially when those courses provide opportunities for students to build science

skills, participate in science as a social and collaborative process, and see themselves represented among scientists from all backgrounds.

Q: What did the study measure?

A: "We developed pre- and post-class surveys measuring students' confidence in their ability to do certain science tasks, not memorizing facts," Egger said. "We asked things like whether they feel comfortable talking about data with other students, rather than about content."

"We implemented these surveys in classes where they were taught the way the instructors had always taught them before, as well as in redesigned classes with new materials and professional development for instructors to focus on creating an equitable learning environment and engaging students in discourse and active engagement in scientific practices."

On the study's results, Hinojosa explains: "Confidence goes up pre- to post-survey in all courses, but the gains were more distinct in the redesigned classes." Beyond reporting higher levels of confidence, "students in the treatment group were more specific in how they would take those skills and use them in their future careers."

"We were working with a big educator group going on to be future teachers. It was great to see many planning to apply these skills in science teaching and doing science practices in their classrooms."

Q: What surprised you about the research?

A: "We were surprised by how little actual science discourse happens in introductory classrooms," Hinojosa reported. "We spent several professional development sessions focused on discourse practices, but many instructors still struggled to get students to do collaborative, small-group work."

"I was surprised that while many students often learn science content, they don't always get opportunities to participate in the kinds of conversations, problem-solving, and collaboration that scientists engage in every day. That was important because those experiences help students begin to see themselves as capable contributors to science. We often think students become scientists by learning content, but our findings suggest they also need opportunities to participate in science as a social and collaborative process."

Q: What should faculty take away or change about their intro courses?

A: "In the dissemination phase, as I lead workshops to help faculty implement these changes in their own classes, we really emphasize giving students the opportunity to engage in science with real questions that they care about. That means getting to know your students, figuring out what they care about, and honoring what they're bringing into the classroom," Egger explained. "Use that to engage in science and do science, don't just talk about science."

"I loved hearing about how instructors and their courses normalized the productive struggle. It's an important lesson in life for students, that science is messy," Hinojosa stated. Egger added, "the materials focus on that idea of productive failure, as part of the learning process. When an experiment fails, you have learned something from it. You redesign and try again. That's part of how we learn."

Q: What might students, particularly first-generation students, take away from your work?

A: "If an introductory class makes you feel you don't belong, that's not a judgement on your ability. Your sense of belonging and your science identity grows over time through your participation and your experience," Hinojosa stated.

Egger added, “I want students to know that they are bringing valuable knowledge and skills into an intro course. My job is to build on those experiences, not replace who they are and where they come from, and to learn another way of engaging with the world and developing their identity as a scientist.”

Q: What’s a myth about STEM students that your research challenges?

A: “I want to challenge the myth of this division of STEM students and non-STEM students,” Egger stated. “That boundary is artificial.”

Hinojosa stated, “the myth about scientists not being social or stuck in their lab. Scientists collaborate every day, which is not something that’s widely shared.”

“In the paper, we mention scientist spotlights,” where, during repeated activities in-class, these spotlights highlighted the diversity of scientists. “It was an effort to show students that there isn’t one stereotype that is a scientist, it can be anybody.”

Hinojosa continues their work in student and educator development as the Director of Evaluation with the K20 Center at the University of Oklahoma, where she leads evaluation efforts, supports continuous improvement, and works with schools and community partners to expand college and career readiness opportunities for students. Egger continues to lead workshops as the PI for the TIDeS Project, encouraging faculty to implement these changes and materials in their classes.

Read the full study: International Journal of Science Education, DOI: https://doi.org/10.1080/09500693.2026.2661392.

Teaching materials from the TIDeS Project are available at: https://serc.carleton.edu/tides/teaching-materials/index.html.