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Education

Re-thinking STEM proved to be smart move by TCNJ

College feels 2004 changes have led to larger number of graduates earning PhDs

By Andrew Sheldon, August 22, 2016 at 3:00 AM



STEM students at TCNJ are active in research projects. - (–COURTESY COLLEGE OF NEW JERSEY)

There's a national push to create more STEM students and a local one to keep college students in the Garden State.

The College of New Jersey feels it has found a way to do both — thanks to moves it made more than a decade ago.

Leaders at TCNJ sat down in 2004 to rewrite its STEM curricula so it required students to explore a cornucopia of subjects and experiences, according to Jeffrey Osborne, the dean of the School of Sciences.

The thought, Osborn said, was to best prepare the student for the challenges of working in the real world.

“We’ve built the critical structure for interdisciplinary connections to be made,” he said. “We reduced the amount

of courses that students were going to take, but increased the level of rigor and engagement of those courses so students were getting a deeper learning experience in those courses.

“When our students leave TCNJ and go to graduate school or to work in industry, they’re going to encounter problems. They’re not going to encounter biology or chemistry alone. They’re going to encounter problems that require them to think across disciplinary boundaries.”

Twelve years later, Osborne said the validation for those changes is in the data.

In 2005, 32 of their undergraduate students were awarded doctorate degrees. By 2014, that number had climbed to 60.

“The number of students who have completed doctorate degrees, who finished their undergraduate degree at TCNJ has increased, for the institution as a whole, almost 100 percent,” Osborn said. “For the School of Science, it’s increased over 100 percent.”

That growth, Osborn said, is affirmation for the school’s reimagining of its curriculum.

“Those numbers are a proxy for the impact that the curricular change at the institution has had on the students’ ability to think critically and abstractly and pursue deeper level questions in STEM,” he said. “It’s a documentation of the impact of those choices and the wonderful successes of our students.”

Students such as Emily Cherney.

Where do doctors come from?

The Top 10 schools in New Jersey whose undergraduates go on to attain doctorate degrees — not necessarily from the same institution — from 2005 to 2014.

Rutgers University (New Brunswick) 1,488

Princeton 1,411

The College of New Jersey 415

Drew University 186

Montclair State University 161

Rutgers (Camden) 153

Rowan University 152

Rutgers (Newark) 133

Stockton University 124

Seton Hall University 107

Source: National Science Foundation

Cherney, who graduated from 2007, went on to receive her doctorate from the Scripps Research Institute in San Diego.

She returned, however, to New Jersey to work, taking a job at Bristol-Myers Squibb in Princeton.

Originally a music student, Cherney was one of the first to experience TCNJ's redesigned curriculum, which stresses interdisciplinary and research-based studies.

"I was basically able to go straight into doing research right around when I switched my major, which was very important," she said. "I would say that, at the time, not all of the students were doing extra, independent research projects. Now, that's shifted, which is, to me, very important for being prepared for the next step after graduation."

And though the gap between science and music may seem vast, Cherney said her interdisciplinary studies were crucial to her growth.

"The focus of practicing an instrument translates well to performing research in a lab," she said. "And having a strong liberal arts background helps you be more creative when looking at problems or data sets in different ways."

Osborn said this type of experience is exemplary of the school's goals.

"We've been investing in this area in a variety of ways and one of the things that enhances our students' success across the sciences and engineering is that they experience an undergraduate education here at the college that's grounded in the liberal arts," Osborn said. "It's not technically focused — there's a lot of technical skill building, but that's contextualized in a broader, liberal arts focus where our students take many courses outside the liberal arts."

"That allows them to really focus deeply on their STEM studies and bring a broad variety of experience and perspective into it."

The other piece to the school's curriculum is its focus on research and experience-based learning.

"A critically important aspect of undergraduate education at The College of New Jersey, especially in STEM fields, is our students' direct engagement in research," Osborn said. "This is one of the signature experiences at TCNJ and, in the sciences, it's really bread and butter to who we are and our engagement in that process."

The classroom then becomes a forum for students to grow from their experiences, Osborn said.

"The classroom is a place to contextualize and consolidate the learning because students are out in the field learning significantly," he said. "The way we move science forward is through the process of research and we designed the curriculum specifically to allow students to be collaborators in that quest for knowledge. Our students, at the undergraduate level, are sharing in the process of creating new knowledge and advance research."

According to Osborn, the school has roughly 1,100 majors in the school of science and about 400 every year take a credit bearing researched-based or internship-based course.

"About 80 percent of our students, when they graduate, have done a significant amount of credit-bearing research," he said.

This is critical to learning science, Osborn said.

"What we're doing here at the college is graduating scientists, not just students of science, because they have deeply engaged in knowledge creating throughout their four-year curriculum and experiences that are

extracurricular.”

Beyond that, Osborne said this approach was adopted to better prepare the emerging workforce.

“We have found that employers, graduate and professional schools are really wanting students that have a deep experience in the sciences but have broad interests outside of their areas as well, who can think abstractly and make connections inherently,” he said. “Businesses are looking for abstract, critical thinkers who can solve problems and that’s the key to how we have designed our curricula.”

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