



## **Preparing Science Teachers at the University of Arizona**

*by Ingrid Novodvorsky, director of the College of Science Teacher Preparation Program, University of Arizona*

Science majors at the University of Arizona (UA) in Tucson who are interested in teaching at the secondary level—middle and high school—have the opportunity to participate in a unique teacher preparation program that integrates the content and pedagogy of science. The College of Science Teacher Preparation Program (CoS TPP) resides entirely in the College of Science, and all of the pedagogy courses are focused on teaching and learning science.

In more traditional programs, students who wish to pursue secondary science certification complete their science and math courses in science departments, and then apply to a separate program in a College of Education. In their education courses, they learn about general pedagogy, but with the typical exception of one science methods course, they never deal with pedagogical issues unique to teaching science. Additionally, they typically earn a degree in education, rather than a degree in science.

In contrast, students in the CoS TPP complete science courses alongside other science majors and remain part of their respective science departments. They have the option of pursuing degrees in science—for example, a bachelor's degree in chemistry—while also completing the pedagogy courses required for certification, or pursuing a degree in science education, which includes the required pedagogy courses. Students who select the option of a science degree plus the pedagogy courses complete about 90 credits of science and math courses, while students in the science education degree programs complete about 60 credits of science and math courses. In either case, students complete a significant number of content courses, assuring they enter teaching with a strong content background.

Another unique feature of the CoS TPP is the fact that there are no admission requirements; students can select the science education major as entering freshmen or anytime during their undergraduate career. There is rigorous readiness-to-teach assessment, however, before a student is allowed to proceed to student teaching. Early in the program, students are given the program's professionalism criteria, which are used to gauge whether they are allowed to remain in the program and advance to student teaching.

The science education faculty members who have experience teaching at the secondary level designed and teach the program's science pedagogy courses. The content of these



courses is aligned with National Science Education Teaching Standards.<sup>1</sup> These courses include field experiences in area middle and high school science classrooms under the direction of carefully selected mentor teachers. These mentor teachers also helped design the tasks that students complete in their classrooms. These tasks include observing small-group work, designing and administering diagnostic assessments, analyzing student work for evidence of understanding, and planning and delivering lessons. The program culminates in a full semester of student teaching. Table 1 lists the science pedagogy courses in the program.

**Table 1 Science pedagogy courses in the College of Science Teacher Preparation Program**

Course	Field Experience
STCH 250—Science teaching (3 credits)	16 hours; 4 separate tasks
STCH 310—Learning science (3 credits)	16 hours; 2 separate tasks
STCH 410—Managing science instruction in diverse classrooms (4 credits)	48 hours; 7 weeks of work with one class, including 2 weeks of teaching
STCH 420—Planning and implementing science curriculum (4 credits)	80 hours; 14 separate tasks
Subject-specific methods courses (biology, chemistry, earth science or physics methods course) (3 credits each)	None
STCH 494a—Science teaching practicum (10 credits)	Full-semester student teaching
STCH 496a—Science teaching seminar (1 credit)	Coincides with student teaching

STCH = science teaching

The CoS TPP was established in 1999, and the first students enrolled in the 2000-01 academic year. Through December 2010, a total of 110 students have completed the program. Of those, 69 are currently teaching or seeking a teaching position, 35 are not teaching by choice, and the status of the remaining six is unknown. Of the 35 who are currently not teaching, 17 taught for two to five years before changing careers, starting graduate school or stopping to raise children. Table 2 summarizes the teaching areas of the 69 who are teaching or seeking a teaching position.

**Table 2 Summary of College of Science Teacher Preparation Program completers' teaching areas**

14 middle school teachers (general/integrated science)	22 high school biology teachers
13 high school chemistry teachers	6 high school earth science teachers
10 high school physics teachers	4 high school mathematics teachers

While the CoS TPP prepares a relatively small number of secondary science teachers each year, the average of 11 teachers per year is approximately double the number of science teachers that were prepared in the College of Education before this program was established. Currently, the UA College of Education prepares secondary science teachers in a program for career changers that combines certification requirements with a master's degree. Thus, the two programs serve different audiences.

### Quality indicators

The quality of the students in the CoS TPP is comparable to other students in the College of Science. Table 3 below lists the average grade-point average of CoS TPP completers and graduates of various majors in the college.

**Table 3 College of Science graduates' or majors' average grade-point averages**

Major or program	Average GPA (throughout last 4 years)
CoS TPP completers	3.17
Chemistry	3.04
Ecology and evolutionary biology	2.95
Geosciences	3.06
Molecular and cellular biology	3.25
Physics	3.15

GPA = grade-point average

The mentor teachers who host CoS TPP students for their field experiences are asked to rate the students in terms of characteristics related to their potential for success as science teachers. Their ratings are consistently high, as shown in Table 4.

**Table 4 Mentor teacher ratings of College of Science Teacher Preparation Program students**

Characteristic	Average rating (out of 5)
Enthusiasm for teaching	4.22

Content knowledge	4.23
Pedagogical knowledge	3.95
Overall potential as a teacher	4.46

As another measure, completers of the CoS TPP are asked to rate their preparation after they have completed their first two years of teaching. Overall, the program completers rate their preparation highly, as shown in Table 5.

**Table 5 CoS TPP completers' rating of their preparation**

<b>Statement</b>	<b>Average rating (out of 5)</b>
The STCH courses and subject methods courses prepared me for my teaching career.	4.36
The field experiences associated with the STCH courses prepared me for my teaching career.	4.59
The science content courses that I took prepared me for my teaching career.	4.5
If I had the chance to make the decision again, I would become a science teacher.	4.3

STCH = science teaching

One of the program completers said about the program and its preparation:

“I am still convinced I must have come from one of the best teacher preparation programs in the country. As I started this year with my first classes, I had a student in one of them ask me how long I had been teaching. They were shocked when I said it was my first year, and several told me I didn't seem like a first year teacher. I also got a similar compliment from one of the veteran teachers at my school. As I compare myself to some of the other first-year teachers at my school, I really think the program did a great job getting us to not only think about everything but also accept the fact that the first couple years you are in survival mode, and that's OK.”

The CoS TPP is a high-quality program that prepares science majors to become successful middle and secondary science teachers.



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### **Reference**

1. National Research Council, *National Science Education Standards*, National Academic Press, 1996.