

PREPARING SUCCESSFUL SCIENCE TEACHERS AT INDIANA UNIVERSITY SOUTHEAST

James E. HOLLENBECK

Indiana University Southeast, USA

Abstract. The science education program at Indiana University Southeast (IUS) is successful with the adoption of a constructivist based philosophy and the National Science Education Standards (NSES). Teachers graduating from the science education program of Indiana University Southeast are qualified to be ranked as “highly qualified educators” as defined by the ‘No Child Left Behind’ Act. With the breadth and depth of knowledge and pre-service teaching experience and classroom work, IUS students are better prepared for teaching. Teacher graduates from the IUS science education program report a high degree of professional success after graduation.

Keywords: science education, curriculum, teacher training, science, education and society (STS), USA education, teacher competency, No Child Left Behind (NCLB), Indiana University School of Education.

Education in the United States is unique when compared to other nations. The United States lacks a central curriculum directed by the national government. The cabinet position, Department of Education, established by President Jimmy Carter is an advisory forum to the president of the United States.

The federal government itself has little direct control on education, other than monetary grants to schools. This is because the constitution of the United States did not address education in the formation of the government. In fact any concern not addressed by the constitution is a state issue. As a

result of this, the fifty states that compose the United States each have their own system of education. Standard and quality of education varies from state to state and relies on the willingness of each state to support their education system.

Each state in the union was “charged” with the mission to establish and oversee their own education system. In the beginning, schools were small and local with local school boards consisting of citizens of the community who would be elected to direct the community schools. The only qualifications for the school board members then and now are to simply be residents of the school’s community and to be of voting age.

In order to bring cohesion about the many education plans in the United States, several professional organizations began to draft “standards” or visions of what the academic disciplines should include. The National Science Education Standards (NSES) were drafted by the National Research Council (NRC) in 1996.¹⁾ The NRC sought to establish a classroom environment where personal relevance of the subject as perceived by the students becomes a focus through the United States. The NSES seeks to improve teacher preparation, student learning and bring the different programs closer in scope and sequence.

With the NSES, many states (except Iowa) established their own academic standards. Indiana published its own academic standards in 2003. In response to the NSES, Indiana examined its teacher licensure procedures, and directed the Indiana Professional Standards Board with assistance and advice from educators, higher education personnel and other concerned citizens, to make sweeping changes in academic programs leading to teacher licensure.

The preparation program at Indiana University Southeast (IUS) was revised in 2002 from a program of three majors and seven support areas to three comprehensive majors and five teaching minors. In 2007 the program was reviewed and updated and a Chemistry teaching major program was added to the program. This change aligned the science teaching program closer to the academic majors, the real needs of our secondary education programs and the Indiana Academic Standards. All students must complete successfully a teacher’s entrance exam, the Praxis I exam, or Professional Standards Preparation Test, (PPST), prior to acceptance to the teacher education program. This independent test is written and administered by the Educational Testing Service (ETS). The students are examined for their competency in Mathematics, Writing and Reading Comprehension skills. At the end of their academic preparation, Indiana requires that teacher candi-

dates take and pass the Praxis 2 or PPST 2 exam over their academic content area. To be recognized as a “highly qualified teacher” as defined by *No Child Left Behind* (NCLB), the teacher must complete an academic concentration at the Master’s degree level, complete a teacher training program and pass a rigorous exam such as the Praxis 2. Their website, is rich with information concerning the exam.²⁾

Students take their science courses at the same time they take their “liberal arts’ courses and education courses. The liberal arts curriculum is to insure that the student is well educated in all areas of knowledge. Liberal courses include courses in the humanities, i.e.: foreign language, literature and the fine arts, etc; social studies i.e.: history, political science and economics, etc; and natural sciences i.e.: biology, chemistry, geology, etc. Education students are expected to do well in these course as well as their major and education courses. Education students must not receive a grade less than a “C” or satisfactory. Education students must maintain a 2.75 grade point average on a four point scale.

All science education majors are required to complete a course titled “Science, Technology and Society (STS) for a Changing Society” as a senior seminar course prior to their student practicum experience. This course is an interdisciplinary science course integrating a holistic view how science is applied to our society and its effect on it. The course addresses concepts of ethics, legal and moral decision making in the realm of science. The Indiana Academic Standards, National Science Education Standards and the National Science Teachers Association all support a comprehensive course on science, technology and society (STS) to be part of science teacher preparation. Indiana University is among the first schools to have a science technology, and society component as part of its required curriculum.

The teacher education student must complete a “major” which consists of thirty five semester hours of concentrated study in an academic area. A semester hour is determined by the length that a class must meet. One hour of academic credit is equal to a one clock hour of class meeting, three days a week over a fifteen week period. Table 1 lists the three science majors and courses offered at IUS.

Table 1. Science Education Majors at IUS

Life Sciences	Earth-Space Sciences	Chemistry
General Biology 1	Introduction to Geology	Principles of Chemistry 1
General Biology 2	Mineralogy	Principles of Chemistry 2
Molecular Biology	Climatology.	Organic Chemistry 1
Genetics and Genetics Lab	Chemistry 1	Organic Chemistry 2
Ecology and Field Biology	General Physics 1	Physical Chemistry Study
Human Biology and Physiology and Plant Physiology	Three Upper Level Courses of Study in Geo-science Electives	One elective course from each area: Analytical Chemistry Biochemistry Inorganic Chemistry
One upper level elective	Solar Astronomy	General Physics 1
Science, Technology and Society for a Changing World	Science, Technology and Society for a Changing World	General Physics 2 Science, Technology and Society for a Changing World

The education concentration at IUS consists of several courses that lead into the next course in a sequence. All of the courses except Computers in Education have a field experience component. The field experience requires that the student observe and participate in the classroom under the supervision of a teacher in a school. All students complete a minimum of 100 clock hours of service prior to their student teaching. This important experience allows the student to reflect on their desire to become an educator, and what level they wish to teach at. During these field experiences, students are evaluated by the supervising teachers of their aptitude and attitude in the classroom. Students are carefully screened during this process to assure that they will be suitable candidates. Table 2 summarizes the field experience/practicum time commitment.

Table 2. Field Experience Commitments

Course	Time Expectation (minimum)	Grade Level	Practice Teaching
Foundations of Teaching	30 clock hours	15 hours at the 1-5 grade levels. 15 hours at the 6-12 grade levels.	Observation only
Education Psychology	30 clock hours	6-8 grade levels.	Will work on minor projects with students and teachers.
General and Reading Methods	40 clock hours	9-12 grade levels	Must deliver 5 lesson plans and work with students and teachers.
Student Teaching	400 clock hours	6-12 grade levels	Assumes full responsibility of the classroom.

In the very first course, Foundations of Teaching, about half of the students, decide not to pursue education as a career. The second course is a block of education psychology courses which examines learning psychology and teaching young adolescents. Generally, this course is completed the semester prior to the final year of the teacher candidate which includes General Methods and Reading Methods in the fall semester, and in the spring semester the students study Science Teaching Methods and complete Student Teaching.

The final year of this four-five year program for the teacher candidate is important as they will take the Praxis 2 exam, and complete three methods courses, which emphasizes the craft of teaching, and a final field experience of forty clock hours at a senior high school. This field experience requires practice teaching in the classroom, assessment of aptitude and attitude by the faculty, and an exit interview. Once the student has completed the prior tasks, they begin their "student teaching" or internship.

The teacher candidate assumes all the responsibilities of the regular teacher for a semester, and is evaluated on their performance by the cooperating teacher and the university supervisor. If the candidate has had a successful experience, maintained a 2.75 grade point average out of a 4.00

grade point average in all required areas, and passed Praxis 2, they can apply for a teacher's license and become a teacher.

The science education program has been successful with the adoption of a constructivist based philosophy. In 2001, only one student was enrolled. Currently, 2006, over 65 students have expressed interest in science education majors. IUS has experienced a 150% growth in science education graduates from 2002–2007 as noted in Table 3.

Table 3. Science Education Graduates

Year	Number of Graduates	Number of Graduates Currently Teaching
2003	14	11
2004	16	14
2005	16	16
2006	18	14
2007	14	14
Total	78	69

IUS is noted as a regional leader in science education. Our students are involved in science and science education research endeavors. Students are able to participate in teacher research projects and science related extramural activities: as volunteer judges for local and regional science fairs, and the Science Olympiad. Our science education majors' present papers and posters at research symposiums, and conferences on the local, state, and national levels. In the past six years IUS students have presented over twenty papers. One student earned a research fellowship in 2006 and developed a multimedia curriculum on ecology using the various biomes of Ecuador. Other students have been involved in researching science learning and second language acquisition. IUS science education majors are sought after by education recruiters locally and on the national level. The final measure of success is that over 88% of our graduates are teaching science. We have a program that is second to no other program.

Notes

¹ National Research Council. *National Science Education Standards*. Washington: National Academy Press, 1996 [http:// www.nap.edu/readingroom/books/nse.html](http://www.nap.edu/readingroom/books/nse.html)

² <http://www.ets.org/praxis>

✉ Dr. James E. Hollenbeck,
Coordinator of Secondary Science Education,
Indiana University Southeast,
247 Life Science Building,
4201 Grant Line Rd.
New Albany, IN 47150 USA
E-Mail: jehollen@ius.edu