

RESOURCES FOR STEM EDUCATION

- An ACT study found that over 90% of all surveyed students indicated that their mother or other female guardian was helpful in selecting their high school courses, whereas tenth-grade students reported that about 70% of their counselors were helpful.¹⁸⁷
- Success in STEM college programs is related to the courses completed in high school,¹⁸⁸ which in turn is highly related to courses taken in middle school.

Whether students are relying more on their mothers or their guidance counselors, data supplied by ACT makes clear that students are not choosing enough of the rigorous courses that will help them succeed in college and the workplace.¹⁸⁹ Instead, far too many of them are enrolling in middle school and high school courses that will lead them to years of remediation at the community college and/or university.

No comprehensive data was found on how well Illinois is meeting the challenge of providing accurate and timely career planning information to parents and students in elementary, middle, and high schools, as well as postsecondary institutions. However, the Illinois Department of Employment Security provides a comprehensive one-stop information center for workforce and career education at <http://www.ilworkinfo.com/>.

Preparation and Professional Development of Educators

In the 2005 debate over raising high school graduation requirements, local education leaders protested that qualified teachers were simply not available for more advanced science and mathematics courses. Research has supported their contention, placing the supply of qualified teachers as a central challenge for upgrading STEM education.

Illinois has a multiple-assessment qualification process for teachers: a passing performance on the *Basic Skills Test* before entrance into a teacher education program, a passing performance on *Content Tests*, and a passing performance on the *Assessment of Professional Teaching (APT)*, an assessment of general knowledge of the teaching profession and pedagogical methodologies. In addition, Illinois has three-tiered licensing: initial, standard, and master, with specific requirements for advancing in level and remaining current in licensure. According to the *Illinois Teacher Salary Study 2003-2004*, the median schedules salary was \$53,820, ranking the state 8th in the nation and 1st in the Midwest.¹⁹⁰

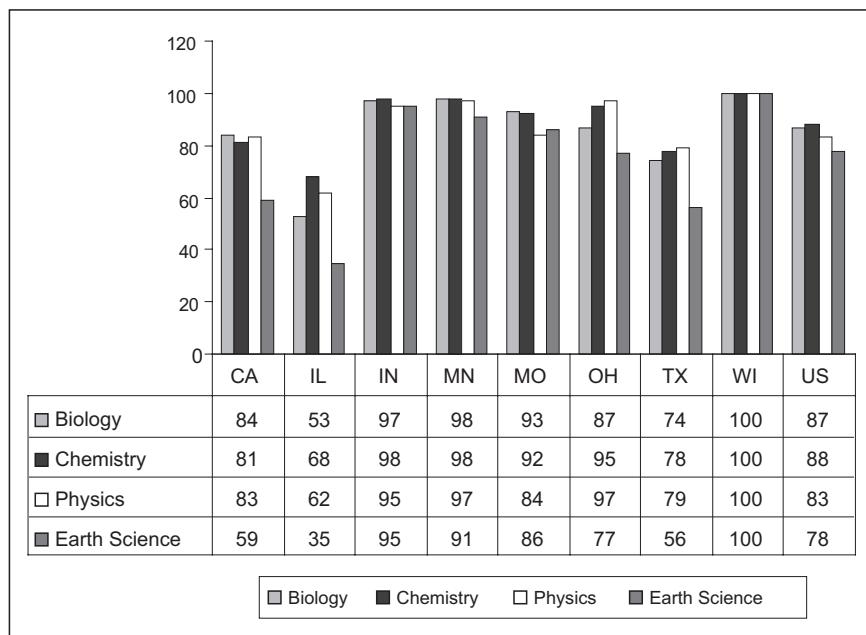
That said, Illinois teachers for mathematics and science are consistently listed as critical shortages. In 2005, 225 school districts reported shortages of physics and chemistry teachers, up 8% and 9% respectively.¹⁹¹ The future need for STEM teachers may be great: about 30% of the math and science teachers for grades 9-12 are over the age of 50.¹⁹²

Illinois high school teachers of science and mathematics are required either to major in their subjects or take 24 academic credits in the subject and pass a test of content knowledge.

CHAPTER VII

Currently, slightly more than 50% of 8th grade mathematics teachers in Illinois are certified to teach mathematics, compared to 61% nationally.¹⁹³ An additional 26% of Illinois 8th grade mathematics teachers hold an elementary certificate, and nearly one-fourth hold neither an elementary nor mathematics certificate. This means that significant numbers of 8th grade students are being taught by teachers who do not hold the proper certification. The same is true for high school; compared to the U.S. averages and other large industrial states and neighboring state, fewer high school science teachers are certified in the high school subjects they teach. In fact, one-third of chemistry teachers, two-fifths of physics teachers, about one-half of biology teachers, and nearly three-fourths of earth science teachers do not hold the proper certifications to teach in their content area.

Figure 36 Percentages of High School Science Teachers Certified in the Subject in Grades 9-12, 2004¹⁹⁴



A 2004 Bayer Facts of Science Survey pointed out a national problem with the preparation of teachers: only 18% of the K-5 teachers with three to five years experience graded their science preparation as an "A". When asked which subject they wished had been emphasized more in their pre-service training, nearly two-thirds of the teachers cited science. The deans of colleges of education (84%) and the teachers (72%) agreed that elementary preservice teachers should be required to take more coursework in science and science teaching methods. Over one-third of the teachers indicated that they use their knowledge of science more from what they learned in high school than in what they learned in college to teach science. Nearly 95% of the K-5 teachers reported teaching reading and mathematics everyday; only 35% teach science everyday, and 29% teach it two or fewer days a week¹⁹⁵

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Illinois has taken steps to improve the quality of mathematics and science teachers. New Associates of Arts in Teaching (AAT) in science and mathematics have been approved for Illinois community colleges for the purpose of increasing the numbers and quality of mathematics and science teachers. Various scholarships and tuition waiver programs are available for those pursuing an education major.¹⁹⁶

Ongoing professional development for the existing cohort of teachers adds another challenge. The *Illinois Survey of Critical Technologies* identified the barriers current teachers face in trying to complete professional development in cutting-edge mathematics and science topics. Illinois needs to find ways to overcome the barriers of lack of time, financial resources, and professional development opportunities.

Support for Innovative Research and Development and STEM Education

Keeping Illinois competitive requires innovative research and development and a highly-skilled STEM workforce. A couple of examples will suffice as a reminder of the competition in this environment. "Of 120 new chemical plants being build around the world with price tags of \$1 billion or more, one is in the U.S. Fifty are in China."¹⁹⁷ Also "in 2003 only three American companies ranked among the top ten recipients of patents granted by the U.S. Patent Office."¹⁹⁸

Developing innovations that will succeed in the global economy requires significant resources for the recruitment and retention of the best STEM workforce and for innovative research. The following section assesses Illinois' capacity for innovation in terms of

- Scholarly articles and patents
- Financial support for STEM students and STEM education
- Investment in research and development