American Chemical Society

Transforming STEM Education for America's Future

Bassam Z. Shakhashiri, Ph.D.
President
American Chemical Society

March 14, 2012

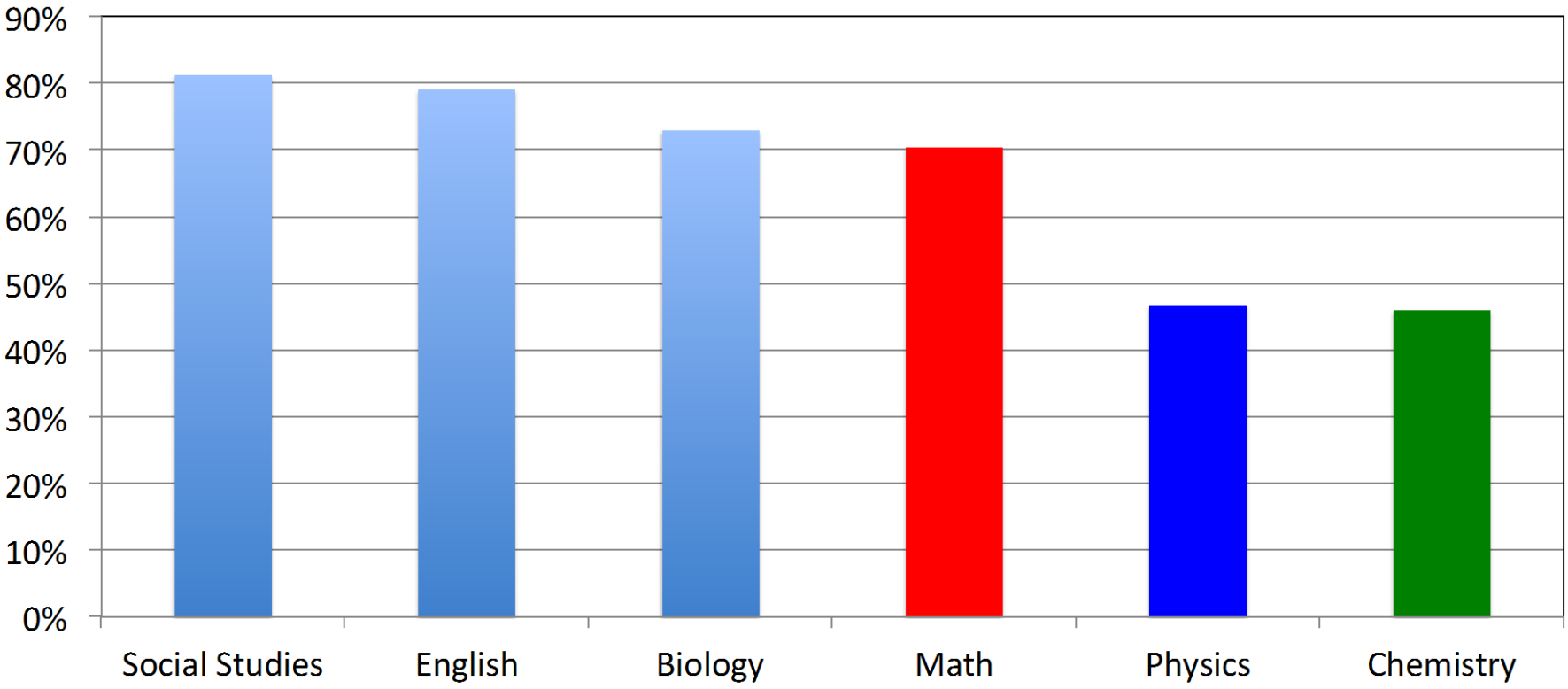
Commitment to K-12 Math/Science Teacher Training

- Mid-1980s, national fears about the rapidly growing Japanese economy.
- Eisenhower Programs for Math and Science Education – state administered K-12 teacher training programs authorized and funded.
  - 1984
    - 75 percent of funds allocated to states and localities.
      - Six-hour, in-service sessions, general awareness of science subjects and science testing standards.
      - 1/3 of all math/science K-12 teachers in 1988-1989 participated in an Eisenhower activity under this allocation.
    - 25 percent to math/science departments at colleges/universities.
      - Held discipline-specific, 60-hour training seminars.
      - High success rate of hands-on teacher preparation.
      - High rate of student success in classrooms.

A Drift Away from Effective, Discipline-based Teacher Training

- 1991
  - SRI Intl review of Eisenhower Program indicated that states and localities focused on “quantity” whereas universities offered “quality” programs.
- 1994
  - Education climate shifts to focus on standards, assessments. Eisenhower programs redefined to cover all core subjects broadly.
  - Programs through state departments/localities ***increased*** to ***84 percent.***
  - Teacher training at math/science departments ***decreased*** to ***16 percent.***
  - Funds more broadly allocated: professional networks, partnerships among schools, align states’ teacher licensing requirements, recruit minorities.
  - Many regulations waived. State/local decision-making authority increased.
- 2000
  - “…Eisenhower funds support a wide … array of professional development opportunities for teachers. However, the extent to which Eisenhower programs are designed to have an impact on teachers’ classroom practice remains an open question.” - *Brookings Institution report, Julia E. Koppich.*

High School Classes Taught by Teacher with Degree in the Field



U.S. Students' Classroom Experience in STEM subjects

- Recent statistics:
  - Only 47 percent of high school physics and chemistry classes are taught by teachers with science degrees.
  - 54 percent of nation's 4th graders and 47 percent of 8th graders never or hardly ever write up results of experiments or write science reports.
  - 39 percent of 8th graders never or hardly ever design science experiments.

National Science Foundation's 2012 Science and Engineering Indicators.

- Instead, students do pre-determined experiments, or view computer modules of STEM topics. Scientists and engineers design experiments and evaluate results. Science literacy requires such hands-on training.
- Reading without decoding words and sentences? Math without sums? Music without hearing? Athletics without exertion?

Best Practices in Teacher Preparation

- "Practice in practice" clinical component – student teachers must have teacher-training experiences in classrooms.
- Program oversight in reviewing the quality of student-teaching experiences.
- Match between student teaching and later teaching experiences: age-level comparable, culture of school district comparable.
- Student-teaching courses must enable students to apply practices and tools to clinical experiences.
- Student teachers complete a capstone project covering a teaching-based subject.

Darling-Hammond, L. (2010) Teacher Education and the American Future, *Journal of Teacher Education*, 61, 35-48

Recent Proposals for Further Change

- FY 2013 budget proposals
  - Change the $150 million formula-based Math and Science Partnership Program to a competitive grant Effective Teaching and Learning: STEM Program.
  - Eliminate or consolidate programs at several agencies to reduce from 235 programs to 209.
- Elementary and Secondary Education Reauthorization proposals
  - Eliminate existing Math and Science Partnership program and numerous other Title II programs in favor of broader, flexible state block grants with no priority for STEM activities.
  - Eliminate current requirement for science testing, which would remove the incentive to focus on teacher training in the STEM disciplines.

ACS Hach Programs Train/Support High School Teachers

- Land Grant Scholarship Program supports undergraduate chemistry majors with expressed interest in teaching high school chemistry.
  - Since 2008-2009, 61 colleges and universities have awarded 245 scholarships.
- Second Career Scholarship Program funds professionals in the chemical sciences who want to pursue masters degrees and teacher certification to become teachers.
  - Since 2008, 21 alumni have completed their degrees and are employed as high school chemistry teachers in 9 states.
- High School Chemistry Grant Program supports classroom learning:
  - Lab equipment/supplies
  - Instructional materials
  - Field studies, field trips, science outreach events

Keys to Successful K-12 STEM Education

- National focus on educational excellence is admirable. To achieve student excellence in science subjects, teacher training must be discipline specific, not generalized.
- Qualified and engaged teachers
- Teaching of content relevant to addressing world challenges
- Ability to track student progress and achievement
- Partnerships between scientific organizations, teachers and government agencies
- Making learning fun – hands on science, demonstration, etc.