I

112TH CONGRESS
1ST SESSION

H. R. 1951

To award planning grants and implementation grants to State educational agencies to enable the State educational agencies to complete comprehensive planning to carry out activities designed to integrate engineering education into K–12 instruction and curriculum and to provide evaluation grants to measure efficacy of K–12 engineering education.

IN THE HOUSE OF REPRESENTATIVES

MAY 23, 2011

Mr. TONKO (for himself, Mr. HINCHEY, Mr. WU, Mr. CAPUANO, Ms. FUDGE, and Mr. CONNOLLY of Virginia) introduced the following bill; which was referred to the Committee on Education and the Workforce

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A BILL

To award planning grants and implementation grants to State educational agencies to enable the State educational agencies to complete comprehensive planning to carry out activities designed to integrate engineering education into K–12 instruction and curriculum and to provide evaluation grants to measure efficacy of K–12 engineering education.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the ''Engineering Education for Innovation Act'' or the ''E^2 for Innovation Act''.

SEC. 2. FINDINGS.

Congress finds the following:

(1) There is a national concern that the Nation's preeminence in science and innovation is eroding. According to the National Science Board's 2010 Science and Engineering Indicators, only 5 percent of college graduates in the United States major in engineering, compared with 12 percent of European students and 20 percent of those in Asia. The report also notes that the performance of elementary and secondary school students in the United States lags behind many nations on international assessments of mathematics and science.

(2) While women earn 58 percent of all bachelor's degrees, they constitute only 18.5 percent of bachelor's degrees awarded in engineering.

(3) African-Americans earn only 4.6 percent of bachelor's degrees awarded in engineering and Hispanics earn only 7.2 percent.

(4) The introduction of engineering education has the potential to improve student learning and achievement in science and mathematics, increase awareness about what engineers do and of engineer-

ing as a potential career, and boost students' technology and engineering literacy, according to a new report, ''Engineering in K–12 Education'' from the National Academy of Engineering (NAE) and the National Research Council (NRC).

(5) The report described in paragraph (4) also identifies the following 3 core principles for K–12 engineering education:

(A) Emphasize engineering design process.

(B) Incorporate important and developmentally appropriate mathematics, science, and technology knowledge and skills.

(C) Promote engineering habits of mind including systems thinking, creativity, collaboration, communication, and attention to ethical considerations.

(6) While exposure to formal engineering education has increased dramatically over the past 15 years, reaching several million K–12 students, most students in the United States have never experienced an engineering course or lesson.

(7) There is also a lack of diversity in these existing K–12 engineering education opportunities. The number of girls and underrepresented minorities participating in K–12 engineering education does

not correspond to their proportion of the general population.

(8) The President's Council of Advisors on Science and Technology (PCAST) report Prepare and Inspire: K–12 Science, Technology, Engineering, and Math (STEM) Education for America's Future recommends that the Nation focus on preparing all students, including girls and minorities underrepresented in STEM fields, in order to meet the national need for a STEM-capable citizenry and a STEM-proficient workforce. The report also notes that achieving the Nation's goals for K–12 STEM education will require partnerships with State and local governments and with the private and philanthropic sectors.

(9) Only a handful of States have integrated engineering into their core academic K–12 standards.

(10) K–12 engineering education in the United States is supported by a relatively small number of curricular and teacher professional development programs.

(11) While science, technology, engineering, and mathematics education is viewed as a national education policy, often the implementation of policies

and initiatives focuses exclusively on mathematics and science and overlooks the engineering and technology education components.

(12) Schools, policy makers, and other stakeholders often narrowly refer to the term ''technologically literate'' as the ability to use educational technologies. Although educational technology is important, it is far from the only type of technology we depend on in a modern society. In 2006, the National Academy of Engineering and the National Research Council's report, ''Technically Speaking'', outlined a broader view of ''technological literacy'', one more consistent with how scientists, engineers, and technologists see the world. In this view, technology and engineering literacy includes—

(A) knowledge of technology, the engineering design process, and impacts on society;

(B) critical thinking and decisionmaking weighing benefits, risks, costs, and tradeoffs; and

(C) capability to use a variety of technologies, apply the design process, fix simple technological problems, and obtain and understand information about technological issues.

(13) The Standards for Technological Literacy, developed by the International Technology and Engineering Education Association and passed by a formal review by the National Academy of Engineering and the National Research Council, closely align with the Academies' concept of technology and engineering literacy in paragraph (11).

(14) To support an innovation economy and maintain our country's vitality and security, we must expand students' understanding of technology and engineering and widen the pipeline to careers in these fields so that a diverse array of talented students can pursue them.

(15) The Federal Government has an interest in expanding K–12 engineering and technology education. The National Assessment of Educational Progress (NAEP) Science 2009 assessment included items testing student's technological design skills. The National Assessment Governing Board (NAGB) will administer a NAEP Technology and Engineering Literacy probe assessment in 2014 that will assess student knowledge in engineering design and systems, information and communication technology, and technology and society.

(16) To further expand K–12 engineering education, this Act seeks to support planning and implementing grants for educational agencies to invest in programs and activities to integrate engineering education into K–12 instruction and curriculum and to fund research on, and evaluation of, such efforts.

SEC. 3. DEFINITIONS.

In this Act:

(1) ENGINEERING.—The term ''engineering'' means a systematic and often iterative approach to designing objects, processes, and systems to meet human needs and wants.

(2) ESEA TERMS.—Except as otherwise provided in this Act, any term used in this Act that is defined in section 9101 of the Elementary and Secondary Education Act of 1965 (20 U.S.C. 7801) shall have the meaning given the term in such section.

(3) HIGH-NEED LOCAL EDUCATIONAL AGENCY.—The term ''high-need local educational agency'' means a local educational agency—

(A)(i) that serves not fewer than 10,000 children from families with incomes below the poverty line; or

(ii) for which not less than 20 percent of the children served by the agency are from families with incomes below the poverty line; and

(B)(i) for which there is a high percentage of teachers not teaching in the academic subjects or grade levels that the teachers were trained to teach; or

(ii) for which there is a high percentage of teachers with emergency, provisional, or temporary certification or licensing.

(4) HIGH-NEED SCHOOL.—The term ''high-need school'' means a public K–12 school—

(A) for which not less than 20 percent of the children served by the school are from families with incomes below the poverty line; and

(B)(i) for which there is a high percentage of teachers not teaching in the academic subjects or grade levels that the teachers were trained to teach; or

(ii) for which there is a high percentage of teachers with emergency, provisional, or temporary certification or licensing.

(5) INSTITUTION OF HIGHER EDUCATION.—The term ''institution of higher education'' has the

meaning given such term in section 102 of the Higher Education Act of 1965 (20 U.S.C. 1002).

(6) K–12.—The term ''K–12'' means kindergarten through grade 12.

(7) STATE EDUCATIONAL AGENCY.—The term ''State educational agency'' includes the State educational agency in a State in which the State educational agency is the sole educational agency for all public schools.

(8) TECHNOLOGY.—The term ''technology'' means any modification of the natural world done to fulfill human needs or desires

(9) TECHNOLOGY AND ENGINEERING LITERACY.—The term ''technology and engineering literacy'' means the capacity to use, understand, and evaluate technology and engineering as well as to understand technological principles and strategies needed to develop solutions and achieve goals.

SEC. 4. PLANNING GRANTS.

(a) PROGRAM AUTHORIZED.—

(1) IN GENERAL.—The Secretary of Education, in consultation with the Director of the National Science Foundation and other relevant heads of Federal agencies, is authorized to award planning grants to State educational agencies to enable such

agencies to complete comprehensive planning to carry out activities designed to integrate engineering education into K–12 instruction and curriculum.

(2) GRANT PERIOD.—A planning grant awarded under this section shall be for a period of not more than 2 years.

(3) NONRENEWABILITY.—The Secretary of Education shall not award a State educational agency more than 1 planning grant under this section.

(4) RESERVATION FOR SMALL STATES.—

(A) IN GENERAL.—Except as provided in subparagraph (B), the Secretary of Education shall reserve not less than 15 percent of the funds appropriated to carry out this section for each fiscal year to award grants under this section to States with populations of less than 2,600,000 on the date of enactment of this Act.

(B) WAIVER.—The Secretary of Education may waive the 15 percent requirement under subparagraph (A) after notifying Congress of such intention.

(b) APPLICATION.—

(1) IN GENERAL.—Each State educational agency desiring a planning grant under this section shall submit an application to the Secretary of Edu-

cation at such time, in such manner, and accompanied by such information as the Secretary of Education may require.

(2) APPLICATION CONTENTS.—Each application described in paragraph (1), at a minimum, shall—

(A) include a description of how the State educational agency proposes to use the planning grant funds to develop a plan designed to integrate engineering education into K–12 instruction and curriculum;

(B) describe the roles and responsibilities of the partners, described in subsection (c), participating in the planning under this section;

(C) provide a budget for the use of the planning grant funds; and

(D) provide such additional assurances and information as the Secretary of Education determines to be necessary.

(c) PARTNERSHIP.—A State educational agency receiving a planning grant under this section shall complete comprehensive planning to carry out activities designed to integrate engineering education into K–12 instruction and curriculum in coordination with partners, including the following:

(1) The Governor of the State or the designee of the Governor.

(2) Not less than 1 faculty member from a school of engineering at an institution of higher education located in the State.

(3) Not less than 1 faculty member from a school of education at an institution of higher education located in the State.

(4) Not less than 1 public elementary school administrator employed in the State.

(5) Not less than 1 public elementary school teacher employed in the State.

(6) Not less than 1 public secondary school administrator employed in the State.

(7) Not less than 1 public secondary school engineering or technology teacher employed in the State.

(8) Not less than 1 representative of the science, technology, engineering, and mathematics business community in the State.

(9) Not less than 1 representative from an informal science education center, if available, a nonprofit organization with a demonstrated history of developing innovative and effective engineering curriculum, or an afterschool program provider.

(10) Not less than 1 representative from a professional engineering society or an academy of science with a chapter or other presence in the State.

(11) Any additional representatives identified by the State educational agency who possess an expertise in developing high-quality K–12 engineering education materials and resources.

(d) REQUIRED ACTIVITIES.—A State educational agency receiving a planning grant under this section shall use the planning grant funds to carry out each of the following activities:

(1) REVIEW.—The State educational agency shall review resources and programs across the State educational agency and its partners that are relevant to the objectives of the grant, and coordinate any new plans and resources under this section with such existing resources and programs.

(2) PLAN.—The State educational agency shall develop an implementation plan to achieve the objective of integrating engineering education into K–12 instruction and curriculum. The plan shall include a description of how the State educational agency will carry out the following:

(A) Set intermediate and long-term measurable goals.

(B) Develop and implement a coherent plan for achieving the goals, including the following core set of activities:

(i) An analysis of the State's existing K–12 content standards and assessments to determine—

(I) the extent to which they address the integration of engineering education into K–12 instruction and curriculum; and

(II) the extent to which they align with workforce and postsecondary expectations.

(ii) An analysis of the State's existing K–12 engineering education curricula, which shall include the development of a baseline analysis of key indicators that measure—

(I) the number and diversity of students who are exposed to this curricula, including populations underrepresented in engineering fields, for

example, girls and underrepresented minorities; and

(II) the effectiveness of the curricula at improving student learning, including—

(aa) increasing understanding of engineering;

(bb) increasing science, technology, engineering, and mathematics career aspirations;

(cc) increasing technology and engineering literacy skills; and

(dd) increasing student achievement in science, technology, engineering, and mathematics subjects for all students.

(iii) An analysis of the State's K–12 engineering and technology education teaching workforce, which shall include the development of a baseline analysis of key indicators that measure—

(I) the number of K–12 teachers who received any certificates or credentials in engineering or technology

education, including the number who received professional development in engineering education;

(II) the number and types of preservice, induction, and professional development engineering and technology education programs; and

(III) the effectiveness of the identified preservice, induction, and professional development engineering and technology education programs as they relate to—

(aa) increasing understanding of engineering;

(bb) increasing science, technology, engineering, and mathematics career aspirations;

(cc) increasing technology and engineering literacy skills; and

(dd) increasing student achievement in science, technology, engineering, and mathematics subjects.

(C) Create a plan for ongoing collection and analysis of data on outcomes, including progress toward outcomes.

(e) SPECIAL RULE.—In the event a State educational agency declines or does not submit an application under this section, the Secretary of Education shall provide for another entity or consortium, with the capacity to carry out the activities under this section, in partnership with the partners listed in subsection (c), in such State, to submit an application.

(f) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to carry out this section such sums as may be necessary for each of fiscal years 2013 and 2014.

SEC. 5. IMPLEMENTATION GRANTS.

(a) PROGRAM AUTHORIZED.—

(1) IN GENERAL.—The Secretary of Education, in consultation with the Director of the National Science Foundation and other relevant heads of Federal agencies, is authorized to award grants to State educational agencies to pay the Federal share of the cost of implementing innovative, integrative engineering education initiatives into K–12 instruction and curriculum.

(2) PARTNERSHIP.—A State educational agency receiving an implementation grant under this section may partner with such entities (including the entities listed in section 4(c)) that the State chooses in order to carry out the activities described in this section.

(b) MINIMUM AMOUNT.—The Secretary of Education shall award a grant under this section in an amount that is a comparably sufficient amount relative to the amounts appropriated to carry out this section.

(c) DURATION AND RENEWAL.—

(1) DURATION.—The Secretary of Education shall award grants under this section for not more than 2 years.

(2) RENEWAL.—The Secretary of Education may renew a grant awarded under this section subject to the progress of the State educational agency in meeting the benchmarks described in subsection (i).

(d) PRIORITY.—

(1) IN GENERAL.—In awarding grants under this section, the Secretary of Education shall give priority to State educational agencies that submit an application under subsection (e) that demonstrates—

(A) satisfaction of the required activities or comparable activities under section 4(d), as determined by the Secretary;

(B) that a significant percentage of persons served by the grant will be students from population underrepresented in engineering fields; and

(C) that the State's partners under subsection (a)(2) agree to pay a portion of the non-Federal share costs, provided in cash or in-kind, of the programs and activities carried out under the grant.

(2) SMALL STATE GUARANTEE.—

(A) IN GENERAL.—In each fiscal year in which a grant is awarded under this section, the Secretary of Education shall ensure that not less than 1 grant be awarded to a State with a population of less than 2,600,000 on the date of enactment of this Act.

(B) WAIVER.—The Secretary of Education may waive the requirement under subparagraph (A) after notifying Congress of such intention.

(e) APPLICATIONS.—A State educational agency that desires to receive a grant under this section shall submit an application to the Secretary of Education at such time,

in such manner, and containing such information as the Secretary of Education may require. Each such application shall include a description of—

(1) how the State educational agency will integrate engineering education into K–12 instruction and curriculum through programs and activities described in subsections (f) and (g); and

(2) the benchmarks developed under subsection (i).

(f) USES OF FUNDS.—A State educational agency that receives a grant under this section shall use the grant funds to pay the Federal share of carrying out the following programs and activities in collaboration with the State's partners under subsection (a)(2):

(1) Implementing challenging academic content standards, achievement standards, and curricula frameworks that include engineering.

(2) Developing new or obtaining effective curricula in engineering education.

(3) Designing and implementing engineering education assessment items and tools.

(4) Developing or improving elementary and secondary teacher preservice, induction, and professional development engineering and technology education programs, including those that lead to a cer-

tificate or other credential in engineering or technology education.

(5) Recruiting qualified teachers to provide engineering education for high-need local educational agencies and high-need schools.

(g) OTHER ALLOWABLE USES OF FUNDS.—In addition to carrying out the programs and activities described in subsection (f), a State educational agency that receives a grant under this section may use the grant funds for the following:

(1) Establishing distance learning modules for teachers or students in engineering education.

(2) Creating online engineering education tools that are widely accessible.

(3) Investing in after-school engineering education programs.

(h) TECHNICAL ASSISTANCE.—The Secretary of Education is authorized to reserve not more than 1 percent of the amounts available to carry out this section to provide technical assistance, directly or by grant or contract with nonprofit organizations with demonstrated expertise in designing, implementing, or evaluating relevant programs, in order to help State educational agencies prepare for, qualify for, apply for, and maintain a grant under this section.

(i) BENCHMARKS.—

(1) BENCHMARKS.—Each State educational agency desiring a grant under this section shall—

(A) develop quantifiable benchmarks for the activities supported under the grant, which shall include increasing student achievement in science, technology, engineering, and mathematics subjects, and may include—

(i) increasing student knowledge and competency of grade-appropriate engineering design skills;

(ii) increasing the number of students who are taught engineering education;

(iii) increasing the number of educators who are prepared to teach engineering education; and

(iv) increasing the number and diversity of students who plan to enroll in postsecondary engineering courses and pursue an engineering degree; and

(B) submit, as part of the application under subsection (e), the benchmarks for approval to the Secretary of Education in order to receive grant funds under this section.

(2) REPORTS.—Each State educational agency receiving a grant under this section shall—

(A) annually measure and report to the Secretary of Education the progress of the State educational agency in achieving the benchmarks developed under paragraph (1); and

(B) collect and report data of those served by the grant relating to the student benchmarks, disaggregated by race, ethnicity, gender, disability status, migrant status, English proficiency, and status as economically disadvantaged, except that such disaggregation shall not be required in a case in which the number of students in a category is insufficient to yield statistically reliable information or the results would reveal personally identifiable information about an individual student.

(3) GUIDANCE.—The Secretary of Education shall provide guidance regarding acceptable data sources and methodologies for—

(A) establishing baselines and performance benchmarks; and

(B) measuring progress by State educational agencies receiving such grants.

(j) NON-FEDERAL SHARE; SUPPLEMENT, NOT SUPPLANT.—

(1) NON-FEDERAL SHARE.—

(A) IN GENERAL.—A State educational agency that receives a grant under this section shall provide the non-Federal share of the costs of the programs and activities described in subsections (f) and (g) that are carried out under the grant. The amount of the non-Federal share under this section for a fiscal year shall be not less than 50 percent. The non-Federal share may be in cash or in-kind, and may be provided from local resources, contributions from private organizations, contributions from the State's partners under subsection (a)(2), or a combination of such sources.

(B) FINANCIAL HARDSHIP WAIVER.—The Secretary of Education may waive or reduce the non-Federal share of a State educational agency that has submitted an application for a grant under this section if the State educational agency demonstrates a need for such waiver or reduction due to extreme financial hardship.

(2) SUPPLEMENT, NOT SUPPLANT.—Grant funds provided under this section shall be used to

supplement, and not supplant, any other Federal or State funds otherwise available to carry out the activities described in this section.

(k) SPECIAL RULE.—In the event a State educational agency declines or does not submit an application under this section, the Secretary of Education shall provide for another entity or a consortium, with the capacity to carry out the activities under this section in such State, to submit an application.

(l) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to carry out this section such sums as may be necessary for each of fiscal years 2014 and 2015.

SEC. 6. RESEARCH AND EVALUATIONS.

(a) IN GENERAL.—The Institute of Education Sciences shall support, directly or through grants or contracts, research on engineering education and evaluation of the grants awarded under this Act, including studies and evaluations that—

(1) assess the effectiveness of the programs and activities carried out by each State educational agency receiving a grant under section 5 in—

(A) improving student achievement in science, technology, engineering, and mathematics subjects;

(B) improving student understanding of engineering;

(C) enhancing technology and engineering literacy of students;

(D) increasing numbers and diversity of students with science, technology, engineering, and mathematics career aspirations; and

(E) increasing the supply of engineering and technology education teachers;

(2) assess how the programs and activities carried out by each State educational agency receiving a grant under section 5 can be replicated by a variety of State educational agencies and local educational agencies;

(3) assess how the programs and activities carried out by each State educational agency receiving a grant under section 5 lead to students developing engineering design ideas, practices and habits of mind over time, and the types of conditions necessary to support these developments;

(4) identify and assess how science inquiry and mathematical reasoning can be connected to engineering design in K–12 curricula and teacher professional development; and

(5) include any other information or assessments the Secretary of Education may require.

(b) DISSEMINATION.—The Secretary of Education shall, based on the results of each evaluation completed under subsection (a), disseminate information and analysis to the public, and provide technical assistance to State educational agencies, on best practices and promising innovations in the field of K–12 engineering education.

(c) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to carry out this section such sums as may be necessary for fiscal year 2015.

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