

111TH CONGRESS
2^D SESSION

S. 3043

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 SENATE OF THE UNITED STATES

FEBRUARY 25, 2010

Mrs. GILLIBRAND (for herself, Mr. KAUFMAN, Ms. SNOWE, Ms. CANTWELL, Ms. KLOBUCHAR, and Mrs. MURRAY) introduced the following bill; which was read twice and referred to the Committee on Health, Education, Labor, and Pensions

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.

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*

1 **SECTION 1. SHORT TITLE.**

2 This Act may be cited as the “Engineering Education
3 for Innovation Act” or the “E² for Innovation Act”.

4 **SEC. 2. FINDINGS.**

5 Congress finds the following:

6 (1) There is a national concern that the Na-
7 tion’s preeminence in science and innovation is erod-
8 ing. According to the National Science Board’s 2010
9 Science and Engineering Indicators, only 5 percent
10 of college graduates in the United States major in
11 engineering, compared with 12 percent of European
12 students and 20 percent of those in Asia. The report
13 also notes that the performance of elementary and
14 secondary school students in the United States lags
15 behind many nations on international assessments of
16 mathematics and science.

17 (2) While women earn 58 percent of all bach-
18 elor’s degrees, they constitute only 18.5 percent of
19 bachelor’s degrees awarded in engineering.

20 (3) African-Americans earn only 4.6 percent of
21 bachelor’s degrees awarded in engineering and His-
22 panics earn only 7.2 percent.

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

1 ing as a potential career, and boost students’ techno-
2 logical literacy, according to a new report, “Engi-
3 neering in K–12 Education” from the National
4 Academy of Engineering (NAE) and the National
5 Research Council (NRC).

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

9 (A) Emphasize engineering design process.

10 (B) Incorporate important and develop-
11 mentally appropriate mathematics, science, and
12 technology knowledge and skills.

13 (C) Promote engineering habits of mind in-
14 cluding systems thinking, creativity, collabora-
15 tion, communication, and attention to ethical
16 considerations.

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

22 (7) There is also a lack of diversity in these ex-
23 isting K–12 engineering education opportunities.
24 The number of girls and underrepresented minorities
25 participating in K–12 engineering education does

1 not correspond to their proportion of the general
2 population.

3 (8) Only a handful of States have integrated
4 engineering into their core academic K–12 stand-
5 ards.

6 (9) K–12 engineering education in the United
7 States is supported by a relatively small number of
8 curricular and teacher professional development pro-
9 grams.

10 (10) While science, technology, engineering, and
11 mathematics education is viewed as a national edu-
12 cation policy, often the implementation of policies
13 and initiatives focuses exclusively on mathematics
14 and science and overlooks the engineering and tech-
15 nology education components.

16 (11) Schools, policy makers, and other stake-
17 holders often narrowly refer to the term “techno-
18 logically literate” as the ability to use educational
19 technologies. Although educational technology is im-
20 portant, it is far from the only type of technology we
21 depend on in a modern society. In 2006, the Na-
22 tional Academy of Engineering and the National Re-
23 search Council’s report, “Technically Speaking”,
24 outlined a broader view of “technological literacy”,
25 one more consistent with how scientists, engineers,

1 and technologists see the world. In this view, techno-
2 logical literacy includes—

3 (A) knowledge of technology, the engineer-
4 ing design process, and impacts on society;

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

8 (C) capability to use a variety of tech-
9 nologies, apply the design process, fix simple
10 technological problems, and obtain and under-
11 stand information about technological issues.

12 (12) The Standards for Technological Literacy,
13 developed by the International Technology Edu-
14 cation Association and passed by a formal review by
15 the National Academy of Engineering and the Na-
16 tional Research Council, closely align with the Acad-
17 emies' concept of technological literacy in paragraph
18 (11).

19 (13) To support an innovation economy and
20 maintain our country's vitality and security, we
21 must expand students' understanding of technology
22 and engineering and widen the pipeline to careers in
23 these fields so that a diverse array of talented stu-
24 dents can pursue them.

1 (14) The Federal Government has an interest
2 in expanding K–12 engineering and technology edu-
3 cation. Testing of technological design skills will be
4 assessed as part of the new National Assessment of
5 Educational Progress Science 2009 assessment to be
6 given to students throughout the United States. The
7 National Assessment Governing Board is currently
8 developing a National Assessment of Educational
9 Progress Technological Literacy probe study to be
10 administered in 2012 that will assess design and
11 systems, information and communication technology,
12 and technology and society.

13 (15) To further expand K–12 engineering edu-
14 cation, this Act seeks to support planning and imple-
15 menting grants for educational agencies to invest in
16 programs and activities to integrate engineering edu-
17 cation into K–12 instruction and curriculum and to
18 fund research on, and evaluation of, such efforts.

19 **SEC. 3. DEFINITIONS.**

20 In this Act:

21 (1) **HIGH-NEED LOCAL EDUCATIONAL AGEN-**
22 **CY.**—The term “high-need local educational agency”
23 means a local educational agency—

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

4 (ii) for which not less than 20 percent of
 5 the children served by the agency are from fam-
 6 ilies with incomes below the poverty line; and

7 (B)(i) for which there is a high percentage
 8 of teachers not teaching in the academic sub-
 9 jects or grade levels that the teachers were
 10 trained to teach; or

11 (ii) for which there is a high percentage of
 12 teachers with emergency, provisional, or tem-
 13 porary certification or licensing.

14 (2) STATE EDUCATIONAL AGENCY.—The term
 15 “State educational agency” includes the State edu-
 16 cational agency in a State in which the State edu-
 17 cational agency is the sole educational agency for all
 18 public schools.

19 (3) TECHNOLOGICAL LITERACY.—The term
 20 “technological literacy”—

21 (A) means the capacity to use, understand,
 22 and evaluate technology as well as to apply con-
 23 cepts and processes to solve problems and reach
 24 one’s goals; and

1 (B) encompasses the 3 areas of technology
2 and society, engineering design and systems,
3 and information and communication technology
4 (as considered by the National Assessment Gov-
5 erning Board in 2010).

6 **SEC. 4. PLANNING GRANTS.**

7 (a) PROGRAM AUTHORIZED.—

8 (1) IN GENERAL.—The Secretary of Education,
9 in consultation with the Director of the National
10 Science Foundation and other relevant heads of
11 Federal agencies, is authorized to award planning
12 grants to State educational agencies to enable such
13 agencies to complete comprehensive planning to
14 carry out activities designed to integrate engineering
15 education into K–12 instruction and curriculum.

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

19 (3) NONRENEWABILITY.—The Secretary of
20 Education shall not award a State educational agen-
21 cy more than 1 planning grant under this section.

22 (4) MAXIMUM GRANT AMOUNT.—A planning
23 grant awarded under this section shall not exceed
24 \$1,000,000 over the period of the grant.

25 (5) RESERVATION FOR SMALL STATES.—

1 (A) IN GENERAL.—Except as provided in
2 subparagraph (B), the Secretary of Education
3 shall reserve not less than 15 percent of the
4 funds appropriated to carry out this section for
5 each fiscal year to award grants under this sec-
6 tion to States with populations of less than
7 2,600,000 on the date of enactment of this Act.

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

12 (b) APPLICATION.—

13 (1) IN GENERAL.—Each State educational
14 agency desiring a planning grant under this section
15 shall submit an application to the Secretary of Edu-
16 cation at such time, in such manner, and accom-
17 panied by such information as the Secretary of Edu-
18 cation may require.

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

21 (A) include a description of how the State
22 educational agency proposes to use the planning
23 grant funds to develop a plan designed to inte-
24 grate engineering education into K–12 instruc-
25 tion and curriculum;

1 (B) describe the roles and responsibilities
2 of the partners participating in the planning
3 under this section;

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

6 (D) provide such additional assurances and
7 information as the Secretary of Education de-
8 termines to be necessary.

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

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

17 (2) Not less than 1 faculty member from a
18 school of engineering at an institution of higher edu-
19 cation located in the State.

20 (3) Not less than 1 faculty member from a
21 school of education at an institution of higher edu-
22 cation located in the State.

23 (4) Not less than 1 public elementary school ad-
24 ministrator employed in the State.

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

3 (6) Not less than 1 public secondary school ad-
4 ministrator employed in the State.

5 (7) Not less than 1 public secondary school en-
6 gineering or technology teacher employed in the
7 State.

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

11 (9) Not less than 1 representative from an in-
12 formal science education center, if available, or a
13 nonprofit organization with a demonstrated history
14 of working in engineering education.

15 (10) Not less than 1 representative from a pro-
16 fessional engineering society or an academy of
17 science with a chapter or other presence in the
18 State.

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

23 (d) REQUIRED ACTIVITIES.—A State educational
24 agency receiving a planning grant under this section shall

1 use the planning grant funds to carry out each of the fol-
2 lowing activities:

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

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

15 (A) Set intermediate and long-term meas-
16 urable goals.

17 (B) Develop and implement a coherent
18 plan for achieving the goals, including the fol-
19 lowing core set of activities:

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

23 (I) the extent to which they ad-
24 dress the integration of engineering

1 education into K–12 instruction and
2 curriculum; and

3 (II) the extent to which they
4 align with workforce and postsec-
5 ondary expectations.

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

11 (I) the number and diversity of
12 students who are exposed to this cur-
13 ricula, including populations under-
14 represented in engineering fields, for
15 example, girls and underrepresented
16 minorities; and

17 (II) the effectiveness of the cur-
18 ricula at improving student learning,
19 including—

20 (aa) increasing under-
21 standing of engineering;

22 (bb) increasing science, tech-
23 nology, engineering, and mathe-
24 matics career aspirations;

1 (cc) increasing technological
2 literacy skills; and

3 (dd) increasing student
4 achievement in science, tech-
5 nology, engineering, and mathe-
6 matics subjects for all students.

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

12 (I) the number of K-12 teachers
13 who received any certificates or cre-
14 dentials in engineering or technology
15 education, including the number who
16 received professional development in
17 engineering education;

18 (II) the number and types of pre-
19 service, induction, and professional
20 development engineering and tech-
21 nology education programs; and

22 (III) the effectiveness of the iden-
23 tified preservice, induction, and pro-
24 fessional development engineering and

1 technology education programs as
2 they relate to—

3 (aa) increasing under-
4 standing of engineering;

5 (bb) increasing science, tech-
6 nology, engineering, and mathe-
7 matics career aspirations;

8 (cc) increasing technological
9 literacy skills; and

10 (dd) increasing student
11 achievement in science, tech-
12 nology, engineering, and mathe-
13 matics subjects.

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

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

1 (f) AUTHORIZATION OF APPROPRIATIONS.—There
2 are authorized to be appropriated to carry out this section
3 \$12,500,000 for each of fiscal years 2011 through 2015.

4 **SEC. 5. IMPLEMENTATION GRANTS.**

5 (a) PROGRAM AUTHORIZED.—

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

14 (2) PARTNERSHIP.—A State educational agency
15 receiving an implementation grant under this section
16 may partner with such entities (including the enti-
17 ties listed in section 4(c)) that the State chooses in
18 order to carry out the activities described in this sec-
19 tion.

20 (b) MINIMUM AMOUNT.—The Secretary of Education
21 shall award a grant under this section in an amount that
22 is not less than \$10,000,000, or a comparably sufficient
23 amount relative to the amounts appropriated to carry out
24 this section. Such amount shall be pro-rated over the pe-
25 riod of the grant.

1 (c) DURATION AND RENEWAL.—

2 (1) DURATION.—The Secretary of Education
3 shall award grants under this section for not more
4 than 4 years.

5 (2) RENEWAL.—The Secretary of Education
6 may renew a grant awarded under this section sub-
7 ject to the progress of the State educational agency
8 in meeting the benchmarks described in subsection
9 (h).

10 (d) PRIORITY.—

11 (1) IN GENERAL.—In awarding grants under
12 this section, the Secretary of Education shall give
13 priority to State educational agencies that submit an
14 application under subsection (e) that dem-
15 onstrates—

16 (A) satisfaction of the required activities or
17 comparable activities under section 4(d), as de-
18 termined by the Secretary;

19 (B) that a significant percentage of per-
20 sons served by the grant will be students from
21 population underrepresented in engineering
22 fields; and

23 (C) that the State's partners under sub-
24 section (a)(2) agree to pay a portion of the non-
25 Federal share costs, provided in cash or in-kind,

1 of the programs and activities carried out under
2 the grant.

3 (2) SMALL STATE GUARANTEE.—

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

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

13 (e) APPLICATIONS.—A State educational agency that
14 desires to receive a grant under this section shall submit
15 an application to the Secretary of Education at such time,
16 in such manner, and containing such information as the
17 Secretary of Education may require. Each such applica-
18 tion shall include a description of how the State edu-
19 cational agency will integrate engineering education into
20 K–12 instruction and curriculum through programs and
21 activities described in subsection (f).

22 (f) USES OF FUNDS.—A State educational agency
23 that receives a grant under this section shall use the grant
24 funds to pay the Federal share of carrying out the fol-

1 lowing programs and activities in collaboration with the
2 State's partners under subsection (a)(2):

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

6 (2) Developing new or obtaining effective cur-
7 ricula in engineering education.

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

10 (4) Developing or improving elementary and
11 secondary teacher preservice, induction, and profes-
12 sional development engineering and technology edu-
13 cation programs, including those that lead to a cer-
14 tificate or other credential in engineering or tech-
15 nology education.

16 (5) Recruiting qualified teachers to provide en-
17 gineering education for high-need local educational
18 agencies and high-need schools.

19 (6) Establishing distance learning modules for
20 teachers or students in engineering education.

21 (7) Creating online engineering education tools
22 that are widely accessible.

23 (8) Investing in after-school engineering edu-
24 cation programs.

1 (g) TECHNICAL ASSISTANCE.—The Secretary of
2 Education is authorized to reserve not more than 1 per-
3 cent of the amounts available to carry out this section to
4 provide technical assistance, directly or by grant or con-
5 tract with nonprofit organizations with demonstrated ex-
6 pertise in designing, implementing, or evaluating relevant
7 programs, in order to help State educational agencies pre-
8 pare for, qualify for, apply for, and maintain a grant
9 under this section.

10 (h) BENCHMARKS.—

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

13 (A) develop quantifiable benchmarks for
14 the activities supported under the grant, which
15 shall include increasing student achievement in
16 science, technology, engineering, and mathe-
17 matics subjects, and may include—

18 (i) increasing student knowledge and
19 competency of grade-appropriate engineer-
20 ing design skills;

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

23 (iii) increasing the number of edu-
24 cators who are prepared to teach engineer-
25 ing education; and

1 (iv) increasing the number and diver-
2 sity of students who plan to enroll in post-
3 secondary engineering courses and pursue
4 an engineering degree; and

5 (B) submit the benchmarks for approval to
6 the Secretary of Education in order to receive
7 grant funds under this section.

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

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

15 (B) collect and report data of those served
16 by the grant relating to the student bench-
17 marks, disaggregated by race, ethnicity, gender,
18 disability status, migrant status, English pro-
19 ficiency, and status as economically disadvan-
20 taged, except that such disaggregation shall not
21 be required in a case in which the number of
22 students in a category is insufficient to yield
23 statistically reliable information or the results
24 would reveal personally identifiable information
25 about an individual student.

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

4 (A) establishing baselines and performance
5 benchmarks; and

6 (B) measuring progress by State edu-
7 cational agencies receiving such grants.

8 (i) NON-FEDERAL SHARE; SUPPLEMENT, NOT SUP-
9 PLANT.—

10 (1) NON-FEDERAL SHARE.—

11 (A) IN GENERAL.—A State educational
12 agency that receives a grant under this section
13 shall provide the non-Federal share of the costs
14 of the programs and activities described in sub-
15 section (f) that are carried out under the grant.
16 The amount of the non-Federal share under
17 this section for a fiscal year shall be not less
18 than 50 percent. The non-Federal share may be
19 in cash or in-kind, and may be provided from
20 local resources, contributions from private orga-
21 nizations, contributions from the State's part-
22 ners under subsection (a)(2), or a combination
23 of such sources.

24 (B) FINANCIAL HARDSHIP WAIVER.—The
25 Secretary of Education may waive or reduce the

1 non-Federal share of a State educational agen-
2 cy that has submitted an application for a
3 grant under this section if the State educational
4 agency demonstrates a need for such waiver or
5 reduction due to extreme financial hardship.

6 (2) SUPPLEMENT, NOT SUPPLANT.—Grant
7 funds provided under this section shall be used to
8 supplement, and not supplant, any other Federal or
9 State funds otherwise available to carry out the ac-
10 tivities described in this section.

11 (j) SPECIAL RULE.—In the event a State educational
12 agency declines or does not submit an application under
13 this section, the Secretary of Education shall provide for
14 another entity or a consortium, with the capacity to carry
15 out the activities under this section in such State, to sub-
16 mit an application.

17 (k) AUTHORIZATION OF APPROPRIATIONS.—There
18 are authorized to be appropriated to carry out this section
19 \$125,000,000 for each of fiscal years 2012 through 2015.

20 **SEC. 6. RESEARCH AND EVALUATIONS.**

21 (a) IN GENERAL.—The Institute of Education
22 Sciences shall support, directly or through grants or con-
23 tracts, research on engineering education and evaluation
24 of the grants awarded under this Act, including studies
25 and evaluations that—

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

4 (A) improving student achievement in
5 science, technology, engineering, and mathe-
6 matics subjects;

7 (B) improving student understanding of
8 engineering;

9 (C) enhancing technological literacy of stu-
10 dents;

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

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

16 (2) assess how the programs and activities car-
17 ried out by each State educational agency receiving
18 a grant under section 5 can be replicated by a vari-
19 ety of State educational agencies and local edu-
20 cational agencies;

21 (3) assess how the programs and activities car-
22 ried out by each State educational agency receiving
23 a grant under section 5 lead to students developing
24 engineering design ideas, practices and habits of

1 mind over time, and the types of conditions nec-
2 essary to support these developments;

3 (4) identify and assess how science inquiry and
4 mathematical reasoning can be connected to engi-
5 neering design in K–12 curricula and teacher profes-
6 sional development; and

7 (5) include any other information or assess-
8 ments the Secretary of Education may require.

9 (b) DISSEMINATION.—The Secretary of Education
10 shall, based on the results of each evaluation completed
11 under subsection (a), disseminate information and anal-
12 ysis to the public, and provide technical assistance to State
13 educational agencies, on best practices and promising in-
14 novations in the field of K–12 engineering education.

15 (c) AUTHORIZATION OF APPROPRIATIONS.—There
16 are authorized to be appropriated to carry out this section
17 \$5,000,000 for each of fiscal years 2013 through 2015.

○