

**Calendar No. 180**

116TH CONGRESS }  
*1st Session* }

SENATE

{ REPORT  
116-78

BUILDING BLOCKS OF STEM ACT

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R E P O R T

OF THE

COMMITTEE ON COMMERCE, SCIENCE, AND  
TRANSPORTATION

ON

S. 737



AUGUST 16, 2019.—Ordered to be printed  
Filed, under authority of the order of the Senate of August 1, 2019

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SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED SIXTEENTH CONGRESS

FIRST SESSION

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### BUILDING BLOCKS OF STEM ACT

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Mr. WICKER, from the Committee on Commerce, Science, and  
Transportation, submitted the following

### R E P O R T

[To accompany S. 737]

[Including cost estimate of the Congressional Budget Office]

The Committee on Commerce, Science, and Transportation, to which was referred the bill (S. 737) to direct the National Science Foundation to support STEM education research focused on early childhood, having considered the same, reports favorably thereon without amendment and recommends that the bill do pass.

#### PURPOSE OF THE BILL

The purpose of S. 737, the Building Blocks of STEM Act, is to direct the National Science Foundation (NSF) to more equitably allocate funding for research in the Discovery Research PreK–12 (DRK–12) program to studies that include a focus on early childhood (birth through age 10)—with the goal of improving research on early childhood development in science, technology, engineering, and mathematics (STEM) programs. The legislation also would expand two existing NSF grant programs; the first to fund research in identifying and understanding what factors contribute to the willingness or unwillingness of young girls to participate in STEM activities, and the second to encourage participation of young girls in computer science activities in pre-K and elementary classrooms.

#### BACKGROUND AND NEEDS

America's STEM workforce is central to our innovative capacity and global competitiveness. Despite making up half of the total

workforce, women are underrepresented in STEM careers, making up less than 25 percent of STEM jobs in 2009.<sup>1</sup> Additionally, studies have shown that girls appear to lose interest in STEM rapidly between early and late adolescence, and there is limited research on the effect of interventions during early childhood.<sup>2</sup>

#### NSF SUPPORT FOR STEM EDUCATION

NSF continues to make the largest financial investment in STEM education of all Federal science agencies and leads Federal research in this area. NSF's DRK-12 program seeks to better understand and improve instruction of STEM education in preK-12 classrooms by enhancing understanding and use of STEM content by both students and teachers, through research and development of innovative STEM education approaches.<sup>3</sup>

#### ADDRESSING GENDER GAPS IN THE STEM WORKFORCE

Over the past decade, employment in STEM occupations has increased by over 10 percent, compared with 5.2 percent net growth in non-STEM occupations, with computer occupations and engineers among the types of STEM occupations with the highest job gains.<sup>4</sup> The number of women entering the workforce to STEM careers has risen significantly over the past 2 decades, and significant strides have been made toward closing the gender gap in several STEM fields.<sup>5</sup> However, significant gender disparities continue to exist in computer and mathematical sciences (25 percent) and engineering (15 percent), and through all levels of education.<sup>6</sup> Given that computer science and engineering careers are among the most rapidly increasing in the workforce, strategic funding by existing NSF STEM programs is needed in order to understand and address the root cause of this gap.

#### SUMMARY OF PROVISIONS

S. 737 would direct NSF to consider age distribution when awarding grants under the DRK-12 program. This bill also would fund research and interventions that support girls in STEM education and computer science activities.

#### LEGISLATIVE HISTORY

S. 737, the Building Blocks of STEM Act, was introduced on March 11, 2019, by Senator Rosen (for herself and Senators Capito, Schatz, Blackburn, Cortez Masto, and Fischer), and was referred to the Committee on Commerce, Science, and Transportation of the

<sup>1</sup> U.S. Department of Commerce, Economics and Statistics Administration. "Women in STEM: A Gender Gap to Innovation" (<https://files.eric.ed.gov/fulltext/ED523766.pdf>).

<sup>2</sup> United Nations Educational, Scientific and Cultural Organization. "Cracking the Code: Girls' and Women's Education in Science, Technology, Engineering and Mathematics (STEM)" (<https://unesdoc.unesco.org/ark:/48223/pf0000253479>).

<sup>3</sup> National Science Foundation, News Release. "NSF awards \$50M in grants to improve STEM education" ([https://www.nsf.gov/news/news\\_summ.jsp?cntn\\_id=297236&org=NSF&from=news](https://www.nsf.gov/news/news_summ.jsp?cntn_id=297236&org=NSF&from=news)) (accessed May 8, 2019).

<sup>4</sup> U.S. Bureau of Labor Statistics, *STEM Occupations: Past, Present, and Future* (<https://www.bls.gov/spotlight/2017/science-technology-engineering-and-mathematics-stem-occupations-past-present-and-future/pdf>) (accessed May 8, 2019).

<sup>5</sup> National Science Foundation, "Has employment of women and minorities in S&E jobs increased?" (<https://nsf.gov/nsb/sei/edTool/data/workforce-07.html>).

<sup>6</sup> National Science Foundation, "Has employment of women and minorities in S&E jobs increased?" (<https://nsf.gov/nsb/sei/edTool/data/workforce-07.html>).

Senate. Senator Blumenthal is an additional cosponsor. On May 15, 2019, the Committee met in open Executive Session and, by voice vote, ordered S. 737 reported favorably without amendment.

Similar legislation, H.R. 1665, the Building Blocks of STEM Act, was introduced on March 11, 2019, by Representative Haley Stevens (for herself and Representative Baird), and was referred to the Committee on Science, Space, and Technology of the House of Representatives. There are seven additional cosponsors.

#### ESTIMATED COSTS

In accordance with paragraph 11(a) of rule XXVI of the Standing Rules of the Senate and section 403 of the Congressional Budget Act of 1974, the Committee provides the following cost estimate, prepared by the Congressional Budget Office:

<b>S. 737, Building Blocks of STEM Act</b>			
As ordered reported by the Senate Committee on Commerce, Science, and Transportation on May 15, 2019			
By Fiscal Year, Millions of Dollars	2019	2019-2024	2019-2029
Direct Spending (Outlays)	0	0	0
Revenues	0	0	0
Deficit Effect	0	0	0
Spending Subject to Appropriation (Outlays)	0	*	n.e.
Pay-as-you-go procedures apply?	No	<b>Mandate Effects</b>	
Increases on-budget deficits in any of the four consecutive 10-year periods beginning in 2030?	No	Contains intergovernmental mandate?	No
		Contains private-sector mandate?	No
n.e. = not estimated; * = between zero and \$500,000.			

S. 737 would modify several National Science Foundation (NSF) programs that provide grants to institutions of higher education and nonprofit organizations. Specifically, the bill would authorize the use of grants to study factors that contribute to female students' participation in science, technology, engineering, and math education, and to develop and evaluate methods to increase female students' participation in computer science. The bill also would direct the NSF to focus on early childhood education within the Discovery Research PreK–12 grant program.

In recent years, the NSF has spent about \$160 million annually on those programs. CBO expects that implementing the bill would not change the total amount of grants awarded. Using information from the NSF, and based on the costs of similar tasks, CBO estimates that any administrative costs incurred under S. 737 would be insignificant; such spending would be subject to the availability of appropriated funds.

The CBO staff contact for this estimate is Janani Shankaran. The estimate was reviewed by Theresa Gullo, Assistant Director for Budget Analysis.

## REGULATORY IMPACT STATEMENT

Because S. 737 does not create any new programs, the legislation will have no additional regulatory impact, and will result in no additional reporting requirements. The legislation will have no further effect on the number or types of individuals and businesses regulated, the economic impact of such regulation, the personal privacy of affected individuals, or the paperwork required from such individuals and businesses.

## CONGRESSIONALLY DIRECTED SPENDING

In compliance with paragraph 4(b) of rule XLIV of the Standing Rules of the Senate, the Committee provides that no provisions contained in the bill, as reported, meet the definition of congressionally directed spending items under the rule.

## SECTION-BY-SECTION ANALYSIS

*Section 1. Short title.*

This section would provide that the bill may be cited as the “Building Blocks of STEM Act”.

*Section 2. Findings.*

This section would find that NSF is a major investor in STEM research and policy setting, and that young children who engage in science activities at an early age develop positive attitudes toward science and pursue STEM careers. This section would note, however, that the majority of NSF STEM research currently focuses on older age ranges. This section also would find that women and girls are underrepresented throughout all levels of education and the STEM workforce.

*Section 3. Supporting early childhood STEM education research.*

This section would direct NSF to consider age distribution in order to more equitably allocate funding for research under the DRK-12 program.

*Section 4. Supporting female students in prekindergarten through elementary school in STEM education.*

This section would authorize NSF grants to identify what factors contribute to young girls’ motivation to participate in STEM activities.

*Section 5. Supporting female students in prekindergarten through elementary school in computer science education.*

This section authorizes NSF grants to develop, implement, and evaluate programs in pre-K and elementary school classrooms that encourage the participation of young girls in computer science.

## CHANGES IN EXISTING LAW

In compliance with paragraph 12 of rule XXVI of the Standing Rules of the Senate, changes in existing law made by the bill, as reported, are shown as follows (existing law proposed to be omitted is enclosed in black brackets, new material is printed in italic, existing law in which no change is proposed is shown in roman):

## AMERICAN INNOVATION AND COMPETITIVENESS ACT

[42 U.S.C. 1862s–5(d)]

**SEC. 305. Programs to expand stem opportunities**

(a) \* \* \*

## (d) GRANTS TO BROADEN PARTICIPATION.—

(1) **IN GENERAL.**—The Director of the Foundation shall award grants on a competitive, merit-reviewed basis, to eligible entities to increase the participation of underrepresented populations in STEM fields, including individuals identified in section 33 or section 34 of the Science and Engineering Equal Opportunities Act (42 U.S.C. 1885a, 1885b).

(2) **CENTER OF EXCELLENCE.**—

(A) **IN GENERAL.**—Grants awarded under this subsection may include grants for the establishment of a Center of Excellence to collect, maintain, and disseminate information to increase participation of underrepresented populations in STEM fields.

(B) **PURPOSE.**—The purpose of a Center of Excellence under this subsection is to promote diversity in STEM fields by building on the success of the **INCLUDES** programs, providing technical assistance, maintaining best practices, and providing related training at federally funded academic institutions.

(3) **RESEARCH.**—*As a component of improving participation of women in STEM fields, research funded by a grant under this subsection may include research on—*

(A) *the role of teacher training and professional development, including effective incentive structures to encourage teachers to participate in such training and professional development, in encouraging or discouraging female students in prekindergarten through elementary school from participating in STEM activities;*

(B) *the role of teachers in shaping perceptions of STEM in female students in prekindergarten through elementary school and discouraging such students from participating in STEM activities;*

(C) *the role of other facets of the learning environment on the willingness of female students in prekindergarten through elementary school to participate in STEM activities, including learning materials and textbooks, classroom decorations, seating arrangements, use of media and technology, classroom culture, and gender composition of students during group work;*

(D) *the role of parents and other caregivers in encouraging or discouraging female students in prekindergarten through elementary school from participating in STEM activities;*

(E) *the types of STEM activities that encourage greater participation by female students in prekindergarten through elementary school;*

(F) *the role of mentorship and best practices in finding and utilizing mentors;*

(G) *the role of informal and out-of-school STEM learning opportunities on the perception of and participation in*

*STEM activities of female students in prekindergarten through elementary school; and*  
*(H) any other area the Director determines will carry out the goal described in paragraph (1).*

\* \* \* \* \*

[42 U.S.C. 1862s-7(b)]

**SEC. 310. Computer science education research**

(a) **FINDINGS.**—Congress finds that as the lead Federal agency for building the research knowledge base for computer science education, the Foundation is well positioned to make investments that will accelerate ongoing efforts to enable rigorous and engaging computer science throughout the Nation as an integral part of STEM education.

(b) **GRANT PROGRAM.**—

(1) **IN GENERAL.**—The Director of the Foundation shall award grants to eligible entities to research computer science education and computational thinking.

(2) **RESEARCH.**—The research described in paragraph (1) may include the development or adaptation, piloting or full implementation, and testing of—

(A) models of preservice preparation for teachers who will teach computer science and computational thinking;

(B) scalable and sustainable models of professional development and ongoing support for the teachers described in subparagraph (A);

(C) tools and models for teaching and learning aimed at supporting student success and inclusion in computing within and across diverse populations, particularly poor, rural, and tribal populations and other populations that have been historically underrepresented in computer science and STEM fields; and

(D) high-quality learning opportunities for teaching computer science and, especially in poor, rural, or tribal schools at the elementary school and middle school levels, for integrating computational thinking into STEM teaching and learning.

(c) **COLLABORATIONS.**—In carrying out the grants established in subsection (b), eligible entities may collaborate and partner with local or remote schools to support the integration of computing and computational thinking within pre-kindergarten through grade 12 STEM curricula and instruction.

(d) **METRICS.**—The Director of the Foundation shall develop metrics to measure the success of the grant program funded under this section in achieving program goals.

(e) **REPORT.**—The Director of the Foundation shall report, in the annual budget submission to Congress, on the success of the program as measured by the metrics in subsection (d).

(f) **DEFINITION OF ELIGIBLE ENTITY.**—In this section, the term “eligible entity” means an institution of higher education or a non-profit research organization.

(3) **USES OF FUNDS.**—*The tools and models described in paragraph (2)(C) may include—*

*(A) offering training and professional development programs, including summer or academic year institutes or*



*workshops, designed to strengthen the capabilities of pre-kindergarten and elementary school teachers and to familiarize such teachers with the role of gender bias in the classroom;*

*(B) offering innovative pre-service and in-service programs that instruct teachers on gender-inclusive practices for teaching computing concepts;*

*(C) developing distance learning programs for teachers or students, including developing curricular materials, play-based computing activities, and other resources for the in-service professional development of teachers that are made available to teachers through the Internet;*

*(D) developing or adapting prekindergarten and elementary school computer science curricular materials that incorporate contemporary research on the science of learning, particularly with respect to gender inclusion;*

*(E) developing and offering gender-inclusive computer science enrichment programs for students, including after-school and summer programs;*

*(F) providing mentors for female students in prekindergarten through elementary school in person and through the Internet to support such students in participating in computer science activities;*

*(G) engaging female students in prekindergarten through elementary school and their guardians about the difficulties faced by such students to maintain an interest in participating in computer science activities;*

*(H) acquainting female students in prekindergarten through elementary school with careers in computer science and encouraging such students to consider careers in such field;*

*(I) developing tools to evaluate activities conducted under this subsection; and*

*(J) any other tools or models the Director determines will accomplish the aim described in paragraph (2)(C).*