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GENERAL DISTRIBUTION MEMORANDUM

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Subject: Selected STEM Education Legislative Activity in the 112th Congress

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This general distribution memorandum summarizes selected legislative activities related to science, technology, engineering, and mathematics (STEM) education—including legislation, hearings, and appropriations—in the 112th Congress. It will not be updated. Please contact the author with additional questions or for more information.

Although STEM education programs and activities can be found across at least 15 federal agencies, most of the funding and programs are in three agencies: the National Science Foundation (NSF), the Department of Education (ED), and the National Institutes of Health (NIH). Further, because almost all of the NIH funding is in a single specialized scholarship program that primarily supports biomedical students and researchers in higher education, this memorandum focuses on STEM education activities at NSF and ED. These two agencies provide much of the federal STEM education assistance for kindergarten-through-grade 12 (K-12) schools, students, and colleges.[1]

The Federal STEM Education Policy Cycle: Where Are We Now?

Congress has historically approached STEM education policy as a kind of two-part question. Programs at the NSF and other science agencies are typically overseen by the House and Senate science committees, and programs at ED are generally handled by the respective education committees. As a result, the legislative conversation about STEM education often occurs within the context of two all-encompassing authorization measures: the America COMPETES Act, which authorizes the NSF and some other science agencies, and the Elementary and Secondary Education Act of 1965, as amended by No Child Left Behind (ESEA), which authorizes ED programs and activities.[2] The America COMPETES Act was reauthorized at the end of 2010 and is in the implementation period of the policy cycle. As such, attention has now turned to the reauthorization of ESEA and to STEM education programs and activities at ED.

[1] This assessment is based on CRS analysis of Office of Management and Budget (OMB) budgetary data for the federal enterprise between FY2005 and FY2010. Known limitations in the OMB data include under-reporting of STEM education activities embedded in research programs at federal science mission agencies and a potential undercount of STEM education activities in ED programs with multiple goals (e.g., teacher preparation programs that support mathematics training as an option among other activities). Data available upon request.

[2] An authorization measure provides general legal authority for agency activities. These types of bills may be contrasted with appropriations measures, which provide funding for those activities.

Policymakers have not yet passed comprehensive legislation to reauthorize ESEA in the 112th Congress, but negotiations between committee leadership and the Obama Administration over the shape and scope of reauthorization are active and ongoing.[3] The Senate Committee on Health, Education, Labor, and Pensions announced agreement on a comprehensive bipartisan bill to reauthorize ESEA on October 17, 2011, and scheduled hearings on the bill beginning on October 19, 2011.[4] The House has not moved on comprehensive legislation to reauthorize ESEA, but it has passed legislation amending the charter school program provisions in ESEA (H.R. 2218).

Prior to the introduction of the Senate proposal for ESEA in October 2011, much of the policy debate over ESEA centered on the Obama Administration's FY2011 budget request for ED, which would have re-organized and consolidated many of the department's programs (thereby effectively rewriting ESEA).[5] Congress did not adopt those changes in 2011. The Obama Administration reasserted its support for its proposed changes in its FY2012 budget request to Congress.[6] However, to the extent that congressional appropriators have moved on funding bills for ED, they have done so in a manner that is consistent with existing law and not the Administration's proposal.[7]

Policy & Legislation in the 112th Congress

Stakeholders with an interest in STEM education suggest a wide and disparate set of policy options for Congress. Among these options are recommendations to include science in school accountability systems, to provide professional development for teachers, and to designate an Assistant Secretary of Education for STEM Education within ED.[8] Other analysts prefer to increase use of alternative certification for teachers, increase use of online education, link teacher pay to performance, and promote school choice.[9] These types of options—from accountability systems to school choice—are typically designed to effect change across the entire U.S. education system and to affect all U.S. students. However, some analysts argue that there are limitations to taking a broad approach and prefer policies that target federal support to high-achieving students with an interest in STEM.[10] Similarly, many analysts have raised concerns about

[3] For more information about ESEA, see the "Elementary and Secondary" section of the CRS website at http://www.crs.gov/Pages/SubIssue.aspx?CLIID=2487&ParentID=5.

[4] U.S. Senate Committee on Health, Education, Labor, and Pensions, "Harkin, Enzi Announce Bipartisan Support for Moving Forward with Education Reform Bill," press release, October 17, 2011 http://help.senate.gov/newsroom/press/release/?id=f320585f-ad1f-48bc-9e68-133ad9b3f37c&groups=Chair.

[5] For more information on the Administration's proposed changes to ESEA, see CRS Report R41355, *Administration's Proposal to Reauthorize the Elementary and Secondary Education Act: Comparison to Current Law*, by Rebecca R. Skinner et al.

[6] U.S. Department of Education, *President's FY2012 Budget Request for the U.S. Department of Education*, February 14, 2011, http://www2.ed.gov/about/overview/budget/budget12/index.html.

[7] The reported version of the Senate Committee on Appropriations' Departments of Labor, Health and Human Services, and Education, and Related Agencies Appropriations Act, 2012 (S. 1599) is based on current law and assumes no changes in the current departmental organization. For more information, see S. Rept. 112-84.

[8] These and other recommendations have been promoted by the STEM Education Coalition and the Triangle Coalition for Science and Technology Education. For more information on the coalitions' positions on STEM education in the 112th Congress, see Letter from STEM Education Coalition to Senators Tom Harkin and Michael B. Enzi, June 20, 2011; and Triangle Coalition for Science and Technology Education, "Doing What's Best for Science, Technology, Engineering, and Mathematics Education," fact sheet, January 2011.

[9] Lindsey Burke and Jena Baker McNeill, "Educate to Innovate: How the Obama Plan for STEM Education Falls Short, *Heritage Foundation Backgrounder* #2504, January 5, 2011, http://www.heritage.org/research/reports/2011/01/educate-to-innovate-how-the-obama-plan-for-stem-education-falls-short.

[10] Robert D. Atkinson and Merrilea Mayo, *Refueling the U.S. Innovation Economy: Fresh Approaches to STEM Education*, Information Technology and Innovation Forum, December 7, 2010, http://www.itif.org/publications/refueling-us-innovation-economy-fresh-approaches-stem-education.

achievement gaps in STEM education and seek policy solutions designed to increase the participation and academic performance of certain under-represented populations (including ethnic and racial minorities, the disabled, and/or women) in STEM fields.[11]

STEM education-related legislation introduced in the 112th Congress includes measures relating to governance and coordination, teachers, engineering education, informal education, and under-represented minorities. Provisions in the recently announced Senate Committee on Health, Education, Labor and Pensions' agreement on ESEA also address STEM education policy issues.

Governance & Coordination

The contemporary federal debate about STEM education policy often focuses on governance concerns. These include a perceived lack of coordination *among* various STEM education stakeholders (e.g., states, local educators, businesses) and *within* the federal STEM education effort itself, which is sometimes characterized as disjointed or duplicative. Policymakers have responded to this perceived fragmentation with primarily two—not mutually exclusive—strategies. The first strategy seeks to improve coordination among stakeholders by establishing or expanding the responsibilities of existing networks and mediating institutions. The second approach seeks to reduce fragmentation through program consolidation.

Both policy strategies—mediating institutions and program consolidation—may be found in bills introduced in the 112th Congress. For example, among other things H.R. 2228 and S. 619 seek to "address the lack of coordination among STEM education efforts in the States"[12] by authorizing planning grants to states to establish networks for communication and collaboration. Policymakers who support these types of policies assert that increased collaboration may help bridge the perceived gap between what students learn in school and the STEM skills employers say they have difficulty finding.[13] Other analysts may consider STEM networks a means to distribute information about best practices in teaching and STEM content. According to one stakeholder, at least 12 states have established statewide STEM education networks that connect educators and employers or that serve related educational purposes.[14]

Several members of the 112th Congress have introduced legislation to consolidate federal STEM education programs that are perceived as duplicative, such as the Mathematics and Science Partnership (MSP) program and other teacher development programs at ED. [15,16] For example, S. 1569 (Empowering Local Educational Decisionmaking Act of 2011), would consolidate 59 ED programs into two formula-driven block grants to states. The Fund for the Improvement of Teaching and Learning in S. 1569, Title II would eliminate the STEM-specific MSP program and consolidate all teacher professional development activities—in all subjects—into a single program. This would have the effect of eliminating what is

[11] For example, see Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline; Committee on Science, Engineering, and Public Policy; Policy and Global Affairs; National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, *Expanding Underrepresented Minority Participation* (Washington, DC: National Academies Press, 2011).

[12] S. 619, Sec. 2, "Part E, "Sec. 2502 (a) and H.R. 2228, Sec. 2, "Part E, "Sec. 2502 (a).

[13] Dear Colleague letter from Representative Ben Ray Lujan, "Strengthen STEM Teacher Training," June 13, 2011.

[14] SciMathMN, "State and National STEM Learning Networks," SciMathMN website, October 13, 2010, www.scimathmn.org/docs/mnstemnet_OtherNetworks.pdf.

[15] ED's MSP program provides for teacher professional development in STEM fields.

[16] U.S. Government Accountability Office, *Opportunities to Reduce Duplication in Federal Teacher Quality Programs* (GAO-11-510T), April 13, 2011, http://www.gao.gov/products/GAO-11-510.

essentially a preference for STEM-focused teacher professional development in existing federal law. S. 1569 has been referred to committee, but further action has not been taken.

As a policy strategy for STEM education, program consolidation is widely debated. Some policymakers see program consolidation as a means to increase program flexibility and improve program responsiveness because federal program managers would have greater authority to shift priorities without having to modify federal law. However, other policymakers may object to this change because it transfers program control from the legislative to the executive branch. Consolidation has also been proposed as a strategy to shift control to the states and as a means to reduce program costs in what is perceived by some analysts as a wasteful and duplicative federal education (and STEM education) effort. Shifting control to the states could increase their ability to respond to local conditions and needs, but might make it more difficult to drive a national STEM education agenda.[17] As for the question of perceived duplication as a rationale for consolidation, the scope and scale of the federal STEM education effort is currently unknown and the extent to which the federal STEM education effort is duplicative is the subject of on-going research.[18] Some policymakers may wish to wait until that research effort concludes before consolidating programs; while others may wish to proceed given preliminary findings that already suggest the potential for duplication, particularly in teacher quality programs at ED (including the MSP).[19] Finally, consolidation opponents raise concerns about potential program impacts from consolidation, arguing that STEM education programs need specified funding streams to avoid being passed over in favor of competing educational priorities. It is unclear if this assertion would hold true in practice.

Teachers

Another topic at the forefront of the federal debate over STEM education policy is teachers. Observers characterize STEM teachers as both a strength and a weakness in the U.S. STEM education system. For example, the influential National Academies report *Rising Above the Gathering Storm* asserted that: "Simply stated, teachers are the key to improving student performance."[20] However, STEM education advocates raise concerns about both the quality and quantity of STEM education teachers in the United States. These concerns focus on perceived weaknesses in both the subject-matter knowledge and pedagogical skills of U.S. STEM teachers, as well as on perceived deficiencies in the flow of entering and leaving teachers in the U.S. STEM teacher labor supply.

Teacher legislation in the 112th Congress includes measures that seek to address both STEM teacher quality and quantity concerns.[21] S. 758 and H.R. 2598, for example, would establish a STEM Master Teacher Corps program at ED. The Master Teacher Corps program would reward "effective" STEM

[17] This would depend on how the grants to states were structured. Federal policymakers could still drive a national STEM education agenda if they make receipt of consolidated program funds contingent on meeting certain defined national goals. However, some states may reject such efforts as overly prescriptive.

[18] Congress has directed both the Office of Science and Technology Policy and the Government Accountability Office to inventory the federal STEM education effort and make recommendations on duplication. The results of these inquiries are expected to be released in late 2011 or early 2012.

[19] U.S. Government Accountability Office, *Opportunities to Reduce Duplication in Federal Teacher Quality Programs* (GAO-11-510T), April 13, 2011, http://www.gao.gov/products/GAO-11-510.

[20] National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, Committee on Prospering in the Global Economy of the 21st Century: An Agenda for America Science and Technology, and Committee on Science, Engineering, and Public Policy, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future* (Washington, DC: National Academies Press, 2007), http://www.nap.edu/catalog/11463.html, p. 113

[21] For information about teacher policy in the 112th Congress, see CRS Report R41267, *Elementary and Secondary School Teachers: Policy Context, Federal Programs, and ESEA Reauthorization Issues*, by Jeffrey J. Kuenzi.

teachers with increased career prestige and pay in return for providing mentoring services to beginning teachers.[22] At the same time it would also increase induction support for new teachers. The policy rational behind these measures is complex, but in essence it relies on the notion that improving certain working conditions (e.g., prestige, pay, and training) will help attract and retain more and better STEM teachers. Researchers have found that working conditions influence teacher turnover and that mentoring may help to reduce turnover. The effectiveness of Master Teacher Corps initiatives will be contingent on a number of factors, including the level of financial incentive that participating teachers receive and teachers' willingness to collaborate. Further, other factors that contribute to turnover among STEM teachers, such as student discipline problems, may still work to push STEM teachers out of the classroom even against the pull of the STEM Master Teacher Corps program.[23] Finally, some analysts may prefer programs that are designed to attract and retain STEM teachers through differential pay incentives or performance bonuses, or may prefer to leave decisions about how to attract and retain STEM teachers to the states.

H.R. 135, H.R. 289, and S. 1055 seek to attract STEM teachers by supporting a portion of their education costs. These bills would allow eligible STEM teachers to claim a refundable tax credit equal to 10% of their undergraduate tuition, up to a maximum of $1,000. The credit would be available annually for up to 10 years for those who remain eligible STEM teachers. For eligible teachers who spend at least one of their first five years teaching in a so-called "high-need" school, the maximum annual credit amount would be increased to $1,500.[24]

Although tax credits may be a welcome benefit to a relatively low-paid entry-level teacher, in order to work as an incentive, federal aid (e.g., tax benefits, scholarships, etc.) must encourage STEM students *to become teachers when they might otherwise not have done so*. The effect of financial incentives generally, and the effects of different forms of financial incentives (e.g., loans, scholarships, tax benefits), on STEM students' college and career choices are not well understood. However, one 2010 case study of a federal program designed to attract STEM students to teaching careers in high-need schools through the use of financial incentives concluded that the aid was not particularly influential on participants' decisions to become teachers. On the other hand, the funding was found to be "somewhat influential" on the decision to teach in a high-need school. The authors also found that the higher the percentage of tuition covered by the funding, the more the funding was perceived to influence the decision to teach or teach in a high-need school, and that career-changers (those entering teaching from another career) tended to perceive the aid as more influential on their decision to become teachers.[25] These findings do not appear to have been replicated by other scholars or applied to the specific case of tax credits for STEM teachers.[26]

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[22] S. 758, Sec. 3, "Chapter B, "Sec. 2155 "(2).

[23] Recent research on STEM teacher turnover, including movement between schools and departures from the profession, shows that mathematics and science teachers are no more likely to take non-teaching jobs than teachers in other fields. Also like teachers in other fields, mathematics and science teacher turnover is greatest in high-poverty, high-minority urban schools, with teachers migrating from high- to low-poverty schools as their careers progress. However, certain working conditions appear to be more significant to turnover among mathematics and science teachers. For mathematics teachers, classroom autonomy, professional development, and degree of student discipline problems were related to turnover. Science teachers are reported to have similar concerns about student discipline and professional development, but maximum potential salary also plays a role in turnover. See, Richard M. Ingersoll and Henry May*, The Magnitude, Destinations, and Determinants of Mathematics and Science Teacher Turnover*, Consortium for Policy Research in Education, October 2010.

[24] For more information about higher education tax benefits, see CRS Report RL32507, *Higher Education Tax Credits: An Economic Analysis*, by Mark P. Keightley; and CRS Report R41967, *Higher Education Tax Benefits: Brief Overview and Budgetary Effects*, by Margot L. Crandall-Hollick and Mark P. Keightley.

[25] Pey-Yan Liou and Frances Lawrenz, "Optimizing Teacher Preparation Loan Forgiveness Programs: Variables Related to Perceived Influence," *Science Education Policy*, v. 95, n. 1 (January 2011), p.139, http://onlinelibrary.wiley.com/doi/10.1002/sce.20409/pdf.

[26] Different types of aid programs may have different impacts on student decisions. There is some evidence, for example, that (continued...)

Other STEM Education Legislation from the 112th Congress

Other STEM education policy topics addressed legislatively in the 112th Congress include engineering education, informal STEM education, and under-represented populations. These bills may be summarized as follows:

- *Engineering Education*—S. 969 and H.R 1951 would award grants to states to plan and implement activities designed to integrate engineering education into K-12 instruction and curriculum.
- *Informal STEM Education*—H.R. 2247, H.R. 2253, and S. 716 would establish the Innovation Inspiration grant program at ED. The program would provide funding for non-traditional STEM education teaching methods and mentoring, and would support student participation in nonprofit STEM competitions.
- *Under-represented Populations*—H.R. 1903 would provide funding for activities designed to engage girls and under-represented minorities in STEM education and employment.

STEM Education in ESEA

On October 17, 2011, the Senate Committee on Health, Education, Labor, and Pensions released draft language to reauthorize ESEA.[27] The proposal includes many provisions that may be of interest to STEM education stakeholders. For example, Sec. 1111 would require states to adopt science standards by December 31, 2013, and would require states to implement statewide assessments in science in order to be eligible for certain grants. These provisions appear to be consistent with current law.

Sec. 4103 is the STEM policy core of the proposed ESEA reauthorization. The Improving Science, Technology, Engineering, and Mathematics Instruction and Student Achievement program would give grants to states to improve STEM instruction and student achievement. Required activities under Sec. 4103 include increasing under-represented minority student access to high-quality STEM courses, implementing evidence-based STEM instruction, providing professional development for teachers and school leaders in STEM, and providing technical assistance to local educators to improve student achievement and narrow achievement gaps. Permissible activities under Sec. 4103 include recruiting STEM professionals to teaching, providing induction and mentoring support to new teachers, developing Internet-based instructional supports, and implementing interdisciplinary approaches by integrating instruction in one or more STEM fields with non-STEM fields such as English or arts. Sec. 4103 also outlines specific requirements for sub-grantees (e.g., local educational agencies), and allows grantees to use funds to support student participation in STEM competitions (e.g., robotics competitions) and to broaden students' interest in STEM careers.

Other provisions of the proposed ESEA that may be of interest to STEM education stakeholders include Sec. 5201, which authorizes the Investing in Innovation program. This existing program would support the development and implementation of research-based practices that, among other things, seek to reduce

(...continued)

certain costs may increase the likelihood that a student will major in a professional field rather than in science or humanities. Other research has shown that certain student populations (e.g., Latinos) are unwilling to take on loans for education.

[27] A copy of the draft bill is available at http://help.senate.gov/imo/media/doc/ROM118313.pdf. The Senate proposal for ESEA includes STEM education language that is consistent with language from S. 1675, which was introduced on October 6, 2011.

achievement gaps, increase college enrollment and persistence, and improve school readiness. Subpart 2—Accelerated Learning would provide support for Advanced Placement and International Baccalaureate courses and would authorize states to pay the Advanced Placement test fees of low-income students. Although these provisions are not specific to STEM, they address general education challenges that are of specific interest to many STEM stakeholders.

Hearings

The House Committee on Science, Space, and Technology has held at least four hearings on STEM education (to date) in the 112th Congress. These include:

- June 16, 2011 – STEM Education in Action: Learning Today… Leading Tomorrow
- September 13, 2011 – Inspiring the Science and Engineering Workforce of Tomorrow
- September 26, 2011 – STEM Education in Action: Communities Preparing for Jobs of the Future
- October 12, 2011 – What Makes for Successful K-12 STEM Education

The Senate Committee on Health, Education, Labor, and Pensions has held at least one STEM education-related hearing during the 112th Congress. That hearing was held on July 15, 2011 and was titled, "Educating Our Children to Succeed in the Global Economy."

Appropriations

The standard appropriations mechanisms that Congress employs to fund the NSF and ED are the Commerce, Justice, Science and Related Agencies and the Labor, Health and Human Services, and Education annual appropriations bills. The status of FY2012 funding for specified STEM education programs at these two agencies in FY2012 congressional appropriations bills is described in **Table 1**.

Table 1. Funding For Specified STEM Education Programs in FY2012 Appropriations Measures

As of October 17, 2011

Bill/Program	House	Senate
Commerce, Justice, Science, and Related Agencies, FY2012	H.R. 2596 and H. Rept. 112-169	S. 1572 and S. Rept 112-78, as introduced. Now included in S. Amdt. 738 to H.R. 2112.
NSF Programs:		
Education and Human Resources Account (TOTAL)[a]	$835.0 million	$829.0 million
Robert Noyce Scholarship Program	*n/a*	*$54.9 million*
Labor, Health and Human Services, and Education, FY2012	n/a	S. 1599, S. Rept. 112-84
ED Programs::		
Mathematics and Science Partnership	n/a	$171.2 million

Bill/Program	House	Senate
Minority Science and Engineering Improvement	n/a	$9.5 million
Graduate Assistance in Areas of National Need	n/a	$31.0 million

Source: H. Rept. 112-169; S. Rept. 112-78; S. Rept. 112-84; and S. Amdt. 738.

Notes: This table includes programs that a) have been identified as a STEM education program by the Office of Management and Budget, and b) have a defined funding level in either an FY2012 funding bill or related committee report. The OMB count of STEM education programs at federal agencies does not include programs where STEM-focused activities are an allowable activity among many others (e.g., teacher training funds that can be used for math or reading training) or where STEM education is a secondary program purpose or activity (e.g., STEM education activities associated with primarily research programs at science mission agencies).

a. The Education and Human Resources account is the primary source of STEM education funding at the NSF.