LEVERAGING ESSA TO PROMOTE SCIENCE AND STEM EDUCATION IN STATES

Introduction

The passage of the *Every Student Succeeds* Act (ESSA) provides states the opportunity to craft new goals and strategies for science education. By setting clear goals for science achievement, states can leverage existing policies, including assessments and graduation requirements, to help drive toward set goals. Generally, states could elect to develop new programs and initiatives using funding provided by ESSA, and/or incorporate science into their new accountability systems. States are crafting their goals and strategies for science education through the development of new consolidated state plans, required by ESSA, and through new programs and initiatives using funding provided by ESSA.

This brief provides a landscape analysis of all states' current assessment requirements and graduation requirements in science to help set the national policy context for science. To look at states' current goals and approaches to science inclusion in their accountability plans under ESSA, as well as how they can leverage funding opportunities in ESSA to support science, this brief limits its scope to only those 16 states and the District of Columbia who submitted plans to the U.S. Department of Education (USED) in the first round of submissions (May 2017). Once the remainder of plans have been submitted, the ESSA-focused sections of this brief will be updated to reflect the remaining states. Further, while the focus of this brief is specifically on science, the way that states develop ESSA strategies does not allow for the disentanglement of science from STEM; therefore, when discussing funding opportunities and state proposals for the use of funds provided through ESSA, the scope will broaden to STEM activities and initiatives.

State Policies Emphasizing Science and STEM

SCIENCE AND ACCOUNTABILITY IN ESSA

Setting goals for science achievement in a state plan, alongside those goals for English language arts (ELA) and mathematics, is an important indicator of a state's commitment to improving science education. While many states have proposed incorporating science assessment results as an Academic Achievement indicator in their initial state plans, they are not setting goals around science the way they are for ELA and mathematics.[1] Looking at ESSA plans submitted to date, only two states — Michigan and Tennessee — set clear achievement goals around science. Other states may have science or STEM goals outside of ESSA, but the scope of this analysis is limited to ESSA plans. **Michigan** has set the long-term goal to have 75 percent of schools and 75 percent of student subgroups meet the 2016–17 statewide proficiency rates at the 75th percentile in science by the end of the 2024–25 school year, coinciding with Michigan's Top 10 in 10 timelines. Michigan set both proficiency and growth goals for science. **Tennessee** has also included science goals in their plan relative to National Assessment of Educational Progress (NAEP) performance and on the state's science assessments. Their stated goal is to rank in the top half of states on NAEP by 2019 and by 2024–25, achieve a 50 percent reduction in the number of students not meeting the on track or mastered level on the state's annual assessment. Currently, state science assessment goals have only been set for high schools.

More states intend to include science achievement in their accountability systems as academic indicators than set science goals in ESSA. Of the 16 states and the District of Columbia that have submitted ESSA plans to date, ten states (*see Table 1*) are including science in their accountability system. All ten of these states are including science assessment as part of an academic achievement or proficiency indicator.

[1] Under ESSA, states are required to set goals for mathematics and ELA, they are not required to set goals for science.

[2] New Jersey and North Dakota are not including science in a meaningful way in their ESSA accountability systems and did not mention plans to do so in the future. Delaware's original submission included science as an Academic Achievement indicator, but the state's revised plan proposes moving science achievement to another indicator.

TABLE 1: STATES PROPOSING TO INCLUDE SCIENCE IN THEIR ACCOUNTABILITY SYSTEMS UNDER ESSA

State	Indicator[3]	Grades Included
Arizona	Academic Achievement	Grades 4, 8 and high school
Colorado	Academic Achievement	Grades 3–11
Connecticut	Academic Achievement	Grades 5, 8, and 10
Delaware	Academic Achievement[4]	Grades 5, 8, and 10
Louisiana	Academic Achievement	Grades 3–8 and high school end-of-course
Massachusetts	Academic Achievement	Grades 5, 8, and 10
Michigan*	Academic Achievement	Grades 4, 7, and 11
Nevada	Academic Achievement	Grades 8 and 10
Tennessee	Academic Achievement Goal	Grade band success rate in 3–5, 6–8, and high school
Vermont	School Quality or Student Success	Grades 4, 8, and 11

**Michigan is also including science assessment results as part of the Academic Progress indicator.*

Five additional states referenced plans to incorporate science indicators in subsequent years, with three states providing a timeline for inclusion and two states noting the desire for inclusion, but no specific timeline. **Maine's** plan indicates that the state will explore the inclusion of a science assessment measure for the 2018–19 school year. **New Mexico** plans to include a Student STEM Readiness indicator beginning in 2018–19 which will draw primarily from performance on science assessments, but will also take into account students' engagement in STEM fields. The state is still developing this indicator and will continue to engage educators, businesses, and industry throughout the process. **Illinois** plans to include science proficiency as a core academic indicator beginning in 2019–20. Both **Oregon** and the **District of Columbia** mentioned the possibility of including indicators of science or STEM in future years, but did not provide a concrete timeline.

Early feedback from USED may cause states to rethink how they incorporate science assessment results in their accountability system. USED's feedback letter to Delaware and Nevada indicated that science assessments could not be included as part of the Academic Achievement indicator as ESEA section 1111(c)(4)(B)(i)(I) only includes proficiency on annual reading/language arts and mathematics assessments. Instead, USED emphasized that a state may include performance on assessments other than reading/language arts and mathematics "in the indicator for public elementary and secondary schools that are not high schools as required under ESEA section 1111(c)(4)(B)(ii) (i.e., the Other Academic indicator) for elementary and secondary schools that are not high schools or in the School Quality or Student Success indicator for any schools, including high schools." ESSA indicates that the academic indicators must be given "much greater weight" than the School Quality or Student Success indicator, and as a result, science may be weighted less if used in the School Quality or Student Success indicator.

[3] ESSA requires that states must include these five indicators in their accountability plans: 1) Academic achievement indicator (measured by proficiency or student growth on annual assessments); 2) Academic progress indicator (for elementary and middle schools only, measured by student growth or another valid and reliable academic indicator); 3) Graduation rate indicator (for high schools only); 4) English language proficiency indicator; and 5) School quality or student success indicator (measured student or educator engagement, student access to advanced coursework, postsecondary readiness, school climate and safety, or any other indicator that meets the requirements).

[4] Delaware's original submission included science as an Academic Achievement indicator. Based upon USED's feedback, Delaware has since released a redline version of their submission that moves science to the School Quality or Student Success indicator.

Beyond the inclusion of science in the academic achievement indicators, there are other ways that states can and are including science implicitly through indicators in their accountability plans. Indicators such as on track to graduate, Advanced Placement (AP), International Baccalaureate (IB), dual enrollment, and career technical education all provide opportunities for schools to earn points in the accountability system for students completing coursework or exams in science or STEM categories. However, this data is generally reported in the aggregate and does not look specifically at the percentage of students completing science courses in their freshman year, the percentage of students earning a 3+ on an AP science exam or a grade of C or better in a dual enrollment course, nor the percentage of students taking STEM coursework or learning STEM skills through CTE opportunities. It is worth noting that **Washington** does provide data on the percentage of 9th graders who failed science, thus providing important information about which subjects students struggle with the most their freshman year. In most states, it is difficult to specifically draw out science exposure and attainment from these indicators.

Assessments

As states propose incorporating science assessments in their accountability systems under ESSA, it is important to understand how science assessment differs from ELA and mathematics assessments and how the administration of science assessments can vary from state to state. Unlike ELA and mathematics assessments, which must be administered every year in grades 3–8 and once in high school (defined as grades 10–12), science assessments must only be administered once per grade band: 3–5, 6–9, and 10–12. Consequently, states are administering science assessments in different grades throughout elementary and middle school, and they have additional leeway to administer either end-of-course assessments or comprehensive assessments in high school.

The tables below look at how often, and in which grades, states administered science assessments for school year 2016–17.

In grades 3–8, **6 states** test students more than once per grade band: Arkansas, Kentucky, Louisiana, Nebraska, South Carolina, and Utah. Four of these states test grades 3–8 while the remaining two, South Carolina and Utah, test in grades 4–8. Arkansas also administers a science assessment in grade 9.

TABLE 2: ELEMENTARY SCHOOL SCIENCE ASSESSMENT TESTED GRADES IN 2016–17

Grade Tested	States
Grade 3	**5 states**: AR, KY, LA, NE, TN
Grade 4	**24 states:** AK, AZ, AR, HI, IN, KY, LA, MI, MT, NE, NH, NJ, NM, NY, ND, PA, RI, SC, TN, UT, VT, WV, WI, WY
Grade 5	**33 states** and the **District of Columbia:** AL, AR, CA, CO, CT, DE, DC, FL, GA, ID, IL, IA, KS, KY, LA, ME, MD, MA, MN, MS, MO, NE, NV, NC, OH, OK, OR, SC, SD, TN, TX, UT, VA, WA

Note: Total exceeds 50 because some states test in multiple grades.

TABLE 3: MIDDLE SCHOOL SCIENCE ASSESSMENT TESTED GRADES IN 2016–17

Grade Tested	States
Grade 6	**9 states:** AR, IN, KY, LA, NE, SC, TN, UT, WV
Grade 7	**11 states:** AL, AR, ID, KY, LA, MI, NE, NM, SC, TN, UT
Grade 8	**44 states** and the **District of Columbia:** AK, AZ, AR, CA, CO, CT, DE, DC, FL, GA, HI, IL, IA, KS, KY, LA, ME, MD, MA, MN, MS, MO, MT, NE, NV, NH, NJ, NY, NC, ND, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VT, VA, WA, WI, WY
Grade 9	**3 states:** AR, WI, WY

Note: Total exceeds 50 because some states test in multiple grades.

In high school, **24 states** and the **District of Columbia** administer end-of-course assessments in science. The other half of states administer a comprehensive assessment either in grade 10 or 11, or sometimes in both grades.

Of the states administering an end-of-course exam, **16 states** and the **District of Columbia** are offering only one assessment in biology. **Eight states** offer multiple end-of-course exams. Of these eight states, the most common end-of-course exam is biology, followed by chemistry.

TABLE 4: HIGH SCHOOL SCIENCE ASSESSMENT TESTED GRADES IN 2016–17

Type of High School Assessment	States
End-of-Course Assessments	**24 states** and the **District of Columbia:** DC, FL, GA, HI, ID, IL, IN, KY, LA, MD, MA, MN, MS, MO, NJ, NY, NC, OH, PA, SC, TN, TX, UT, VA, WA
Grade 10	**12 states:** AL, AK, AZ*, AR, CT, DE, MT, NV, OK, WV, WI, WY
Grade 11	**16 states:** AL, CO, IA, KS, ME, MI, NE, NH, NM, ND, OR, RI, SD, VT, WI, WY

Note: California is currently piloting a new assessment and is doing selected testing in grades 10, 11, and 12. The assessment is expected to be operational in 2018–19.

**In Arizona, students take the science assessment in grade 10, but the assessment may be taken by grade 9 students who are enrolled in a life sciences course.*

TABLE 5: HIGH SCHOOL END-OF-COURSE ASSESSMENTS BY STATE AND CONTENT AREA

State	Biology	Chemistry	Other Options
District of Columbia	X		
Florida	X		
Georgia	X		Physical Science
Hawaii	X		
Idaho	X	X	
Illinois	X		
Indiana	X		
Kentucky	X		
Louisiana	X		
Maryland	X		
Massachusetts	X	X	Technology Engineering, Introductory Physics
Minnesota*	X		
Mississippi	X		
Missouri	X		Physical Science
New Jersey	X		
New York		X	Physical Setting/Earth Science, Physical Setting/Physics, Living Environment
North Carolina	X		
Ohio**	X		
Pennsylvania	X		
South Carolina	X		
Tennessee	X	X	
Texas	X		
Utah	X	X	Earth Science, Physics
Virginia	X	X	Earth Science
Washington	X		

**Minnesota's end-of-instruction science assessment is in life science or biology.*

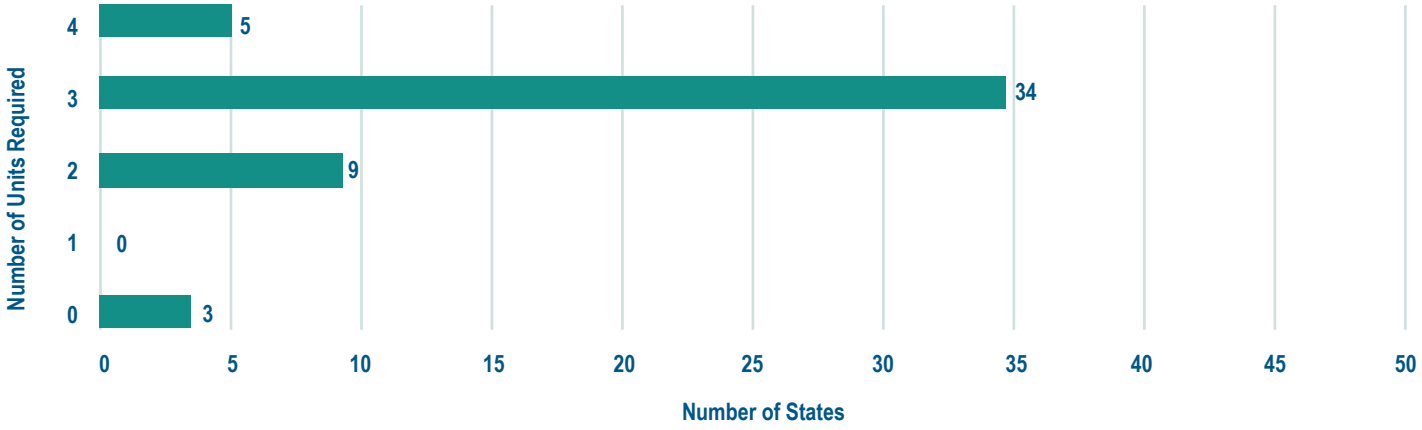
***In Ohio, beginning with the class of 2018, the physical science EOC will be administered.*

Graduation Requirements

Graduation requirements serve as a mechanism in states to make sure that all students are exposed to and receive specific science content. Below is the current landscape of graduation requirements across states for the class of 2017.

Four states and the **District of Columbia** expect students to complete four units of science prior to graduation. Nearly two-thirds of states require students to complete at least three units of science prior to graduation. **Nine states** require only two units of science prior to graduation and **three states,** Colorado, Massachusetts, and Pennsylvania, all local control states, specify no course or unit requirements.

CHART 1: NUMBER OF SCIENCE UNIT REQUIREMENTS TO EARN A REGULAR DIPLOMA, BY STATE



In terms of course specificity, states range from providing no guidance, to specifying some topics or concepts to be covered, to specifying courses. Over half of states specify that students complete biology[5] prior to graduation. Other states go further in identifying additional courses or content students should complete prior to graduation. Many states require students to complete, in addition to biology, either chemistry, physics, or a physical science. For example, **Texas** requires students to complete biology, chemistry, and physics, with flexibility in which course can fulfill the fourth science requirement. **Maryland** requires "three credits; one in Biology; two that must include laboratory experience in any or all of the following areas: earth, life, environmental, or physical science."

Currently, **Hawaii, New York,** and **Texas,** have STEM diploma or endorsement options that students can choose to complete. Both Hawaii and Texas require students to complete four units of science rather than three units to earn the STEM option. **Ohio** recently approved an Honors STEM diploma that requires five units of science. Other states, including **Colorado,** are in the process of developing or implementing STEM diploma or endorsement options.

[5] States that named biology or biological sciences in their graduation requirements were considered to require students to complete coursework in biology prior to graduation.

STEM and ESSA Funding

Several provisions in ESSA allow — and even encourage — the use of federal funds to support STEM education. The statutory language itself frequently calls out STEM education, and guidance released by USED in April 2017, *Resources for STEM Education,* which was intended to "help SEAs, LEAs, and their partners better understand how to use Federal funds to support innovative, equity-focused pre-kindergarten through grade 12 (PreK-12) STEM education strategies," points to provisions that could be used to support STEM education without explicit identifying STEM.[6]

While ESSA provides an opportunity for states to further their commitment to science, the information provided by states in their state plans under ESSA is likely not comprehensive of all initiatives underway to support science education. Additionally, given the variety of definitions and interpretations of what activities, content, and courses compose STEM[7], this brief does not present one definition of STEM and recognizes that states may define STEM differently. The following section addressing ESSA and recent USED guidance will look at STEM more broadly since science generally cannot be separated from states' discussions of STEM.

[6] While ESSA provides multiple opportunities for states to allocate funds to support science initiatives, the availability of these funds remains uncertain as the Fiscal Year 2018 budget will not be settled until fall 2017.

[7] Some states also include the arts and refer to STEAM education—science, technology, engineering, arts, and mathematics.

ESSA Provision	Purpose	How STEM Fits In
Title I, Part A: Improving Basic Programs Operated by State and Local Educational Agencies	To provide all children significant opportunity to receive a fair, equitable, and high-quality education, and to close educational achievement gaps	**ESSA Provision** No explicit reference to STEM **USED Guidance** Schools operating a Title I schoolwide program may use these funds to: • acquire devices, including tablets and laptops; • support STEM coursework; and • expand learning time through before- and after-school programs and summer programs and opportunities
Title I, Part B: State Assessment Grants	To pay for the development of state assessments, standards, and to carry out assessment activities	**ESSA Provision** States can use these funds to update science assessments to include engineering design and practices **USED Guidance** No mention of this provision
Title II, Part A: Supporting Effective Instruction	To (1) increase student achievement consistent with the challenging State academic standards; (2) improve the quality and effectiveness of teachers, principals, and other school leaders; (3) increase the number of teachers, principals, and other school leaders who are effective in improving student academic achievement in schools; and (4) provide low-income and minority students greater access to effective teachers, principals, and other school leaders	**ESSA Provision** States can award subgrants to districts to provide incentive pay to attract teachers in "high-need academic subject areas," provide increased teacher supports in various forms (e.g., hiring STEM coaches, partnering with non-profits), and recruit qualified individuals from other fields to become teachers **USED Guidance** Opportunity to support and recruit educators in STEM disciplines • Implement alternate routes to obtain teacher certification • Provide STEM teachers with professional learning and leadership support
Title II, Part B: National Activities	To research and support comprehensive performance-based compensation systems or human capital management systems for teachers or school leaders who raise student academic achievement and close the achievement gap between high- and low-performing students and to evaluate the effectiveness, fairness, quality, consistency, and reliability of those systems	**ESSA Provision** State grant to create and elevate a STEM Master Teacher Corps **USED Guidance** Can fund teacher recruitment in STEM fields through the Teacher and School Leader Incentive Program

ESSA Provision	Purpose	How STEM Fits In
Title III, Part A: English Language Acquisition, Language Enhancement, and Academic Achievement Act	To help ensure that English learners attain English proficiency and can meet the same challenging State academic standards that all children are expected to meet; to support development and capacity to provide effective language instruction educational programs, and promote family and community participation in those programs	**ESSA Provision** No explicit reference to STEM **USED Guidance** • States may use these funds to upgrade programs to increase digital learning resources and materials in non-English languages to support achievement in STEM areas • States may use these funds to assist English learners in achieving at higher levels in science. Strategies can include science professional learning for educators, providing technical assistance to districts, or implementing or upgrading programs
Title IV, Part A: Student Support and Academic Enrichment Grants	To increase capacity of states and districts to 1) provide students with access to a well-rounded education, 2) improve school conditions for student learning, and 3) improve the use of technology to increase digital literacy of all students	**ESSA Provision** These funds may focus on increasing access and student engagement in STEM for underrepresented students. Allowable activities that promote STEM education include: • expanding high-quality STEM courses; • increasing access to STEM for underserved and at-risk student populations; • supporting the participation of students in STEM nonprofit competitions; • providing hands-on learning opportunities in STEM; • integrating other academic subjects, including the arts, into STEM subject programs; • creating or enhancing STEM specialty schools[8]; integrating classroom-based and after-school and informal STEM instruction; and • integrating other subjects (including the arts) into STEM programs **USED Guidance** Reiterates allowable activities listed in the law, and adds that these funds can be used to: • provide professional development to educators on incorporating technology into effective STEM instruction through personalized learning or blended learning • build technological capacity and infrastructure by acquiring software and devices
Title IV, Part B: 21st Century Community Learning Centers	To provide opportunities for communities to establish or expand activities in community learning centers that provide academic enrichment, particularly by offering students who attend low-performing schools a broad array of additional services, programs, and activities; to offer families of students served by community learning centers opportunities for active and meaningful engagement in their children's education	**ESSA Provision** These funds can support the creation of programs promoting STEM skills and "nontraditional STEM teaching methods" **USED Guidance** Further clarifies that these nontraditional methods include "hands-on, active STEM-rich experiences"

[8] ESSA defines "STEM-focused specialty school" as a "school, or dedicated program within a school, that engages students in rigorous, relevant, and integrated learning experiences focused on science, technology, engineering, and mathematics, including computer science, which include authentic schoolwide research." Elementary and Secondary Education Act of 1965, 20 U.S.C. §4102(8) (2015)

How States Propose to Use Federal Funds

Despite the uncertainty about the availability of federal funds to support STEM, our review of ESSA plans included looking at how states intend to leverage ESSA to support STEM. Below are examples of how states have proposed, in their state plans, to use ESSA funds to support STEM education. Due to the flexibility in grants and the varying levels of detail provided by states in their plans, what follows is not exhaustive of state proposals, nor do state ESSA plans necessarily clearly define the full extent to which states propose to use ESSA funding for STEM. It is also important to note that many states will use additional state funding to support STEM education, and thus this list is not exhaustive of all STEM programs in the following states.

Several themes emerge from a review of state plans in STEM. One is that states have articulated a need to increase student interest and engagement in STEM, and are trying to focus resources to that end. Another is a focus on equity, as several states are focusing resources on closing longstanding gaps in access and achievement within the STEM fields. A third is that states are providing extensive opportunities to teachers for professional learning to increase innovative practices and to embed STEM principles in instruction.

Specifically:

- **Colorado** will allow districts to apply for **Title IV, Part A** funds to support STEM programs and to provide professional learning on the use of technology to enable teachers to increase student achievement in STEM areas.
- **Louisiana's** ESSA plan specifies **Title I** funds will support, in part, career and technical education courses and advanced courses such as dual enrollment. The plan also suggests districts could use **Title IV, Part B** funds to support an afterschool STEM program.
- **Maine** designed a **Title II**-funded project to build the capacity of teacher leaders in formative assessment and three-dimensional instruction in science so that they may, in turn, facilitate their students' conceptual understanding and deep learning of science.
- **Michigan** intends to use **Title IV, Part A** funds to support professional development for STEM including coding and game design, professional development on how to embed STEM, specifically engineering design principles, computational thinking, and app design, in other content areas.
- **Nevada** will provide **Title IV, Part A** funds to support districts to provide equitable access to coursework, including science and engineering, for underrepresented student populations.
- **North Dakota** will allow **Title IV, Part A** funds to support districts that develop a comprehensive, innovative learning plan that demonstrates innovative practices and increases rigorous learning for students using STEM and STEAM strategies.
- **Oregon** and **Tennessee** intend to use **Title IV, Part A** funds to support district programming to improve instruction and student engagement in STEM, including computer science, and increasing access to these subjects for underrepresented groups.

Conclusion

ESSA has given states the opportunity to review their current goals, policies, and initiatives around science and to elevate the importance of science in their states, both through accountability systems and through funding of programs and initiatives to provide better support to STEM. Of the states that have submitted ESSA plans in the first round of review, more than half propose the inclusion of science assessment results as part of their accountability system, thus signaling the importance of science in student learning and school outcomes.

While the funding landscape remains uncertain, state ESSA plans provide an opportunity to evaluate state priorities for science education. However, it is important to remember that state ESSA plans provide just one lens through which to evaluate how states have prioritized science education in their state. States have many opportunities to promote science in their states through policy decisions in graduation and assessment policy and through programming using other sources of state funding.