Transitioning to New Mexico's STEM Ready! Science Standards

October 22, 2018 • Debra N. Thrall, PhD

NMSTA leadership

Anna Suggs (Las Cruces), President
Jessica Sanders (Roswell), President Elect
Deb Novak (NMMNHS), Past President
Amy Lopeman (Las Cruces), Secretary
Cecilia Hernandez (NMSU), Co-Treasurer
Tori Gilpin (Gadsden), Co-Treasurer
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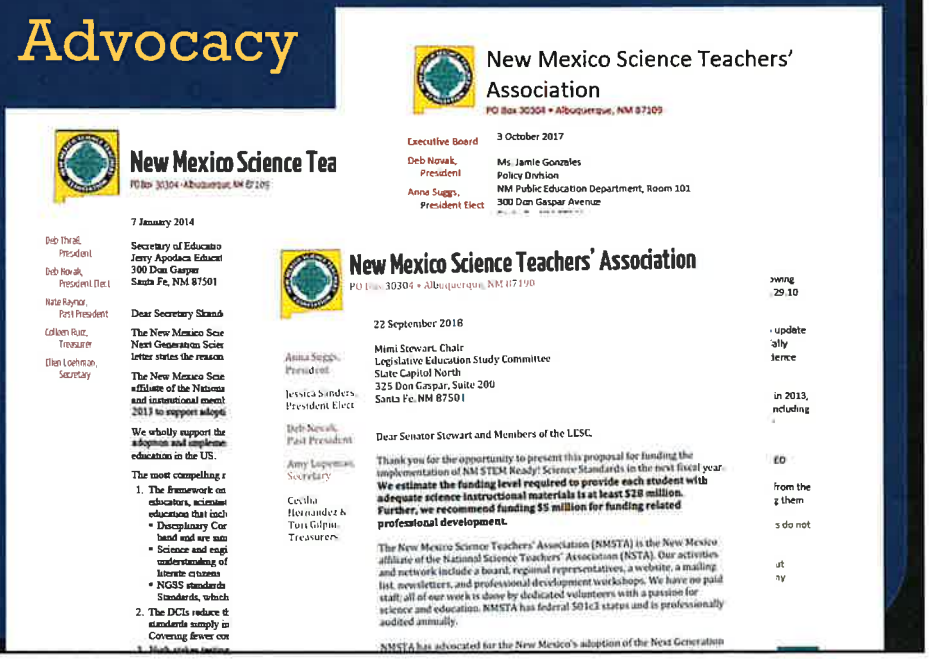
Danielle Kusmak (Tularosa), Membership
Cynthia Connolly (NMBG), Industry Rep
Heidi Karr (Des Moines), Regional Rep

NMSTA activities

- Maintain a website – www.nmsta.org
- Communicate with our members
- Communicate with other organizations
- Host an annual conference – JumpStart
- Facilitate professional development
- Advocate on behalf of science educators
- Recruit sponsors and donors

Advocacy



New Mexico Science Teachers' Association
PO Box 30304 • Albuquerque, NM 87109

Executive Board
Deb Novak, President
Anna Suggs, President Elect

3 October 2017

Ms. Jamie Gonzales
Policy Division
NM Public Education Department, Room 101
300 Don Gaspar Avenue

New Mexico Science Tea
PO Box 30304 • Albuquerque, NM 87109

Deb Thrall, President
Deb Novak, President Elect
Nate Raynor, Past President
Colleen Ruiz, Treasurer
Ellen Loehman, Secretary

7 January 2014

Secretary of Educatio
Jerry Apodaca Educat
300 Don Gasper
Santa Fe, NM 87501

Dear Secretary Skand

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Next Generation Scie
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22 September 2018

Mimi Stewart, Chair
Legislative Education Study Committee
State Capitol North
325 Don Gaspar, Suite 200
Santa Fe, NM 87501

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Dear Senator Stewart and Members of the LESC,

Thank you for the opportunity to present this proposal for funding the implementation of NM STEM Ready! Science Standards in the next fiscal year. **We estimate the funding level required to provide each student with adequate science instructional materials is at least $28 million. Further, we recommend funding $5 million for funding related professional development.**

The New Mexico Science Teachers' Association (NMSTA) is the New Mexico affiliate of the National Science Teachers' Association (NSTA). Our activities and network include a board, regional representatives, a website, a mailing list, newsletters, and professional development workshops. We have no paid staff; all of our work is done by dedicated volunteers with a passion for science and education. NMSTA has federal 501c3 status and is professionally audited annually.

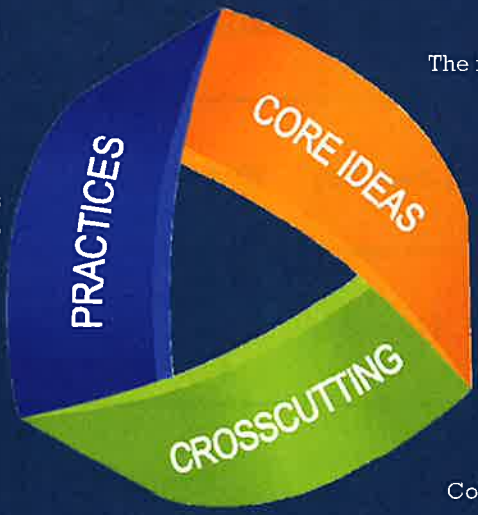
NMSTA has advocated for the New Mexico's adoption of the Next Generation

A Framework for K–12 Science Education, 2012

By the end of the 12th grade, students should have gained sufficient knowledge of the practices, crosscutting concepts, and core ideas of science and engineering . . . .

. . . It is especially important to note that the above goals are for all students, not just those who pursue careers in science, engineering, or technology or those who continue on to higher education.

A significant logo



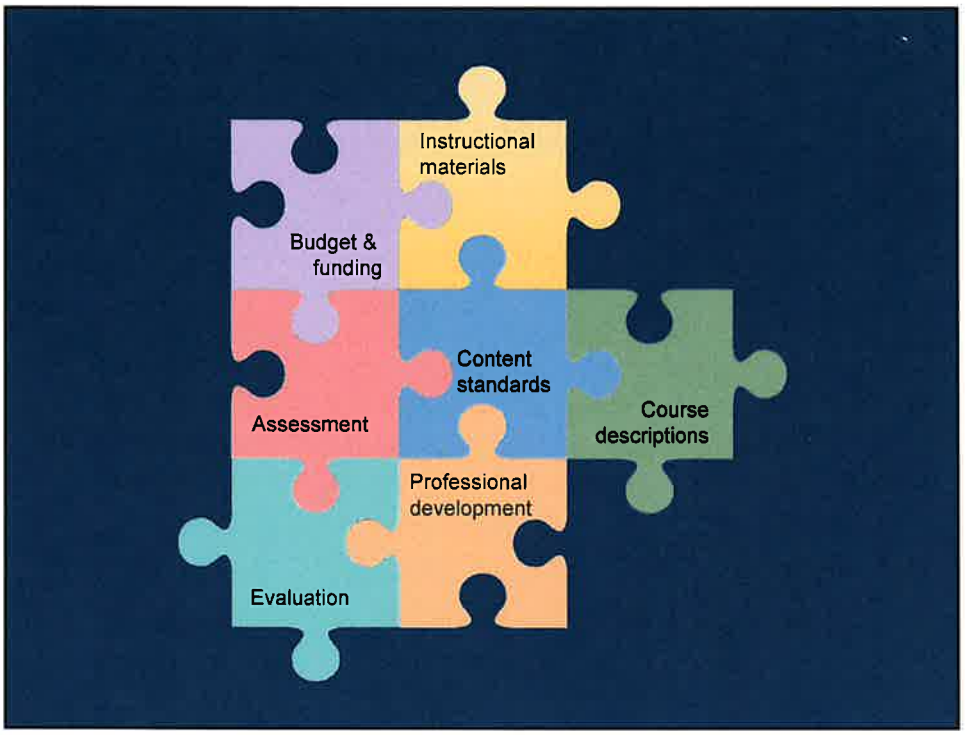
What students do

Strand 1 of the 2003 New Mexico standards

The facts of science & technology

Strands 2 & 3 of the 2003 New Mexico standards

Coherence across disciplines



PED Timeline	2017-2018	2018-2019	2019-2020
Standards	2003 standards	2018 standards	2018 standards
Instructional materials	2012 materials	2012 materials	2019 materials
SBA	4, 7, 11 grades	4, 7, 11 grades 5, 8, 11 grades field test	5, 8, 11 grades with aligned science test
EOCs	Aligned to 2003 standards	Hybrid	Aligned to 2018 standards

NMSTA members' concerns

- Very short implementation timeline
- Different pedagogy requires different instructional materials
- Full implementation requires sustained professional development
- School Grades now include science

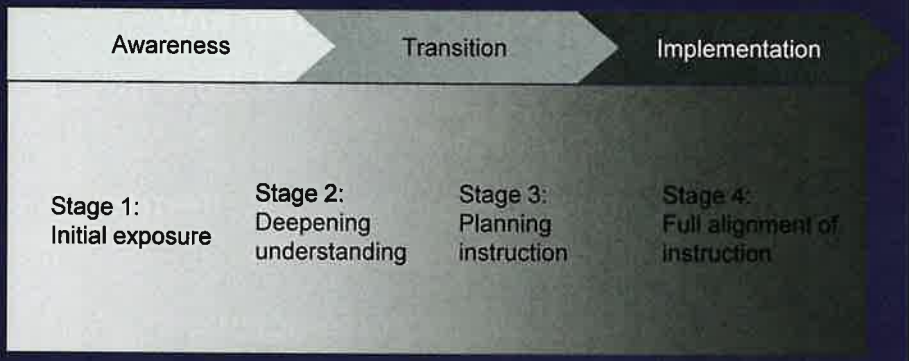
JumpStart participant comments

"Quickly going through the powerpoint was great to cover a lot of information but more time was definitely needed to absorb it all." *Grants, October 2018*

"I would really like a longer more in-depth training to create actual lessons." *Ruidoso, September 2018*

"Show more of what it looks like." *Gadsden Administrator, August 2018*

Teacher learning and implementation



Professional development strategies

- **Leadership Institute**
  baseline of expectations and shared understanding of changes that are needed
- **Funding to Districts**
  innovative, local PD via Math and Science Proficiency Fund

Estimated cost of teacher professional development

Leadership Institute	2-day training for teams from all districts and charter schools	$700,000
District Funding	For innovative local solutions implemented by districts	$4.3M
Total		$5M

Instructional materials funding

Inflation rate between 2105 and 2018 = 29.11%

Estimated cost of instructional materials

Grade	Enrollment	Total cost $M	Cost/ student
K-5	151,250	$12.0	$79.66
6-8	76,047	$8.6	$113.50
9-12	81,301	$7.4	$90.63
Total	308,598	$28.0	$94.60

Summary of our proposal

Professional development for science

Minimum funding: $5 million

Instructional materials for science

Minimum funding: $28 million

Thank you for your support

Debra N. Thrall, PhD

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www.nmsta.org

NEW MEXICO SCIENCE TEACHERS' ASSOCIATION

New Mexico Science Teachers' Association

PO Box 30304 • Albuquerque, NM 87190

22 September 2018

Mimi Stewart, Chair
Legislative Education Study Committee
State Capitol North
325 Don Gaspar, Suite 200
Santa Fe, NM 87501

Dear Senator Stewart and Members of the LESC,

Thank you for the opportunity to present this proposal for funding the implementation of NM STEM Ready! Science Standards in the next fiscal year. **We estimate the funding level required to provide each student with adequate science instructional materials is at least $28 million. Further, we recommend funding $5 million for funding related professional development.**

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NMSTA has advocated for the New Mexico's adoption of the Next Generation Science Standards (NGSS) since their release in 2013. We funded Math & Science Bureau Chief, Lesley Galyas, to attend a national NSTA conference to learn more. We had a sit-down meeting with Secretary Skandera in 2016. We were delighted when HB211 was passed in 2017 and disappointed when it was vetoed. We submitted comments and attended the PED rule-change hearing in October 2017. We celebrated when NGSS was adopted with only minor additions.

We enthusiastically support the new science standards and have committed to making them work, even with a very short implementation timeline. However, our members are concerned about two issues: (1) the adequacy of funding for instructional materials that will be required to implement the new standards and (2) sufficient training for teachers and administrators. There are various factors behind this collective anxiety. Each is summarized below, and an elaboration is included in Appendix 1.

1. NGSS is based on different pedagogy and requires appropriate instructional materials and training for implementation.
2. FY2012 funding for adoption of science materials was woefully inadequate, so schools were unable to purchase textbooks and materials during the last adoption cycle.
3. The approved New Mexico ESSA stipulates that science counts in School Grades and elementary schools are putting a renewed emphasis on science instruction.
4. The increased cost of instructional materials has far outpaced appropriations.

Instructional Materials

Based on conservative calculations, we estimate the minimum cost required to provide each student with adequate science instructional materials is at least $28 million. This does not include supplementary materials, Spanish language and adaptive materials, or replacement supplies during years 2-6 of the adoption cycle. A summary of the estimate follows, and the calculations and assumptions are detailed in Appendices 2-4.

Grade band	Enrollment	Estimated cost, millions	Cost per student
Elementary K-5	151,250	$12.0	$79.66
Middle 6-8	76,047	$8.6	$113.50
High 9-12	81,301	$7.4	$90.63
Totals / average	308,598	$ 28.0	$94.60

As a reminder, the Instructional Materials Adoption cycle for FY2020 includes both Science and Art and any appropriations should adequately fund both disciplinary areas.

Professional Development

We advocate for an appropriation of at least $5 million to support professional development. Successful implementation of the NM STEM Ready! Science Standards will require a significant investment in professional development for teachers and administrators, a responsibility of both the NM PED and local districts/charter schools. At a minimum, the NM PED should provide leadership training for district and charter school teams and administer money for locales to fund innovative, local professional development initiatives. The calculations and assumptions are detailed in Appendix 5.

Please feel free to contact us (ngss@nmsta.org) with questions or comments. We welcome the opportunity to present our proposal at an upcoming LESC meeting.

Respectfully submitted,

Anna Suggs, President
Jessica Sanders, President Elect
Deb Thrall, NGSS Science Saturday Coordinators
Ellen Loehman, NGSS Science Saturday Coordinators

Appendices

1. Concerns related to the adequacy of funding for instructional materials
2. Elementary school funding estimate assumptions and calculations
3. Middle school funding estimate assumptions and calculations
4. High school funding estimate assumptions and calculations
5. Professional development assumptions and calculations
5. References and data sources

Appendix 1
Concerns related to adequacy of funding for instructional materials

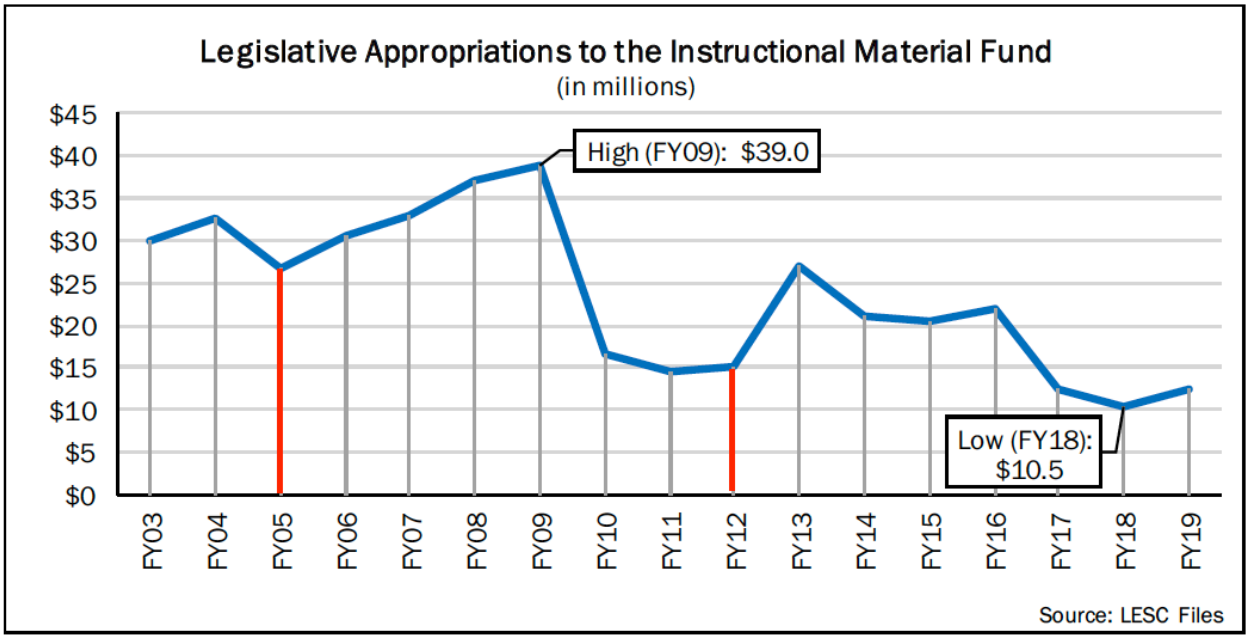
1. **NGSS is based on different pedagogy and requires appropriate instructional materials and training for implementation.**

   The Framework for Science Education describes a vision for science education in which students do not simply learn about science, but actually ARE scientists and engineers. This requires active participation from students as they plan and conduct investigations and solve problems. *Doing* science is much different than *learning about* science. Units are structured along storylines and problem-based units. Lessons are structured based on student input (and not simple worksheets).

   While we do have many members who spend hours crafting exceptional and original lessons and units from Internet sources, we do not believe this is a teacher's role. Teachers should be provided with curriculum and materials that are already aligned to the Framework principles, leaving them free to serve as facilitators.

   When New Mexico adopted the Common Core State Standards, both math and language arts required different kinds of instructional materials, which was reflected in funding increases during those years. Similarly, the adoption of new science standards will require increased funding.

2. **FY2012 funding for adoption of science materials was woefully inadequate, so schools were unable to purchase sufficient textbooks and other instructional materials during the last adoption cycle.**



The figure above, from a July 2018 LESC report, shows legislative funding for instructional materials over 16 years. The two most recent science adoptions are shown in red. Funding in FY2005 was about $27M and funding in FY2012 was about $15M.

Many schools simply did not purchase science materials in 2011 and are using battered textbooks that are now 15 years old. Some schools purchased digital subscriptions whose six-year contract expired last year. Other schools used funding intended for other subjects to purchase science materials.

STEM Education is vital if our state is to produce scientifically and technically prepared citizens and work force. The legislature can and must do better to support students during this funding cycle. This opportunity will not occur for science for another six years.

3. **The approved New Mexico ESSA stipulates that science counts in School Grades and elementary schools are putting a renewed emphasis on science instruction.**

   We have conducted several district trainings for elementary teachers as part of our NGSS Science Saturday trainings. Many of the teachers admit that they have not been teaching science because 'it doesn't count.' Well, now it does.

   Our ESSA plan says that science test scores count for 5% of School Grades, starting this year. Many elementary schools lack even the most basic science tools such as magnifiers and thermometers. Districts that have not used instructional materials funding for elementary science will be scrambling to support their elementary classrooms and students.

4. **The increased cost of instructional materials has outpaced funding from the legislature.**

   It is difficult to do an apples-to-apples comparison of instructional materials costs, because the nature of the materials themselves are different. One textbook that was approved for both 2011 and 2018 is HMH *Modern Chemistry*. A cost comparison is:

2011 Modern Chemistry	$87.45
2018 Modern Chemistry	$103.05

   This represents a 17.8% increase over 7 years. Even not adjusting for inflation or additional students in the public-school system, a 17.8% increase in cost from 2005 funding would require an allocation of $31.8M to be equivalent to the 2005 funding level (which most of us considered adequate).

   Teachers in other states have lamented the same thing – see the article Fizz! Pop! Bang! Teachers find new science standards fun, but costly.

We have been using this graphic in our Science Saturday trainings, as a reminder of the constraints put on implementation of new science standards. We certainly want it to be good. Now, the State has opted for fast, so this process won't be cheap.

Appendix 2
Elementary School Estimate

Assumptions

1. Elementary school includes K-5. This does not consider pre-K instructional materials or schools where 6th grade is included in an elementary school.
2. Instructional materials are kit-based (no textbooks). There is no provision for Spanish language or adaptive materials, which may add to the cost.
3. We have selected the top-rated STEMscopes; the cost is from the Adopted Materials spreadsheet.
4. Enrollment data is taken from the PED data for 2017-2018. There were 10,108 students enrolled in pre-K programs. They are not included in cost calculations.
5. Materials' cost basis is a digital subscription per student for 6 years and one grade-level kit per classroom (without student workbooks or journals; it does not include annual materials replenishment).
6. The number of classrooms is estimated by the number of students per grade level ÷ 20. This underestimates the number of kits required.
7. The cost calculation is:
   ($34.50 * number students) + (cost of grade-level kit * number classrooms)

Estimate worksheet

Grade	# students	# classrooms	Subsciption per student	Kit cost per classroom	Total cost
K	23,794	1190	$34.5	$440	$1,344,361
1	24,250	1213	$34.5	$1,010	$2,061,250
2	24,383	1219	$34.5	$725	$1,725,097
3	25,964	1298	$34.5	$740	$1,856,426
4	26,483	1324	$34.5	$1,230	$2,542,368
5	26,376	1319	$34.5	$1,220	$2,518,908
Total	151,250	7563			$12,048,410
Cost per student		$79.66			

Appendix 3
Middle School Estimate

Assumptions

1. Middle school includes grades 6-8, and students move from class to class, with designated science teachers. Teachers have a class load of 30 students/class and 150 students/day.
2. Instructional materials are priced for two different options: a textbook-based program and an activity-based online program. There is no provision for Spanish language or adaptive materials, if they have different costs. There is no provision for smaller classes in smaller schools.
3. We have selected these top-rated publisher programs: Pearson Elevate Science (printed textbook + digital subscription) and STEMscopes (entirely online). Costs are from the Adopted Materials spreadsheet.
4. Enrollment data is taken from the PED data for 2017-2018.
5. There is no provision for replacement consumable costs in either program.

Estimate worksheet #1 – textbook based adoption (Pearson Elevate Science)

1. This program is a blended model: printed textbook + digital subscription. The materials cost includes a printed textbook, 6-year digital subscription ($96.97) and classroom kit for each teacher ($2,368.97). There is no provision for replacement consumables costs.
2. Materials costs are as follows:
   student blended subscription = number of students * $96.97
   classroom kit cost = number of students / 150 * $2,368.97

Grade	# students	Student subscription	Materials kit		Total student cost	Materials cost
6	25,571	$96.97	$2,368.97		$2,479,620	$403,846
7	25,466	$96.97	$2,368.97		$2,469,438	$402,188
8	25,010	$96.97	$2,368.97		$2,425,220	$394,986
Totals	76,047				$7,374,278	$1,201,020
			Grand total		$8,575,298	
			Cost per student		$113	

Note: The calculation of 30 students/period and 150 students/day greatly underestimates the number of classroom kits needed.

Estimate worksheet #2 – activity kit-based adoption (STEMscopes)

1. The subscriptions costs are calculated for 6 years as:
   student costs = number of students * cost ($86)
   teacher costs = (number of students ÷ 150) * cost ($524)

2. Material kit costs are calculated for a single year, without replacement cost for consumables.
   kit costs = (number of students ÷ 150) * cost (varies by grade level)

Grade	Enrollment	Kit cost, each	Student subsciption, total	Teacher subscription, total	Materials, total
6 - Earth	25,571	$3,898	$2,199,106	$89,328	$664,437
7 - Life	25,466	$2,485	$2,190,076	$88,961	$421,934
8 - Physical	25,010	$4,486	$2,150,860	$87,368	$747,899
Total	76,047	Totals	$6,540,042	$265,658	$1,834,270
		Grand total	$8,639,970		
		Cost per student	$114		

Note: The calculation of 30 students/period and 150 students/day underestimates both the number of classroom kits needed and the cost of teacher subscriptions.

The two programs have similar costs/student. There are other middle school programs, and they appear to have equivalent costs. An average value is used in the overall estimate of total minimum costs.

Appendix 4
High School Estimate

Assumptions

1. High school includes grades 9-12.
2. Classes are the domain specific model – biology, chemistry and physics; books are as best a match as possible.
3. Enrollment data is taken from the PED data for 2017-2018 Science Course count. We combined courses into the following overall categories: Biology, Chemistry, Physical Science, Physics, Earth & Space Science. Other courses such as Anatomy and Physiology and Marine Biology were combined with AP courses (the textbooks in these classes tend to cost significant more). As a reality check, the total high school enrollment is 100,442 according to the 2017-2018 data, and the number of students enrolled in science classes is 81,301.
4. There is no cost included for workbooks, lab manuals, digital subscriptions, study materials, lab materials or equipment – textbooks only.
5. There is no provision for Spanish language or adaptive materials.
6. Textbook costs are taken from the Adopted Materials spreadsheet.

Estimate worksheet

Course	Enrollment	Textbook	Cost	Total cost
Biology	23,185	Miller & Levine Student Edition	$89.97	$2,085,954
Chemistry	15,910	HMH Modern Chemistry	$79.35	$1,262,459
Physical science	10,073	None found - use HMH cost	$72.75	$732,811
Earth & space	4,809	HMH Science Dimensions Earth and Space Science	$72.75	$349,855
Physics	5,765	HMH Physics Student Edition	$79.90	$460,624
Integrated science	9,302	None found - use HMH cost	$72.75	$676,721
AP & 4th year	9,690	Campbell Biology, AP Edition	$172.47	$1,671,234
Not accounted for	2,567	Unknown	$50.00	$128,350
Totals	81,301			$7,368,007
Cost per student:		$90.63		

We would also point out that there are no high school textbooks on the PED list for approved core basal materials. Districts will need to be creative with funding allocations if there is no exception made to the allocation process for this year.

Accelerate Learning STEMscopes also has approved materials for high school. The cost per student is likely equivalent to the cost for middle school: about $114 per student and would not provide printed materials.

Note: In the summary table, the high school enrollment number counts only the number of students enrolled in science courses (81,301 of 100,442 enrolled students).

Appendix 5
Professional Development Estimate

Assumptions

1. A combination of state-led and district-led professional development will be the most cost-effective model for training teachers and administrators in an initial implementation phase that will focus on awareness and capacity building. Our estimate assumes that teams will be trained at the state level, and these trainers will be responsible for training personnel at the district/charter level. Training at the state level will be conducted by professionals with NGSS expertise.
2. The Leadership Institute totals are based on teams of 4 people from each of 89 school districts (356 people) and 2 people from each of 96 charter schools (192 people). This estimate assumes that teams from urban districts might be larger and teams from rural districts might be smaller. Data for the number of school districts and charter schools were drawn from NM PED website. Data for NM per diem rates are from NM DFA.
3. Full implementation will require job-embedded, school-level professional development for classroom implementation and must stretch across multiple years. Districts are best positioned to develop and deliver this phase of implementation which can be funded through the Mathematics and Science Proficiency Fund. This funding level should be sustained for at least three years.
4. The Mathematics and Science Proficiency Fund was established as part of the Mathematics and Science Education Act of 2007. The fund "is created as a non-reverting fund in the state treasury… The fund shall be administered by the [Public Education Department], and money in the fund is appropriated to the department to provide awards to public schools, school districts, public post-secondary educational institutions and persons that implement innovative, research-based mathematics and science curriculum and professional development."
5. Teacher preparation programs are an essential partner in this effort, which will require commitments from higher education institutions and the Higher Education Department. This proposal does not address this need.

Estimate worksheet – NM STEM Ready! Leadership Institute (2 days)

Item	Cost	Number	Total
Per Diem	$85/day x 2 days = $170/person	548 people	$93,160
Travel	$.43/mi x 234 mi = $100 person	548 people	$54,800
Meeting Space	$50/person	548 people	$27,400
Materials	$100/person	548 people	$54,800

Contract for Content Development and Delivery			$50,000 - $100,000
Substitutes and/or stipends	$240/day x 2 days = $480/person	548 people	$263,040
Administer program			$50,000-$100,000
		TOTAL	$600,000 - $700,000

Mathematics and Science Proficiency Fund

Existing balance	~$4.3 million
To fund district-level professional development activities.	

Appendix 6
References & data sources

Student enrollment data – https://webnew.ped.state.nm.us/wp-content/uploads/2018/01/2017-2018-Enrollment-by-district-by-location-by-grade-1.xls

Charter School data - https://webnew.ped.state.nm.us/bureaus/charter-schools/find-a-charter/

Course enrollment in science classes – https://webnew.ped.state.nm.us/wp-content/uploads/2018/02/17_18-Total-Students-by-Grade-Science-Courses.xls

Cost of instructional materials – https://webnew.ped.state.nm.us/wp-content/uploads/2018/08/2018-Science-and-Art-Adopted-Instructional-Materials-w-Scores.xlsx

Highest rated instructional materials – https://webnew.ped.state.nm.us/wp-content/uploads/2018/09/2018-Science-Highest-Scored-by-Grade.xlsx

Historical levels of instructional materials funding from July 2018 LESC brief – https://www.nmlegis.gov/handouts/ALESC%20071818%20Item%207%20.1%20-%20Instructional%20Materials%20Brief.pdf

A Framework for Science Education – https://www.nap.edu/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts

Next Generation Science Standards – https://www.nap.edu/catalog/18290/next-generation-science-standards-for-states-by-states

New Mexico ESSA Plan – https://webnew.ped.state.nm.us/wp-content/uploads/2018/02/FINAL-APPROVED-NM-State-ESSA-Plan.pdf

New Mexico School Districts – https://webnew.ped.state.nm.us/information/school-district-websites/

New Mexico Department of Finance and Administration – http://nmdfa.state.nm.us/Memos_and_Notices.aspx