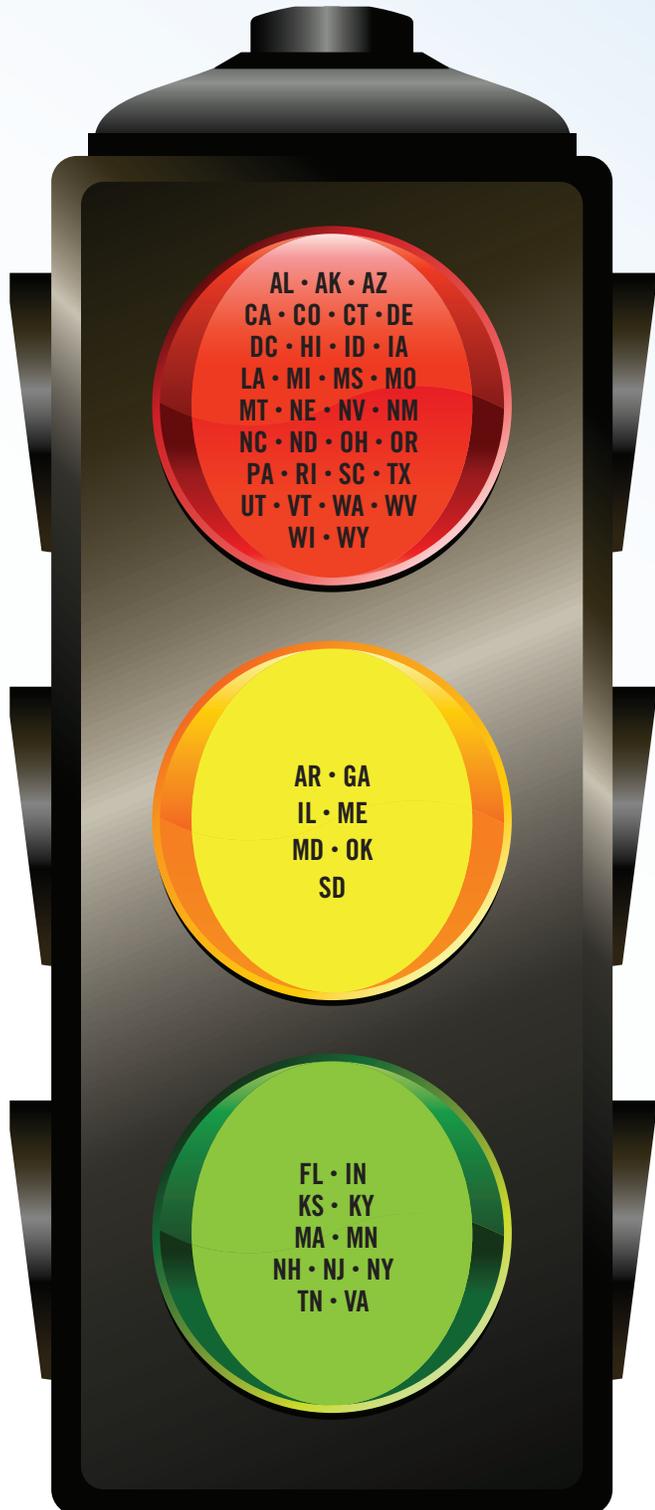


THE ALL-PURPOSE SCIENCE TEACHER: AN ANALYSIS OF LOOPHOLES IN STATE REQUIREMENTS FOR HIGH SCHOOL SCIENCE TEACHERS



The basic story line of the STEM (Science, Technology, Engineering and Mathematics) crisis is, at this point, well known. In an increasingly interdependent and technology-driven economy, America is falling behind. A substantial number of students cannot perform basic math. U.S. students lag behind peers in international comparisons of science and math knowledge and skills. Fewer American students than ever are graduating from college with math and science degrees, and there is a shortage of K-12 teachers in STEM fields.

In this paper, the National Council on Teacher Quality (NCTQ) shows that the problem is deeper still. The U.S. suffers not only because of the math and science teachers we *don't* have – in many cases we also set unacceptably low expectations for the STEM teachers we *do* have.

Based on their high school science licensure requirements, many states seem to presume that it is all the same to teach anatomy, electrical currents and Newtonian physics. NCTQ's analysis of state policies regarding these requirements finds that many states fail to guarantee that biology, chemistry and physics teachers have mastered the content they teach. Most states cling to a loose definition of "science teacher" – ultimately treating specialized science teachers as interchangeable.

We aren't arguing that it is impossible for a talented teacher to be proficient in all scientific subjects. And we certainly aren't arguing that more paper credentials are the needed fix. If teachers were truly evaluated based on their effectiveness, how they acquired their subject-matter knowledge would be irrelevant. No matter what their majors or paths into teaching, if teachers were required to pass rigorous tests of content knowledge in the specific fields of science they are tasked to teach, there might not be reason for alarm. But more often than not, this is not what happens and not what states require.

As a result, it is necessary to examine preparation and credentialing requirements, which, as we show, include some pretty big loopholes for secondary science educators. NCTQ finds, in fact, that all but 11 states allow secondary science teachers to obtain general-science certifications or combination licenses across multiple science disciplines. In most cases, these teachers need only pass a general-knowledge science exam that does not ensure subject-specific content knowledge.

In many cases, states and districts argue that the all-purpose science teacher is a consequence of, rather than a contributor to, the STEM crisis. Shortages of science teachers force districts and states to be flexible in their assignment of individuals across the science disciplines. Even the U.S. Department of Education buys into this mindset, allowing states flexibility in granting highly-qualified teacher (HQT) status to teachers without requiring them to demonstrate mastery of a specific science field. As HQT guidelines from the Department explain:

Science teachers, like rural teachers, are often needed to teach in more than one field of science. Some states allow such science teachers to be certified under a general science certification, while others require a subject-specific certification (such as physics, biology or chemistry). In science, where demand for teachers is so high, the Department is issuing additional flexibility for teachers to demonstrate that they are highly qualified. States may determine—based on their current certification requirements—to allow science teachers to demonstrate that they are highly qualified either in “broad field” science or individual fields of science (such as physics, biology or chemistry).

It may be a sign of just how troubled science education in the U.S. is that policymakers consider it reasonable not to require specialized knowledge to teach the various science fields. A look at how the broad field definition of a science teacher works shows just how thin tests of science knowledge may be. Most of the states with a general science certification or license for secondary science teachers require prospective teachers to take the Praxis 2 General Science: Content Knowledge assessment. The table below breaks down the topics covered by that test.

Praxis 2 Overview	
General Science: Content Knowledge	
Total Number of Questions : 120	
CONTENT CATEGORY	# QUESTIONS
1. Scientific Methodology, Techniques and History	12
2. The Physical Sciences	48
3. The Life Sciences	24
4. The Earth Sciences	24
5. Science, Technology and Society	12

Even without knowing the cut, or passing, scores for any given state (which may be very low – a topic for another paper), a simple look at the breakdown of the various topics as a percentage of the test’s total questions is telling. A test taker could flunk a section like biology or Earth sciences, or incorrectly answer many – even all – chemistry or

physics questions, and still be in a position to teach those subjects to high school students.

The bottom line is that the so-called flexibility of the “broad field” science teacher is a fantasy. In reality, the concept of the all-purpose science teacher not only masks but perpetuates the STEM crisis, and does so at the expense of students.

NCTQ is not minimizing the very real shortage of highly-qualified and effective science teachers. Rural districts, in particular, often find themselves in positions where they believe they have no choice but to be more flexible in their assignment of teachers across science disciplines. But there are strategies districts and states can pursue to improve the pipeline of science teachers – strategies that use technology, distance-learning and alternate routes into STEM fields, such as UTEACH. (For more information, see NCTQ’s *Tackling the STEM Crisis* at: <http://www.nctq.org/p/publications/>.)

We also understand that the problem can’t be solved overnight. But it does no one any good – not teachers, students, future scientists, or society in general – to create loopholes and use the notion of “flexibility” to cover up the fact that our nation’s students aren’t acquiring the scientific knowledge and skills they need for success in the 21st century. Unless we demand that STEM teachers have deep knowledge of the subject matter they are teaching, we won’t get to the root of the problem.

Having reviewed each state’s secondary-school science certification policies, NCTQ divides the states into three categories, below. A green light indicates that a state has adequately ensured that its high school teachers possess the content knowledge necessary to teach specific scientific subjects. Yellow means the state combines subject-area science certification with general-knowledge science assessments, thus allowing teachers to teach specific courses without the requisite content knowledge. Finally, we expose states with catch-all science certification requirements, including some that make no demands on teachers to demonstrate specific content expertise, by giving them red lights.



ALABAMA

Status: RED

Secondary science teachers in Alabama have the option of a comprehensive teaching license with a specialization in general science. Candidates must earn an academic major in a science discipline and take a minimum of one course in each of the specified areas of biology, chemistry, physics and Earth and space science. Candidates are only required to pass the Praxis 2 General Science test, which combines all subject areas and does not report performance in any specific area. As a result, candidates could take little coursework in chemistry, for example, and answer many questions wrong on the combination content test, yet still go on to teach chemistry to high school students.



ARKANSAS

Status: YELLOW

Although Arkansas does not offer a general science certification for secondary science teachers, it does have a combined physical/Earth science licensure area. The state does not mandate specific major/minor requirements. Candidates are required to pass the Praxis 2 Earth and Space Sciences test and the Physical Science content knowledge test, the latter of which combines both physics and chemistry and does not report scores for the individual subject areas. Therefore, a candidate could take little coursework in physics, for example, and answer many questions incorrectly on the combination content test, yet go on to teach physics to high school students.



ALASKA

Status: RED

Secondary teacher candidates in Alaska may pursue an endorsement in general science. Content tests are not required for initial licensure and are only mandated once candidates apply for the professional license, usually after three years. Even at that point, only the Praxis 2 General Science exam is required.



CALIFORNIA

Status: RED

Teachers in California may teach “Foundational-Level General Science” on the state’s Single Subject Teaching Credential. These candidates are required to pass just two separate subtests on the state’s science content exam – each covering a host of general science topics. An additional subtest, which is not required, covers areas of concentration such as biology and chemistry.



ARIZONA

Status: RED

Arizona offers an approved area of endorsement in secondary general science, which requires 12 semester hours of life science courses and 12 semester hours of physical science courses. A content test is not required. Therefore, not only are candidates not required to take an appropriate amount of coursework in the areas of physics and chemistry—and arguably enough in biology—but the state also does not require a test to ensure adequate subject-matter knowledge.



COLORADO

Status: RED

Colorado only offers an endorsement in science education that combines physics, biology, chemistry, Earth and space science and environmental science. This appears to be the only secondary science endorsement that can be added to a certificate. Candidates must pass either the state’s own science test or the Praxis 2 General Science test. There appear to be no subject-specific assessments offered in the fields of science, such as biology or chemistry.



CONNECTICUT

Status: RED

Connecticut allows for a general science endorsement. Candidates must complete a major comprised of at least 39 semester hours of science coursework, including studies in biology, chemistry, physics and Earth science. But because there are no requirements pertaining to the distribution of these credits, this approach does not guarantee adequate knowledge in particular areas of science. Candidates are only required to pass the Praxis 2 General Science (and content essay) test. These combination assessments fail to note performance in any specific science discipline, and a candidate could answer many questions wrong in one area yet still pass the test.



FLORIDA

Status: GREEN

Florida does not offer general science certification for secondary teachers, nor does it allow any combined-subject science certifications. To teach biology, chemistry, Earth-space science or physics, candidates must specialize in those fields and demonstrate subject-matter knowledge in any and all areas of science that they teach.



DELAWARE

Status: RED

Delaware offers certification in integrated science; a major or its equivalent in any science discipline or related field is acceptable for eligibility. Candidates are only required to pass the Praxis 2 General Science test. So teachers are not exclusively tested on the specific content area they plan to teach, and are not required to major in that particular subject.



GEORGIA

Status: YELLOW

Georgia offers a general, broad field certification in science for grades 7-12. Because of the state's strong coursework and content test requirements, however, it earns a yellow light. Teacher preparation programs in Georgia must require a major in one of the science specialty areas (biology, chemistry, Earth and space science and physics) and at least two additional areas of science concentration, defined as a minimum of 15 semester hours. Science teacher candidates must also pass the state's science assessment, which consists of two subtests: one includes Earth science and life science, and the other includes physical science and characteristics of science. So, although the state's requirements fall short of ensuring mastery of each and every science discipline, it does have measures in place that are on the right track.



DISTRICT OF COLUMBIA

Status: RED

The District of Columbia allows a general science certification. Teachers need only take 6 semester hours in each of the following: biology, chemistry, physics, Earth and space science and environmental science. Candidates also only have to pass the Praxis 2 General Science content knowledge test. Therefore, it is possible for a candidate to take just 6 semester hours of biology, answer many biology questions incorrectly on the combination content test, and then go on to teach biology at the secondary level.



HAWAII

Status: RED

Hawaii offers the certification field of Science 7-12. Candidates are only required to pass one of the following Praxis 2 content knowledge tests: Biology, Chemistry, General Science, Physics or Physical Science. There is no guarantee that secondary science teachers will take adequate coursework or that they possess the requisite knowledge in the particular science area they plan to teach. In fact, a teacher may be teaching physics, having only been tested on her knowledge of biology.



IDAHO

Status: RED

Idaho's Natural Science endorsement for grades 6-12 appears to be the equivalent of the general science endorsement found in other states. Although the state requires an initial endorsement in biological science, physical science, physics, chemistry, Earth science, geology or agriculture science and technology, candidates need only earn an additional 24 semester credit hours in the remaining areas of science. For example, if someone has an endorsement in biological science, he/she must take a minimum of 8 semester hours in each of the following: physics, chemistry and Earth science or geology. Candidates are also only required to pass the Praxis 2 General Science test. Therefore, a teacher could take minimal coursework in chemistry, for example, and answer many questions incorrectly on the combined content test—yet still go on to teach chemistry at the high school level.

The state also offers a physical science endorsement, which requires a minimum of 8 credit hours in both chemistry and physics. Candidates must only pass the Praxis 2 Physical Science test. Neither the coursework requirements nor the combined content test ensures adequate subject matter knowledge in the area of chemistry or physics.



INDIANA

Status: GREEN

Indiana does not allow general science certification for secondary teachers. Although the state allows a physical science certification (combining chemistry and physics), it requires that candidates demonstrate content knowledge on both the Praxis 2 Chemistry and Physics tests, rather than a more general test of knowledge, to obtain that certification.



IOWA

Status: RED

Iowa offers a general science endorsement; candidates must complete a total of 24 semester hours in science, spread across coursework in biological science, chemistry and physics. Iowa also offers a physical science endorsement, requiring 24 semester hours in physical sciences and including coursework in physics, chemistry and earth science. Secondary teachers are not required to pass a content test. General science content requirements and a lack of content testing fail to guarantee requisite content knowledge in any specific area of science.



ILLINOIS

Status: YELLOW

Beginning February 1, 2012, Illinois will no longer offer a certification in general science for secondary teachers, nor will it allow any other combination science certifications, thus ensuring that teachers will obtain adequate subject-matter knowledge in each science subject they teach. This notably improves Illinois's current red-light-worthy policy regarding science teachers, which allows a teacher in one area of science to teach another subject area without passing a specific test. NCTQ commends the state for closing this loophole; however, we give the state a yellow light for the long delay before it goes into effect.



KANSAS

Status: GREEN

Kansas does not offer certification in general science for secondary teachers, nor does it allow any other combination science certifications, ensuring that any secondary-level science teacher has passed a subject-matter test and is qualified in the specific area of science that he/she is teaching.



KENTUCKY

Status: GREEN

Kentucky does not offer certification in general science for secondary teachers, nor does it allow any other combination science certifications. Therefore, the state ensures that secondary science teacher candidates have adequate subject-matter knowledge in the specific areas of science they are teaching.



MARYLAND

Status: YELLOW

Although the state does not offer a general science certification for secondary teachers, Maryland has a physical science certification, for which candidates must complete either a major or at least 36 hours of content coursework in the certification area. The state does not articulate how many of those credits, however, must be in the area of chemistry or physics for teachers planning to teach those specific subjects. Candidates must also only pass the combination Praxis 2 Chemistry, Physics and General Science test, in which chemistry and physics each account for less than half of the test. Therefore, candidates could presumably answer many questions wrong in chemistry or physics and still pass the test.



LOUISIANA

Status: RED

Louisiana requires that high school science teachers have two focus areas, one primary and one secondary, only one of which must be in science at all. In addition, general science is considered focused enough to be an area of specialty. As a result, if a teacher's primary teaching area is general science, he/she must take a total of 22 hours of science coursework. If the teacher's secondary teaching area is general science, then he/she must take just 10 hours of science coursework. Candidates also must only pass the Praxis 2 General Science test to teach high school science courses. Neither the coursework requirements nor the combined content test ensure adequate subject-matter knowledge in any area of science.



MASSACHUSETTS

Status: GREEN

Massachusetts does not offer certification in general science for secondary teachers, nor does it allow any other combination certifications, ensuring that any secondary-level science teacher has passed a subject-matter test and is qualified in the specific area of science that he/she is teaching.



MAINE

Status: YELLOW

Maine does not offer a general science certification for secondary science teachers, but it does have a physical science endorsement area. Candidates must complete 24 semester hours in an area relevant to the endorsement, which could include chemistry, physics, geology, Earth science, soil science, astronomy, meteorology and oceanography. Unfortunately, the state does not specify that chemistry teachers must take a majority of coursework in chemistry or that physics teachers should earn most of their credits in physics, thus failing to ensure adequate content preparation in either subject area. Candidates also must only pass the Praxis 2 Physical Science content knowledge test, a combination test that does not generate subscores for each particular subject.



MICHIGAN

Status: RED

Michigan's version of general science is its "integrated science" endorsement, which allows candidates to teach biology, chemistry, physics, and Earth/space science at the secondary level. Candidates must earn either a "group major" of 36 semester hours of the subjects above distributed among three major categories—life sciences, physical science and Earth/space science—or a "comprehensive group major," with a minimum of 50 semester hours distributed among the three categories. Prospective high school science teachers are also only required to pass the state's Integrated Science test, which combines all scientific areas but does not report results for specific subjects. Candidates could, hypothetically, take just 6 semester hours of chemistry, answer very few questions correctly in the chemistry section of the state's test and still go on to teach the subject to high school students.



MINNESOTA

Status: GREEN

Minnesota does not offer certification in general science for secondary teachers, nor does it allow any other combination certifications. The state ensures that secondary science teacher candidates have adequate subject-matter knowledge in the specific areas of science they are teaching.



MONTANA

Status: RED

Montana offers a broad-field science endorsement. Although the state articulates that this endorsement must include a concentration in one discipline—biology, Earth science, chemistry or physics—coupled with “balanced study” in the other three, there is no guarantee that candidates will have the requisite content knowledge to teach at the secondary level. This is especially the case considering that Montana has yet to adopt subject-matter testing requirements as part of its teacher certification process.



MISSISSIPPI

Status: RED

Mississippi offers a supplemental endorsement in general science, which can be added to a certificate with 21 hours of coursework in the subject. A content test is not required. Even though this is a supplemental endorsement, the state is effectively allowing candidates with minimal coursework in a particular area of science—and no testing requirement—to teach virtually any science subject at the secondary level.



The state also offers an endorsement in physical science. A subject-area major is required, but candidates only have to pass the Praxis 2 Physical Science test, which combines both physics and chemistry.

NEBRASKA

Status: RED

Nebraska’s natural science endorsement is the equivalent of the general science endorsement found in other states. Coursework requirements include 48 semester hours of lab-based coursework in the natural sciences (biology, chemistry, Earth science and physics), with half of them focused on one area and the other half distributed among the remaining three. This means that a candidate, who is not required to pass a content test, could take as few as 8 semester hours in chemistry, yet still teach the subject at the secondary school level.



MISSOURI

Status: RED

Missouri offers an endorsement in general science. Candidates must take two semester hours in history/philosophy of science and technology, as well as a total of 30 hours in science courses that includes chemistry, biology, physics, Earth science, astronomy and environmental science. They are also only required to pass the Praxis 2 General Science test. Neither the coursework requirements nor the combined content test ensures adequate subject-matter knowledge in any area of science.



The state also offers an endorsement in physical science, requiring candidates to earn 40 semester hours of lab-based courses in the sciences—36 in chemistry, Earth science and physics and 4 in biology. Again, absent a specific content test requirement for chemistry and physics, these coursework requirements fail to ensure adequate subject-matter knowledge in either subject.



NEVADA

Status: RED

Nevada offers an endorsement in general science. Candidates must complete either a major (36 credit hours) or a minor (24 credit hours) in general science. Requirements for the major include at least 3 semester hours in each of the following: biology; chemistry; physics; and Earth science, space science, electronics or engineering. Requirements for the minor include at least 3 semester hours each in chemistry, physics and biology. Candidates are also only required to pass the Praxis 2 General Science: Content Knowledge, Part 1 test and a General Science essay test. Therefore, someone could take just 3 semester hours in physics, for example, and answer many questions incorrectly on these combination content tests, yet still go on to teach high school physics.

The state also offers an endorsement in physical science. Requirements for this major include at least 6 semester hours each in chemistry and physics, and 3 semester hours each in geology, Earth science, electronics or engineering. Requirements for the minor include 3 semester hours in each of the following: chemistry; physics; geology; and Earth science, space science, electronics or engineering. Candidates are only required to pass Part I of the Praxis 2 General Science test.



NEW JERSEY

Status: GREEN

New Jersey does not offer certification in general science for secondary teachers. The state does offer a physical science endorsement, but it ensures that candidates have the requisite knowledge in both chemistry and physics. Candidates must complete either a 30-credit coherent sequence of courses in physics and a minimum of 15 credits in chemistry, or a 30-credit coherent sequence of courses in chemistry and a minimum of 15 credits in physics. Secondary level science teaching candidates in physical science also must pass three separate Praxis 2 tests in chemistry, physics and general science.



NEW MEXICO

Status: RED

New Mexico does not offer endorsements in biology, chemistry or other specific science disciplines; the state only offers an endorsement in "science". Beginning teachers adding the endorsement to an initial license must take 24 to 36 semester hours in science. They are only required to pass the state's science assessment, which combines all subject areas. These vague coursework requirements, coupled with a general content test, do little to ensure adequate content knowledge in any area of science at the secondary level.



NEW HAMPSHIRE

Status: GREEN

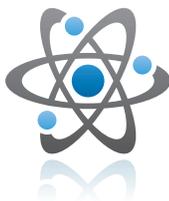
New Hampshire does not offer certification in general science for secondary teachers. It should be noted, however, that the ETS/Praxis website refers to a physical science certification. NCTQ encourages New Hampshire to ensure its testing requirements are listed accurately.



NEW YORK

Status: GREEN

New York does not offer certification in general science for secondary teachers, nor does it allow any other combination certifications. The state ensures that high school teachers have adequate subject-matter knowledge in the specific areas of science they teach.



NORTH CAROLINA

Status: RED

North Carolina offers a secondary teaching licensure area in science. Coursework requirements are unclear, as the state seems to rely on the HQT requirement of an undergraduate major, while North Carolina's standards articulate that high school teachers must "have depth in one or more specific content areas or disciplines." Candidates must only pass the Praxis 2 General Science test. Interestingly, however, the state does not require a minimum score. Rather, candidates must earn a certain combined score from the General Science test and Life or Physical Science pedagogy tests. Not only are the state's vague coursework requirements unlikely to ensure adequate content knowledge, but combining the content test scores with the pedagogy assessments waters down the state's already weak effort to ensure that teaching candidates demonstrate adequate subject-matter knowledge in science.



OHIO

Status: RED

Ohio articulates that preparation in a given teaching field "shall constitute at least an academic major or its equivalent with sufficient advanced coursework in all areas to be taught." This sounds promising, but at the secondary level, Ohio allows for a major in "integrated science." That translates into 30 to 36 credits across all of the relevant fields of science, meaning a candidate need not be adequately trained in a specific field.

Candidates have two options when it comes to Praxis 2 testing requirements. The first is passing both the Chemistry, Physics and General Science test as well as the Biology test. Candidates could get many questions wrong regarding chemistry, physics, and/or Earth and space science, yet still pass the test—and ultimately teach the subjects in high school. The second option requires candidates to pass both the Biology and General Science tests as well as one of the following: Chemistry, Physics, or Earth and Space Sciences. This option also does not guarantee requisite content knowledge in each of the subject areas in integrated science.



NORTH DAKOTA

Status: RED

North Dakota offers a composite science endorsement for secondary teachers. To earn this endorsement, candidates must hold a composite science degree, a total of 42 credits across the following areas: biology/life, Earth/geology, chemistry, physics and physical science. Just 12 of those credits must be in the subject a candidate wishes to teach. Aside from watering down the coursework requirements, the state demands that prospective high school science teachers only pass the Praxis 2 General Science test to teach a specific course. Together, these requirements fail to ensure that teachers master any specific discipline.



OKLAHOMA

Status: YELLOW

Although the state does not allow a general science endorsement, Oklahoma does offer a physical science certification area. State regulations require an undergraduate subject major, including 18 hours in each assigned area. However, candidates must only pass a Physical Science test that combines both chemistry and physics.



OREGON

Status: RED

Oregon offers a secondary endorsement in integrated science. A content major is not required and candidates are only required to pass the Praxis 2 General Science test. Vague coursework requirements, coupled with a general content test, do not ensure adequate content knowledge in any area of science at the secondary level.

The state also offers a combined endorsement in chemistry and physics. Candidates are given two options regarding Praxis 2 testing: The first is to pass both the Chemistry and Physics tests; the second is to pass only the combined Chemistry, Physics and General Science test. If a candidate chooses the second option, he/she may get many questions wrong regarding chemistry or physics, yet still pass the test—and ultimately teach that subject in high school.

For a single endorsement in chemistry or physics, candidates must pass either the subject-specific Praxis 2 content tests or the combined Chemistry, Physics and General Science test. Again, if the candidate chooses the latter option, there is no guarantee of adequate subject-matter knowledge.



SOUTH CAROLINA

Status: RED

South Carolina offers a secondary certificate in science; teachers with this certificate may teach all science courses in high school. Candidates must pass the Praxis 2 Biology and General Science test or the Chemistry, Physics and General Science test. Neither of these combination testing options ensures adequate subject-matter knowledge for all areas of secondary science included in South Carolina's certificate.

South Carolina also has other problematic testing requirements for its single-subject science certificates. Biology teachers must pass the combination Biology and General Science test; chemistry and physics teachers must pass the combined Chemistry, Physics and General Science test. It is unclear why the state does not simply require the single-area content knowledge tests, rather than these combination tests, which do not guarantee subject-matter knowledge in a particular area.



PENNSYLVANIA

Status: RED

Pennsylvania offers a certificate in General Science for secondary teachers. Candidates must only pass the Praxis 2 General Science test. Vague coursework requirements, coupled with a general content test, do not ensure adequate content knowledge in any area of science at the secondary level.



SOUTH DAKOTA

Status: YELLOW

Although the state does not offer a general science certification for secondary teachers, South Dakota does have a physical science certification, for which candidates must earn an academic major. However, absent a double-major requirement in both physics and chemistry, this coursework requirement cannot guarantee requisite content knowledge in both subject areas. These candidates are also only required to pass the Praxis 2 Physical Science test, which combines physics and chemistry and does not generate any information on how teachers performed in either specific content area.



RHODE ISLAND

Status: RED

Rhode Island offers a certificate in general science for secondary teachers. Candidates must earn a total of 30 semester hours, with just a minimum of 6 semester hours each in biology, physics and chemistry. This means a candidate, who is not required to pass a content test, could take as few as 6 semester hours in chemistry, for example, yet still teach the subject to high school students.



TENNESSEE

Status: GREEN

Tennessee does not offer certification in general science for secondary teachers, nor does it allow any other combination certifications. The state ensures that high school teachers have adequate subject-matter knowledge in the specific areas of science they teach.



TEXAS

Status: RED

The state offers a certificate in science, grades 8-12, in which candidates may teach all science courses in high school. Candidates are only required to pass the state's content test in science, which combines all areas of science and does not report results in any particular subject area. Therefore, candidates could answer many questions incorrectly in one subject area, yet still pass the test—and go on to teach that subject at the secondary level.

Texas also offers a certificate in physical science for grades 8-12, in which candidates may teach physics and/or chemistry in high school. These candidates must only pass the combination physical science assessment. Neither option guarantees subject-matter knowledge in all fields that a science teacher could teach in high school.



VERMONT

Status: RED

Vermont offers an endorsement in general science and requires a major in biology, chemistry, physics, or Earth/environmental/atmospheric sciences, or the equivalent in undergraduate and/or graduate coursework. The state also articulates that candidates must meet a passing score on the Praxis 2 General Science multiple choice or essay test and one subject-specific test of their choosing. Although requiring a passing score on a single-subject content test is a step in the right direction, it—along with Vermont's coursework requirements—only ensures requisite subject-matter knowledge in one area. That leaves out all the other science courses that could be taught at the secondary level with a general science endorsement.



UTAH

Status: RED

Utah offers teachers an integrated science endorsement, which requires coursework in the following areas: general biology (or both general botany and general zoology), ecology, heredity/genetics, chemistry, general physics, astronomy, Earth systems science, geology, teaching methods in science and safety certification. There seems little assurance that candidates will gain sufficient content knowledge in any single area of science based on these general requirements. Candidates must pass the Praxis 2 General Science test, which does not ensure requisite knowledge in all subject areas.

Utah also offers an endorsement in physical science. Candidates may teach physics and/or chemistry, and although the state articulates that endorsements are granted for all subjects in which candidates have at least a minor (16 semester hours of credit), it is not clear whether these teachers would need a minor in both subject areas. Also, these candidates must pass the Praxis 2 Physical Science test or the Chemistry, Physics and General Science test. These combination tests do not guarantee sufficient content knowledge in both chemistry and physics, as one could get many questions wrong in one subject, yet still pass the test—and ultimately teach that subject in high school.

The state also has additional problematic testing requirements, allowing candidates seeking chemistry or physics endorsements to pass either the subject-specific Praxis 2 exam or a more general combination test.



VIRGINIA

Status: GREEN

Virginia does not offer certification in general science for secondary teachers, nor does it allow any other combination certifications. The state ensures that secondary science teacher candidates have adequate subject-matter knowledge in the specific areas of science they are teaching.



WASHINGTON

Status: RED

Washington offers a secondary endorsement in general science. The state's vague requirement indicates that teachers must complete an approved preparation program in the professional field of certification. Candidates are also only required to pass the state's science assessment, which combines physical science, Earth and space science, biology, and scientific processes and inquiry without separate passing scores for each area. Neither the coursework requirements nor the combined content test ensures adequate subject-matter knowledge in any area of science.



WEST VIRGINIA

Status: RED

West Virginia offers an endorsement in general science (grade 5-adult). Because there is no corresponding baccalaureate degree in general science, the state requires not less than 48 credit hours of science coursework. Candidates must also pass all of the following Praxis 2 tests: Biology (Part I only), Physical Science and General Science (Part II only).

However, the state allows a passing score for either the chemistry or physics subject-specific endorsements to be submitted in substitution for the physical science test requirement outlined above. Thus, although West Virginia requires more tests than many of the other states that allow a general science endorsement, its requirements still do not ensure adequate subject-matter knowledge. For example, a teacher candidate could go on to teach high school physics by submitting a passing score on the chemistry content knowledge exam.



WISCONSIN

Status: RED

Wisconsin offers a broad field science license for secondary teachers. To qualify, a candidate must complete a science program major or a major in physical science (combination of physics and chemistry), Earth and space science or life and environmental science (which is a combination of biology and environmental studies). The science program must include competencies in each of these subcategories with a concentration in at least one.

Interestingly, regardless of science license (broad field, biology, chemistry, Earth and space science, life and environmental science, physics or physical science), the state only requires candidates to pass the Praxis 2 General Science assessment. So while the state's coursework requirements may ensure requisite content knowledge in one area, those requirements—along with requiring only a combination content test—do not guarantee that a teacher is qualified to teach all science subjects at the secondary level.



WYOMING

Status: RED

Wyoming does not offer a general science certification for secondary teachers, but does have a physical science endorsement, which combines chemistry and physics. Because the state does not articulate a major requirement for one or both subject areas for that endorsement and, furthermore, does not require any subject-matter testing for its secondary teachers, Wyoming earns a red light.



 National Council on Teacher Quality

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