Standard 8: High School Content

The program ensures that teacher candidates have the content preparation necessary to successfully teach to increasingly rigorous state standards.

Why this standard?

High school teacher candidates must develop a sophisticated level of knowledge in the subjects they wish to teach if they are to help their students succeed in increasingly rigorous classrooms and graduate from high school college and career ready.

What is the focus of the standard?

If a state does not have regulations that require that all high school teacher candidates pass adequate subject-matter licensing tests, the program's subject preparation requirements are examined. At the undergraduate level, candidates should earn an academic major if they are going to teach one subject, or two minors in related disciplines if they are going to teach under a composite certification (i.e., general science or general social science). At the graduate level, the transcript review process is examined to check that programs are verifying that their incoming candidates have sufficient content knowledge in the area they wish to teach.

Standard applies to secondary programs.

Standard and Indicators ..... **page 2**

Rationale ..... **page 4**
The rationale summarizes research about this standard. The rationale also describes practices in the United States and other countries related to this standard, as well as support for this standard from school leaders, superintendents and others education personnel.

Methodology ..... **page 7**
The methodology describes the process NCTQ uses to score institutions of higher education on this standard. It explains the data sources, analysis process, and how the standard and indicators are operationalized in scoring.

Research Inventory ..... **page 21**
The research inventory cites the relevant research studies on topics generally related to this standard. Not all studies in the inventory are directly relevant to the specific indicators of the standard, but rather they are related to the broader issues that the standard addresses. Each study is reviewed and categorized based on the strength of its methodology and whether it measures student outcomes. The strongest "green cell" studies are those that both have a strong design and measure student outcomes.

Standard and Indicators

Standard 8: High School Content

The program ensures that teacher candidates have the content preparation necessary to successfully teach to increasingly rigorous state standards.
Standard applies to: Secondary programs.

Institutions of higher education have traditionally articulated their vision of teacher preparedness in a subject area by defining a prescribed course of study through a major or minor. For high school teachers charged with teaching many different subjects subsumed under one certification, pursuing multiple majors is impractical. A credit count system is also particularly challenging to impose on teacher candidates entering graduate programs of study.

Indicators that the program meets the standard:

8.1 Using an outcomes-based approach, in every subject a teacher will be qualified to teach, each pathway to high school certification listed below requires either:

- Rigorous stand-alone tests.

OR

- A rigorous test of multiple subject areas that provides cut-scores for each separate subject-specific test section, or a series of rigorous stand-alone tests.

Absent such licensing tests used to verify competency, we look for institutions to require or verify courses of study as follows:

At the undergraduate level:

8.2 A high school teacher candidate seeking certification in mathematics must have a major consisting of at least 30 semester credit hours, including at least 24 credit hours of general audience[1] mathematics coursework.

8.3 A high school teacher candidate seeking certification in English must have a major consisting of at least 30 semester credit hours, including at least 24 credit hours of general audience English coursework.

8.4 A high school teacher candidate seeking science certification in a state that requires single-subject certification must have a major in the single teachable science discipline for which certification will be awarded of at least 30 semester credit hours, including at least 24 credit hours of general audience coursework. A high school teacher candidate seeking science certification in a state that offers general science certification must have coursework preparation that consists of at least 15 credit hours (the equivalent of one minor) in at least two teachable science disciplines (biology, chemistry, physics or earth science).

[1] Courses which are intended for any student on campus, not just prospective teachers.

8.5 A high school teacher candidate seeking social science certification in a state that requires single-subject certification must have a major in the single teachable social science discipline for which certification will be awarded of at least 30 semester credit hours, including at least 24 credit hours of general audience coursework. A high school teacher candidate seeking social science certification in a state that offers social science certification must have a major in history, or coursework preparation that consists of at least 15 credit hours (the equivalent of one minor) in history and in at least one other teachable social science (government/political science, economics or psychology).

At the graduate level:

8.6 The burden posed by a stringent credit count does not relieve the program of its responsibility to ensure that high school teacher candidates in each pathway to certification (mathematics, English, the sciences, the social sciences) meet requirements for content knowledge preparation. If candidates have significant weaknesses in content knowledge, the program works with the candidate to remedy them.

- When applications to the program, catalogs or other public documents do not describe such a process, the presumption will be made that no content preparation requirements are imposed on graduate teacher candidates.

Rationale

Standard 8: High School Content

The program ensures that teacher candidates have the content preparation necessary to successfully teach to increasingly rigorous state standards.

Standard applies to secondary programs.

Why this standard?

High school teacher candidates must develop a sophisticated level of knowledge in the subjects they wish to teach if they are to help their students succeed in increasingly rigorous classrooms and graduate from high school ready for college and a career.

What is the focus of the standard?

If a state does not have regulations that require that all high school teacher candidates pass adequate subject-matter licensing tests, the program's subject preparation requirements are examined. At the undergraduate level, candidates should earn an academic major if they are going to teach one subject, or two minors in related disciplines if they are going to teach under a composite certification (i.e., general science or general social science). At the graduate level, the transcript review process is examined to check that programs are verifying that their incoming candidates have sufficient content knowledge in the area they wish to teach.

Rationale

Research base for this standard

"Strong research"[1] conducted in the United States found that students of teachers with a bachelor's or master's degree in mathematics achieved greater results in mathematics than did students of teachers with other majors (although the same did not hold true for science).[2] In Germany, researchers found that while content knowledge in a subject was not sufficient for a teacher to effectively teach a subject, having that content knowledge enables the development of pedagogical content knowledge (e.g., specific methods to communicate content or identify students' misunderstandings), which was critical for effective teaching.[3] However, one study found no correlation between teachers' content courses and students' achievement; this study only looked at math and reading achievement and therefore would not have captured an effect of content courses on achievement in other areas such as science or social studies.[4]

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[1] NCTQ has created "research inventories" that describe research conducted within the last decade or so that has *general* relevance to aspects of teacher preparation also addressed by one or more of its standards (with the exceptions of the Outcomes and Evidence of Effectiveness standards). These inventories categorize research along two dimensions: design methodology and use of student performance data. Research that satisfies our standards on both is designated as "strong research" and will be identified as such. That research is cited here if it is *directly* relevant to the standard; strong research is distinguished from other research that is not included in the inventory or is not designated as "strong" in the inventory. Refer to the introduction to the research inventories for more discussion of our approach to categorizing research. If a research inventory has been developed to describe research that generally relates to the same aspect of teacher prep as addressed by a standard, the inventory can be found in the back of this standard book.

[2] Goldhaber, D. D., & Brewer, D. J. (2000). Does teacher certification matter? High school teacher certification status and student achievement. *Educational Evaluation and Policy Analysis, 22*(2), 129-145.

[3] Baumert, J. (2010). Teachers' mathematical knowledge, cognitive activation in the classroom, and student progress. *American Educational Research Journal, 47*(1), 133-180.

[4] Harris, D. N., & Sass, T. R. (2011). Teacher training, teacher quality and student achievement. *Journal of Public Economics, 95*, 798-812. Note: This study relates to several NCTQ standards. Although it meets the criteria for strong research, the study's findings run contrary to the conclusions of most strong research in the field.

Additional research studies[5] have demonstrated the positive impact of teacher content knowledge on student achievement. Teacher content preparation in math and science had a positive effect on how much math and science high school students learn.[6] One study found that high school teachers' content coursework had a higher payoff for less experienced teachers,[7] and another found that when hiring novice teachers, selecting those who excelled academically can make up for their lack of teaching experience.[8]

Several studies have found that while teachers' pedagogical knowledge may play a larger role in students' success than content knowledge, content knowledge is still essential. In addition to Baumert et al.'s findings, cited above, another study reiterated the importance of both content and pedagogy, indicating that the former was necessary but not sufficient.[9]

Other support for this standard

For decades, teacher preparation and higher education reformers attempted to improve the rigor of undergraduate teacher preparation programs by promoting the requirement of full academic majors for prospective teachers. For example, the Holmes Group of the mid-1980s, a group of education school deans, advocated for programs in which teachers complete a traditional bachelor program with a content-area major and then devote an additional year to teacher preparation, such as through a postbaccalaureate program. While this type of program has not always been executed effectively, the concept shows the ongoing emphasis on teachers' content knowledge.

In general, most other research indicates that strong subject-matter expertise makes for better teaching, especially at the high school level and especially for teachers of mathematics and science.[10]

The structure of the standard acknowledges that most states offer certification in the sciences and social sciences such that teachers with specialization in any one subject area may also teach other subject areas.[11] Based on their high school science licensure requirements, many states seem to presume that a teacher with a background in one science area is equally capable of teaching anatomy, photochemical reactions and Newtonian physics. Most states allow teachers to obtain general science or combination licenses across multiple science disciplines, and, in most cases, these teachers need only pass a general knowledge science exam that does not ensure subject-specific content knowledge. This means that a teacher with a background in biology could be fully certified to teach chemistry or physics having passed only a general science test—and perhaps answering most of the chemistry or physics questions incorrectly.

In contrast to most of the field, California State University, Long Beach requires its secondary sciences candidates to earn two relevant minors, in keeping with our standard.

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[5] "Additional research" is research that is not designated as "strong" because it is not as recent and/or does not meet the highest standards for design methodology and/or use of student performance data.

[6] Monk, D. (1994). Subject-area preparation of secondary mathematics and science teachers and student achievement. *Economics of Education Review, 13*(2), 125-145; Goldhaber, D. D., & Brewer, D. J. (1997). Why don't schools and teachers seem to matter? Assessing the impact of unobservables or eduational productivity. *Journal of Human Research, 32*(3), 505-523.

[7] Monk, D. (1994).

[8] White, B. R., Presly, J. B., & DeAngelis, K. J. (2008). Leveling up: Narrowing the teacher academic capital gap in Illinois. *Illinois Education Research Council,*1-44.

[9] Monk, D. (1994).

[10] Chaney, B. (1995). Student outcomes and the professional preparation of 8th grade teachers. *NSF/NELS: 88 Teacher transcript analysis.* Rockville, MD: Westat; Goldhaber, D., & Brewer, D. J. (1997); Goldhaber, D. D., & Brewer, D. J. (1998, October). When should we reward degrees for teachers? *Phi Delta Kappan, 80*(2), 134-138; Goldhaber, D. D., & Brewer, D. J. (2000); Monk, D. (1994); Rothman, A. (1969). Teacher characteristics and student learning. *Journal of Research in Science Teaching, 6*(4), 340-348; Rowan, B., Chiang, F., & Miller, R. J. (1997, October). Using research on employees' performance to study the effects of teachers on students' achievement. *Sociology of Education, 70,* 256-284; Wenglinsky, H. (2000). *How teaching matters: Bringing the classroom back into discussions of teacher quality*. Princeton, NJ: Educational Testing Services, www.ets.org/media/research/pdf/picteamat.pdf; Carlisle, J. F., Correnti, R., Phelps, G., & Zeng, J. (2009). Exploration of the contribution of teachers' knowledge about reading to their students' improvement in reading. *Reading and Writing: An Interdisciplinary Journal, 22,* 459-486. Includes evidence specifically related to the importance of secondary social studies knowledge.

[11] National Council on Teacher Quality. (2010). *The all-purpose science teacher: An analysis of loopholes in state requirements for high school science teachers;* http://www.nctq.org/p/publications/docs/NCTQ_All_Purpose_Science_Teacher.pdf

Districts undoubtedly appreciate the flexibility that these broad field licenses offer, especially given the very real shortage of teachers in many science disciplines. But the all-purpose science teacher not only masks but also perpetuates the shortage of STEM teachers with strong STEM backgrounds, which leads to fewer students with a strong foundation in STEM who can pursue STEM professions. This cycle of inadequate preparation merely prolongs the STEM crisis.

Just as with an umbrella science certification, most states offer a general social studies license at the secondary level. For this certification, teachers can have a background in a wide variety of fields, ranging from history and political science to anthropology and psychology. Under such a license, a teacher who majored in psychology could be licensed to teach secondary history having passed only a general knowledge test and answering most—and perhaps all—history questions incorrectly.

Given the prevalence of these pathways into high school teaching, requiring a major (30 semester hours) in each of the subjects in which a teacher is certified (e.g., biology and chemistry for a teacher with a general science certification) would be unrealistic. On the other hand, requiring anything less than at least two minors (15 semester hours each) for general social studies and general science certifications would clearly be inadequate.

This standard garners support from school district superintendents.

Scoring Methodology

How NCTQ scores the High School Content Standard

Standard and indicators

Data used to score this standard

Evaluation of high school[1] teacher preparation programs on Standard 8: High School Content uses the following sources of data:

- State regulations that specify the types of high school teacher certification available
- State documents that outline possible teaching assignments for teachers with each type of certification
- Course requirements and descriptions found in institution of higher education (IHE) catalogs
- Degree plans provided by IHEs
- Relevant IHE web pages, including web pages for the college of education and the registrar, and those relevant to graduate school admission
- Admissions-related documents, including transcript review forms

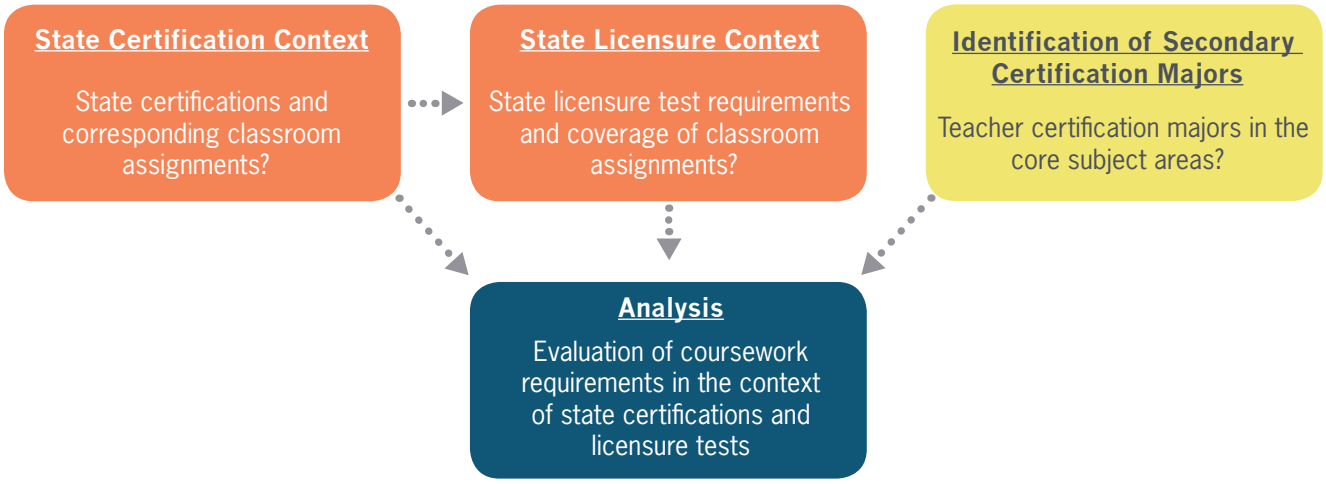
Who analyzes the data

Two general analysts evaluate each program using a detailed scoring protocol from which this scoring methodology is abstracted. For information on the process by which scoring discrepancies are resolved, see the "scoring processes" section of the General Methodology.

Scope of analysis

There are four major steps in analysis. First, the secondary certifications offered in each state are examined. Second, an evaluation of licensure test adequacy is completed for each certification. Next, the majors leading to certification are identified for each secondary program. (More discussion of evaluation using coursework descriptions is found here. Finally, if licensure tests are not adequate for a specific certification, analysts examine the coursework preparation required by individual secondary majors.)

[1] For information on each state's form of secondary certification (middle school, high school, and general secondary), refer to the Teacher Licensing Structure Infographics. For purposes of evaluation, "high school certification" refers to certification for the higher level secondary grades when middle school certification is offered in a state; in all other cases, "high school certification" refers to certification for the entire secondary grade span.



A detailed explanation of each step in this process follows. Evidence of coursework satisfying Indicators 8.2-8.5 follows the scoring process explanation.

State certification context

As illustrated in the High School/Secondary Certification Framework Infographics, each state has a unique organization for secondary certification, making it necessary to evaluate this standard within a state context. Evaluation begins by using state regulations to identify all certifications available to teach at the high school level in the core subject areas or "pathways"[2] of English, mathematics, the sciences, and the social sciences.

Certifications within the sciences and social sciences pathways can be either single subject or multiple subject. Single-subject certifications allow an individual to teach only the subject specified on the certification. Multiple-subject certifications allow an individual to teach in two or more subject areas. The most common certifications of each type are listed below:

Single-subject Certifications

English • Mathematics • Biology • Chemistry
Earth and Space Sciences • Physics • History • Economics
Political Science • Psychology • Geography

Multiple-subject Certifications

Physical Science (Physics and Chemistry) • General Science (Biology, Chemistry, Earth and Space Sciences, and Physics) • Social Studies (Economics, Geography, History, Political Science, and Psychology)

After determining the organization of secondary certifications for a state, we review all available information on which secondary-level courses the state allows a teacher with a given certification to teach. For example, in most states, single-subject certification in biology only allows teachers to teach biological science courses. However, in Illinois and Oregon an individual certified in biology can also teach chemistry and physics courses. Consequently, in those two states, biology is treated as a multiple-subject certification.

[2] The term "pathway" is one used by NCTQ to provide a useful standard term for a grouping of certifications in a subject area.

State licensure context

With each state's approach to certification fully researched, evaluation of this standard continues with a review of the state licensing test(s) required for each certification. Under Indicator 8.1, if a test adequately measures content knowledge for the subject(s) for which certification is sought, content preparation is deemed adequate without any examination of course requirements for majors leading to those certifications. For this edition of the *Review*, a test is considered to adequately measure content knowledge if it has a cut-score that ensures that 5 percent or more of test-takers do *not* pass.[3] Note that in the case of multiple-subject certifications, such as general science or social studies, the state must require a separate test for each subject area covered under the certification to satisfy content preparation requirements.[4]

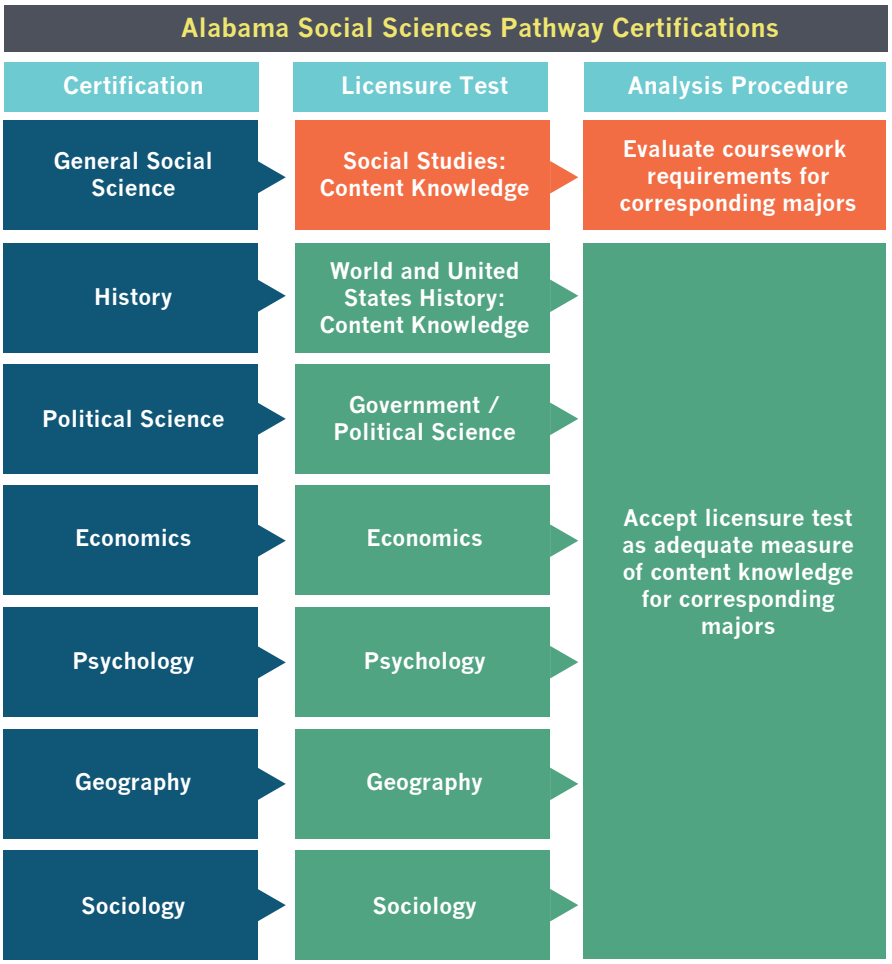
Because there is generally only single-subject certification in the English and mathematics pathways, evaluation under Indicators 8.2 and 8.3 with either licensing tests or coursework requirements is straightforward, and examples are not provided in this methodology discussion. The tremendous diversity of certifications in the sciences and social sciences pathways, however, complicates their evaluation. The High School/Secondary Certification Framework Infographics show the structure of secondary certification in each state. Examples of how we deal with these complications in evaluating **undergraduate** teacher preparation programs in **Alabama** and **Colorado**, two states with substantially different secondary certification frameworks, may therefore prove helpful.

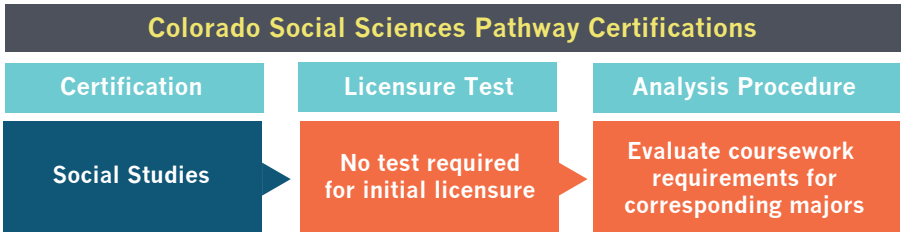
[3] In the absence of technical report data that validate the passing rates for each licensure test, we will presume that cut-scores are set too low to verify content knowledge.

[4] For example, physical science certification must require candidates to pass both a chemistry and a physics test. The single test for physical science is insufficient because a candidate could score poorly on either the chemistry or physics section and still teach both subjects. If, however, a social science or general science certification only allows for assignment to introductory general science or social studies courses, the general content knowledge test is considered adequate.

How evaluation of the secondary program context and analysis of the standard differs by state: An example in the social sciences pathway

The graphics below illustrate the organization of the two states' social sciences pathway, related certification-specific testing and resulting method of NCTQ evaluation:





Because the "general social science" certification in Alabama and the "social studies" certification in Colorado allow for teaching assignments in any social sciences course, and neither state requires adequate testing for this certification, an evaluation of coursework for corresponding majors is necessary. While the social studies certification is the only certification offered in Colorado's social sciences pathway, Alabama offers additional single-subject certifications in this pathway, each with appropriately matched possible secondary assignments and adequate testing. Because these certifications are adequately tested in Alabama, an evaluation of coursework for their corresponding majors is not required.

Identification of secondary certification majors

The majors leading to secondary certification offered by each IHE are identified. Because this identification is central to evaluation, two analysts independently complete this work, and a third analyst reconciles the results, investigating all discrepancies. The end product for each state is an extensive database identifying the pathways offered at each program, as well as the majors available in the social sciences and sciences pathways. Below are examples of an entry for an IHE in Alabama and Colorado. The majors requiring coursework evaluation because of inadequate licensure testing are circled in red:

University	State	High School Pathways					High School Social Studies Majors	High School Science Majors
		Initial Cert.	Undergraduate					
			Eng	Math	SS	Sci		
Sample IHE	Alabama	Yes	Yes	Yes	Yes	Yes	Social Studies, History, Political Science	General Science, Physical Science, Biology, Chemistry, Physics

University	State	High School Pathways					High School Social Studies Majors	High School Science Majors
		Initial Cert.	Undergraduate					
			Eng	Math	SS	Sci		
Sample IHE	Colorado	Yes	Yes	Yes	Yes	Yes	Social Studies, History, Political Science	General Science, Physical Science, Biology, Chemistry, Physics

Analysis

A secondary program satisfies Indicator 8.5 if *all* majors offered ensure adequate content knowledge for the relevant certifications. In turn, this means that multiple-subject certifications require either the equivalent of 30 semester credit hours (SCHs) in history or 15 SCHs in at least two social sciences, one of which must be in history, with economics, political science or psychology as the possible second 15 SCHs minor. Single-subject certifications that are not adequately tested require 30 SCHs in the licensed subject area. Up to five majors per program are examined under Indicator 8.5 until one fails or all pass.[5]

In Alabama, as discussed above, only the general social science certification is not adequately tested. As a result, majors leading to that certification are analyzed first; if they require adequate coursework, the history and political science majors automatically pass because of state certification tests.

[5] With the aim to ensure that all majors provide adequate preparation, when a program offers more than five majors, the ones most likely to pass are excluded from evaluation. The "Order of Evaluation of Majors in the Social Sciences Pathway" table provides the hierarchy of analysis. We make the assumption that if the five weakest majors are satisfactory, then all majors will provide adequate preparation.

When there is only a single certification for the social sciences pathway, such as in Colorado, majors are scored in order of weakest to strongest because all majors allow for the same teaching assignments. The order of analysis is predetermined in each state to ensure consistency. In Colorado (and most other states), the following order of evaluation is followed when multiple majors lead to the state's "general social science" certification:

Order of Evaluation of Majors in the Social Sciences Pathway
Anthropology
Sociology
Geography
Non-standard majors*
Social Studies
Psychology
Economics
Political Science/Government
History
* any non-listed degree route leading to social science certification (such as Mexican- or African-American Studies)

The following examples illustrate how undergraduate majors in the social sciences pathway in Alabama and Colorado have been evaluated under this standard:

University	State	Certification	Majors	Subject-area Credit Counts								Pathway Outcome
				HIS	PS	ECON	PSYCH	GEOG	SOC	ANTH	Unassigned*	
Troy University	Alabama	General Social Science	Social Science	3	-	-	-	-	-	-	33	Fail
		History	History	*Not evaluated because Social Science major failed analysis*								
University of North Alabama	Alabama	General Social Science	General Social Science	30	12	6	-	20	-	-	6	Pass
		Geography	Geography	*Passes with state licensure test - coursework evaluation not required*								
		History	History	*Passes with state licensure test - coursework evaluation not required*								
University of Northern Colorado	Colorado	Social Studies	Geography	12	3	3	-	39	-	-	-	Fail
			Africana Studies	*Not evaluated because Social Science major failed analysis*								
			Mexican-American Studies	*Not evaluated because Social Science major failed analysis*								
			Social Science	*Not evaluated because Social Science major failed analysis*								
			History	*Not evaluated because Social Science major failed analysis*								
Western State College	Colorado	Social Studies	Economics	15	15	27	-	9	-	-	-	Pass
			Politics & Government	15	33	12	-	9	-	-	-	
			History	36	9	9	-	9	-	-	-	

* Unassigned credits are those that are required in the social sciences but are not specified. An example from **Troy University**: *Select at least 24 hours of additional 3,000/4,000-level courses from anthropology, economics, geography, history, political science, psychology or sociology (six hours may be used from ECO 2251, ECO 2252, GEO 2210, ANT 2200, POL 2260 [World Politics] or SOC 2230) in at least three disciplines.*

Note that for each secondary program, the final determination is a ''pathway outcome'' pass or fail. In order for the secondary program's social sciences pathway to pass, all majors in all certifications must satisfy Indicator 8.5.

How evaluation of the secondary program context and analysis of the standard differs by state: An example in the social sciences pathway

The evaluation of preparation in the sciences is completed in the same manner as in the social sciences. With Alabama and Colorado continuing as examples, the tables below illustrate the certifications in the two states' sciences pathway, related certification-specific testing, and resulting method of NCTQ evaluation:

Alabama Sciences Pathway Certifications

Certification	Licensure Test	Evaluation Procedure
General Science	General Science: Content Knowledge	Evaluate coursework requirements for corresponding majors
Physical Science	Chemistry, Physics and General Science	Evaluate coursework requirements for corresponding majors
Physics	Physics: Content Knowledge	Accept licensure test as adequate measure of content knowledge for corresponding majors
Chemistry	Chemistry: Content Knowledge	
Biology	Biology: Content Knowledge	
Earth and Space Science	Earth and Space Sciences: Content Knowledge	

Colorado Sciences Pathway Certifications

Certification	Licensure Test	Evauation Procedure
Science	No test required for initial licensure	Evaluate coursework requirements for corresponding majors

Identification of secondary certification majors

After considering whether each certification has licensure-test requirements that ensure adequate content preparation, coursework evaluation is necessary for the science majors circled in red below:

University	State	High School Pathways					High School Social Studies Majors	High School Science Majors
		Initial Cert.	Undergraduate					
			Eng	Math	SS	Sci		
Sample IHE	Alabama	Yes	Yes	Yes	Yes	Yes	Social Studies, History, Politial Science	General Science, Physical Science, Biology, Chemistry, Physics

University	State	High School Pathways					High School Social Studies Majors	High School Science Majors
		Initial Cert.	Undergraduate					
			Eng	Math	SS	Sci		
Sample IHE	Colorado	Yes	Yes	Yes	Yes	Yes	Social Studies, History, Politial Science	General Science, Physical Science, Biology, Chemistry, Physics

Analysis

A secondary program satisfies Indicator 8.4 if *all* majors offered ensure adequate content knowledge for the relevant certifications. Single-subject certifications require 30 SCHs in the licensed subject area. Multiple-subject certifications require at least 15 SCHs in any two sciences: biology, chemistry, earth and space sciences, or physics. Up to five majors per program are examined under Indicator 8.4 until one fails or all pass.[6]

In the case of multiple science majors leading to the same certification, the order in which majors are examined is shown below:

Order of Evaluation of Majors in the Sciences Pathway
General Science
Physical Science
Life/Natural Science
Geology
Physics
Chemistry
Biology
Earth and Space Sciences

[6] With the aim to ensure that all majors provide adequate preparation, when more than five majors are offered by a program, the ones most likely to pass are excluded from evaluation. The "Order of Evaluation of Majors in the Sciences Pathway" table provides the hierarchy of analysis. We make the assumption that if the five weakest majors are satisfactory, then all majors will provide adequate preparation.

The following examples illustrate how the majors for certifications in the sciences pathway at several IHEs in Alabama and Colorado have been evaluated under this standard:

University	State	Certification	Majors	Subject-area Credit Counts					Pathway Outcome
				Biology	Chemestry	Physics	Earth Science	Unassigned	
Alabama State University	Alabama	General Science	General Science	24	24	18	-	-	Pass
		Chemistry	Chemistry	*Passes with state licensure test - coursework evaluation not required*					
		Biology	Biology	*Passes with state licensure test - coursework evaluation not required*					
University of West Alabama	Alabama	General Science	General Science	23	-	8	8	9	Fail
		Chemistry	Chemistry	*Not evaluated because Social Science major failed analysis*					
		Biology	Biology	*Not evaluated because Social Science major failed analysis*					
Birmingham Southern College	Alabama	Physics	Physics	*Passes with state licensure test - coursework evaluation not required*					Pass
		Chemistry	Chemistry	*Passes with state licensure test - coursework evaluation not required*					
		Biology	Biology	*Passes with state licensure test - coursework evaluation not required*					
Colorado State University - Pueblo	Colorado	Science	Physical Science	8	23	22	4	-	Fail
			Physics	8	10	31	4	-	
			Chemistry	*Not evaluated because Social Science major failed analysis*					
			Biology	*Not evaluated because Social Science major failed analysis*					
University of Colorado Denver	Colorado	Science	General Science	20	19	19	10	-	Pass

Note that for each secondary program, the final determination is a "pathway outcome" pass or fail. In order for the secondary program's social sciences pathway to pass, all majors in all certifications must satisfy Indicator 8.5.

More information about analysis of coursework requirements

How do analysts evaluate course menus? A major allowing teacher candidates to select from a menu of course choices can affect the credit count in coursework evaluation when it includes courses in subjects that do not suffice for content preparation for any given pathway. For example, a social studies major may allow candidates to choose eight courses from among seven social science subject areas with the only restriction being that credits are distributed over at least three of them. While a candidate might select courses that fall almost entirely within the history minor and the second minor required (government/political science, economics or psychology) by Indicator 8.5, it is also possible that none of the eight courses will do so. For this reason, the major would fail on analysis and the secondary program would fail on evaluation of the social sciences pathway.

Below is an example of how analysts evaluate a menu of course choices for part of a major in the social sciences. Note that the analyst could create many different combinations of four courses, of which five are listed. While one possibility entails 12 SCHs of history coursework, two others contain far less and two contain none at all. Because a teacher candidate might choose the first or the second distribution of coursework, this program would not receive credit for requiring any history coursework in this "choose four" requirement.

Course Choice Menu Example

Choose five of the following courses:

- ANTH 212 – Cultural Anthropology (3)
- ANTH 221 – Physical Anthropology (3)
- ANTH 270 – Urban Anthropology (3)
- ECON 201 – Principles of Macroeconomics (3)
- ECON 202 – Principles of Microeconomics (3)
- GEOG 101 – Introduction to Geography (3)
- HIS 120 – American History until 1877 (3)
- HIS 121 – American History since 1877 (3)
- HIS 201 – Ancient World History (3)
- HIS 202 – Medieval World History (3)
- PS 221 – Legislative Process (3)
- PS 272 – International Relations (3)
- PSYCH 101 – General Psychology (3)
- SOC 101 – Introduction to Sociology (3)

Possibility #1

HIS	PS	ECON	PSYCH	GEOG	SOC	ANTH
–	–	–	–	–	3	9

Possibility #2

HIS	PS	ECON	PSYCH	GEOG	SOC	ANTH
–	–	3	–	3	3	3

Possibility #3

HIS	PS	ECON	PSYCH	GEOG	SOC	ANTH
12	–	–	–	–	–	–

Possibility #4

HIS	PS	ECON	PSYCH	GEOG	SOC	ANTH
6	6	–	–	–	–	–

Possibility #5

HIS	PS	ECON	PSYCH	GEOG	SOC	ANTH
3	–	–	3	3	3	–

How do analysts evaluate courses taught with a religious perspective? Courses offering religious perspectives do not receive credit in the evaluation of this standard.[7] This includes science coursework that explicitly endorses religion or pseudo-scientific principles such as creationism or intelligent design, literature courses that entail religious study of the Bible (as opposed to analysis of the Bible as literature), and history courses that focus exclusively on the establishment or development of religions.

Coursework evaluation at the **undergraduate** level is facilitated by the specificity with which most secondary teacher preparation programs outline course requirements in catalogs. In **graduate programs**, because this specificity is less common, analysts determine if the catalog, admissions documents (such as applications and transcript review forms) or other publicly available materials show a clear institutional commitment to ensuring that graduate high school teacher candidates meet the same requirements as outlined above, with explicit mention of acceptable undergraduate majors and/or minors and an indication of the potential for imposition of remedial coursework requirements. Graduate programs may also meet this standard by requiring candidates to complete 15 SCHs (the equivalent of a minor) of graduate-level content coursework, which ensures candidates have an understanding of higher-level concepts relevant to the candidates' area of certification. It is important to note that at the graduate level, the program may offer only a single secondary education major with multiple certifications offered within that major. In such cases, identification focuses on the possible certification options.

[7] If the programs offering these courses *only* prepared educators to teach in private religious K-12 schools, such coursework would be appropriate. All programs in the *Review*, however, are publicly approved to prepare *public* school teachers.

Overall program rating

The final program rating for an undergraduate or graduate secondary program on this standard is based on the proportion of the four pathways offered by the program for which content preparation is determined to be adequate either by licensure tests at the state level or coursework evaluation at the program levels.

Information on content preparation is generally accessible in publicly available materials. If after an exhaustive search of IHE catalogs and websites we find no public mention of expectations for content preparation, we presume that none exists and score accordingly. With the exception of 18 programs that did not specify coursework requirements for at least one major, all high school programs in the sample could be evaluated on this standard.

Common misconceptions about how analysts evaluate the Common Core High School Content Standard:

- *Because all licensing tests required for certification adequately evaluate content knowledge, coursework preparation is not relevant for certifications for which licensing tests are mandatory.* Licensing tests serve as an adequate measure of content knowledge only when all possible teaching assignments allowed under the certification are tested with independent cut-scores, the cut-scores are set at a sufficiently high level to ensure rigor, and the test is required for initial licensure.
- *Preparation in any of the social sciences fields is interchangeable.* Except for single-subject certifications in the social sciences with matching teaching assignments (e.g., a certification in sociology that only allows for a sociology teaching assignment), we consider history, political science/government, economics, and psychology coursework relevant for evaluation under this standard, not coursework in fields such as anthropology, geography or sociology.
- *Recommended coursework can receive credit. T*eacher preparation programs must *require* coursework to ensure that teacher candidates receive the necessary background knowledge on subjects they will teach.

Examples of what does and does not satisfy the standard's indicators

Determining the adequacy of content preparation on the basis of licensure tests (Indicator 8.1)

✔ · fully satisfies the indicator	✘ · does not satisfy the indicator
The state requires a single-subject licensing test with a rigorous cut-score for each **single-subject** *certification with a matching teaching assignment.* *The state requires a single-subject licensing test for all possible teaching assignments allowed by each* **multiple-subject** *certification.* *Tests considered for this indicator include: Praxis II, AEPA, CSET, FTCE, GACE, ICTS, MTEL, MTTC, MTLE, NMTA, NYSTCE, CEOE, ORELA, TExES, and WEST-E.*	**Single-subject** or **multiple-subject** certifications require general or multiple-subject licensing tests. **Single-subject** or **multiple-subject** certifications do not require licensing tests.

Considerations for coursework evaluation of majors in mathematics, English, the sciences and the social sciences pathways (Indicators 8.2-8.5)

✔ · **acceptable** (coursework covers content)	✔ · **not acceptable** (coursework focuses on methods of instruction, not content)
In **Mathematics:** **STAT 317 - Statistics for Engineers and Scientists.** *Calculus-based probability and statistics: distribution theory, estimation, hypothesis testing, applications to engineering and the sciences.* **MAT 305 - The History of Mathematics.** *Mathematical thought from ancient to modern times, major theorems of mathematics, problems of different periods and the context in which mathematics developed.*	*In* **Mathematics:** **MAE 4634 - Programs in Teaching of Mathematics.** *A consideration of special programs, strategies and materials. Emphasis on individual needs of students.* **MTE 428 - Methods of Teaching Mathematics in Secondary School.** *Examines secondary school curricular material and analyzes instructional devices. Teaching strategies, evaluative techniques, diagnosis, and remediation and problem solving.*
In **English:** **LIT 200 - World Literatures to 1500**. *Significant literary texts from the beginnings of writing to 1500 from Europe, Asia and Africa.* **COM 301 - Public Relations Writing.** *Writing documents to create relationships between organizations and their public, e.g., press releases, fact sheets, brochures and speeches.*	*In* **English:** **EDUC 405 - Literacy in the Content Area.** *The course shows teachers how to apply reading methodology to subject-area learning. It takes a balanced approach, providing a realistic and practical treatment of reading and methodology issues, theory and research.* **ENG 413 - Using Literature in Intermediate and Adolescent Classrooms.** *This course takes a practical approach to the study and selection of literature for use in teaching intermediate and adolescent students. Various educational methods that integrate children's literature into the intermediate and adolescent curriculum are reviewed.*

In the **Sciences:**

BIO 300 - Ecology and Population Biology.
Nutrient cycling and energy flow, populations, population genetics, use and construction of phylogenies, communities and biodiversity. (Counted for Biology)

GEOL 211 - Historical Geology.
This course covers the diversity of life, catastrophic extinctions and the effect of biologic change on the environment. The basic principles of stratigraphy, use of stable isotopes to interpret sedimentary environments and the stratigraphic and tectonic history of the earth are also explored. (Counted for Earth and Space Sciences)

In the **Sciences:**

ED 542 - Science Pedagogy in the Secondary School. *Through campus and school-based experiences, students will learn how to engage young people in learning about science and how to make decisions about planning instruction and developing assessment based on a sound knowledge base for applying content, materials, and methods (including educational technology) appropriate for high school students.*

BIOL 440 - Methods of Teaching Science.
Methods, philosophy and structure of science; application in teaching middle and secondary school science courses.

In the **Social Sciences:**

PS 441 - The Legislative Process.
A study of Congress and the state legislatures, covering the legislative power structure, legislative committees, the selection of legislators and the roles they play, decision making, and the relationship between the legislative and executive branches. (Counted for Political Science)

AAS 587 - U.S. Civil Rights Movement since 1930.
This course will focus on the struggle for African-American equality in the United States during the mid-20th century. It will examine key civil rights issues, events, leaders and organizations on both the local and national levels. Using historical documents and documentary film presentations, this course will discuss the status of race relations in America over the past 50 years. (Counted for History)

PSYC 411 - Cognitive Psychology.
Research and theories on sensory memory, attention, short-term and working memory, human learning and forgetting, imagery, long-term memory, speech perception, reading, language, thinking and problem solving, and decision making. (Counted for Psychology)

In the **Social Sciences:**

EDU 391 - Initial Clinical Experience in Social Studies.
This initial clinical experience is designed to provide undergraduates in secondary education programs with school-based classroom experiences that prepare them to effectively student teach at the secondary school level. Students are placed in a secondary school setting under the guidance of a school-based teacher and a college-based supervisor.

PSY 336 – Education Psychology.
This course is designed for teachers and individuals who are concerned with directing and influencing personality development and learning in human beings. It is hoped that they will be able to apply the principles of psychology to education and the teaching-learning process.

HIS 473 – Principles and Practices of Teaching History. *Development of a philosophy for teaching history in the secondary schools. Current trends and issues curriculum programs, teaching strategies, classroom procedures, and materials will be examined and developed. Field experience is required.*

Considerations for coursework evaluation of majors in mathematics, English, the sciences and the social sciences pathways (Indicators 8.2-8.5)

Content Preparation	
✔ · fully satisfies the indicator	✘ · does not satisfy the indicator
For all certifications that are not adequately tested, the program requires undergraduate coursework entailing: ■ For **single-subject** certifications: ➤ a 30 SCHs content-area major. ■ For **multiple-subject** certifications, one of: ➤ two 15 SCHs minors in the possible assignment areas. ➤ a total of 50 SCHs in the sciences or social sciences. ➤ a program that may require graduate coursework entailing a total of 15 SCHs. (For the sciences and social sciences, this need not be limited to a single content area.)	■ The program fails to specify undergraduate coursework requirements. ■ The program specifies that candidates for **single-subject** certification may be admitted with fewer than 30 SCHs in the relevant content area. ■ The program specifies that candidates for **multiple-subject** certification may be admitted with only a major, or a major and insufficient credits in a second content area.

Research Inventory

Researching Teacher Preparation: Studies investigating the preparation of teacher candidates in elementary, middle, and high school content

These studies address issues most relevant to Standards 6–8: Elementary Content, Middle School Content, and High School Content.

Area of Research	Total Number of Studies	Studies with Stronger Design		Studies with Weaker Design	
		Measures Student Outcomes	Does Not Measure Student Outcomes	Measures Student Outcomes	Does Not Measure Student Outcomes
Std. 6	16	3 Citations: 3, 11, 13	2 Citations: 15, 25	0	11 Citations: 1, 6, 12, 16, 17, 19, 21, 23, 24, 27, 28
Std. 7	9	3 Citations: 3, 7, 13	2 Citations: 9, 26	0	4 Citations: 1, 8, 18, 22
Std. 8	13	4 Citations: 2, 4, 10, 13	2 Citations: 9, 26	0	7 Citations: 1, 5, 14, 20, 22, 23, 29

Note: Citation 1 and 13 are cross-listed with RI 6, 7, and 8; Citation 2 is cross-listed with RI 15: Secondary Methods; Citation 3 is cross-listed with RI 5: Elementary Mathematics, RI 6 and 7, and RI 14: Student Teaching; Citation 5 is cross-listed with RI 15: Secondary Methods; Citation 14 is cross-listed with RI 9: Content for Special Education and RI 5: Elementary Mathematics; Citations 6, 12, 16, 18, 21 and 25 are cross-listed with RI 5: Elementary Mathematics.

Citations for articles categorized in the table are listed below.

Databases: Education Research Complete and Education Resource Information Center (peer-reviewed listings of reports on research including United States populations).

Publication dates: Jan 2000 – June 2012

See *Research Inventories: Rationale and Methods* for more information on the development of this inventory of research.

1. Backhus, D. A., & Thompson, K. (2006). Addressing the nature of science in preservice science teacher preparation programs: Science educator perceptions. *Journal of Science Teacher Education, 17*(1), 65–81.

2. Baumert, J., Kunter, M., Blum, W., Brunner, M., Voss, T., Jordan, A., & ... Tsai, Y. (2010). Teachers' mathematical knowledge, cognitive activation in the classroom, and student progress. *American Educational Research Journal, 47*(1), 133–180.

3. Boyd, D. J., Grossman, P. L., Lankford, H., Loeb, S., & Wyckoff, J. (2009). Teacher preparation and student achievement. *Educational Evaluation and Policy Analysis, 31*(4), 416–440.

4. Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2010). Teacher credentials and student achievement in high school. *Journal of Human Resources, 45*(3), 655–681.

5. Conner, A., Edenfield, K. W., Gleason, B. W., & Ersoz, F. (2011). Impact of a content and methods course sequence on prospective secondary mathematics teachers' beliefs. *Journal of Mathematics Teacher Education, 14*(6), 483–504.

6. Cramer, K. (2004). Facilitating teachers' growth in content knowledge. *Yearbook (National Council of Teachers of Mathematics), 66*, 180–194.

7. Dee, T. S., & Cohodes, S. R. (2008). Out-of-field teachers and student achievement: Evidence from matched-pairs comparisons. *Public Finance Review, 36*(1), 7–32.

8. Feuerborn, L. L., Chinn, D., & Morlan, G. (2009). Improving mathematics teachers' content knowledge via brief in-service: A US case study. *Professional Development in Education, 35*(4), 531–545.

9. Gleason, J. (2010). Reliability of the content knowledge for teaching-mathematics instrument for pre-service teachers. *Issues in the Undergraduate Mathematics Preparation of School Teachers, 1.*

10. Goldhaber, D. D., & Brewer, D. J. (2000). Does teacher certification matter? High school teacher certification status and student achievement. *Educational Evaluation and Policy Analysis, 22*(2), 129–145.

11. Goldhaber, D. (2007). Everyone's doing it, but what does teacher testing tell us about teacher effectiveness? *Journal of Human Resources, 42*(4), 765–794.

12. Hart, L. C., & Swars, S. L. (2009). The lived experiences of elementary prospective teachers in mathematics content coursework. *Teacher Development, 13*(2), 159–172.

13. Harris, D. N., & Sass, T. R. (2011). Teacher training, teacher quality, and student achievement. *Journal of Public Economics, 95*(7), 798–812.

14. Livy, S., & Vale, C. (2011). First year pre-service teachers' mathematical content knowledge: Methods of solution for a ratio question. *Mathematics Teacher Education and Development, 13*(2), 22–43.

15. Luera, G. R., Moyer, R. H., & Everett, S. A. (2005). What type and level of science content knowledge of elementary education students affect their ability to construct an inquiry-based science lesson?. *Journal of Elementary Science Education, 17*(1), 12–25.

16. Matthews, M. E., & Seaman, W. I. (2007). The effects of different undergraduate mathematics courses on the content knowledge and attitude towards mathematics of preservice elementary teachers. *Issues in the Undergraduate Mathematics Preparation of School Teachers: The Journal, 1*.

17. May, M. (2005). Improving teacher preparation. *Journal of Social Studies Research, 29*(2), 4–8.

18. McLeod, K., & Huinker, D. (2007). University of Wisconsin–Milwaukee mathematics focus courses: Mathematics content for elementary and middle grades teachers. *International Journal of Mathematical Education in Science & Technology, 38*(7), 949–962.

19. Morgan, P. W. (2008). Elementary education candidates' background knowledge and attitudes toward science: Are liberal arts teacher preparation and core courses enough?. *AILACTE Journal, 5*, 45–60.

20. Nathan, M. J., & Petrosino, A. (2003). Expert blind spot among preservice teachers. *American Educational Research Journal, 40*(4), 905–928.

21. Norton, S. (2010). How deeply and how well? How ready to teach mathematics after a one-year program?. *Mathematics Teacher Education and Development, 12*(1), 65–84.

22. Saderholm, J. C., & Tretter, T. R. (2008). Identification of the most critical content knowledge base for middle school science teachers. *Journal of Science Teacher Education, 19*(3), 269–283.

23. Sanchez, R. M. (2010). The six remaining facts: Social studies content knowledge and elementary preservice teachers. *Action in Teacher Education, 32*(3), 66–78.

24. Sanger, M. J. (2007). The effect of inquiry-based instruction on elementary teaching majors' chemistry content knowledge. *Journal of Chemical Education, 84*(6), 1035-1039.

25. Schmidt, W. H., Cogan, L., & Houang, R. (2011). The role of opportunity to learn in teacher preparation: An international context. *Journal of Teacher Education, 62*(2), 138–153.

26. Swackhamer, L., Koellner, K., Basile, C., & Kimbrough, D. (2009). Increasing the self-efficacy of inservice teachers through content knowledge. *Teacher Education Quarterly, 36*(2), 63–78.

27. Tairab, H. (2010). Assessing science teachers' content knowledge and confidence in teaching science: How confident are UAE prospective elementary science teachers?. *International Journal of Applied Educational Studies, 7*(1), 59–71.

28. Weinburgh, M. (2007). The effect of "Tenebrio obscurus" on elementary preservice teachers' content knowledge, attitudes, and self-efficacy. *Journal of Science Teacher Education, 18*(6), 801–815.

29. Wilburne, J. M., & Long, M. (2010). Secondary pre-service teachers' content knowledge for state assessments: Implications for mathematics education programs. *Issues in the Undergraduate Mathematics Preparation of School Teachers: The Journal, 1*.