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Analyzing prep program content coverage

Sample

This analysis examines a sample of 1,095 programs comprising 817 undergraduate elementary programs, 250 graduate programs, and 28 alternative route programs. All programs in this sample are evaluated on content preparation in literature and composition, history and geography, and science (using data collected for Standard 6: Elementary Content in the *Teacher Prep Review*). Almost all programs (N=811 undergraduate programs, 213 graduate programs, and all alternative route programs) are also evaluated on elementary mathematics (using data collected for Standard 5: Elementary Mathematics in the *Teacher Prep Review*).¹

The institutions housing undergraduate and graduate programs are split between public institutions (44 percent) and private institutions (56 percent).

The most common grade span for undergraduate and graduate programs is from kindergarten to grade 6, representing 25 percent of the sample (followed by 17 percent spanning grades 1 to 6, and 13 percent spanning kindergarten to grade 8). Some programs cover older grades (23 percent of the sample's certification span extends to grade 8), and many programs cover younger grades (1 percent start at birth, 24 percent start at preschool, and 52 percent start at kindergarten).

Of the 28 alternative route programs, 11 are housed in institutions of higher education, while the remaining 17 are not.

The most common grade span for the alternative route programs in this sample is from early childhood through grade 6, representing 61 percent of the sample. The remaining programs start in kindergarten or grade 1 (one starts in grade 4) and extend until grades 5, 6, or 8.

To select the sample of undergraduate and graduate programs, NCTQ looked at the size of all programs producing teachers based on the data from Title II. For the top 200 institutions, as measured by the number of new teachers graduated each year, we evaluated both an undergraduate and a graduate elementary program when they were offered. For all other institutions (with the exception of those that produced fewer than 20 teachers per year, which were removed from the sample), we attempted to evaluate one of its elementary programs; if an institution had both an undergraduate and a graduate elementary program, we randomly chose either the undergraduate or graduate division for the *Teacher Prep Review*.

Alternative route programs were selected primarily because they produced a large number of teachers, they were structured as internships (in which the teacher candidate became the teacher of record in tandem with beginning professional coursework), and they resided in states with classroom readiness mandates stipulating that teachers meet some minimum requirement before becoming the teacher of record.



Data sources used for analysis

To evaluate programs' content requirements, analysts looked at data from a number of sources, many of which were publicly available on institutions' websites. Other materials (e.g., some course syllabi) had to be requested from the institution.

- Course catalogs
- Degree plans
- Institutions' websites
- Pre-admission tests that require a separate cut-score in each subject
- Admissions documents, including transcript review forms and advising sheets
- Course syllabi (primarily to evaluate elementary mathematics)
- Assigned primary textbooks in required elementary math content courses (primarily to evaluate elementary mathematics)
- State regulations regarding content preparation of elementary teacher candidates
- Integrated Postsecondary Education Data System (IPEDS) data on mean university SAT/ACT scores and mean SAT/ACT scores self-reported to the College Board (only to determine program selectivity as part of the evaluation of elementary mathematics)

Who analyzed the data?

For literature and composition, science, and social studies, data were analyzed by a general analyst. This analyst evaluated each program using a detailed scoring protocol from which the scoring methodology was abstracted. Twenty percent of programs were randomly selected for analysis by a second general analyst. For information on how these analysts are screened and hired, and for the

process by which scoring discrepancies are resolved, see the *Teacher Prep Review's* methodology here:

<https://www.nctq.org/review/how>.

For elementary mathematics, a subject specialist² evaluated each program using a detailed scoring protocol from which the scoring methodology was abstracted. Twenty percent of programs were randomly selected for a second evaluation to assess scoring variances.

Scope of the analysis

Admissions testing in undergraduate, graduate, and alternative route programs

For all subjects, analysts looked for evidence that the teacher prep program requires an adequate test on any content area as a condition of admission into the program.³ This analysis considered a program to have aligned coverage of any subject in which it has an appropriate admissions test.

An adequate test is one that makes sure the candidate has a strong grasp of each subject area (literature and composition, science, social studies, and elementary math). This test could be a single rigorous content exam with separate cut-scores provided for all subjects (such as the Praxis Elementary Education: Multiple Subjects test) or subject-specific exams (such as Advanced Placement, College Level Examination Program [CLEP] or SAT II tests). The requirement of separate cut-scores or separate tests ensures that the candidate truly knows each subject and that, for example, an especially strong grasp of science concepts does not obscure the candidate's weak knowledge of social studies.

Analyzing undergraduate coursework: English language arts, science, and social studies

For any subject not covered by an admission test, analysts used sources, including course catalogs and degree plans, to identify the content coursework that teacher candidates are required to take in order to meet general education requirements and/or teacher preparation program requirements. This analysis includes any prerequisite coursework for these course requirements.

Analysts used catalog course descriptions to evaluate whether the courses address the specified topics and are rigorous and comprehensive enough to ensure that graduates will be able to add value above and beyond that provided by elementary grade textbooks and curriculum guides.⁴ Courses are evaluated to determine if they align with the needs of aspiring elementary teachers. Courses had to meet four general criteria to achieve alignment, listed below. When necessary and available, analysts consulted syllabi and/or bookstore listings of required textbooks to assist in this evaluation; the additional analysis occurred only in rare instances. In general, course titles and descriptions offer enough information to identify courses that are inadequate for the needs of aspiring elementary teachers.

Criteria to determine if coursework is aligned with the needs of elementary teacher candidates

1. Attainability: The scope of the course could feasibly be taught in a semester, rather than being too broad to cover the topics in sufficient detail in the time allowed. Examples of courses where the subject matter was too ambitious would be a history course covering all of world history or a single science course purporting to cover multiple branches of science.

2. Breadth: The course (or a combination of required courses) was broad enough to give the candidate a foundation in the full range of content a candidate would need to know. This was in contrast to a required course or menu of course options on narrow topics. Many college courses appropriately address a narrow and specific topic on the assumption that high schools cover the broader material. However, for teacher candidates who may lack a basic understanding of a subject (as the test results so clearly illustrate), specialized courses would need to be preceded by more introductory exposure that builds the foundational knowledge teachers need. An example of an overly narrow course would be a U.S. history course on the Industrial Revolution that could be the only U.S. history course a candidate had to take. This problem was most common in some of the science courses where teacher candidates could often choose from a menu of options to satisfy core requirements, and many focused narrowly on current events rather than first having covered the foundational content. One example of this is a course called *Chemistry for Changing Times*, which examines “how chemistry-related concepts appear in our day-to-day lives.”



3. Relevance: Courses covered the topics most likely to be useful for the elementary classroom. While almost any topic might prove useful at some point to at least some of the students, the institutions should focus on the topics likely to be useful to most students. Courses such as *The Sexual Revolution in America*, an American government course applying a religious perspective, or one featuring films that would not be seen by children, may be appropriate college courses under different circumstances, but they lack relevance for elementary teachers.

4. Prioritizing content, not pedagogy: Courses should teach core content for a general college audience, rather than focus on pedagogy for teacher candidates (which would reduce the time and attention given to key concepts and skills). Examples of courses that fall short of this criterion include *Literature for Elementary Education Majors* and *Physics for Educators*, both of which incorporate a heavy focus on *how* to teach alongside the content. The exceptions to this are elementary math and children's literature, which may only be of interest to a teacher candidate audience, although they should still address content rather than pedagogy.

course selections is deemed inadequate. Similarly, if the menu is too long (seven or more courses), it is deemed insufficient because it is too likely that one or more courses from which candidates can choose will be inadequate. For example, at one undergraduate elementary preparation program we evaluated, candidates are not provided any guidance on their choice of science coursework. They can choose any two courses from a list that includes 41 different courses in nine different departments. While some of these courses would certainly fulfill our science topic requirements, the program would not receive credit in the science subject area because a teacher candidate can choose two that would not.

How do analysts evaluate a menu of course choices?

In some cases, institutions or programs give candidates a list of courses from which to choose to satisfy a requirement (e.g., a list of 10 courses, any one of which could fulfill a U.S. History general education requirement). Programs do not get credit for requiring aligned content if this menu of courses allows candidates to opt out of coursework that is considered essential, or if one or more of the



Analyzing graduate coursework: English language arts, science, and social studies

When graduate programs do not have acceptable admissions tests, analysts reviewed other admissions documents (such as applications and transcript review forms) or other publicly available materials to see if programs expect incoming candidates to have taken coursework in relevant content areas.

Because programs may require additional content coursework as part of the program (or may require remedial coursework for candidates who did not meet entry requirements), analysts also reviewed graduate course requirements, states' required content preparation for subject requirements (i.e., English language arts, social studies, sciences),

and specific topics (e.g., composition, American history, biology). Sufficient coverage of a subject area is considered three courses, or nine semester credit hours.

For alternative route programs, only admissions tests are considered. Because teacher candidates in these routes often become the teacher of record in charge of a program almost immediately upon entering the program and because content coursework is generally not within the purview of alternative programs, it is essential that candidates have content knowledge when they begin teaching, rather than learn the content over the course of their program.

Description of courses that would address content topic areas

English language arts

World Literature: A survey course that covers major literary genres and the significant works and movements of Western literature beginning with ancient Greek and/or Roman sources. The course may also include movements and timelines from elsewhere throughout history. Courses that address only portions of world literature, e.g., British literature, exclusively, do not receive credit.

American Literature: A course that covers major authors and themes in American literature from roughly the colonial period to the modern era. Courses that exclusively address a single theme or time period in American literature do not receive credit.

Writing, Grammar, & Composition: A course that addresses composition, in particular the writing of expository, argumentative, descriptive, and narrative essays. An outstanding course reviews or expects mastery of the rules of traditional grammar, but this is not a requirement.

Children's Literature: A course that provides an introduction to major authors, works, and forms of children's literature. The course should include some examination of children's literature as a historical phenomenon. Courses on methods of instruction in children's literature which do not provide a survey of authors and works in that literature do not receive credit.



History and Geography

American history: A course in either early or modern American history (or, preferably, a course in each). Early American history courses focus on U.S. history from the colonial period or the founding of the republic to the Civil War or Reconstruction. Acceptable start dates or periods: 1492-1776. Acceptable end dates or periods: 1865-1900. Modern American history/political science courses focus on U.S. history from the Civil War or the Reconstruction era to the modern period (beginning anywhere from 1865 to 1900 and concluding near the present). Courses that cover a narrower span of U.S. history (e.g., 1945 to the present) do not receive credit unless an additional course is required that completes the time span, or the course focuses on the constitutional underpinnings, the specific branches of government, and state and national features of our democracy. A single course that covers both early and modern American history will only receive credit for early American history.

World history: A course in either ancient or modern world history (or, preferably, a course in each). Ancient world history courses provide general narratives of all major civilizations in ancient times. Modern world history courses provide general narratives of all major civilizations in modern times. NCTQ generally respects the division between ancient and modern world history chosen by the institution. A single course that covers both ancient and modern world history offers credit in ancient world history only.

World Geography: A course that analyzes the world from a geographic perspective emphasizing the unique qualities of world regions; the spatial interactions of people, elements, and regions; and major regional and global problems and prospects. The course should address both physical and cultural geography.

Science

Biology: An introductory course covering biology and matter related to biological processes, including topics such as cellular structures and dynamics, genetics, taxonomy, evolution, plant and animal physiology, developmental biology, and ecology. Cellular and molecular biology should be a more significant feature of a course than evolution and/or ecology (alternatively, an introduction to life sciences, of which a substantial portion is biology content). Courses must emphasize basic themes in biological science, not current issues or methods of instruction.

Chemistry: An introductory course covering topics such as measurement, matter and energy, atomic theory and structure, the periodic table, chemical reactions, stoichiometry, chemical bonding, states of matter, reaction rates and equilibria, acids and bases, nuclear chemistry and biochemistry (alternatively, an introduction to physical science in which chemistry is the primary content presented). Courses must emphasize basic themes in chemistry, not current issues or methods of instruction.

Physics: An introductory course covering motion, energy, conservation laws, gravity, phase changes, thermodynamics, electricity, magnetism, sound, light, and wave dynamics (alternatively, an introduction to physical science in which physics is the primary content presented). Courses in which three to four earth science topics (geology, meteorology, astronomy and oceanography) are included may also be accepted. Courses must emphasize basic themes in physics, not current issues or methods of instruction.



Analyzing graduate & undergraduate coursework: elementary mathematics

Expert analysts evaluated undergraduate and graduate teacher preparation programs' elementary math preparation by examining admissions tests, course descriptions, syllabi, and required primary textbooks in coursework designed for teacher audiences.

Required textbooks were evaluated in each of our topic areas (numbers and operations, algebra, geometry, and data analysis) according to a specific protocol.⁵

Analysts scored syllabi based on coverage in lectures, assignments, and/or assessments of 12 essential subtopic subsumed within those four critical topic areas.⁶ For credit to be awarded, mention of a subtopic is needed only in a course topic outline, a listing of lectures, or a listing of assignments; no textbook coverage of a topic is necessary. However, because of the many subtopics that the evaluation looks for in lectures and assignment, the analysis also considered the sections of the textbook to which the syllabus explicitly connects that instruction.

Textbooks were also reviewed in their entirety to determine the adequacy of their treatment of the 12 essential subtopics. This analysis evaluated textbooks' treatment of these subtopics based on the depth of coverage in these areas and their use of word problems in each topic area.

When syllabi were not available, analysts reviewed course descriptions and required textbooks to determine which topics were likely addressed in a course.

Analysis also considered the total number of course credits devoted to elementary math concepts. Expert mathematicians assert that prep programs would need two to three courses to adequately teach these elementary math topics. Accordingly, for programs

that are themselves selective in their admissions criteria or are housed in selective institutions, six semester credit hours devoted to elementary mathematics are needed to teach essential topics; for less selective programs, eight semester credit hours are needed.⁷

However, for this report, coverage of elementary math is considered sufficient if a program requires at least six credit hours of math content (or at least four credit hours in selective programs) and covers the vast majority of topics through both coursework and textbooks.⁸

Common misconceptions about how analysts evaluated elementary mathematics:

- **Any math content course required of teacher candidates is relevant.** As it would be for any undergraduate or graduate student, it may be advisable for teacher candidates to take a variety of math courses in addition to elementary math courses. However, this analysis evaluated only elementary math content coursework because of the unique value the coursework provides for professional preparation.
- **Elementary math methods coursework that addresses content is interchangeable with elementary math coursework entirely focused on content.** An elementary math methods course should be grounded in an understanding of the relevant content, and references to that content are essential to full development of pedagogy. However, even the most content-infused math methods course is not a substitute for elementary math content coursework.

For alternative route programs, only admissions tests that adequately address elementary mathematics are considered.



Estimating the number of teacher candidates who do not pass the content licensure test nationally

To estimate the number of teacher candidates who do not qualify to teach because they fail to pass the elementary content licensure test, we used several sources of data:

- Title II elementary teacher production data by state, cleaned and averaged across 2014 to 2016.⁹
- Title II racial and ethnic demographics of teacher candidates enrolled in teacher prep programs by state from 2014-2016.¹⁰
- Praxis Elementary Education: Multiple Subjects test pass rates -- based on test takers' best scores in a three-year period. These data include both the pass rate for all test takers on the four parts of the exam, as well as the pass rate disaggregated by race/ethnicity.¹¹

This analysis assumes that the number of completer programs reported to Title II represent aspiring teachers who both completed their teacher preparation coursework *and* passed the licensure test.¹² For the purpose of this analysis, we assumed that people who were in elementary teacher prep programs and did not complete the program failed to do so due to the elementary content licensure test (recognizing that, in reality, course requirements or other licensure tests could have been additional barriers), and assumed that there was no differential attrition prior to this test along racial or ethnic lines.

We used the above data to calculate would be completers, which included both the actual completers and the people who finished their course requirements but did not pass the licensure test. Using the three-year pass rate of 72 percent provided by ETS for the Praxis exam, we calculated how many

people *could have* completed their program if the pass rate reached 100 percent. We assumed that the passing rate from the Praxis Elementary Education: Multiple Subjects test would be consistent with the required elementary content licensing tests for all states, recognizing that this test may be more challenging than that required in states without separate subtests. (For examples of pass rates in states that publicly report them, see Appendix E: First-time pass rates by state.)

For example, Alabama produced an average of 1,447 teacher prep program completers per year, and we assumed that this represents the 72 percent of people who reached the end of the program and were able to pass the test. We set up a proportion to calculate how many people could have entered the workforce given a 100 percent passing rate:

$$\frac{(1447 \text{ completers})}{72\% \text{ passing rate}} = \frac{X \text{ would-be completers}}{100\% \text{ passing rate}}$$

Solving for X gives a value of 2,010 would-be completers.

Next, we assumed that the racial demographics of teacher candidates at the point of enrollment mirror those who *would* complete a program were it not for low passing rates on licensure tests (that is, our would be completers). This approach assumes that there is no differential attrition across racial groups for any other reason (e.g., difficulty passing courses or student teaching, choosing to leave the program, failure rates on licensure tests other than the content exam).¹³



We then applied the differential pass rates by a racial subgroup provided by ETS to estimate how many would be completers from each racial subgroup are likely to pass the licensure test and become a completer. The difference between these calculated completers by racial subgroup and the estimated would be completers by subgroup are summed to estimate both the number of would be teachers by racial subgroup who cannot enter the profession due to this licensure test, and the total number of would be teachers who cannot enter the profession due to the licensure test. Note that the total difference between the calculated total completers using this method and the actual total completers across all states is 446 and averages only nine teacher candidates by state, suggesting that these calculated estimates are likely very close to the true values.

Note that the Praxis pass rate figures are based on the highest score over three years, meaning that some of these completers may have taken their licensure test multiple times over a course of months, if not years, before ultimately passing and becoming licensed.

New Jersey is omitted due to concerns about the quality of data reported to Title II.



Endnotes

- 1 The remaining six undergraduate programs are not included in the elementary mathematics analysis because their math scores are undergoing review.
- 2 For the background of the expert analysts, visit https://www.nctq.org/dmsView/Math_syllabus_reviewers_bios_1_0
- 3 Any standardized test of content mastery will suffice, including a demonstration through any high school- or college-level examination generally accepted as a substitute for college coursework or a suitably rigorous elementary content test (such as those normally used for licensing purposes) with scores provided for all subjects. However, the test must provide a separate cut-score for each subject (e.g., a test that produces a combined score for science and social studies is not considered sufficient).
- 4 Course descriptions are admittedly short and cannot convey full information about the scope of a course, but they can be appropriately used in a very circumspect and circumscribed manner.
- 5 The evaluators assess the topics in each critical area on the basis of coverage, connection, integrity, the sufficiency and significance of examples, and whether the text addresses methods of teaching.
- 6 Whole numbers and place value; fractions and integers; decimals (including ratio, proportion, percent); estimation; constants, variables, expressions; equations; graphs and functions; measurement; basic concepts in plane and solid geometry; polygons and circles; perimeter, area, surface area, volume; probability and data display and analysis.
- 7 A selective program is highly likely to draw almost all potential teachers from the top half of students, as measured by an institutional average SAT or ACT score in the 70th percentile or better or by other measures of selectivity such as Barron's rankings of "most competitive," or by program average SAT or ACT scores at the 60th percentile.
- 8 "Sufficient" math coverage in this report is analogous to a program earning an A or B on the *Teacher Prep Review's* Elementary Mathematics Standard.
- 9 NCTQ staff cleaned these data and averaged the completer data across these three school years. Data for New Jersey were removed from analysis because the production data was anomalous, showing a rate of teacher production inexplicably higher than that of other states. Title II data were retrieved from U.S. Department of Education, Higher Education Act Title II State Report Card System. (2014-2016). Completers, by state, by program type. Retrieved from <https://title2.ed.gov/Public/DataTools/Tables.aspx>.
- 10 U.S. Department of Education, Higher Education Act Title II State Report Card System. (2017). Enrollment by state, by gender and race/ethnicity. Retrieved January 30, 2018, from <https://title2.ed.gov/Public/DataTools/Tables.aspx>. Note that Title II does not report demographics of completers, only enrollees.
- 11 ETS. (2018). Praxis elementary education: Multiple subjects passing rate summary.
- 12 This assumption is reasonable given that "Some institutions require individuals enrolled in teacher education programs to pass the state licensure assessment in order to complete the program; other institutions do not. Consequently, institutions that require students to pass state assessments for program completion will report 100 percent pass rates" (U.S. Department of Education, Office of Postsecondary Education, Preparing and Credentialing the Nation's Teachers: The Secretary's 10th Report on Teacher Quality). 2016. Washington, DC. Retrieved March 21, 2018, from <https://title2.ed.gov/Public/TitleIIReport16.pdf>). Given that the average pass rate reported by traditional teacher preparation programs is 95 percent (compared with the 72 percent pass rate reported by ETS), it is likely that most programs make passing the licensure test a requirement for completing the program. (U.S. Department of Education, 2016.)
- 13 Because Title II data does not double-count someone as both enrolled and a completer in the year they complete their teacher prep program (but only counts them as a completer), people enrolled in one-year programs may not be represented in enrollment data. We assumed that the race/ethnicity of people in one-year programs does not systematically differ from those in longer programs.