

Teacher Qualifications Associated with Success in Algebra I

February 19, 2020

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Who We Are

The Regional Educational Laboratory (REL) Central at Marzano Research serves the applied education research needs of Colorado, Kansas, Missouri, Nebraska, North Dakota, South Dakota, and Wyoming.



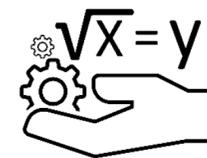
COLLEGE & CAREER READINESS RESEARCH ALLIANCE

An alliance united by goals ensuring that all students graduate from high school prepared to enter the workforce or enroll in postsecondary degree or certification programs.

Areas of Focus



Postsecondary
Success Assessment



Algebra I
Readiness Support

Identifying Factors Associated with Student Success in
Algebra I



Meet Our Presenters

- Joshua Stewart, REL Central
- Neal Finkelstein, REL West
- E. Wyatt Gordon, ETS
- Facilitator: Mike Siebersma, REL Central

Goals

- To convey the research on the importance of student success in Algebra I.
- To review the findings from the REL Central report—*Associations Between the Qualifications of Middle School Algebra I Teachers and Student Math Achievement*—and discuss potential policy and practice implications.⁵
- To present constructs and principles assessed in math certification exams.

Why This Study?

Neal Finkelstein, REL West
Joshua Stewart, REL Central

College Bound in Middle School and High School? How Math Course Sequences Matter

Neal Finkelstein
REL West at WestEd
San Francisco, CA

REL Central Webinar
February 19, 2020



Math Placement Policy: Mastering Algebra

Opening a Gateway to College Access

Algebra at the Right Time

By Jason Snipes & Neal Finkelstein, REL West, WestEd

Mastering algebra is a fundamental step toward gaining access to and preparing for the higher-level math courses that high school students must complete in order to be prepared for college. Three recent REL West studies shed important light on policies and practices that affect student success in algebra and preparation for higher-level math courses.⁴

What is the course objective for the senior year of high school?

Mapping the Pathway for Four Years of Math

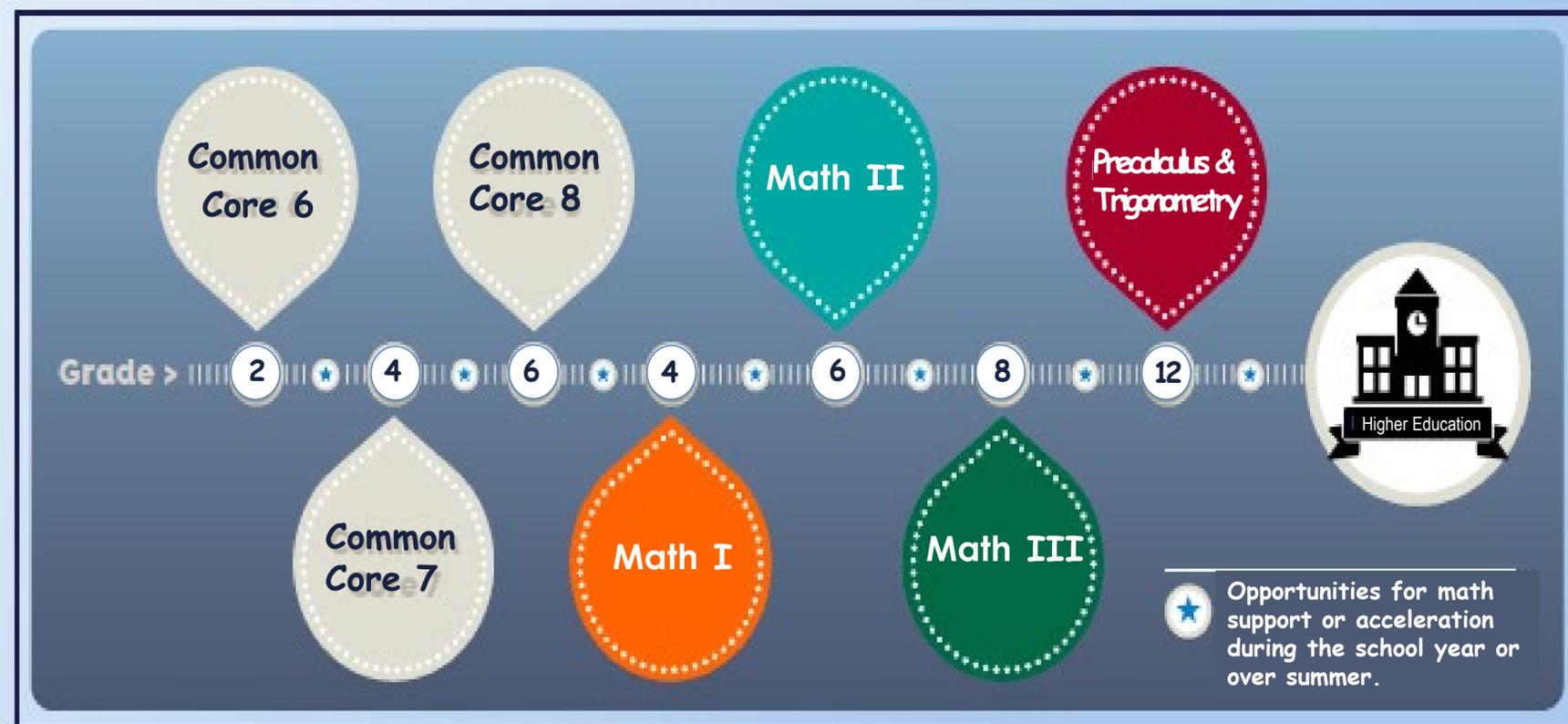


Four Years of Math

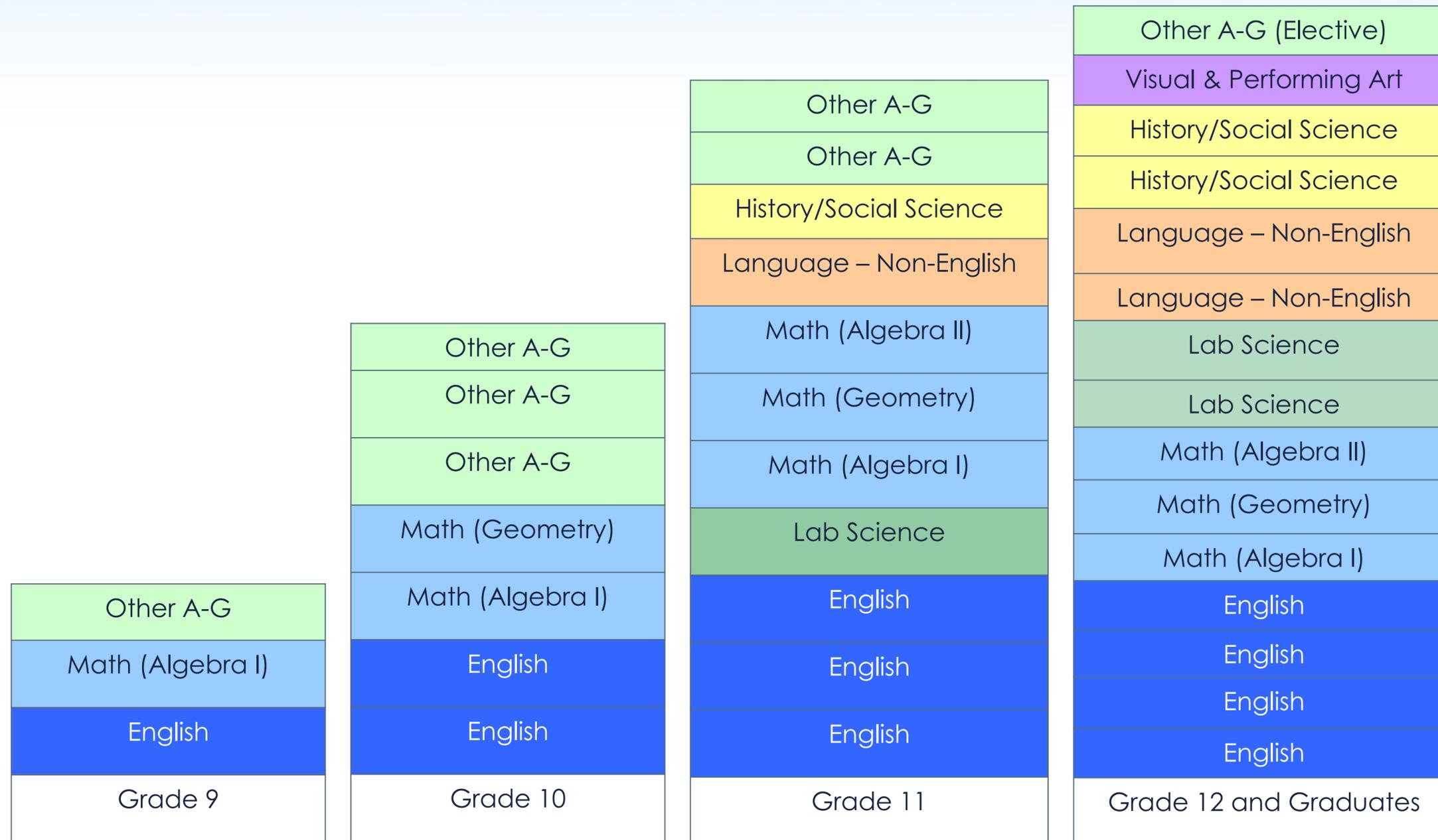
Use the sample standard high school math pathway below to map out a course of study that matches your student's goals.

Sample Pathway

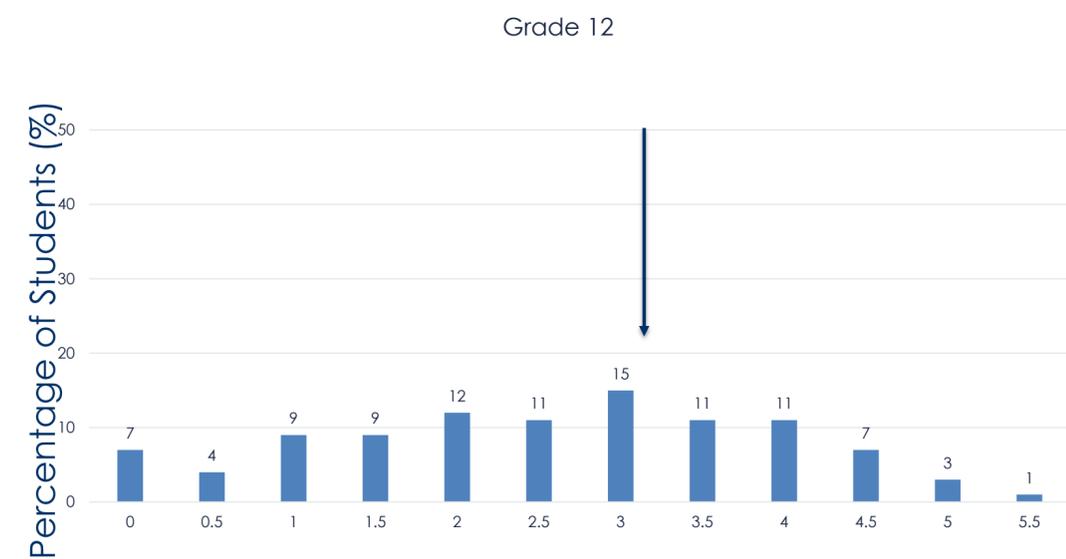
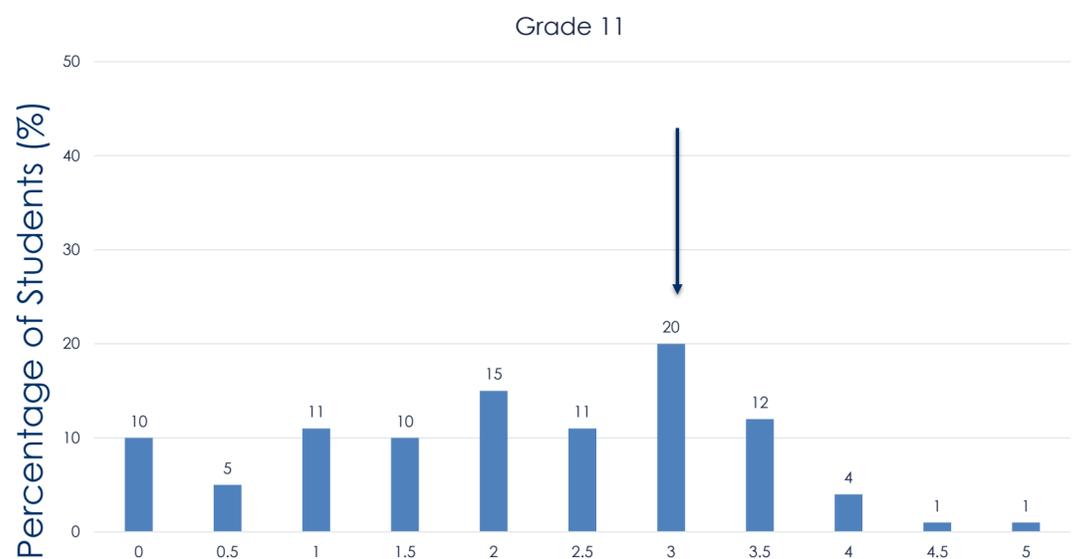
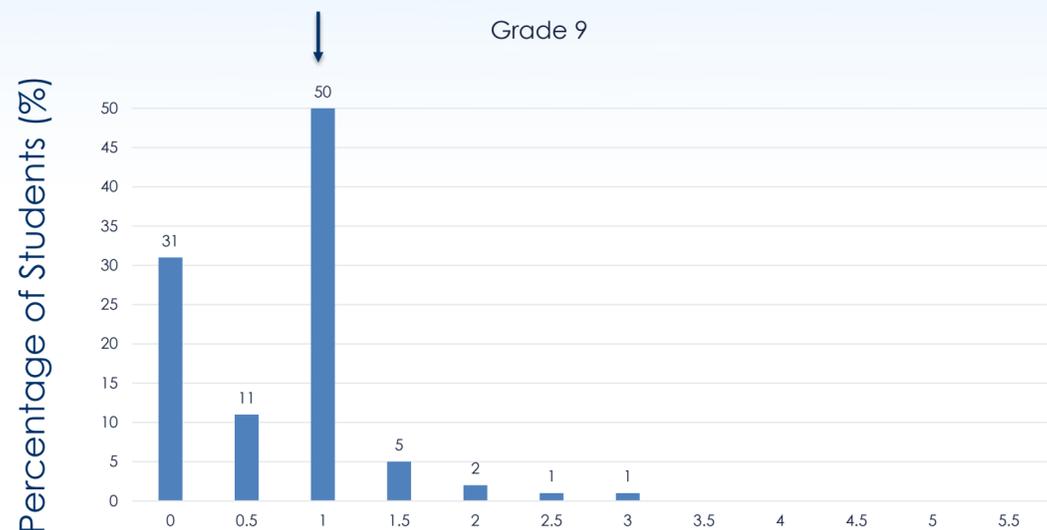
If your students took the standard math course in each grade beginning in middle school, this would be the pathway to ensure that they take four years of high school math. Acceleration of support to stay on course may be available before, during, or after the school day, or over the summer.³



High School Course Requirements for College Access



Cumulative Units Completed in Math, by Grade Level



Cumulative C-units

Note: Vertical arrow represents the required number of units to meet benchmarks at each grade level.

Findings from Related Work

Finding: Math performance in grade 7 is predictive of high school math course-taking.

Students who perform well in grade 7 math are likely to take more-advanced courses in high school compared to those who struggle with middle school math.¹

Findings from Earlier Work

Finding: Many students repeat algebra, but few repeaters achieve proficiency on their second attempt.

Roughly one-third of students in our study sample repeated Algebra I at some point between grades 7 and 12 — repetition that yielded discouraging results.¹

Repeating and Passing Rates Among Students Within the Sample

| | Percentage |
|---|------------|
| Algebra I pass rate in grade 8 among students who first took Algebra I in grade 8 | 62.69 |
| Algebra I pass rate in grade 9 among students who first took Algebra I in grade 9 | 37.60 |
| Proportion of the sample who took Algebra I in grades 8 and 9 | 22.72 |
| Proportion of the sample who took Algebra I in grades 9 and 10 | 13.49 |
| Proportion of the sample who took Algebra I in grades 8, 9, and 10 | 4.43 |
| Proportion of the sample who ever repeated Algebra I | 33.57 |
| Proportion of the sample who ever repeated Geometry | 15.96 |
| Proportion of the sample who ever repeated Algebra II | 10.17 |
| Proportion of the sample who ever repeated Algebra I, Geometry, or Algebra II | 49.70 |
| Proportion of the sample who ever passed Algebra II | 44.24 |
| Proportion of the sample who did not take a math course in grade 12 | 30.18 |

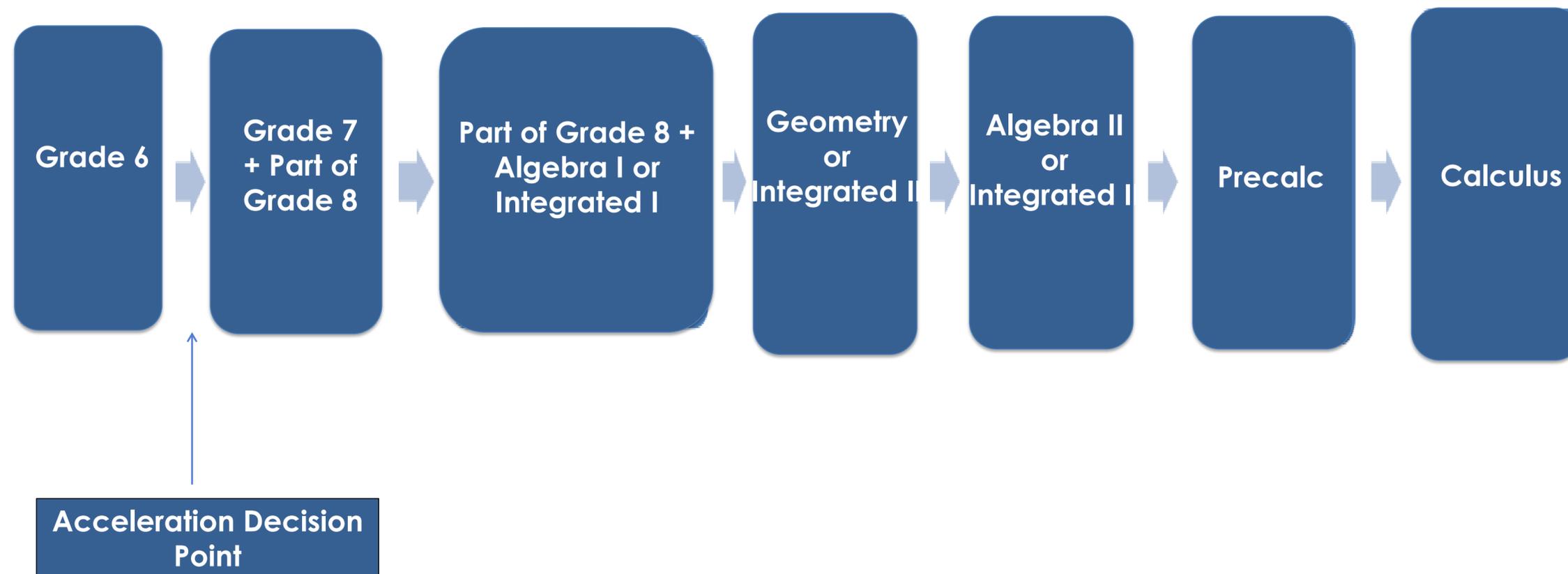
Considerations for Standards-Aligned Implementation

Decisions to accelerate students while in middle school should be carefully considered.

Solid evidence of mastery of prerequisite standards should be required. Diagnostic testing can help identify strengths and challenges in particular areas of math content.¹

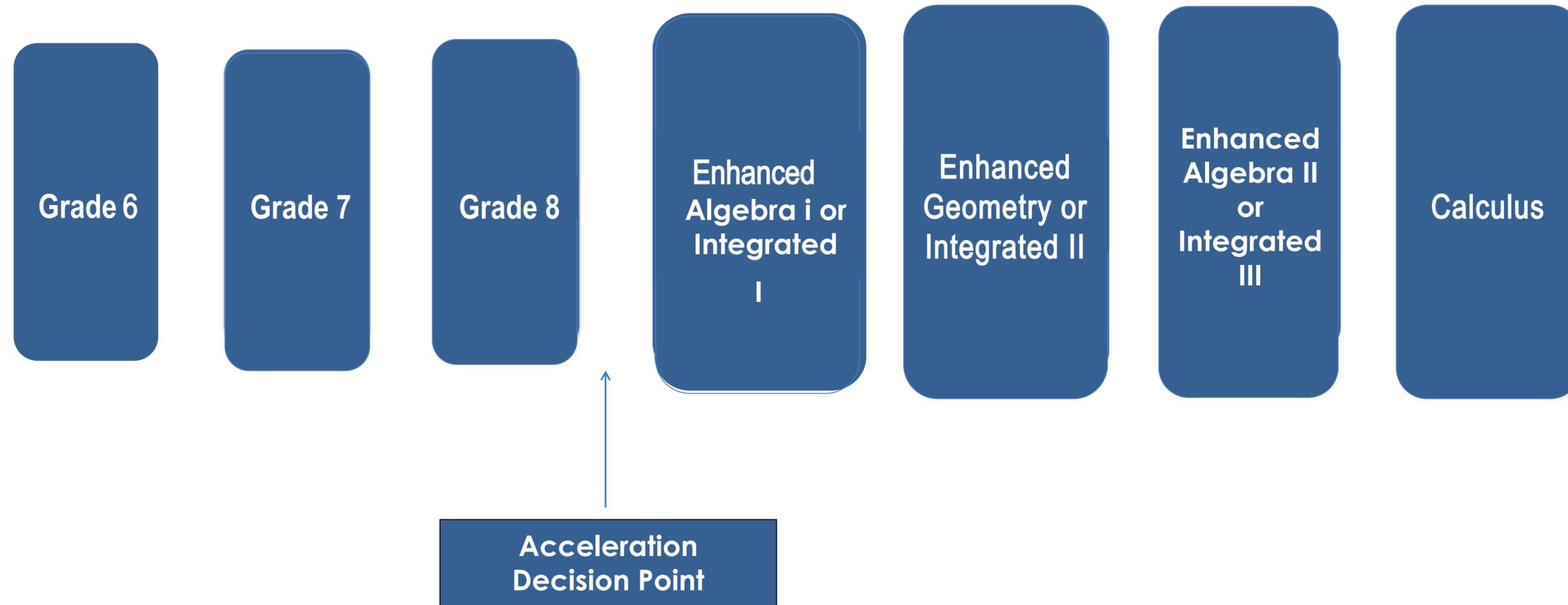
Two Ways to Calculus

1. Compacting in Middle School



Two Ways to Calculus

2. Enhanced Pathway in High School



Study Overview and Findings

Joshua Stewart, REL Central

The REL Central Study

- Gaps in research on algebra taught in middle school.
- 429 teachers in 276 schools teaching algebra in middle school across Missouri.
- Variation in qualifications among teachers.
- Opportunity to use evidence in setting certification rules for teachers teaching algebra in middle school.⁵

Poll: Algebra I in Your Context

- Does your state or district offer Algebra I at the middle school level?
 - Yes
 - No
 - Don't Know

Poll: Algebra I in Your Context

- Which of the following does your state or district prioritize when placing Algebra I teachers?
 - Advanced degree
 - Performance on math certification exam
 - College major
 - High school certification
 - Middle school certification
 - Other

Associations Between Middle School Algebra I Teacher Qualifications and Student Achievement

Joshua Stewart

Christopher Rhoads

Marina Serdiouk

Douglas Van Dine

Trudy Cherasaro

Mary Klute⁵

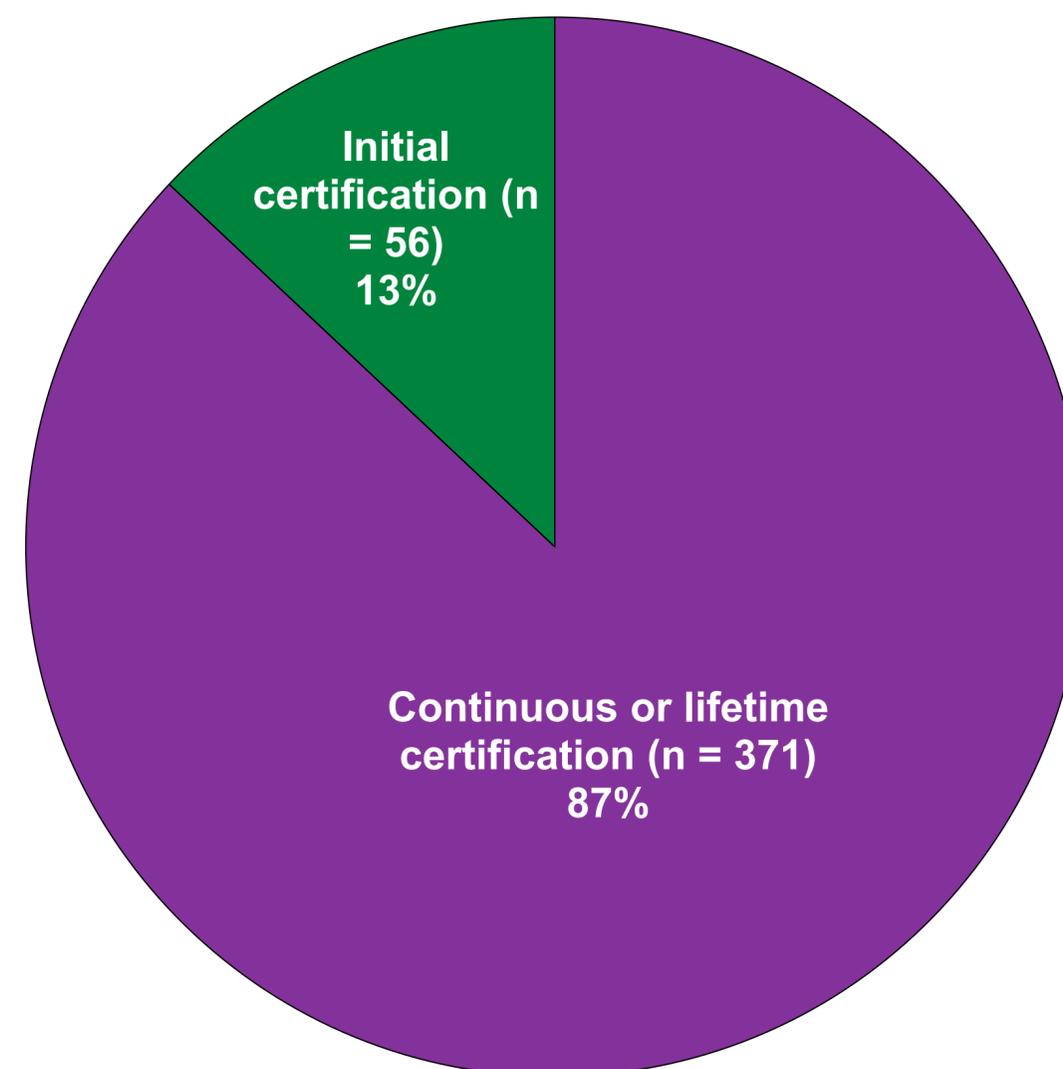
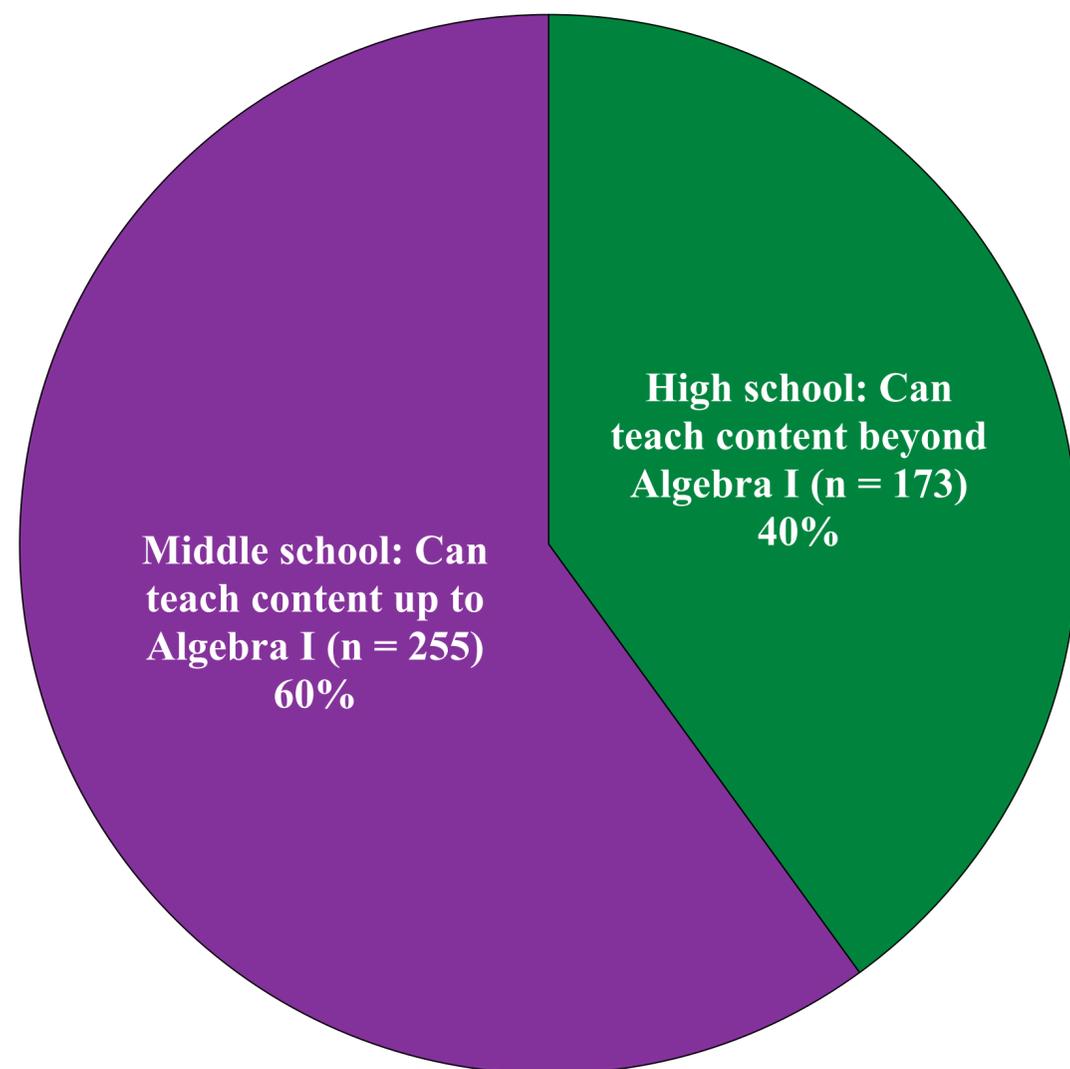
Research Questions

- What are the qualifications (education background, certification, and scores on certification exams) of middle school Algebra I teachers in Missouri?
- Which teacher qualifications are most highly associated with student performance on the Algebra I Missouri Assessment Program (MAP) End-of-Course (EOC) exam?
- How do specific teacher qualifications relate to performance on the Algebra I MAP EOC exam for under-represented student subgroups and disadvantaged student subgroups?

Descriptive Findings

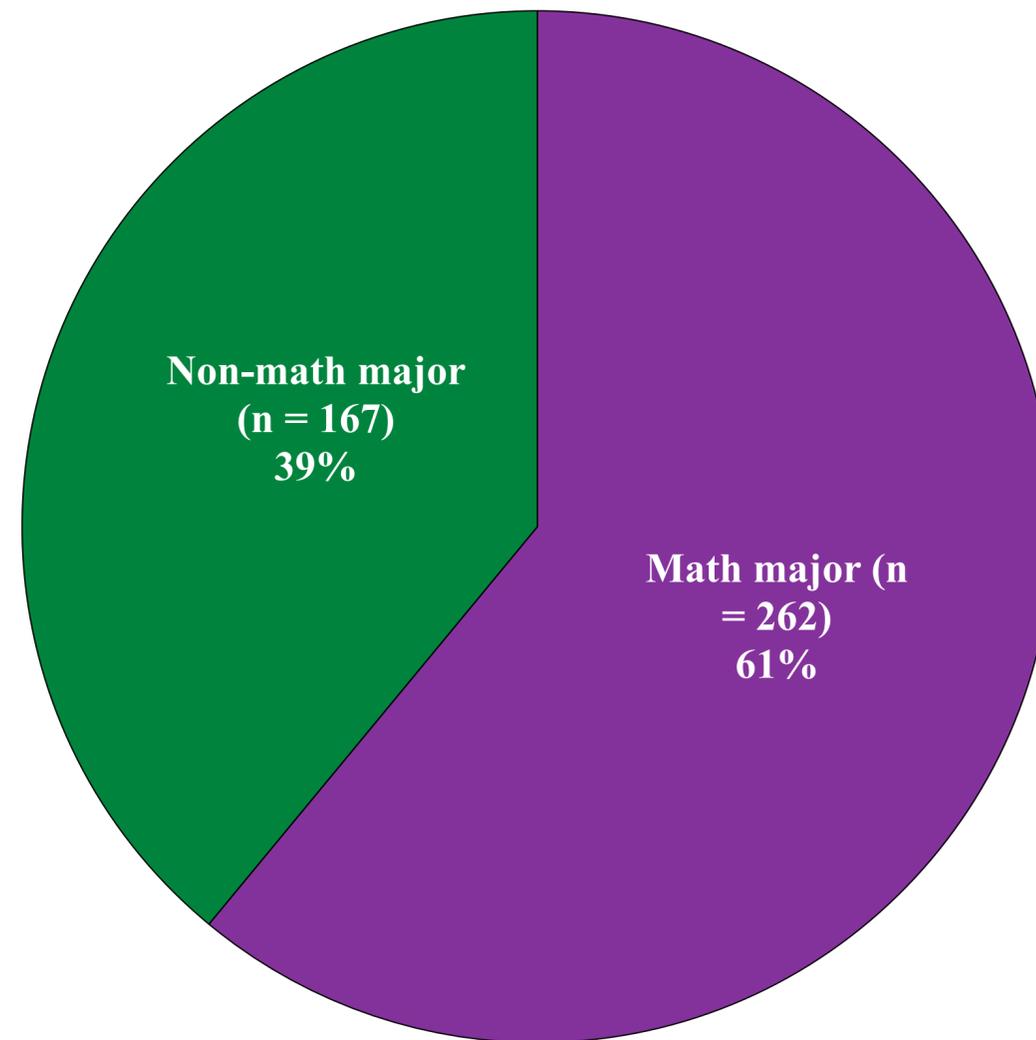
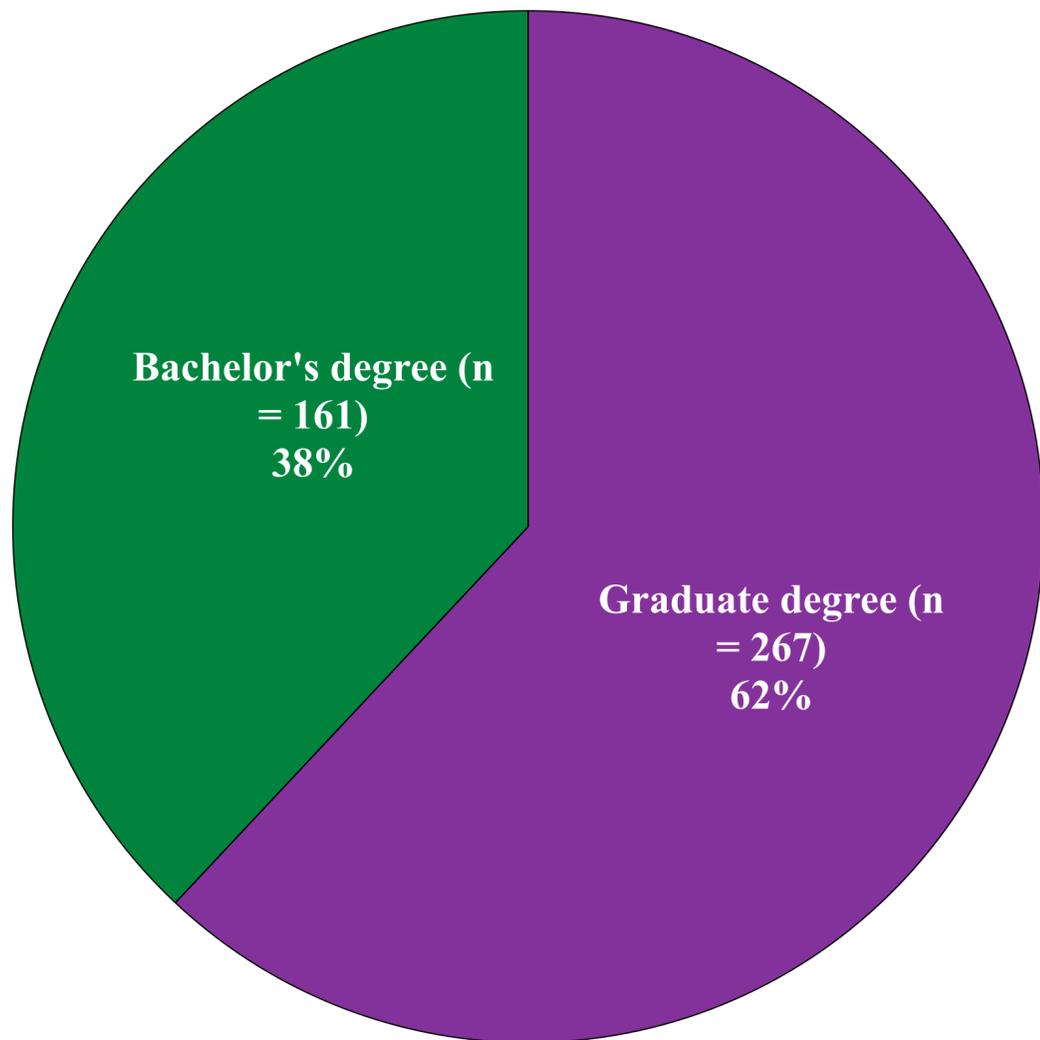
Descriptive Findings

Most middle school Algebra I teachers in Missouri were certified to teach content up to Algebra I, and most held a continuous or lifetime certification



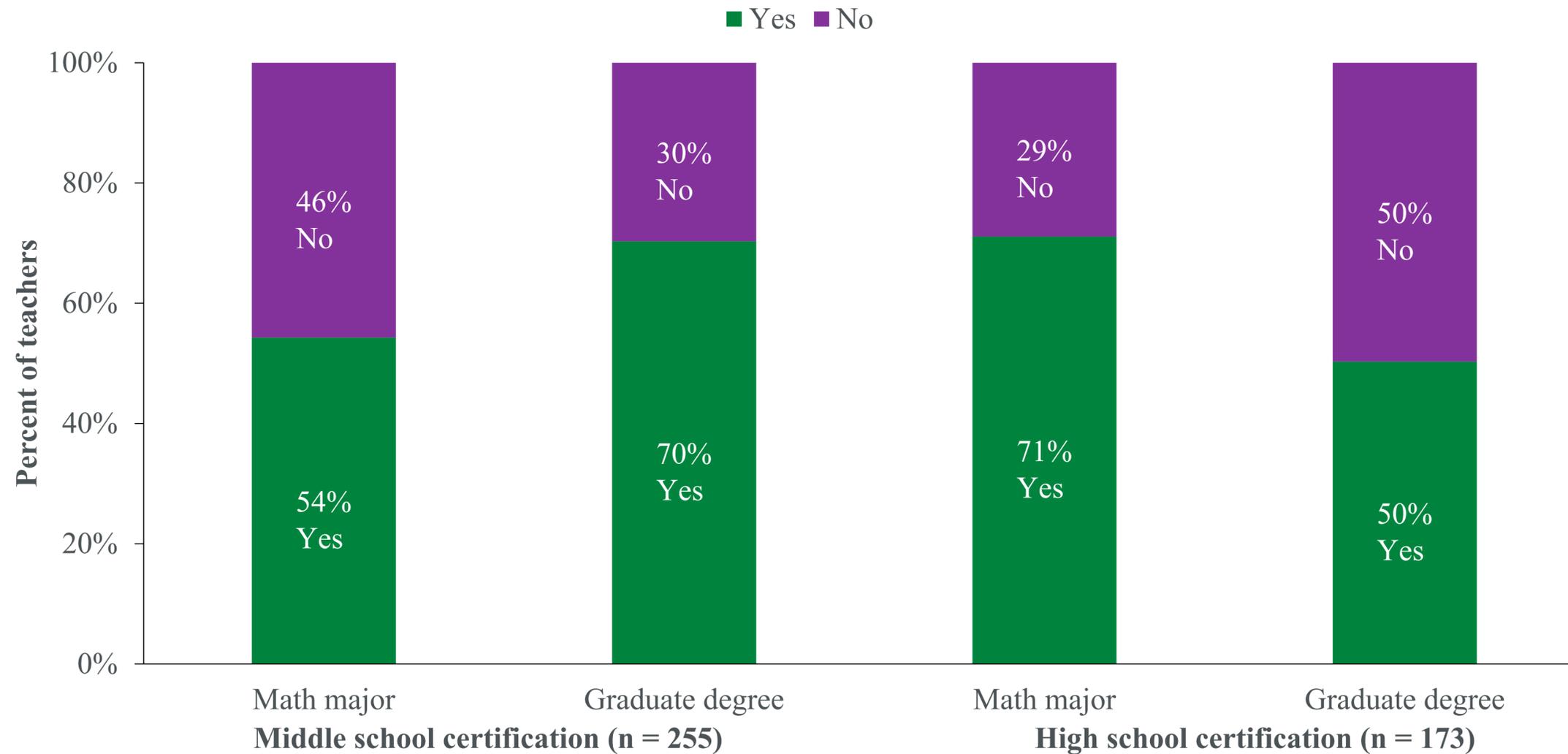
Descriptive Findings cont. ...

Most middle school Algebra I teachers in Missouri held graduate degrees, and most majored in math



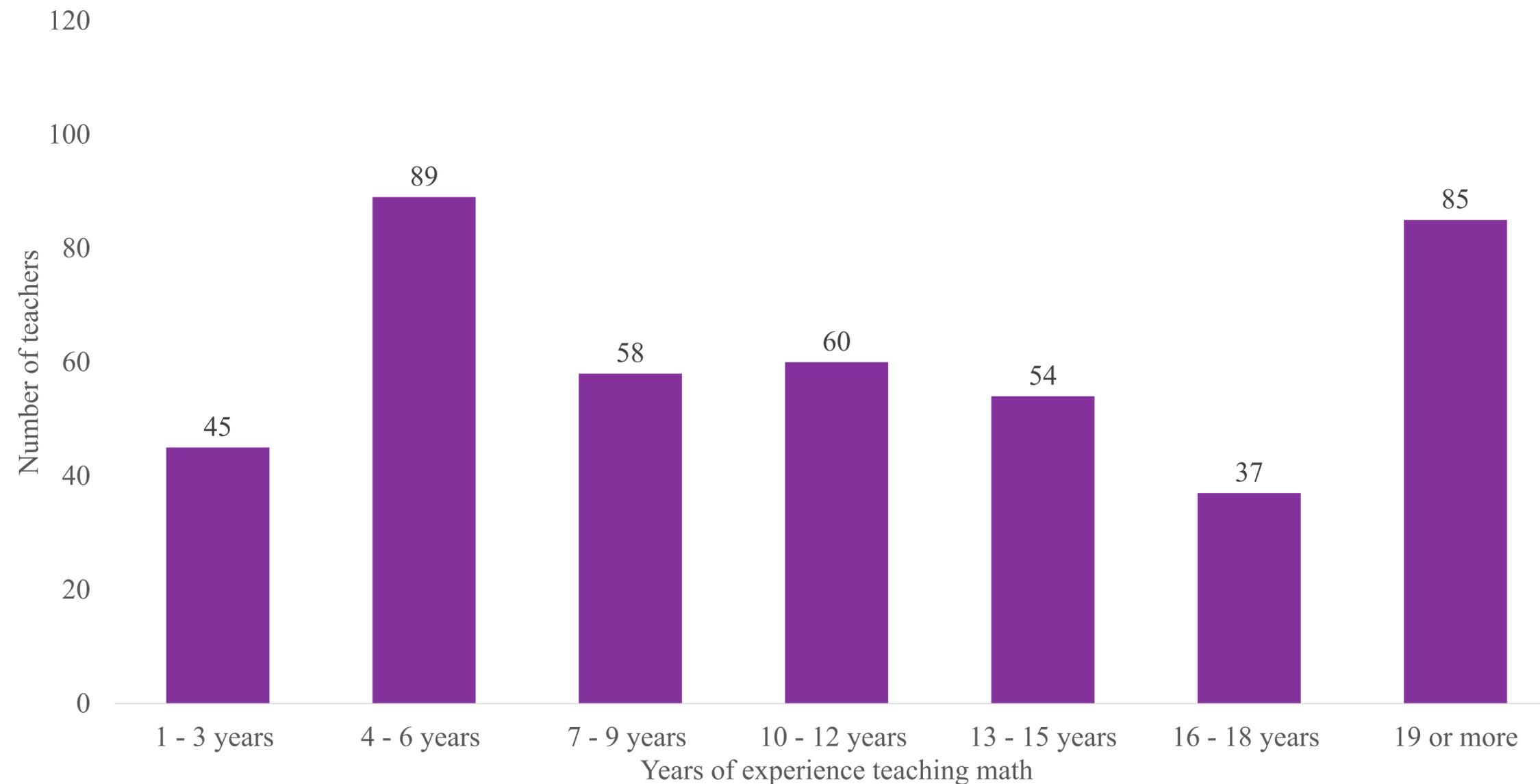
Descriptive Findings cont. ...

A smaller proportion of teachers with middle school certifications majored in math, but a larger proportion held graduate degrees compared to teachers with high school certifications



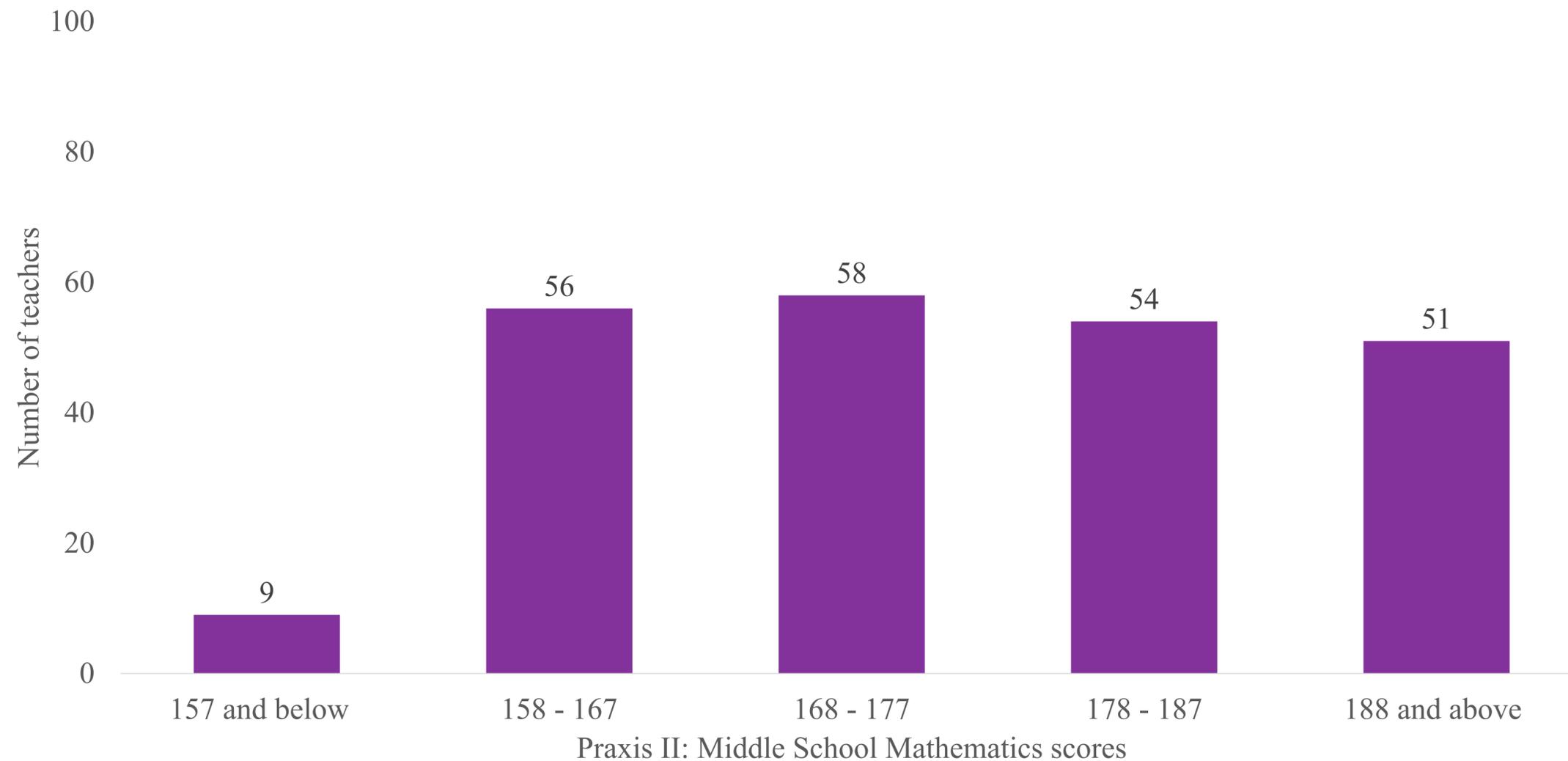
Descriptive Findings cont. ...

Four to six and nineteen or more years of math teaching experience were the two largest categories of years of teaching experience for middle school Algebra I teachers



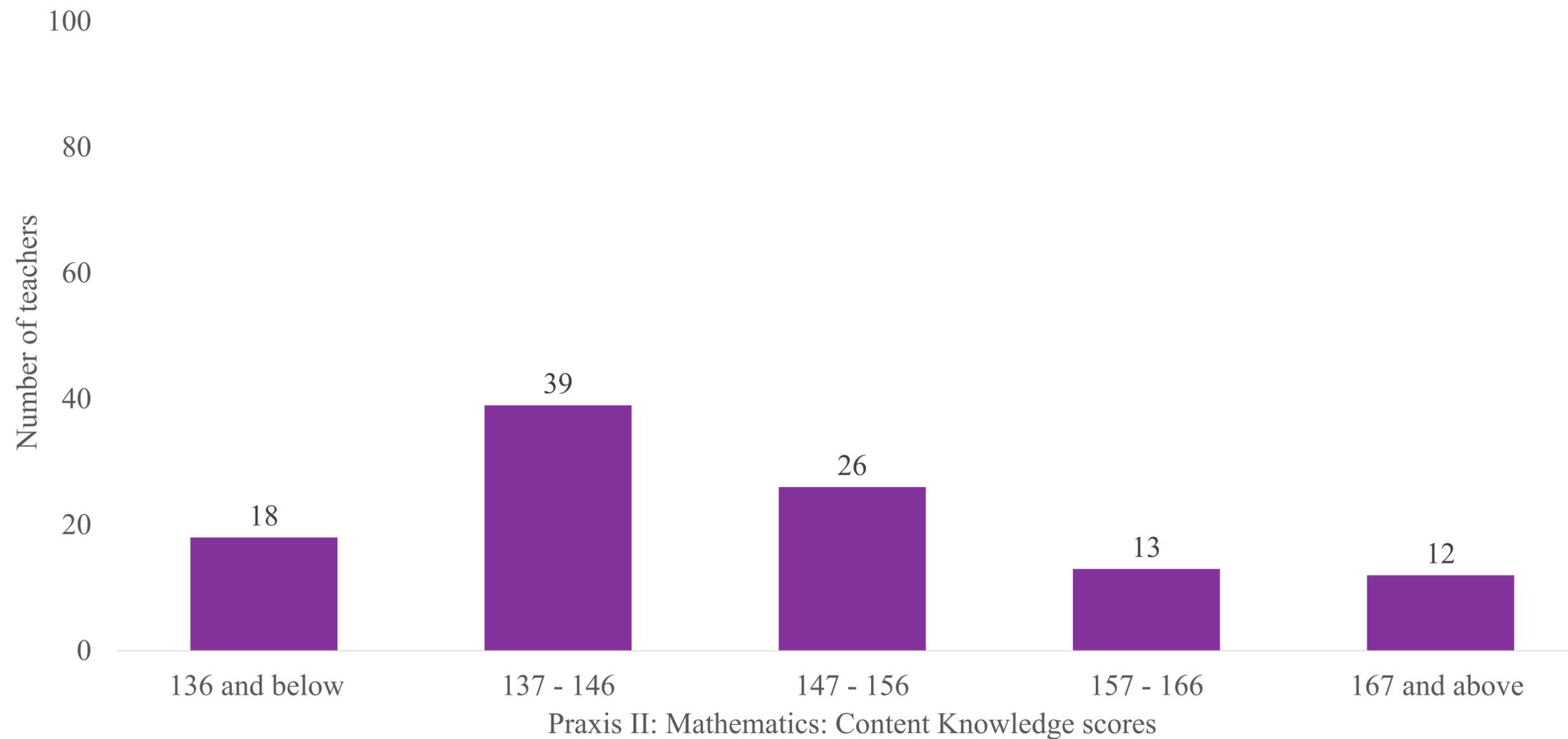
Descriptive Findings cont. ...

Most teachers who took the Praxis II: Middle School Mathematics exam earned a passing score (158 or above)



Descriptive Findings Cont

Most teachers who took the Praxis II: Mathematics: Content Knowledge exam earned a passing score



Regression Findings

Qualifications Associated with Algebra I Achievement

- Teacher performance on math certification exams and years of experience teaching math were the qualifications most strongly associated with middle school students' performance in Algebra I.
- Teacher performance on math certification exams and years of math teaching experience were also strongly associated with achievement in Algebra I for students in under-represented subgroups and disadvantaged subgroups.

A number of middle school teacher qualification variables were strongly associated with student achievement

| Teacher qualification | Overall | Subgroups |
|---|---------|---|
| Certification exams | | |
| Praxis II Middle School Mathematics | Yes | Students receiving special education services, students eligible for the federal school lunch program |
| Praxis II Mathematics | Yes | |
| Praxis II Mathematics: Content Knowledge | | Black students |
| Missouri Educator Gateway Assessment Middle School Education: Mathematics | | Hispanic students |
| Background | | |
| Years of experience teaching math | Yes | Hispanic students, students eligible for the federal school lunch program |
| Education specialist degree | | Black students, Hispanic students |
| Certifications | | |
| Math certification type = continuous | | Students eligible for the federal school lunch program |

Implications of the Study Findings

Certification Exams

- Results suggest that gateway assessments are potentially useful measures of teachers' ability to successfully guide students through Algebra I in the middle grades.

Teaching Experience

- Findings suggest that schools and districts should make targeted choices regarding the experience of teachers selected to teach Algebra I to middle school students, specifically in schools with higher populations of under-represented and disadvantaged students.

Teacher Certification Level

- Study results did not align with prior research that found positive links between teacher certification levels and student achievement in math.

Educational Attainment

- Educational attainment was not associated with Algebra I achievement for students overall or for those from under-represented or disadvantaged groups.

Examination of Content and Constructs Assessed in a Math Teacher Certification Exam

E. Wyatt Gordon, ETS

The *Praxis*® Tests: Advancing Education Through Teacher Quality

*E. Wyatt Gordon, Ed.D.,
Executive Director of Professional Educator Programs*

ETS

February 19, 2020



ETS: A Leader in Assessment of Educators (1 of 2)

- Since its founding, ETS has been a leader in licensure and certification assessments for educators (including teachers and school leaders)
- *Praxis*[®] assessments launched in 1993
- *Praxis* assessments are:
 - Administered on computer at approximately 600 test centers in the United States and Canada
 - Used for licensure by 39 U.S. states and territories and for certification by agency users
- To meet the needs of *Praxis* assessment clients, the tests are adapted to fit different kinds of licenses and to align with different standards

ETS: A Leader in Assessment of Educators (2 of 2)

- For a licensure system, *Praxis*[®] assessments support the implementation of quality standards:
 - Requiring teachers to demonstrate they have critical knowledge and skills before taking on new jobs or new roles in education
 - Establishing for teachers, for teacher educators and for professional development providers, the standards they are aiming to meet — evaluated in the same way for every educator

Overview of *Praxis*® Assessments

Praxis assessments include:

Tests of Academic Skills

Praxis **Core Academic Skills for Educators** (Core) tests measure academic skills essential for all candidates preparing to be teachers. *Praxis* Core has three separate tests:

Reading: focused on understanding, analyzing and evaluating different kinds of informational text across a range of subject areas

Writing: assessing language usage, revision, argumentative writing and writing of informational and explanatory text (with two essay responses)

Mathematics: focused on key concepts in mathematics and the ability to solve problems and reason in a quantitative context

Licensure and Certification Tests

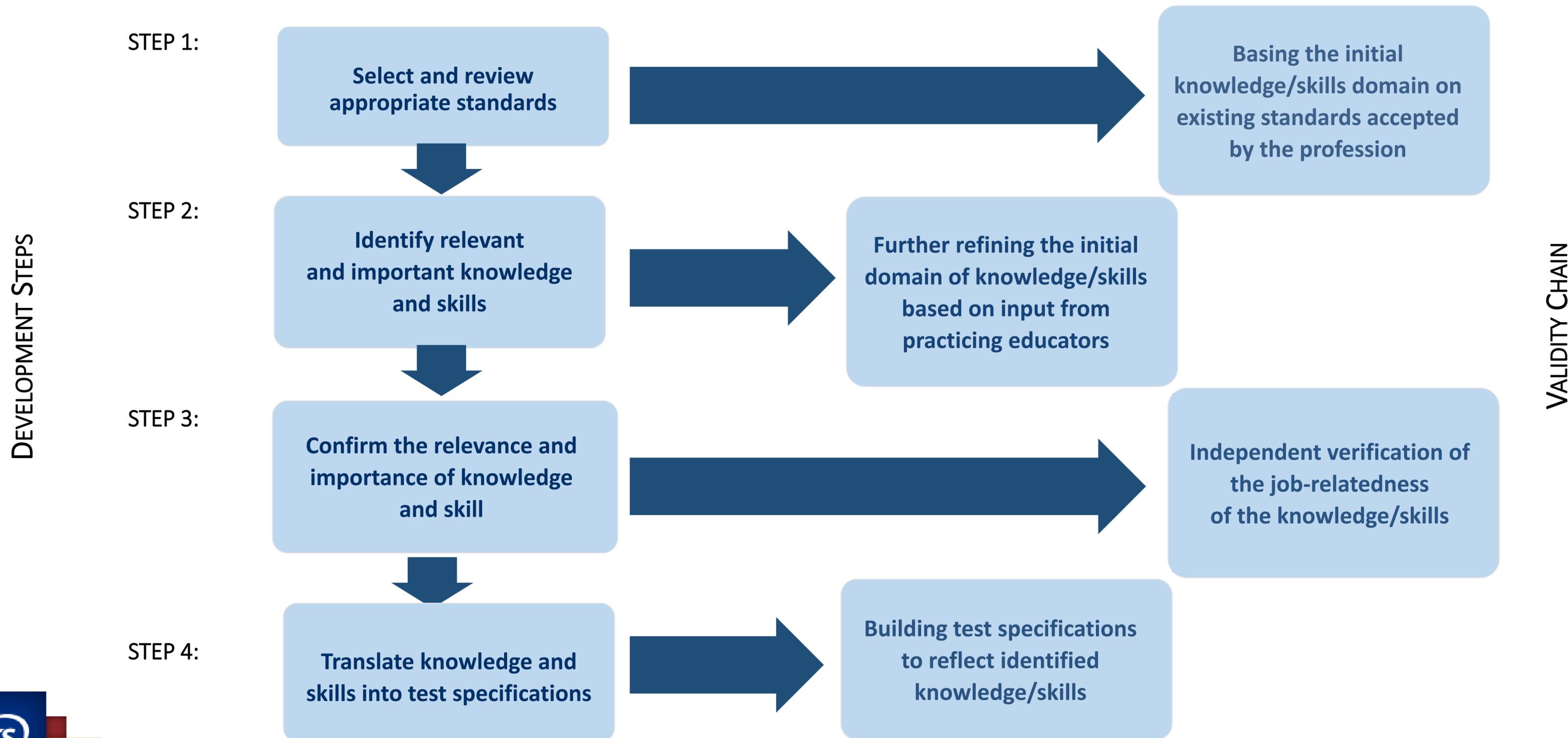
90+ *Praxis* assessments of teacher candidates' knowledge and skills, including:

- Content knowledge in the subjects they will teach
- Understanding of pedagogy (e.g., knowledge of teaching principles and practices and how students learn)
- Assessments of specialized educational roles, such as School Leader, Reading Specialist, and Teacher of the Deaf and Hard of Hearing

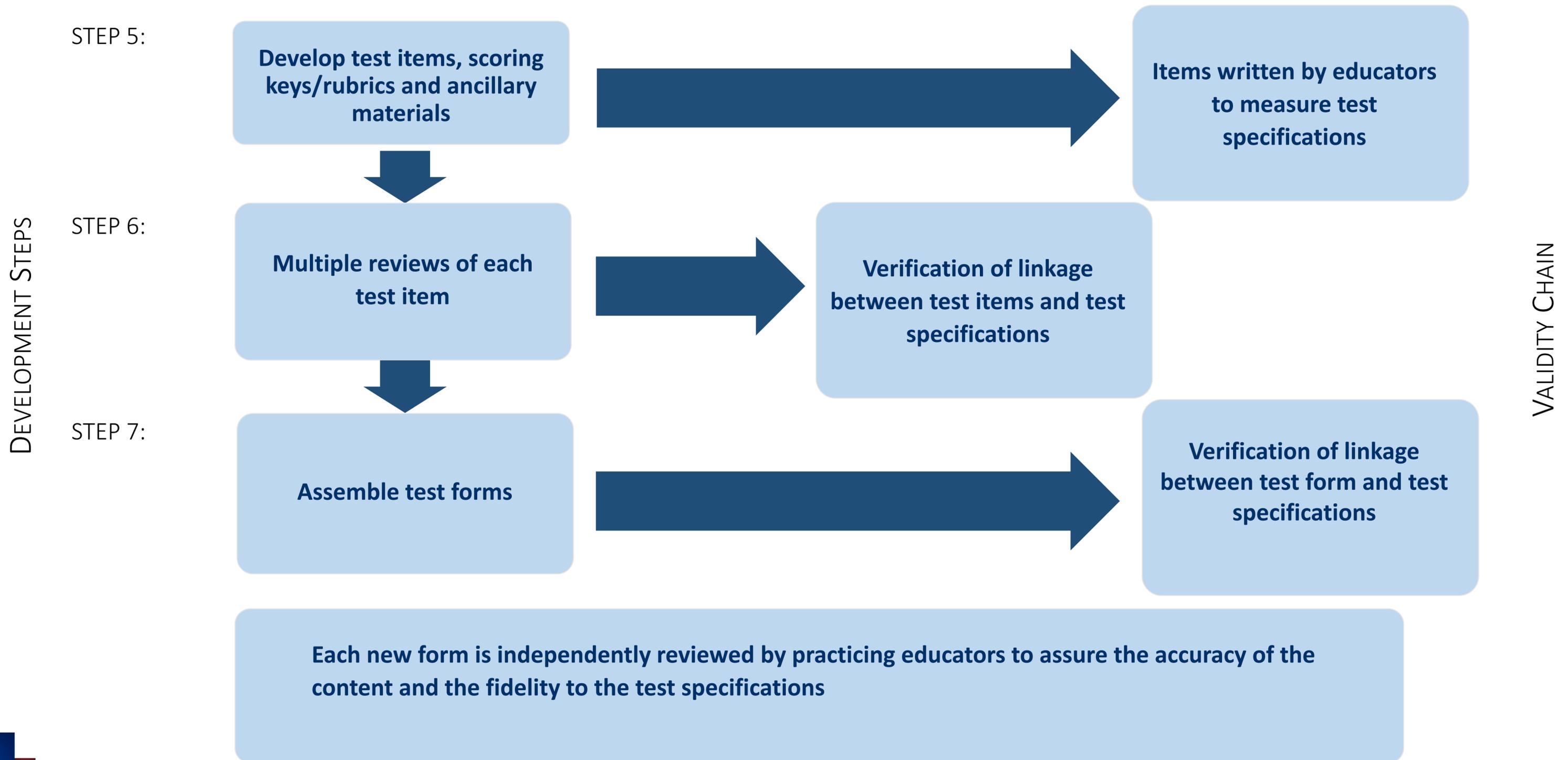
The Nature and Purpose of the *Praxis*® Assessments

- Measure subject-specific content knowledge for new teachers
- Developed by ETS in collaboration with practicing teachers and teacher educators
- Each state adopts the most appropriate tests for teacher licensure/certification titles
- Each state or credentialing agency sets the passing score for each test

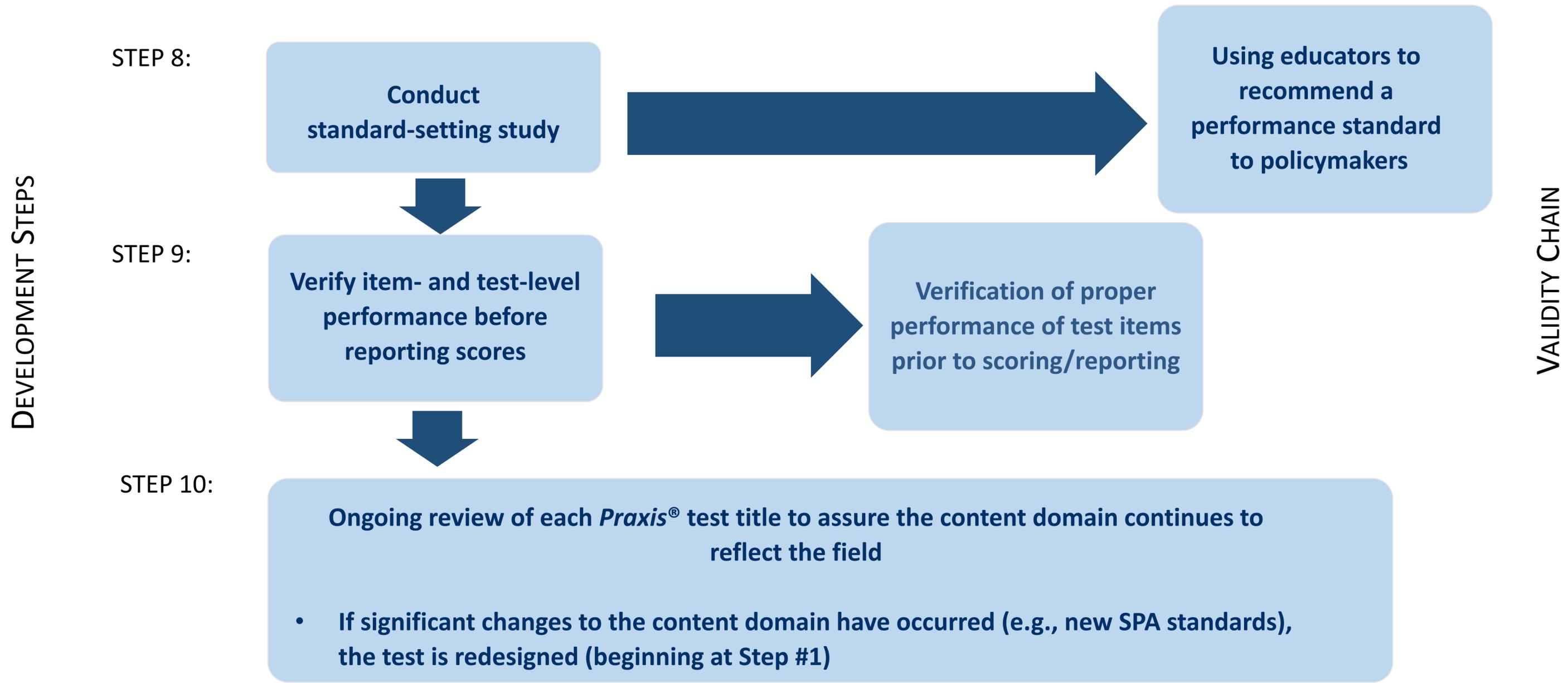
Development Steps and Validity Chain (1 of 3)



Development Steps and Validity Chain (2 of 3)



Development Steps and Validity Chain (3 of 3)



Middle School Mathematics Test Structure and Design

- Test specifications
 - Based on national and state standards for grades 6–8
 - Some concepts are not emphasized (e.g., statistics, similarity transformations)
 - Some concepts from high school mathematics are included (e.g., radicals, rational expressions, nonlinear equations and inequalities (absolute value, quadratic, exponential), function notation, domain and range, geometric constructions)
- 2 hours test with 55 questions:
 - 35 multiple-choice questions with four options, 20 questions in other formats

Mathematics: Content Knowledge Test Structure and Design

- Test specifications
 - Based on national and state standards for grades 9–12
 - Some concepts are not included (e.g., vectors)
 - Some concepts from middle school mathematics are included (e.g., ratios, proportions and percents)
 - Some concepts from calculus and discrete mathematics are included
- 2.5 hours test with 60 questions:
 - About 40 multiple-choice questions with four options
 - About 20 questions in other formats

Overall Questions and Answers

- Submit your ideas and questions through the chat box.
 - What might be some policy or practice implications of the findings in the report?
 - How do the findings affirm or challenge your prior understanding of the topic?
 - What other questions do you have for the presenters?

References

1. Finkelstein, N., Fong, A., Tiffany-Morales, J., Shields, P., & Huang, M. (2012). *College bound in middle school & high school? How math course sequences matter*. Center for the Future of Teaching and Learning at WestEd. <https://eric.ed.gov/?id=ED538053>
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3. Regional Educational Laboratory West. (n.d.). *Four years of math* [Flyer]. U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance. <https://www.wested.org/wp-content/uploads/2017/03/resource-Four-Years-Of-Math-Traditional-Stats.pdf>
4. Snipes, J., & Finkelstein, N. (2015). *Opening a gateway to college access: Algebra at the right time* (Research brief). Regional Education Laboratory West. <https://eric.ed.gov/?id=ED559739>
5. Stewart, J., Rhoads, C., Serdiouk M., Van Dine, D., Cherasaro, T., & Klute, M. (2019). [*Associations between the qualifications of middle school Algebra I teachers and student math achievement*](#) (REL 2020–005). U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Central. <https://ies.ed.gov/ncee/edlabs/projects/project.asp?projectID=4568>

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