

The background of the slide is a composite image. The top left shows a line of yellow school buses with "SCHOOL BUS" written on their fronts. The bottom left shows a classroom with blue walls, decorated with colorful balloons and framed pictures. Several desks and chairs are arranged in the room.

Standards and Assessment A Focus on Science

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Agenda

- Kentucky Academic Standards for Science
- State and Federal Statutory Requirements for Assessments
- Kentucky Summative Assessment (KSA) and Alternate KSA for Science
- Science Performance
- Efforts to Support Student Growth
- Graves County: K-12 Science Experience
- Science: Transition to SAT
- Future of Assessments

KBE Actions to Advance Science Education

- Foster Strategic Conversations by Asking Deep Questions
- Raise Awareness
- Advocate for Funding
- Highlight the Importance of Opportunity and Access Through Policy
- Promote Evidenced-Based Practices
- Support Collaboration

Kentucky Academic Standards (KAS) for Science

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Kentucky Academic Standards (KAS) for Science

Review and Implementation Timeline

October 2020	<i>KAS for Science review began</i>
October 2022	<i>The commissioner presents feedback and recommended revisions to the Interim Joint Committee on Education</i>
December 2022	<i>KBE approved revised KAS for Science</i>
March 2023	<i>March leadership roll-out</i>
July 2023	<i>KAS for Science adopted into law</i>
August 2023	<i>Revised standards are implemented in all schools.</i>

Guiding Principles

Determined by Review Committee (RC)
and Advisory Panels (APs)

- Standards should be limited in number and be written in clear and precise language.
- K–12 alignment guides evidence-based, developmentally appropriate learning that progresses logically across grade levels.
- Using observations and evidence, students make sense of the natural world.
- Students need sustained opportunities to work with and develop the underlying ideas and to appreciate those ideas' interconnections over a period of years rather than weeks or months.
- Teachers at all grade levels have ongoing access to high quality science professional learning and resources to help students make sense of the natural world.

KAS for Science “At a Glance”

- *KAS* places equal importance on the mastery of important science concepts and disciplinary practices.
- Students engage with the disciplinary tools of science - science and engineering practices and crosscutting concepts.
- Students use the tools to acquire, refine and extend knowledge and understanding of core science ideas within the three disciplinary lenses of physical science, life science, and earth and space science.
- Students engage in the engineering design process as they solve problems or analyze solutions by applying science core ideas.

“Kentucky Academic Standards for Science”

Performance Expectation (PE): The performance students demonstrate to show mastery

K-PS2-1. Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.

Clarification Statement: Examples of pushes or pulls could include a string attached to an object being pulled, swings on a playground, a person pushing an object, a person stopping a rolling ball, and two objects colliding and pushing on each other.

Assessment Boundary: Assessment is limited to different relative strengths or different directions, but not both at the same time. Assessment does not include non-contact pushes or pulls such as those produced by magnets.

Clarification Statement: Provide examples or additional information

Assessment Boundary: States the limit of assessment for large-scale assessment

Foundation Boxes: Provides further information about each dimension that was combined to develop the PE.

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concepts
<p>Planning and Carrying Out Investigations With guidance, plan and conduct an investigation in collaboration with peers.</p>	<p>PS2.A: Forces and Motion Pushes and pulls can have different strengths and directions. Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it.</p> <p>PS2.B: Types of Interactions When objects touch or collide, they push on one another and can change motion.</p> <p>PS3.C: Relationship Between Energy and Forces A bigger push or pull makes things speed up or slow down more quickly.</p>	<p>Cause and Effect Simple tests can be designed to gather evidence to support or refute student ideas about causes.</p>

State and Federal Statutory Requirements for Assessments

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Federal and State Assessment Requirements (1)

Every Student Succeeds Act (ESSA)	Kentucky Revised Statute (KRS) 158.6453	Current Assessments
<p>General mathematics and reading/language arts for grades 3-8 and at least once in grades 9-12</p> <p>ESSA requires that each State that seeks Title I, Part A funds implement a statewide set of annual academic assessments in mathematics, reading or language arts, and science.</p>	<p>1. A criterion-referenced test each in mathematics and reading in grades three (3) through eight (8) and one (1) time within the high school grades that is valid and reliable for an individual student and that measures the depth and breadth of Kentucky's academic content standards;</p>	<p>Reading and Mathematics Kentucky Summative Assessment (KSA) based on Kentucky Academic Standards (KAS) Grades 3-8, 10</p>
<p>General science administered at least once in each of these grade spans: 3-5, 6-9, and 10-12</p> <p>ESSA requires that each State that seeks Title I, Part A funds implement a statewide set of annual academic assessments in mathematics, reading or language arts, and science.</p>	<p>2. A criterion-referenced test each in science and social studies that is valid and reliable for an individual student as necessary to measure the depth and breadth of Kentucky's academic content standards to be administered one (1) time within the elementary, middle and high school grades, respectively;</p> <p>3. An on-demand assessment of student writing to be administered one (1) time within the elementary, middle, and high school grades, respectively; and</p> <p>4. An editing and mechanics test relating to writing, using multiple choice and constructed response items, to be administered one (1) time within the elementary, middle and high school grades, respectively.</p>	<p>Science, Social Studies and Writing Kentucky Summative Assessment (KSA) based on Kentucky Academic Standards (KAS) Science: Grades 4, 7, 11 Social Studies and Writing (on-demand and editing and mechanics): Grades 5, 8, 11</p>
<p>Alternate assessment aligned with alternate academic achievement standards in mathematics, reading/language arts, and science for students with the most significant cognitive disabilities for the grades described above</p>	<p>The Kentucky Board of Education shall add any other component necessary to comply with the Every Student Succeeds Act of 2015, Pub. L. No. 114-95, or its successor, as determined by the United States Department of Education.</p>	<p>Alternate Assessments Kentucky Summative Assessment (Alternate KSA) based on Kentucky Academic Standards (KAS) Grades 3-8, 10, 11</p>

Federal and State Assessment Requirements (2)

Every Student Succeeds Act (ESSA)	Kentucky Revised Statute (KRS) 158.6453	Current Assessments
ESSA does not require a college admissions exam.	A college admissions examination to assess English, reading, mathematics, and science in the spring of grade eleven (11)	College Admissions Exam (The SAT) Grade 11
English language proficiency (ELP) assessments for all English learners (ELs) grades K-12 Alternate ELP assessments (AELPA) for ELs with the most significant cognitive disabilities in grades K-12	The Kentucky Board of Education shall add any other component necessary to comply with <u>the Every</u> Student Succeeds Act of 2015, Pub. L. No. 114-95, or its successor, as determined by the United States Department of Education.	English Language Proficiency WIDA Screener for Kindergarten ACCESS Placement Test ACCESS for ELLs® Alternate ACCESS for ELLs® Grades K-12

Kentucky Summative Assessment (KSA) and Alternate KSA for Science

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Science: Kentucky Summative Assessment (KSA) and Alternate KSA

KSA and Alternate KSA

Standards	Kentucky Academic Standards
Test	Administered at grades 4, 7, and 11
Focus	Disciplinary Core Ideas (DCI), Science & Engineering Practices (SEP), Crosscutting Concepts (CCC)
Skills Measured	Content knowledge, application, inquiry-based problem solving
Used in Accountability	Yes-State Assessment Results for Science to meet federal requirements
Statutory Requirements	State and Federal testing requirements

Crosscutting Concepts
Practices
Core Ideas



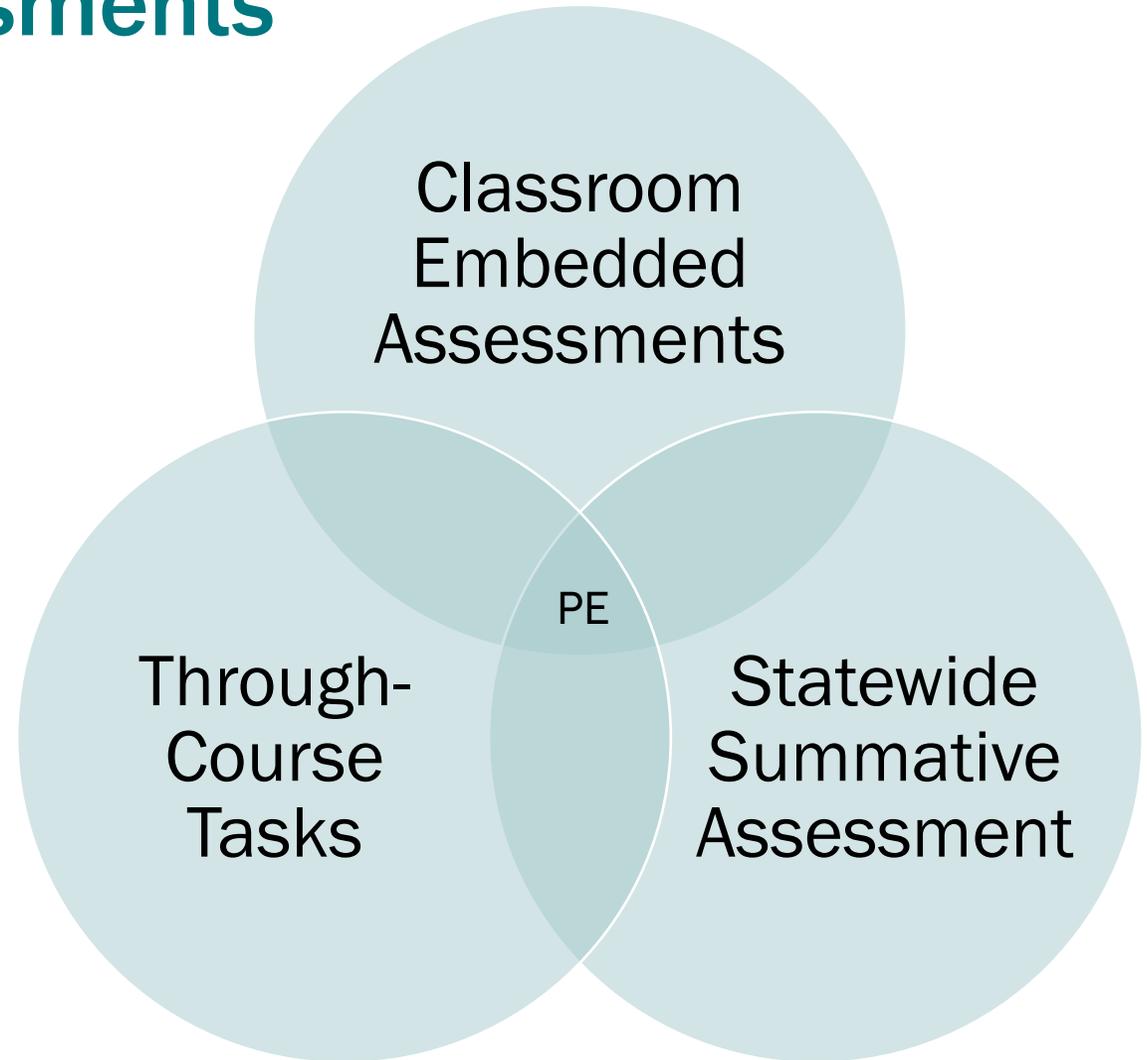
Kentucky Summative Assessment (KSA) for Science

Review and Implementation Timeline

- **Historical Context**
 - 2015: Kentucky Academic Standards (KAS) for Science aligned to Next Generation Science Standards (NGSS);
 - 2018-2019: Initial assessments launched, and standard setting conducted in grades 4 and 7;
 - 2020: Field test in high school;
 - 2022: Performance levels standards validation conducted;
 - 2023: New KAS Science Standards adopted;
 - 2025: Redesign introduces shorter clusters and standalone items;
 - 2025: Performance levels standards setting conducted.

A SYSTEM of Science Assessments

- Built on teaching and learning in classroom
- Each component adds and elicits new evidence of students' learning
- Defensible evidence of the student attainment of the standard—as the standard was intended—is generated
- Supports different purposes/users/uses



KSA and AKSA Overview

- KSA is a criterion-referenced assessment, created to measure Kentucky standards.
- Kentucky Teachers are involved in all processes related to the development of the KSA and AKSA:
 - Development, revision, and review of content standards,
 - Assessment blueprint alignment,
 - Development of assessment items, and
 - Standard setting to set cut scores that define performance levels.

Phenomenon/Cluster - Based Assessment

- A phenomenon is an observable event or process in the natural world (e.g., why does ice float, why do volcanoes erupt, why does a metal bridge expand in summer?).
- Instead of asking direct factual questions, the KSA present a real-world phenomenon and require students to:
 - Analyze the situation
 - Apply scientific principles
 - Construct explanations or solve problems based on evidence
- Phenomenon/item cluster approach—test is no longer a collection of individual items.
- Dimensionality—an intentional effort was made to create items that attempt to measure attainment of a SEP or CCC as well as the DCI.

PDF of released item cluster example is available in the KBE Portal.

Scientific and Engineering Practices

- Asking questions and defining problems
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations and designing solutions
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

Crosscutting Concepts

- Patterns
- Cause and effect
- Scale, proportion, and quantity
- Systems and system models
- Energy and matter: Flows, cycles, and conservation
- Structure and function
- Stability and change

Disciplinary Core Ideas

- Physical Science
- Life Science
- Earth and Space Science
- Engineering Design

Science Assessment Blueprint Percentages

Grade 4	
Domain	Target %
Physical Science	30-45
Life Science	20-35
Earth and Space Science	25-40
Engineering Design (ETS1) for grades K-2 and 3-5	5-15
Grade 7	
Domain	Target %
Physical Science	35-50
Life Science	15-30
Earth and Space Science	15-30
Engineering Design (ETS1) for grades 3-5 and MS	5-15
High School	
Domain	Target %
Physical Science	20-35
Life Science	30-45
Earth and Space Science	20-35
Engineering Design (ETS1) for MS and HS	5-15

Science Assessment Refresh Goals (2025)

- Provide entry points for all students
- Maintain the alignment of the *KAS for Science* and assessment blueprint
- Reduce reading load
- Provide broader content coverage

Science Performance

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NAEP Science 2015

Grade 4

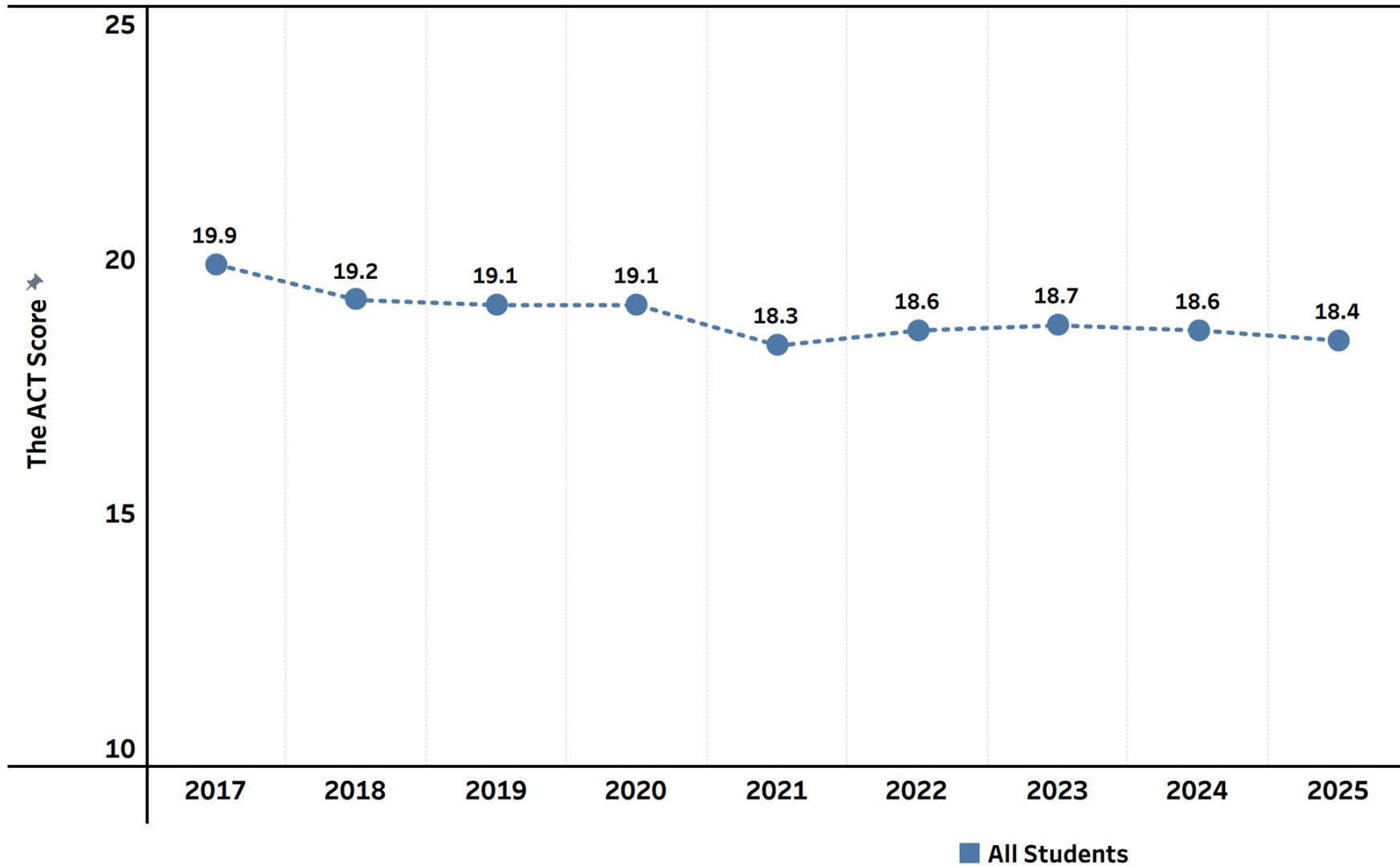
- In 2015, the average science score for fourth-grade students in Kentucky was 160. This was higher than that for the nation's public schools (153).
- The average score for students in Kentucky in 2015 (160) was not significantly different from that in 2009 (161).
- In 2015, the percentage of students in Kentucky who performed at or above *Proficient* was 44 percent. This was greater than that for the nation's public schools (37 percent).

Grade 8

- In 2015, the average science score for eighth-grade students in Kentucky was 157. This was higher than that for the nation's public schools (153).
- The average score for students in Kentucky in 2015 (157) was not significantly different from that in 2009 (156) and was not significantly different from that in 2011 (157).
- In 2015, the percentage of students in Kentucky who performed at or above *Proficient* was 35 percent. This was not significantly different from that for the nation's public schools (33 percent).

The Average ACT Score - Science

All Students



Note that the state requires a college admissions exam for the 11th grade.

Percentage of Students Performing at Proficient/Distinguished Levels Science

Subject	Year	Elementary	Middle	High
Science	2018	31% ¹	26% ¹	30% ²
	2019	32% ¹	26% ¹	30% ²
	2020	-----	No State Assessment	-----
	2021	-----	Limited Participation ³	-----
	2022	29%	22%	14%
	2023	35%	23%	10%
	2024	34%	22%	6%
	2025 ^{1,4}	37%	29%	21%

¹ Assessed with new Kentucky Academic Standards for Science.

² Reported Performance Level Percentages are for the ACT and Alternate K-PREP assessment.

³ Assessed Kentucky Academic Standards to meet federal testing requirements with limited participation and no accountability.

⁴ Science scores reported for 2025 are based on revised standards, a redesigned assessment, and newly established performance levels.

As these changes may affect comparability with prior years, science trends should be interpreted with care.

Efforts to Support Student Growth

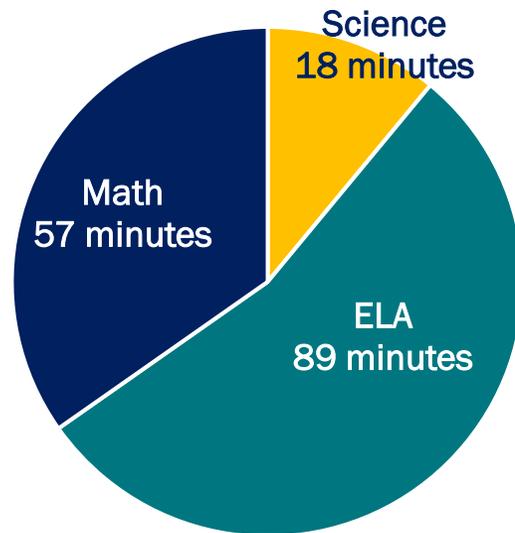
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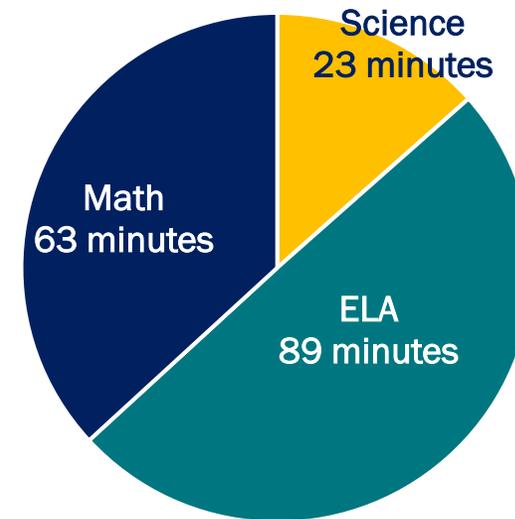
Prioritizing instructional time for science remains a challenge nationwide

Teachers in **grades K-3** reported daily instructional minutes by content area



■ Science ■ ELA ■ Math

Teachers in **grades 3-5** reported daily instructional minutes by content area



■ Science ■ ELA ■ Math

Banilower, E., et al. (2018). *Report of the 2018 National Survey of Science and Mathematics Education*. Horizon Research, Inc.

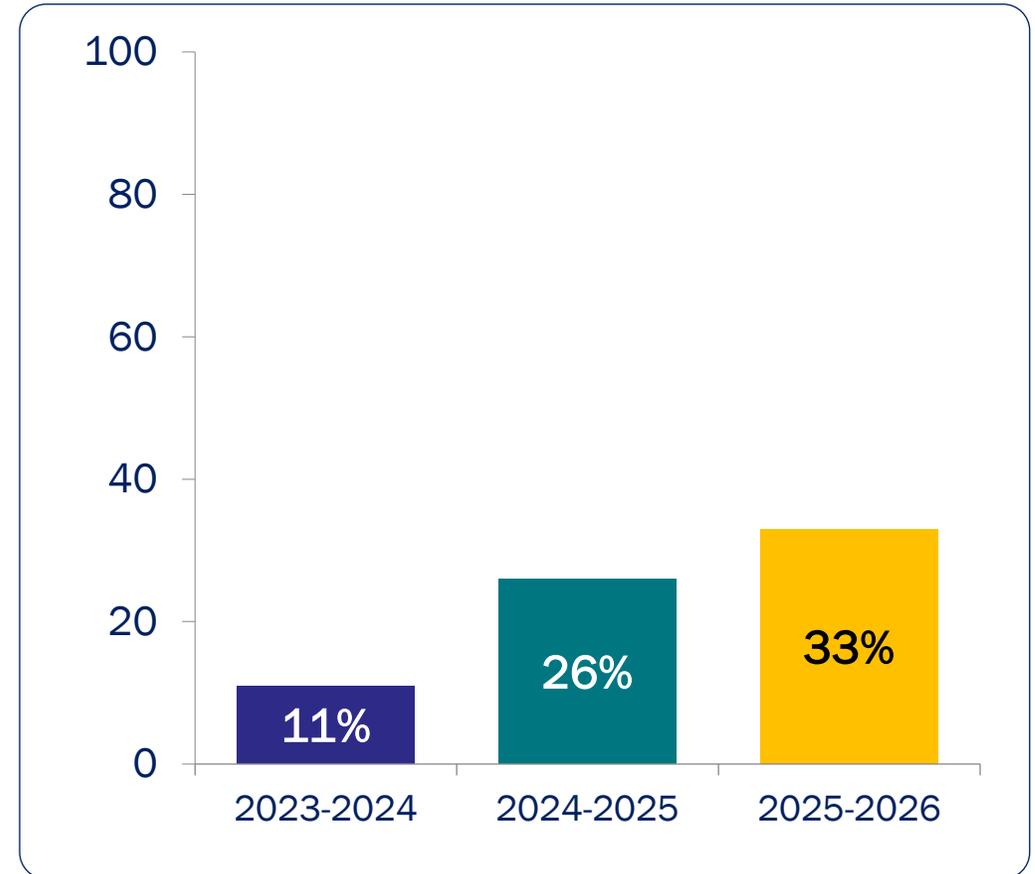
Banilower, Eric R. (2019). *Understanding the Big Picture for Science Teacher Education: The 2018 NSSME+*. Vol. 30, no. 3. pp. 201-208. Journal of Science Teacher Education.

State Implementation of Science HQIRs

Percentage of teachers reporting weekly use of fully-aligned science curricula

State	2025
Texas	3%
Oregon	3%
Mississippi	3%
Tennessee	3%
Virginia	3%
Maryland	7%
Ohio	8%
New Mexico	10%
Massachusetts	17%
Arkansas	18%
New York	20%
Kentucky	23%
Nebraska	24%
Rhode Island	32%
Louisiana	41%
Delaware	50%

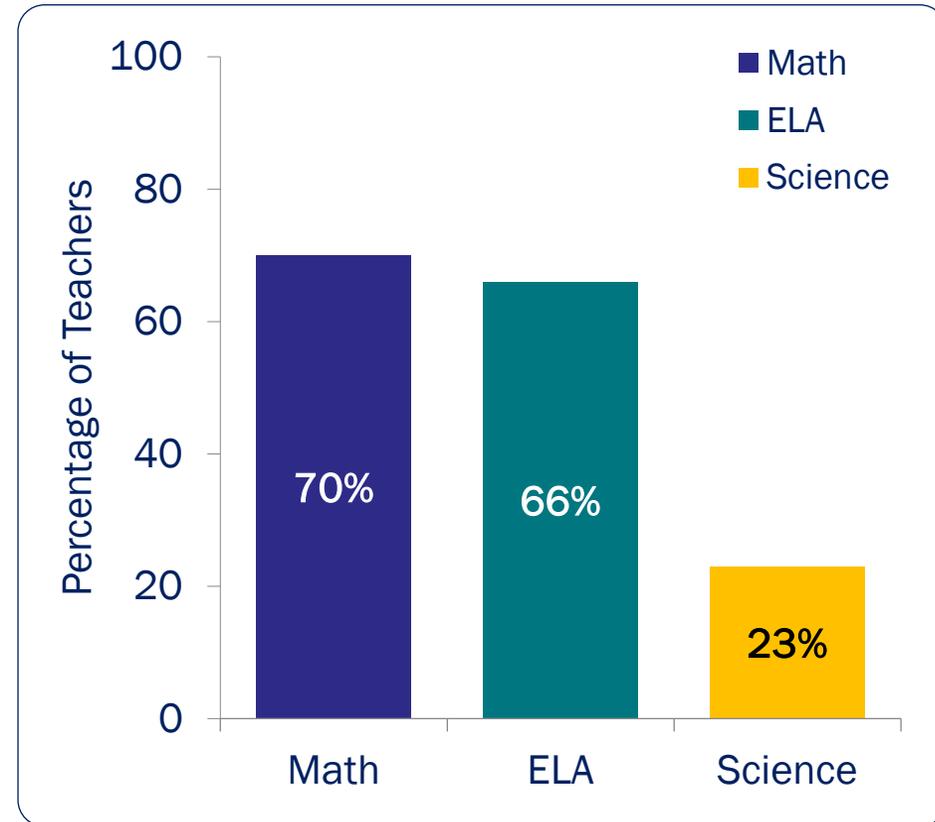
Percentage of KY schools that have adopted a science HQIR (2023-2026)



Kentucky Regular Use of HQIRs by Content Area

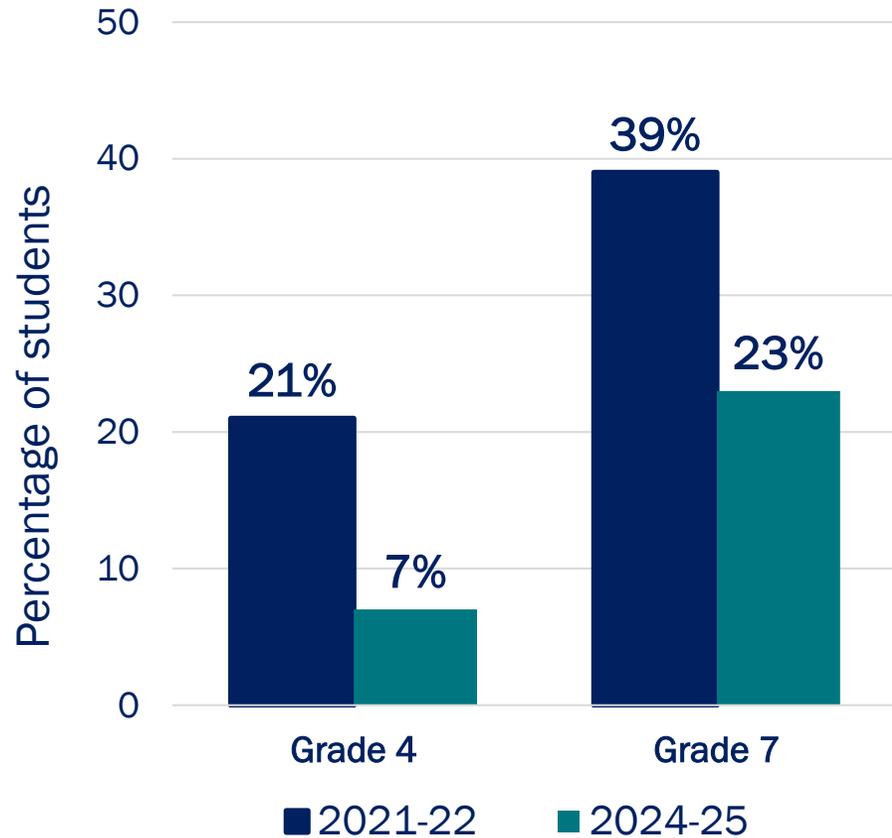
Percentage of KY K-12 teachers regularly using HQIRs by content area (2025)

About one-quarter of KY science teachers said they used standards-aligned science curricula

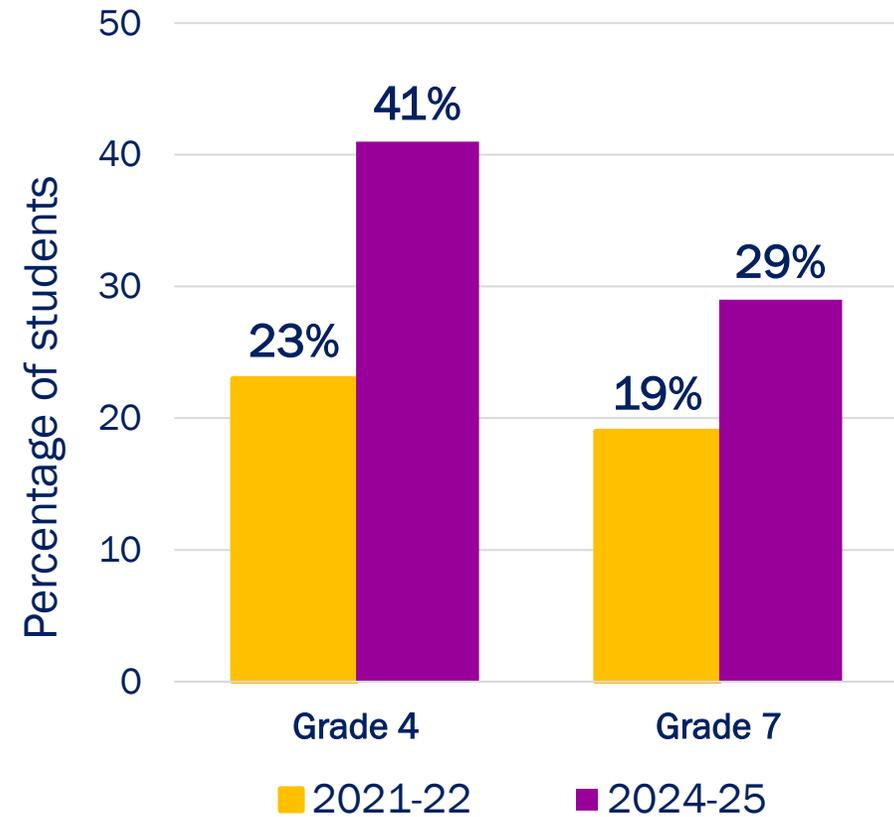


District Science HQIR Pilot Outcomes

Novice Reduction



Increase in P/D



Encouragement of using Science HQIRs as the basis for daily lessons lags behind ELA and Math

Which of the following does your school principal most encourage you to use as the basis of your lesson plans? (Percentage of teachers)

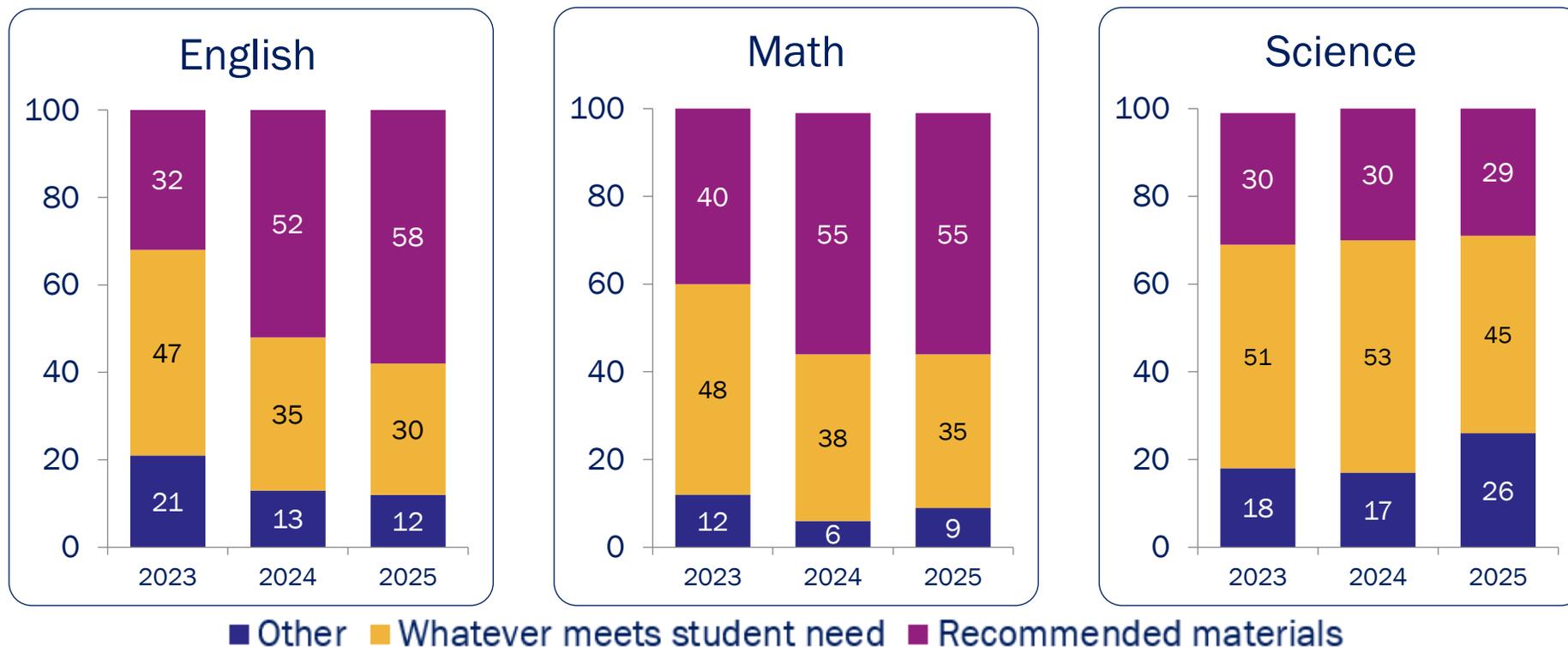


Figure shows teacher responses, separated by subject, to the following survey item: “Which of the following does your school principal most encourage you to use as the basis for your ELA/Math/Science lesson plans (pick one)?” The “Other” portion of the bars reflects respondents who answered “Other,” “Materials I have developed on my own,” and “Materials I have developed in collaboration with other [SUBJECT] teachers.”

Doan, S., et al. (2025). *American Instructional Resources Survey 2019-2025*. RAND Corporation.

Kentucky Department of Education. (2025). *Kentucky Reading Academies: Supporting Literacy in the Commonwealth*. [Infographic](#).

Science Supports for High-Quality Standards-Aligned Instruction

Professional Learning (PL)

- Annual Day of Science Learning to gain a deeper understanding of the *Kentucky Academic Standards (KAS) for Science*
- Kentucky Science Teacher Association Conference and Higher Ed Summit
- Vibrant Learning in science training - using an anchoring phenomenon

Resources/Materials

- Science-specific tools for intellectual preparation and implementation planning guides to support HQIR implementation
- KAS for Science resources aligned to KDE Markers for HQIRs

Partnerships

- Educational Cooperative Science monthly collaboration meeting
- Kentucky Atlas of Phenomena with new educator developed local bundles

Results-driven Initiatives for Science Education (RISE) Science Leadership Academy

- Curriculum-based professional learning (CBPL) using HQIR-aligned resources to drive systematic instructional change; establishes a connected science network with a clear, coherent K–12 vision for Kentucky

Graves County K-12 Science Experience



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Board Role and Call for Support

- Promote increased access to HQIR and associated funding - ABR
- Promote curriculum-based PL and associated funding - ABR
- Support continued principal leadership development

Science: Transition to SAT

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Science Assessments

KSA

ACT

SAT

Standards	Kentucky Academic Standards: Life Science, Physical Science, Earth & Space Science	ACT's College Readiness Standards	Shows alignment to the NGSS
Science Section	Administered at grades 4, 7, and 11	Enhanced ACT: Science is now optional with additional costs; separate science reasoning section; no longer included in Composite score	Science concepts integrated into Reading and Math sections
Focus	Disciplinary Core Ideas, Science & Engineering Practices, Crosscutting Concepts	Data interpretation, research summaries, scientific reasoning	Application of science in context (graphs, charts in reading/math)
Skills Measured	Content knowledge, application, inquiry-based problem solving	Interpretation, analysis, evaluation, reasoning, and problem-solving skills required in the natural sciences.	Evidence-based reasoning, problem-solving with scientific context
Used in Accountability	Yes-State Assessment Results for Science	No (science section)	No (science section)
Statutory Requirements	State and Federal testing and reporting requirements	State Statute: College Admissions Exam	State Statute: College Admissions Exam

[KAS/SAT Alignment Template](#): Appendix D: Alignments of Science Standards to SAT

Postsecondary Readiness

Senate Bill 25 (2023) requires that postsecondary readiness for each high school student, be measured by one of the following indicators that are intended to signal a student's readiness for the next step in their postsecondary plans whether that be the pursuit of college coursework and/or entry into the workforce:

- Meeting or exceeding a college readiness benchmark score on the college admissions examination or a college placement examination approved by the CPE;
- Achieving a minimum of three (3) hours of dual credit by completing a course approved by the KBE or qualifying for a minimum of three (3) hours of postsecondary articulated credit associated with a statewide articulation agreement;
- Achieving a benchmark score on an AP, IB, CAI, or other nationally recognized exam approved by the KBE that generally qualifies the student for three (3) or more hours of college credit;
- Completing a required number of hours or achieving a benchmark within an apprenticeship, cooperative, or internship that is aligned with a credential or associate degree and approved by the KBE after receiving input from the LSAC; or
- Achieving any industry-recognized certifications, licensures, or credentials, with more weight in accountability for industry-recognized certifications, licensures or credentials identified as high demand.

Note: Council on Postsecondary Education does not set a science benchmark. [Academic Readiness Indicators - Fall 2025-Spring 2028](#).

SAT Test Specifications at a Glance

Category	Reading and Writing (RW) Section	Math Section
Format	Two-stage adaptive test design: one Reading and Writing section administered via two separately timed modules	Two-stage adaptive test design: one Math section administered via two separately timed modules
Test length (number of operational and pretest questions)	1st module: 25 operational questions and 2 pretest questions 2nd module: 25 operational questions and 2 pretest questions	1st module: 20 operational questions and 2 pretest questions 2nd module: 20 operational questions and 2 pretest questions
Time per stage	1st module: 32 minutes 2nd module: 32 minutes	1st module: 35 minutes 2nd module: 35 minutes
Total number of questions	54 questions	44 questions
Total time allotted	64 minutes	70 minutes
Scores reported	Total score RW and Math section scores	Total score RW and Math section scores
Question type(s) used	Discrete; four-option multiple-choice	Discrete; four-option multiple choice ($\approx 75\%$) and student-produced response (SPR) ($\approx 25\%$)
Stimulus topics	Literature, history/social studies, humanities, science	Science, social science, real-world topics
Informational graphics	Yes; tables, bar graphs, line graphs	Yes

PDF of SAT sample items is available in the KBE Portal.

ACT/SAT Concordance Tables

- ACT/SAT concordance tables were co-developed by College Board and ACT to support individual-level score interpretation, primarily to inform higher education policies such as admissions.
- They are not intended for:
 - Aggregated reporting
 - Trend continuation
 - Group-level or accountability comparisons
- Using concordance tables for those purposes would risk misinterpretation.
- For additional detail, see the [Guide to the 2018 ACT®/SAT® Concordance](#).

ACT to SAT Data Trends

- Historical results from ACT can continue to provide valuable context, particularly at the state, district, school, and student group levels.
- It is appropriate to reference prior results qualitatively to understand longer-term patterns and context. However, direct quantitative comparisons or trend claims should not be made across the two assessments.
- Trend analysis should begin with the SAT results from the first administration as the baseline.

Future of Assessments

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Current Initiatives

- Competitive Grant on State Assessments (CGSA) funding the Kentucky United We Learn (KUWL) Initiative (i.e. off-grade testing)
- High School Transformation

Discussion