# Science TEKS Review
# Work Group A Recommendations

Work Group A met in February 2020 to identify key areas and recurring topics from feedback collected related to the TEKS review process, including SBOE guidance to work groups, content advisor consensus recommendations, and the results of the Science TEKS Review Survey (December 2019–January 2020). The work group was charged with developing recommendations for how subsequent science TEKS review work groups could address the feedback received.

Work Group A developed recommendations around the following specific topics:



## Vertical and Horizontal Alignment

The recommendations outlined below serve to address issues related to vertical and horizontal alignment but should be reexamined periodically throughout the review process to ensure that alignment is achieved.

| Focus Area | Work Group A Recommendation | Rationale for Recommendation |
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| Lack of continuity of core ideas across the grade levels<br><br>Lack of connections within the same grade level and course | The core ideas are from *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas* (2012)<br>• Physical science found on page 105<br>• Life science found on page 142<br>• Earth science found on page 171<br><br>Use the K-12 Framework as guidance to ensure that all of the core ideas are covered in a K-12 alignment when cognitively or content appropriate.<br><br>Introduce the cross-cutting concepts in the TEKS introduction and reinforce connections to these concepts in the language of the TEKS (knowledge and skills statements and student expectations). This will also support K-12 alignment.<br><br>To further support vertical alignment, work groups may need to add or remove student expectations | There are significant gaps of core ideas across grade levels. The content advisors identified that circuits appear in 5th grade and then do not appear again until Integrated Physics and Chemistry (IPC) or Physics.<br><br>Some core ideas are not explicitly identified in certain grade levels, for example light and sound in regards to waves at the elementary level.<br><br>Connections within the standards should be intuitive. Forcing connections creates discontinuity. |

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| | and/or modify the language of existing student expectations. This process should include—<br>1. checking that all core ideas have either been introduced or represented and scaffolded in ways that are cognitively appropriate and<br>2. re-evaluating once the vertical alignment has been completed to ensure that core ideas and cross-cutting concepts are authentically and coherently connected across student expectations when appropriate **within the grade level or course**. | |
| Mathematical knowledge and skills required for science content do not align to the math TEKS | Analyze the math TEKS to ensure that the mathematical skills that are needed in science are taught within the same year or prior year when cognitively appropriate.<br><br>An evaluation or crosswalk of the connected mathematical and science skills to develop recommendations that would ensure alignment is recommended.<br><br>Integrate computational or quantitative concepts that are developmentally grade-level appropriate into the scientific and engineering practices. | The lack of mathematical knowledge and skills should not impede a student's ability to master science content.<br><br>The content advisors also recommended math integration with science. |
| Disproportionate amount of TEKS to the instructional/ learning time to allow for depth of learning | Ensure that the amount of instructional time needed for student mastery of the TEKS can be covered within the instructional year. This can be done by considering the following:<br>• Grade band endpoints recommended in the K-12 Framework<br>• Amount of standards<br>• Depth of the standards | Some standards are so broad that it is difficult to cover all related content with the depth required for mastery.<br><br>The K-12 Framework provides grade band endpoints that provide guidance into the appropriate level of depth. |
| Scaffolded language | Ensure that the vocabulary is grade-level appropriate and aligned to build across grade levels. | The vertical progression of academic language should be clearly articulated across the TEKS. Survey results indicated this progression is not evident at this time. |

## Introduction to TEKS

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| Redundancies exist between the introduction to the TEKS and the knowledge and skills statements | Remove the redundancies and make the language more concise/specific.<br><br>Work Group A recommends that the introduction for each course or grade level be revisited after the TEKS have been revised to confirm that there are no redundancies and the introduction is very concise and specific to the course or grade level. | This will clarify the information in the introduction and delineate it from the standards.<br><br>This is consistent with the content advisor consensus recommendations. |
| Clarify the expectations for and different types of "investigations" | Define or explain what student learning through investigations entails, including the primary types of investigation (descriptive, experimental, comparative)<br><br>Work Group A recommends keeping the current percentages of classroom and outdoor/laboratory investigations for K-12 the same. | The concerns raised in the survey regarding the percentage of instructional time spent in investigation suggests that there is some confusion about what is considered an investigation. Investigations include student learning through the scientific/engineering practices that Work Group A has recommended integrating into the TEKS.<br><br>The content advisors and the majority of survey respondents indicated that the current percentages of instructional time for classroom and outdoor/laboratory investigations are appropriate. |
| Scientific and engineering practices should be integrated with the current process skills | Revise the current section of the introduction that addresses the process skills to define and distinguish between scientific and engineering practices.<br><br>(*Refer to K-12 Framework, Chapter 3.) | As a proposed new strand name and addition to the science TEKS, engineering practices, their role in science education, and their correlation with scientific practices need to be defined in the introduction. See recommendation below (pp. 7-8).<br><br>Defining and differentiating between scientific and |

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| | | engineering practices establishes more clarity. |
| Cross-cutting concepts | Add a definition/explanation of cross cutting concepts to the introduction.<br><br>(*See K-12 Framework, p. 84.) | Survey responses indicated that cross-cutting concepts are not fully understood and connections are not being made within the TEKS. |

## Language of the TEKS

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| Consider technical edits and clean up scientific language as recommended by the content advisors | Remove redundant and unnecessary language, i.e., in SE 3.A. remove "so as to encourage critical thinking by the student" because it is already stated in the knowledge and skills statement.<br><br>Use age-appropriate scientific language to avoid misconceptions.<br><br>(*See recommendation in the content advisor consensus recommendations and initial reviews.) | The recommended edits will clarify the standards, eliminate misconceptions, and provide more concise language. |
| Clarify boundaries recommended by the content advisors | Ensure that the standards are clear and specific.<br><br>Reference endpoints in the K-12 Framework to inform the student expectations for each grade level and/or course.<br><br>(*See K-12 Framework, p. 301-302 and Chapters 5-7.) | Clear and specific student expectations naturally establish boundaries. |
| Cross-cutting concepts | Identify opportunities in the TEKS to reinforce the concept of cross-cutting standards.<br><br>Add cross-cutting concepts language to the knowledge and skills statements and/or student expectations when appropriate.<br><br>(*See K-12 Framework, p. 84.) | There are cross-cutting concepts inferred in the current TEKS, but the language is inconsistent and doesn't help teachers make clear connections between those concepts. Using more consistent and precise terminology forges those connections. |

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| Active language in student expectations<br>*investigations | Ensure that the rigor of the verbs is appropriate.<br><br>Add more specificity to the student expectations such as instead of only "observe" include the actions students are expected to take such as "observe and detect patterns" or "observe and collect data," etc.<br><br>Determine whether the verbs allow for sufficient opportunities to meet the percentage of investigation time noted in the introduction. | Survey indicated adding rigorous learning goals for all students when appropriate. (Question #22).<br><br>Active verbs ensure that students have opportunities to apply the scientific and engineering practices with the content. |

## Amount and Organization of Content

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| **HIGH SCHOOL** | | |
| There are too many standards, which leads to an emphasis on discrete facts and does not lend itself to teaching scientific processes. | In evaluating each course, determine whether current standards are important for all students to know using the K-12 Framework as a guide.<br>• Consider eliminating standards and being explicit/going deeper on remaining standards (for example, Biology 6.D is very general.).<br><br>Review the high school portion of Question #24 from the educator survey to determine what educators felt was important to remove from the high school standards.<br>• An illustration and example provided from the survey was to replace dihybrid crosses with other topics such as genetic engineering or DNA fingerprinting. | Both the survey and content advisor consensus recommendations suggested removing standards in high school courses.<br><br>Using the K-12 Framework provides a common resource for determining relevance and emphasis of specific standards.<br><br>Several survey responses were specific about which topics should be removed from certain courses. |
| Lack of strong alignment from middle to high school | Revise high school standards prior to revising K-8 standards. | Backward design (UbD) allows for intentional scaffolding from high school to K-8. |
| Some content is duplicated horizontally in high school | Identify and evaluate redundancies between high school science courses and determine whether those standards belong in multiple courses or if they should be changed/removed in one of the courses.<br>• An example is that Biology knowledge and skills statement 12 and Aquatic Science | This will help inform the amount and depth of standards in each course (depth and breadth of TEKS). |

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| | knowledge and skills statement 5 show a strong overlap.<br>• Be sure to examine the relationship between IPC, Chemistry, and Physics where redundancies may be appropriate. | |
| Consistent language in Biology | Direct the work groups to strongly consider maintaining the language in Biology student expectations in 3.A, 4.A, 6.A, and 7.B. | SBOE Guidance<br>Refer specifically to the conversation about student expectation 3.A. |
| Process standards across high school courses are not aligned in terms of number and general content | When possible, evaluate and align language and numbers of the process standards across all high school science courses. | Some process standards were standardized during streamlining but only in Biology, Chemistry, IPC, and Physics. |
| **MIDDLE SCHOOL** | | |
| The strands are not evenly weighted or effectively sequenced within and across grade levels. | Ensure there is a balance of content (life, physical, and Earth/space science) within each grade level across 6th-8th grades. One way to ensure a more evenly weighted distribution of the standards within each content area is to add, delete, or modify existing student expectations. | Balanced content will reinforce and spiral concepts and support vertical alignment in middle school.<br><br>Content advisors recommended reducing Earth/space science coverage, however Work Group A wants to ensure that all students receive a foundation in Earth/space science. |
| **ELEMENTARY SCHOOL** | | |
| Lack of K-12 alignment | Evaluate current TEKS through the lens of backward design. Consider the addition, deletion, or modification of current student expectations based upon the K-12 Framework and vertical alignment.<br><br>Ensure that the K-8 TEKS support the high school TEKS and that high school TEKS build from the K-8 TEKS. | Content advisor recommendation<br><br>Mastery of content is increased when alignment is intentional and systemic. |

## Scientific and Engineering Practices

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| The categorical section for the "process skills" | Change the current strand names for the process skills, e.g., "scientific processes" and "scientific investigation and reasoning" to "scientific and engineering practices" to be consistent at each grade level and course (K-12). | The current strand names for the process skills vary across K-12. This recommendation fosters K-12 vertical alignment and better reflects the practices students will apply in science. |
| Lack of engineering standards | Work Group A recommends the following protocol be followed to ensure that engineering practices are addressed in the standards:<br>1. Compare the current process standards with the eight engineering practices identified in the K-12 Framework (page 42).<br>2. Using the K-12 Framework, identify—<br>a. how the current student expectations for process skills are already aligned and<br>b. where there are gaps.<br>3. Develop recommendations for how the current standards can be enhanced, revised, and streamlined to reflect research-based scientific and engineering practices.<br><br>Refer to "Practices for K-12 Science Classrooms" from the K-12 Framework, Chapter 3.<br>○ Box 3.1--PDF page 42<br>○ Box 3.2 --PDF pages 50-53 | Content advisors recommend incorporating engineering design and application into the process skills<br><br>There is a critical need for exposure to and application of engineering practices in K-12 education (see deeper rationale on Page 42-43 *of K-12 Framework*). These skills foster critical thinking and problem-solving, which are applicable in and beyond the classroom. |
| Scientific tools and safety | Keep scientific tools and safety as separate student expectations, but ensure that they are the same student expectation number/letter for every grade level (example: K.1.A-5.1.A; 6.1.A-8.1.A; Biology 1.A, Physics 1.A, etc.) | The list is helpful for teachers and districts when planning their investigations and equipment needs. Maintaining the same knowledge and skills statement and student expectation numbers/letters across grade levels supports vertical alignment. |

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| Lack of obvious integration of scientific and engineering practices (current process skills) with content | Work Group A recommends that the proposed scientific and engineering practices "stand alone" as their own strand, similar to the current process skills. However, we further recommend integrating scientific and engineering practices into student expectations within the content standards to which they are most interconnected and applicable. This can be accomplished by identifying content student expectations that lend themselves to the application of scientific and engineering practices.<br><br>Example of an existing student expectation with an integrated scientific/engineering practice: Grade 7, 8.C, ***model*** the effects of human activity on groundwater and surface water in a watershed<br><br>Example of an existing student expectation that could be revised to integrate a scientific/engineering practice: Grade 8, 7.C, relate the positions of the moon and sun to their effect on ocean tides<br>REVISE TO READ AS: relate the positions of the moon and sun to their effect on ocean tides ***using models or simulations***<br><br>Creating models and simulations is a scientific/engineering practice that allows students to analyze and test existing systems. | There can be a disconnect between the process skills and how they apply to content.<br>Integrating scientific and engineering practices with content student expectations informs and aligns instruction.<br><br>There was a high level of support for this integration from survey respondents. |