# Smart Biology Texas

## Smart Biology Texas Executive Summary

### Section 1. Science-Related Texas Essential Knowledge and Skills (TEKS) and English Language Proficiency Standards (ELPS) Alignment

| TEKS Student % | TEKS Teacher % | ELPS Student % | ELPS Teacher % |
|---|---|---|---|
| 84.44% | 84.44% | 100% | 100% |

### Section 2. Instructional Anchor

- The materials are somewhat designed to strategically and systematically integrate scientific and engineering practices, recurring themes and concepts, and grade-level content as outlined in the TEKS.
- The materials somewhat anchor the learning in phenomena and problems as the key lever for driving learning and student mastery of disciplinary knowledge and skills.

### Section 3. Knowledge Coherence

- The materials are somewhat designed to build knowledge systematically, coherently, and accurately.
- The materials provide some educative components to support teachers' content and coherence knowledge.

### Section 4. Productive Struggle

- The materials provide some opportunities for students to engage in productive struggle through sensemaking that involves reading, writing, thinking, and acting as scientists and engineers.

### Section 5. Evidence-Based Reasoning and Communicating

- The materials somewhat promote students' use of evidence to develop, communicate, and evaluate explanations and solutions.
- The materials provide some teacher guidance to support student reasoning and communication skills.

### Section 6. Progress Monitoring

- The materials include some TEKS-aligned and developmentally appropriate assessment tools.
- The materials include some guidance that explains how to analyze and respond to data from assessment tools.
- The assessments are somewhat clear and easy to understand.

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## Section 7. Supports for All Learners

- The materials do not provide guidance on fostering connections between home and school.
- The materials include some listening, reading, writing, and speaking supports to help Emergent Bilinguals meet grade-level science content expectations.
- The materials do not include a variety of research-based instructional methods that appeal to a variety of learning interests and needs.
- The materials include some guidance, scaffolds, supports, and extensions that maximize student learning potential.

## Section 8. Implementation Supports

- The materials include year-long plans with some practice and review opportunities that support instruction.
- The materials include some classroom implementation support for teachers and administrators.
- The materials provide some implementation guidance to meet variability in program design and scheduling.

## Section 9. Design Features

- The visual design of materials is somewhat clear and easy to understand.
- The materials are not intentionally designed to engage and support student learning with the integration of digital technology.
- The digital technology or online components are not developmentally and grade-level appropriate and provide support for learning.

## Section 10. Additional Information

- The publisher submitted the technology, price, professional learning, and additional language supports.

# Smart Biology Texas

## Indicator 2.1

Materials are designed to strategically and systematically integrate scientific and engineering practices and course-level content as outlined in the TEKS.

| | | |
|---|---|---|
| 1 | Materials provide multiple opportunities for students to develop, practice, and demonstrate mastery of appropriate scientific and engineering practices as outlined in the TEKS. | PM |
| 2 | Materials strategically and systematically develop students' content knowledge and skills as appropriate for the concept and grade level or course as outlined in the TEKS. | PM |
| 3 | Materials include sufficient opportunities, as outlined in the TEKS, for students to ask questions and plan and conduct classroom, laboratory, and field investigations and to engage in problem-solving to develop an understanding of science concepts. | PM |

## Partial Meets | Score 2/4

The materials partially meet the criteria for this indicator. Materials are designed to have some strategic and systematic integration of scientific and engineering practices and course-level content as outlined in the TEKS.

Materials provide some opportunities for students to develop, practice, and demonstrate mastery of appropriate scientific and engineering practices as outlined in the TEKS. Materials sometimes strategically and systematically develop students' content knowledge and skills as appropriate for the concept and grade level or course as outlined in the TEKS. Materials include some opportunities, as outlined in the TEKS, for students to ask questions and plan and conduct classroom, laboratory, and field investigations, and to engage in problem-solving to develop an understanding of science concepts.

Evidence includes but is not limited to:

Materials provide multiple opportunities for students to develop, practice, and demonstrate mastery of appropriate scientific and engineering practices as outlined in the TEKS.

- SEPs are not addressed directly within any provided vendor materials for students or teachers. Activities are not TEKS aligned or designed with science and engineering principles in mind. There are no opportunities to foster SEPs besides the application question that students get in every chapter. For example, students can practice their content knowledge by using quizzes at the end of each module in every chapter. For instance, the quiz at the end of Chapter 7, Module 1 references content knowledge about cellular respiration that was presented in that module. However, specific SEPs are not practiced throughout the lesson or the unit.
- Although the materials contain detailed text, the product lacks opportunities for students to apply their knowledge through continuous practice and demonstration. For example, students are exposed to a laboratory investigation in the GO BEYOND: Techniques and Experiments sections of chapter assessments. The chapter 6 example, where students observe an experiment performed by Joseph Priestley, demonstrates the connection between photosynthesis and cellular respiration. However, students are not challenged to conduct a laboratory investigation themselves. Another example is in Chapter 10 (Techniques and Experiments). Students are asked to describe how DNA polymerase and sequencing are used in everyday life, but the

materials offer few opportunities for the students to research or explain these processes. In the teacher guide for the material, the answer is brief, with very little allusion to potential explanations that students may generate.

- The material contains a list of learning pathways, but there are few embedded opportunities present that actually allow students to develop, practice, and demonstrate mastery. For example, students can demonstrate (but not develop or practice) their content knowledge using the short answer assessment questions at the end of each chapter. One example is found in the student edition in the assets section of Chapter 3, which includes the following text, " Answer the following questions in sentence form, using your own words. 1) Explain the difference between hypotonic, hypertonic, and isotonic solutions. 2) What are hydrophobic interactions? 3) What is the relationship between the sun and molecular movement?" However, no correlation to standards is present in the assessment.

Materials strategically and systematically develop students' content knowledge and skills as appropriate for the concept and grade level or course as outlined in the TEKS.

- Materials contain a general scope and sequence, as outlined in the teacher guide. There is no support given to teachers to aid in the strategic development of students' content knowledge and skills. The online teacher modules are identical to the student modules. The materials do not contain documentation on TEKS alignment or how the product is connected to Texas standards.
- The chapters and modules are organized in a manner that allows a natural flow of learning, but there is no guidance for teachers to strategically and chronologically track students' content development. The units are designed with similar information, but the chapters are taught in isolation and do not actually reference each other via formative assessments and extension activities. For example, Chapter 19 (Individual, Population, and Community Interactions) is organized into four modules (Organismal Ecology, Population Ecology Parts 1 and 2, and Community Ecology) that present content; these four modules progressively build on one another but do not explicitly reference each other.
- At the end of each module, there is a quiz that assesses students' content knowledge from that particular module. Module 5 serves as an assessment that contains several sections. The Assess section prompts students to answer questions directly about content knowledge. The Apply section prompts students to develop answers related to content knowledge through self-reflection and group discussion. The Go Beyond section challenges students to extend their learning to real-world scenarios, scientific history, and relevant techniques and experiments. Only limited support for tracking student content development across the modules is present.
- Within each assessment of knowledge (Go Beyond), the students are asked to analyze or apply their knowledge in several ways. However, there are no instructions for measuring knowledge of the Apply section, and the questions are vague, such as "Design an ecosystem." This can lead students to design something that does not exist in nature or is incorrect. For example, students are asked a few questions about DNA and replication in the Assess portion of Module 4 of Chapter 10. Then, in the Apply section, one of the questions asks students, "Can you think of an example in our everyday world that is similar to the semi-discontinuous nature of DNA replication? If so, why does this example exist? If not, why do you think humans would not develop such a thing?"

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Materials include sufficient opportunities, as outlined in the TEKS, for students to ask questions and plan and conduct classroom, laboratory, and field investigations and to engage in problem-solving to develop an understanding of science concepts.

- The materials are entirely online and do not contain sufficient instructional guidance on how to conduct classroom, laboratory, and field investigations. The embedded materials provide some hands-on problem-solving opportunities. For example, in Unit 4, in Chapter 9, the techniques and experiments portion asks students to explain what the central dogma has to say about the flow of DNA, RNA, and protein. While this is an assessment where students can research knowledge and use scripted procedures to answer questions, there are no opportunities present for students to conduct or plan their own investigations. Within the Apply section for Chapter 9, Go Beyond, the students are asked a "what if" question that requires them to predict and explain a scientific practice. However, the Apply section varies from chapter to chapter in what the students are being asked. For example, the Apply section of Chapter 14, Module 6 prompts students with the following question, "Humans perform artificial selection both on purpose and unintentionally. What is an example of unintentional artificial selection by humans? What is the result of this selection, and how is it significant?" The apply activity for Chapter 5 requires students to "Design a hypothetical signal transduction pathway that includes the use of ATP, GTP, signal amplification, and at least three real molecules/proteins that we learned about in this chapter. What initiates the pathway, and what is the end result?" The level of higher-order thinking skills varies greatly between the chapters.

The materials are not aligned with the actual TEKS, and there is no documentation outlining how embedded opportunities accurately align with Texas standards.

# Indicator 2.2

Materials anchor the learning in phenomena and problems as the key lever for driving learning and student mastery of disciplinary knowledge and skills.

| | | |
|---|---|---|
| 1 | Materials embed phenomena and problems across lessons to support students in constructing, building, and developing knowledge through authentic application and performance of scientific and engineering practices and course-level content as outlined in the TEKS. | PM |
| 2 | Materials intentionally leverage students' prior knowledge and experiences related to phenomena and engineering problems. | PM |
| 3 | Materials clearly outline for the teacher the scientific concepts and goals behind each phenomenon and engineering problem. | PM |

## Partial Meets | Score 2/4

The materials partially meet the criteria for this indicator. Materials anchor some of the learning in phenomena and problems as the key lever for driving learning and student mastery of disciplinary knowledge and skills.

Materials embed some phenomena and problems across lessons to support students in constructing, building, and developing knowledge through authentic application and performance of scientific and engineering practices and course-level content as outlined in the TEKS. Materials leverage some students' prior knowledge and experiences related to phenomena and engineering problems. Materials outline for the teacher some scientific concepts and goals behind each phenomenon and engineering problem.

Evidence includes but is not limited to:

Materials embed phenomena and problems across lessons to support students in constructing, building, and developing knowledge through authentic application and performance of scientific and engineering practices and course-level content as outlined in the TEKS.

- There are no TEKS-aligned or SEPs-related activities specifically developed in this material, and the lessons are only found at the end of each chapter rather than being built upon throughout the units. For example, students are asked to think about how we might be able to manipulate the macromolecular machines involved in photosynthesis in order to produce solar energy for ourselves. After they analyze and research the problem independently, students form small groups to share ideas. Once they reach a group consensus, students create short presentations, including visuals, to present them to the class. No connections to state standards are accurately provided at any point in the lesson or its presentation.
- The materials do not specifically address the relationship between unit concepts and associated phenomena. Students have some opportunities for constructing, building, and developing knowledge, but it is not consistently provided through authentic experiences and is not tied to scientific and engineering principles. For example, in Chapter 13, Module 4, students are provided with an example of the eye to guide their understanding of the evolution of complex structures. Students and teachers are not given sufficient support to grapple with this

phenomenon and to construct, build, and develop knowledge through performance of SEPs and course-level content.

- The student edition of the text/online resources contains material that is detailed and accurate but does not specifically connect to SEPs and does not provide support for the 3-D learning model. Materials lack anchoring phenomena for concrete understanding. For example, within the apply activity for Chapter 19, students are asked to design their own ecosystem with a certain set of parameters (mutualism, parasitism, etc.). Students are then asked to explain models to their groups and the classroom using visuals for evaluation. There is no guidance given as to how SEPs are connected to daily lessons throughout the activities.

Materials intentionally leverage students' prior knowledge and experiences related to phenomena and engineering problems.

- There are multiple ways to learn each lesson, as evidenced by text and video covering the same content. There is no teacher support for differentiation utilizing prior knowledge or new learning connections. Teacher guidance on topics is unclear. For example, in Chapter 18, Module 1, Lesson 3, students are provided with an example of elephants' thick legs to explain how organisms are adapted to their environment. Another example includes a Go Beyond careers section explaining how evolutionary biologists study a wide range of topics of the biological history of Earth. There are no activities or prompts provided for students to activate prior knowledge or to make connections to SEPs or the TEKS standards.
- The organization of the materials flows in a logical sequence but does not assess or activate students' prior knowledge. For example, in Chapter 2, The Atomic World, From Atoms to Molecules; Module 1, Interactions Between Atoms, 1. Covalent Bonds, the text mentions, "In the previous chapter," provides connections that allow for consistent flow across all units.
- The materials do not explicitly mention scaffolding of prior knowledge and relationships to phenomena and SEPs.

Materials clearly outline for the teacher the scientific concepts and goals behind each phenomenon and engineering problem.

- The dashboard does not contain any background information or getting started guides that clearly outline the student learning goals that are connected to the phenomenon or problems. The dashboard only shows the table of contents of teacher and student chapters and modules.
- Materials are not explicitly anchored in phenomena and/or express problem-solving-based learning as a tool for learning key content. For example, in the Go Beyond, Techniques, and Experiments section of Chapter 19, Module 5, students are provided three different examples of survivorship curves and asked which curves are most aligned to humans. However, this problem is not linked to any particular learning goal or SEPs. Also, the introductory video for evolution shows various organisms that lead to the diversity of life. The video provides an overview that connects the various modules that are covered in the unit to show how evolution leads to diversity over 4.5 billion years. The content in the chapters does not relate this information to learning goals or SEPs. Content on the provided phenomenon is incomplete.

The material lacks guidance for teachers on specific strategies to conceptually tie unit concepts to related phenomena and student experiences. There is some guidance provided in the Teaching Tips/Suggestions section for the teacher to address misconceptions and to help struggling students. For example, for Chapter 3, The Molecular and Macromolecular Worlds, Module 3: Interactions Between

Molecules, there is no "Engage'' activity or other connecting material to familiarize students with previously witnessed scenarios that tie into unit concepts or to guide teachers during support.

# Smart Biology Texas

## Indicator 3.1

Materials are designed to build knowledge systematically, coherently, and accurately.

| | | |
|---|---|---|
| 1 | Materials are designed for students to build and connect their knowledge and skills within and across units. | PM |
| 2 | Materials are intentionally sequenced to scaffold learning in a way that allows for increasingly deeper conceptual understanding. | PM |
| 3 | Materials clearly and accurately present course-specific core concepts and science and engineering practices. | DNM |
| 4 | Mastery requirements of the materials are within the boundaries of the main concepts of the course. | DNM |

## Partial Meets | Score 3/6

The materials partially meet the criteria for this indicator. Materials provide some educative components to support teachers' content and knowledge coherence.

Materials are somewhat designed for students to build and connect their knowledge and skills within and across units. Materials are somewhat intentionally sequenced to scaffold learning in a way that allows for increasingly deeper conceptual understanding. Materials do not clearly and accurately present course-specific core concepts and science and engineering practices. Mastery requirements of the materials are not within the boundaries of the main concepts of the course.

Evidence includes but is not limited to:

Materials are designed for students to build and connect their knowledge and skills within and across units.

- Each unit begins with an introduction in the first chapter module - this introduction links the current unit to the previous unit. For instance, the introduction to Unit 4 (which can be found in Chapter 13, Module 1, Lesson 1) states, "In the first two units of this 'Life' series, we learned what cells are and how they're powered. In Unit 3, we then pressed the 'play' button to see how cells and multicellular organisms grow and reproduce. In this unit, we're now going to 'fast forward' to see what happens to these organisms with repeating cycles of growth and reproduction throughout long periods of time." Another example is in the introduction to genetics, the text reads, "In Units 1 and 2, we learned what cells are and how they're powered. In Unit 3, we're now going to press the play button to see what cells do through time. In short, cells grow to double in size and then divide in two. We're going to start this module by understanding how Unit 3 serves as an important transition unit between Units 1-2 and Units 4-5. We're then going to learn about the central dogma of biology: transcription from DNA to RNA, followed by translation from RNA to protein. The central dogma underlies everything that takes place inside a cell."
- Each unit progressively builds complexity, as outlined in the unit introduction in the first chapter module. The teacher guide directly states that students will go from "simple to complex," meaning that their knowledge will progressively build upon itself. For instance, the following progression is seen in Unit 4 (Evolution): Definition of evolution and why it happens (Chapter

13), evidence of evolution (Chapter 14), the development of life throughout Earth's history (Chapter 15), microevolution (Chapter 16), and macroevolution (Chapter 17). Another example of this progression is seen within the module on the cell cycle. There are six lessons. Lesson 1 starts with an overview of DNA replication, Lesson 2 moves into DNA replication initiation, and Lesson 3 progresses to the replisome and the fork. The module continues to increase in complexity, covering the antiparallel problem in Lesson 4. Lesson 5 teaches DNA replication as semi-discontinuous, and Lesson 6 ends with the result of DNA replication.

- Although the Pacing Guide contains anecdotal mention of logical sequencing, building knowledge and skills within and across units (Unit 1: Atoms to Cells, Starting Small to Understand Big), the teacher materials do not provide a unit overview that shows explicitly how each unit connects to other units within the series in the scope and sequence.
- The description in the table of contents states that it includes a “summary and features of each unit.” However, it primarily serves as a list of topics covered in each chapter. The unit summaries are the only place that connects previous and future learning. This is only provided as a very broad overview.

Materials are intentionally sequenced to scaffold learning in a way that allows for increasingly deeper conceptual understanding.

- Each chapter contains an introductory video in the first module. In subsequent modules, videos summarize Lesson content, and figures/models serve as a visualization for Lesson content. Finally, at the end of each chapter, the Go Beyond sections serve as an assessment that challenges students to use abstract reasoning based on the content they learned throughout the chapter. For instance, Chapter 16 (Microevolution) begins in Module 1 with a video that ties in prior knowledge while presenting a summary of the chapter as a whole. This video references prior content, such as the presence of genotypic/phenotypic variations and the importance of DNA mutations as the driver of these variations. Students have learned about these topics prior to this chapter. Module 2 provides figures that depict measuring genotype and allele frequencies within a population. Module 3 contains models that visualize changes to populations, such as genetic drift. Another example is in Module 3, which begins with an intro video on how mutations come from mistakes. There are figures of images that detail more content, followed by lesson text. The module progresses from an introduction of mutations to small-scale mutations, then large-scale mutations, how harmful mutations are eliminated, how neutral mutations are accumulated, how beneficial mutations spread, to how beneficial mutations create new alleles. Finally, in Module 4's Go Beyond: Scientific History, students are asked to incorporate the knowledge they developed throughout Chapter 16 to explain the diversity of beak shapes in a particular region's bird species. However, there are no opportunities for students to answer questions or have discussions to activate prior knowledge before explicit learning of the new content other than the Go Beyond modules that students perform after they have completed the unit.
- Within the Pacing Guide, the materials are sequenced, but there are no scaffolds provided to teachers to enhance learning beyond simple recall questions. However, when following the suggested guide, the first module of each unit does briefly mention previous units. The new setting of the stage and making connections does not have specific information for each lesson, such as lesson questions, phenomenon or design challenges, what students do and figure out, or how they end up representing what they figure out. The Pacing Guide, in the hands of a practiced teacher, can confer items in the Scientific Concepts column as being sequenced for increasingly deeper conceptual understanding. However, that process is not specifically

outlined. It also does not clearly outline what prior knowledge mastery is required before beginning each unit.

- In Chapter 3, the text tries to outline the learning order but includes complex vocabulary without defining terms (hydrophobic vs. hydrophilic). It also uses abstract concepts and wording that can make it difficult for the learner to comprehend. For example, the text states, "However, generally speaking, interactions between molecules are transient events that are eventually disrupted by the random, temperature-induced movements of both molecules. Of course, the stronger the intermolecular forces between them, the harder it will be for random movements to overcome these forces and break the intermolecular bond." Words Such as transient, intermolecular force, etc., are not easily understandable to all students. Also, within Unit 2, Module 3, there is a lesson on Chemical Energy within the natural world. However, this lesson is preceded by a lesson on Chemical Bonds, which is a more abstract concept.

Materials clearly and accurately present course-specific core concepts and science and engineering practices.

- Materials include a general sequence within each chapter: an introductory module, modules containing course-specific content and quizzes, and an assessment module, which also includes APPLY and Go Beyond extension activities. For instance, this general sequence can be seen in Chapter 14 (The Evidence of Evolution). Materials do not provide specific learning models/routines such as The new SEPS activities do not follow the 5E model (Engage, Explore, Explain, Elaborate, Evaluate) explicitly, nor is the learning content of the resource presented to students in a structured fashion (sues as POE (Predict, Observe, Explain) or 5E) explicitly or implicitly aligned to the materials. Another example is in chapter 14. Students can choose to conduct research and answer a question on examples of artificial selection, but the text does not offer supporting details to confirm student learning.
- Chapter 7 discusses the breakdown of glucose to provide cellular energy (a course-specific core concept) in an accurate method. The processes of glycolysis, the Krebs cycle, the electron transport chain, and chemiosmosis are all discussed in a detailed and scientifically accurate manner.
- Within each Go Beyond, students are asked to assess and apply their knowledge. Within each unit, there is an APPLY section. Within Chapter 6, the APPLY unit asks students to build a model that has the lowest potential energy, which is a scientific practice. Also, within Chapter 6, Go Beyond: Experiments and Techniques, the students are given a virtual experiment and asked to explain what is happening based on what they see, another scientific practice.
- The teacher Pacing Guide lists the TEKS addressed for each unit and mentions core concepts, such as understanding the production of ATP and the importance of photosynthesis, but the items listed in the Scientific Concepts/Science and Engineering Processes column do not appear truly aligned with the SEPs. The new Pacing Guide continues to show topics and/or concepts instead of science and engineering practices. The TEKS listed are incorrect and do not correlate to Texas Biology standards. The SEPs are actionable tasks students use to demonstrate mastery. For example, in the Student Edition of Chapter 3, the text, 3D animations, illustrations, and quiz reflect the scope and sequence, but their connection to the TEKS and SEPs is not embedded for student self-reflection or metacognition.

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Mastery requirements of the materials are within the boundaries of the main concepts of the course.

- The Pacing Guide provides the following TEKS correlations for Chapter 9, Modules 1, 2, 3 (The Growing Cell | From Genes to Proteins): 7.A, 7.B. Outside of these TEKS correlations present in the Pacing Guide, there are no specific learning targets referenced explicitly in the units/chapters/lessons themselves. For example, the Pacing Guide provides the following TEKS correlations for Chapter 17 (Macroevolution of Species and Biological Diversity): 4.C, 10.C. Outside of these TEKS correlations present in the Pacing Guide, there are no clearly defined boundaries provided for mastery of content. There are additional summaries, but it does not explicitly state a learning target for students for each day of learning.
- Within the teacher guide, units are arranged to progressively build upon each other. In the scope and sequence, the main topics covered are found in the Scientific Concepts and Science and Engineering Practices. However, there are no specific ways to demonstrate mastery of learning as there are no specific learning targets for students to reach. The only clearly defined boundaries of the course are the specific questions each GoBeyond asks each student. The teacher guide does not outline mastery requirements. Additionally, the module quizzes do not meet the rigor for EOC testing; they are all multiple-choice, surface/factual questions. They assess only basic understanding, not mastery. The materials attempt to outline mastery and assess students in a more rigorous fashion but still do not align with the rigor of the State of Texas assessment item expectations.
- The materials do not have a vertical alignment document, TEKS progression information, or other reference that defines the boundaries of the course. Accurate TEKS information is missing from the documents.The introduction to each chapter provides a quick overview of the content that was covered up to that point.

# Smart Biology Texas

## Indicator 3.2

Materials provide educative components to support teachers' content and knowledge coherence.

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|---|---|---|
| 1 | Materials support teachers in understanding the vertical alignment of course-appropriate prior knowledge and skills guiding the development of course-level content and scientific and engineering practices. | DNM |
| 2 | Materials contain explanations and examples of science concepts, including course-level misconceptions to support the teacher's subject knowledge and recognition of barriers to student conceptual development as outlined in the TEKS. | DNM |
| 3 | Materials explain the intent and purpose of the instructional design of the program. | PM |

## Partial Meets | Score 3/6

The materials partially meet the criteria for this indicator. Materials provide some educative components to support teachers' content and knowledge coherence.

Materials do not support teachers in understanding the vertical alignment of course-appropriate prior knowledge and skills guiding the development of course-level content and scientific and engineering practices. Materials do not contain explanations and examples of science concepts, including course-level misconceptions to support the teacher's subject knowledge and recognition of barriers to student conceptual development as outlined in the TEKS. Materials somewhat explain the intent and purpose of the instructional design of the program.

Evidence includes but is not limited to:

Materials support teachers in understanding the vertical alignment of course-appropriate prior knowledge and skills guiding the development of course-level content and scientific and engineering practices.

- The materials contain a pacing guide and table of contents that outline TEKS correlations (such as Chapter 17 alignment to TEKS 4.C and 10.C) and general scope and sequence, but materials do not provide detailed instructions for implementation of activities. There is no document detailing how the materials gain complexity besides the suggested scope and sequence. Materials do not provide any explicit references to content-knowledge development across grade levels for teachers to understand the importance of vertical alignment and accessing prior knowledge. The teacher edition of the online platform is the exact same as the student edition of the online platform.
- The scope and sequence provides a general outline of the course that is suggested for teachers to use. However, there aren't any references to TEKS students should have mastered in previous grade levels, only within the course.
- Materials do not support teacher guidance in vertical alignment of prior knowledge to development of course-level mastery through science and engineering practices. The teacher implementation guide links to the Pacing Guide, which outlines a suggested schedule of

chapters and modules within associated “scientific principles/science and engineering practices,” but actually is just a list of content topics, not SEPs. It also contains no details describing how or why those materials scaffold previous learning to new content.

- The introduction to each unit discusses the content students should have mastered in prior chapters, but there are no connections or detailed instructions to promote depth and complexity of future skills or content. There are no projections made to promote depth and complexity of future learning.

Materials contain explanations and examples of science concepts, including course-level misconceptions to support the teacher's subject knowledge and recognition of barriers to student conceptual development as outlined in the TEKS.

- The teacher edition of the online platform is identical to the student edition of the online platform. Besides a TEKS alignment and ELPS alignment, there is some information for teachers to address student misconceptions about some of the units, but it is not comprehensive to all units. There is no guidance to show the source of alignment of the proposed misconceptions. s for the teacher to peruse to address student misconceptions. This can be seen, for instance, in Chapter 3 (The Molecular and Macromolecular World), where there are no additional teacher supports provided to recognize barriers to student conceptual development. In another example, the Go Beyond sections at the end of each chapter ask extension questions to assess student knowledge, but the materials do not include any guidance for the teacher regarding possible misconceptions.
- The table of contents contains unit summaries but lacks details of common grade-level misconceptions or how materials are directly aligned to the TEKS.
- The Apply section at the end of each chapter presents students with questions with which students will reflect individually and then in groups before presenting to the class. For instance, the questions in the Apply section for Chapter 3 (The Molecular and Macromolecular Worlds) are as follows: Question 1: What is a real-world analogy for the explanation behind hydrophobic interactions? Question 2: Imagine that you are suddenly a mosquito. What are three things that you now have to deal with that you didn't have to before in terms of the properties of water at different scales? While some questions are provided, there is no teacher support included in the materials that provide sources of possible student responses and misconceptions regarding the questions. No potential barriers to learning are addressed, and the video material is identical to the text material. I. All material is submitted in short-answer format, offering no means to differentiate.

Materials explain the intent and purpose of the instructional design of the program.

- The materials include an overview that provides a rationale for the instructional design of the program. Rationales are included in sections titled: See, Interact, Understand; Don't Memorize, Understand; From Small to Big; Not Your Ordinary Textbook. For example, the Narrated Orientation video provides a general overview for navigating the course materials on the online platform, including units, chapters, modules, lessons, and assessments. There are introductory videos and images, some lessons have interactive structures, then a module quiz. Then the narration video highlights the Assess, Apply, and Go Beyond components all connected to the units and chapters.

- Within the scope and sequence, there is an explanation of materials that address the purpose behind each material and potential ways a teacher can use them, such as using the GoBeyond first to engage students. However, there is a lack of documentation demonstrating the intent behind the materials. It is simply stated that teachers are free to use the materials however they need to within their classroom. The teacher guide provides an overarching explanation of the intent and purpose of the program design but does not provide specific guidance for implementation. For example, it does not provide a mastery framework that identifies the intent of the instructional design. There is a lack of documentation demonstrating the intent behind the materials. It is simply stated that teachers are free to use the materials however they need to within their classroom.
- The teacher guide consists of guiding questions for each unit and Go Beyond examples but does not outline a specific rationale for either component. There are no tangible instructions for implementation or intent of the design. For example, the teacher guide states, “We have created our content in a way to provide students opportunities to make connections between core concepts and scientific/engineering practices by introducing biology concepts from simple to complex. Therefore, we suggest teaching this course in the following order. However, teachers are welcome to build their own sequence of learning objectives.” There is no specific guidance for implementation.

# Smart Biology Texas

## Indicator 4.1

Materials provide opportunities for students to engage in productive struggle through sensemaking that involves reading, writing, thinking, and acting as scientists and engineers.

| | | |
|---|---|---|
| 1 | Materials consistently support students' meaningful sensemaking through reading, writing, thinking, and acting as scientists and engineers. | M |
| 2 | Materials provide multiple opportunities for students to engage with course-level appropriate scientific texts to gather evidence and develop an understanding of concepts. | PM |
| 3 | Materials provide multiple opportunities for students to engage in various written and graphic modes of communication to support students in developing and displaying an understanding of scientific concepts. | PM |
| 4 | Materials support students to act as scientists and engineers who can learn from engaging in phenomena and engineering design processes, make sense of concepts, and productively struggle. | PM |

## Partial Meets | Score 2/4

The materials partially meet the criteria for this indicator. Materials provide some opportunities for students to engage in productive struggle through sensemaking that involves reading, writing, thinking, and acting as scientists and engineers.

Material consistently supports students' meaningful sensemaking through reading, writing, thinking, and acting as scientists and engineers. Materials provide some opportunities for students to engage with course-level appropriate scientific texts to gather evidence and develop an understanding of concepts. Materials provide some opportunities for students to engage in various written and graphic modes of communication to support students in developing and displaying an understanding of scientific concepts. Materials support some students to act as scientists and engineers who can learn from engaging in phenomena and engineering design processes, make sense of concepts, and productively struggle.

Evidence includes but is not limited to:

Materials consistently support students' meaningful sensemaking through reading, writing, thinking, and acting as scientists and engineers.

- The material overview makes several statements that appear to support student sensemaking of important concepts. For example, the section titled "Changing How the World Understands Biology" in the Smart Biology Overview states, "Using a visual approach to allow students to fully understand biology enables them to devote their energy into thinking of ways to creatively advance the field rather than spending energy trying to understand structures, movements, or concepts that we can easily show them." The visual approaches that are emphasized in the text include introductory videos at the beginning of each chapter, module videos breaking down content that is presented within a lesson, and figures that serve as models for building content knowledge (such as Figure 3 in Chapter 1, Module 2, Lesson 1, which visually represents the size of an atom by comparing its size to the size of other structures). In another example, the

Overview states, “BIOLOGY Texas is an Animated Textbook with a highly visual approach to understanding biology and a long overdue alternative to the traditional textbook. By witnessing these incredible visualizations and interacting with our 3D interactive structures, students can truly understand biology. Through the use of accurate and realistic 3D visualizations and interactive structures, this digital resource takes students on an incredible journey into a live world of scientific discovery.”

- The Apply sections of assessments that are found at the end of each chapter contain activities that support student sensemaking through reading, writing, and acting as scientists and engineers. For instance, the first question of the APPLY section in Chapter 14 states, “Humans perform artificial selection both on purpose and unintentionally. What is an example of unintentional artificial selection by humans? What is the result of this selection, and how is it significant?” After being posed this question, students reflect individually through writing and in groups through building a presentation, which promotes scientific communication skills. Another example is in the Apply activity for Chapter 1. This activity requires students to select between one of the following questions: How would our lives be different if electron shells 2 and up only held a maximum of 6 electrons rather than 8? Why do everyday objects appear solid despite the incredible amount of empty space between subatomic particles? In the first step, students analyze. research, and draft notes of a possible solution individually. In step 2, students form small groups to discuss their individual conclusions. In step 3, the group comes to a consensus. In step 4, students prepare a presentation that includes visuals, their reasoning and interpretation, and their conclusion to present to the class. In the last step, each group gets evaluated by their peers and their teacher on “criteria such as: content, supportive arguments, clarity of presentation (including tone of voice and engagement), visualizations (quality, clarity, and relevance), and organization.”
- The materials provide a number of resources for student sensemaking. Within the teacher guide, the authors define their goal is for students to understand and not memorize. Within the teacher guide, teachers are encouraged to pause frequently and ask students questions about the videos and reading present. In both the teacher and student materials, students have a notebook at their disposal. Students are encouraged to use this item using a teacher-created template. The suggested template from the authors includes one where students will synthesize information at the end. Also, the new hands-on wet labs provide ample opportunities for students to participate in inquiry-based investigation, where students sequentially work through hands-on activities writing, thinking, reading, thinking, and acting as scientists and engineers. The Making Connections resource is sequenced to support logical sensemaking through “asking the question, planning the investigation, preparing and carrying out the investigation, analyzing the data, etc.,” which are all systematic approaches to sensemaking.

Materials provide multiple opportunities for students to engage with course-level appropriate scientific texts to gather evidence and develop an understanding of concepts.

- The section titled “GO BEYOND: Real World Relevance,” which is found in the assessment materials at the end of each chapter, occasionally includes purposeful and targeted activities for student engagement. For instance, the Real World Relevance activity for Chapter 9 (The Growing Cell|From Genes to Proteins) contains two figures with appropriate text descriptions. The activity asks students to apply what they learned about X chromosome inactivation to calico cats. While there is no specific reference to pre-reading or vocabulary emphasis, the GO BEYOND: Real World Relevance for Chapter 1 provides students with examples of everyday

items for the first 18 elements on the periodic table and challenges students to replace those elements with more items they can think of.

- The section titled "GO BEYOND: Techniques and Experiments" occasionally contains activities that support students in gathering evidence to aid in the development of understanding of a certain concept. For instance, the Techniques and Experiments activity for Chapter 7 (How Cells Extract Energy from Glucose) provides students with figures of three separate beakers containing varying amounts of glucose. Students are challenged to apply what they know about cellular respiration to explain why the balloon attached to the top of each beaker is different. Furthermore, the materials give the teacher the option to allow students to conduct this experiment themselves.
- There is text for every module in every chapter and unit. The text is merely the written version of the module video. For example, in module 2 of chapter 19, population density is explained in text and audiovisual format. However, there are no text supports for understanding and no vocabulary supports besides a glossary with a series of undefined words at the end of each chapter.
- The additional labs partially allow students to engage in grade-level reading; however, the text does not differentiate for all learners (ESL, Special Ed, etc.), providing some opportunities for students to demonstrate mastery of key concepts. For example, in Module 2 | Interactions Between Atoms | 2. Non-Covalent Bonds, there is one standardized text available to students without specific support for differentiated reading. The lab instructions are complete and succinct but do not allow for the differentiation of unique student populations. These labs are a one-size-fits-all approach to reading and hands-on, inquiry-based learning.
- The APPLY activity for Chapter 1 requires students to select between one of the following questions: How would our lives be different if electron shells 2 and up only held a maximum of 6 electrons rather than 8? Why do everyday objects appear solid despite the incredible amount of empty space between subatomic particles? In the first step, students analyze research and draft notes of a possible solution individually. In step 2, students form small groups to discuss their individual conclusions. In step 3, the group comes to a consensus. In step 4, students prepare a presentation that includes visuals, their reasoning and interpretation, and their conclusion to present to the class. In the last step, each group gets evaluated by their peers and their teacher on "criteria such as: content, supportive arguments, clarity of presentation (including tone of voice and engagement), visualizations (quality, clarity, and relevance), and organization."

Materials provide multiple opportunities for students to engage in various written and graphic modes of communication to support students in developing and displaying an understanding of scientific concepts.

- The lessons contain an APPLY section that provides authentic opportunities for students to engage in content practice and mastery. For example, in the APPLY section for Chapter 8, students are posed the following question: "How do you think we might be able to manipulate the macromolecular machines involved in photosynthesis in order to produce solar energy for ourselves?" Students use written presentations and graphics or models to develop an answer to this question. Also, in the APPLY section for Chapter 11, students are asked the following question: "Draw an image that shows visually how multicellular organisms grow through the growth and division of their cells, while for single-celled organisms, growth occurs simply by an increase in the size of the single cell." Students use written presentations and graphics or models to develop an answer to this question. Another example is in the APPLY activity for Chapter 11. In this activity, students are required to select between one of the following

questions: Question 1. Draw an image that shows visually how multicellular organisms grow through the growth and division of their cells, while for single-celled organisms, growth occurs simply by an increase in the size of the single cell. Question 2. If crossover and the independent assortment of chromosomes did not occur, generation after generation, explain what we would expect to see with regard to heritable traits in humans. In the first step, students analyze research, and draft notes of a possible solution individually. In step 2, students form small groups to discuss their individual conclusions. In step 3, the group comes to a consensus. In step 4, students prepare a presentation that includes visuals, their reasoning and interpretation, and their conclusion to present to the class. In the last step, each group gets evaluated by their peers and their teacher on "criteria such as: content, supportive arguments, clarity of presentation (including tone of voice and engagement), visualizations (quality, clarity, and relevance), and organization." Finally, in the APPLY section of the Go Beyond section for Chapter 19, students are asked to create a new ecosystem or to compare the adaptations of two different species and judge how they came to be successful. These types of activities, while encouraging students to show their knowledge, are limited to the end of the unit.

- Students are given opportunities to reflect and make sense of natural phenomena using experiments. For example, the students are given a peppered moth experiment to complete. However, there are no follow-up questions or any analysis to be made from this investigation. The hands-on labs provide a variety of opportunities for students to engage with various written and graphic modes of communication; however, these opportunities are not all available simultaneously. They are dependent on which mode of understanding is demonstrated for each scientific concept.
- Students have a blank digital note-taker during every lesson that is saved in a central location that can be exported later. However, there is no guidance on what students should take notes on or explicit references back to the digital note-taker.

Materials support students to act as scientists and engineers who can learn from engaging in phenomena and engineering design processes, make sense of concepts, and productively struggle.

- Each chapter contains a section titled "GO BEYOND: Techniques and Experiments" in the assessment materials. Due to the 100% digital nature of this resource, this section does not allow students to design and carry out their own experiment in order to engage in sensemaking and productive struggle. For instance, the Techniques and Experiments section for Chapter 11 (The Multicellular Life | Sexual Reproduction and Meiosis) presents students with a diagram of the life cycle of a particular organism and asks students to identify the organism whose life cycle is found in the diagram. However, there are no opportunities for designing and carrying out an experiment in the activity.
- Each chapter contains a section titled APPLY in the assessment materials. In this section, students translate their conceptual knowledge from the chapter to a new situation. For instance, the APPLY activity for Chapter 19 contains the following question: "Design and draw a hypothetical ecosystem that includes at least four different species and includes mutualism, predation, and herbivory." Students must use the knowledge that they gained from the unit and transfer it to this activity. Also, students are given an experiment on plants to assess whether they move. Students are instructed to give the plant certain conditions and to write down what happens and measure plant growth. Then, students will be asked to determine if the plant was near a light source or not. This experiment is one of the few where students analyze their own data.

- Lessons are not explicitly phenomena-based, and lessons do not consistently include high-interest activities that allow students to engage in sensemaking. For example, in Chapter 18, the materials state, “Now that you've learned all of the information in this chapter and completed all of the quiz questions, it's time to assess your knowledge, apply your knowledge, and then go beyond, using the blue buttons on the left. To assess your knowledge, you'll be asked some questions that require a written response. To apply your knowledge, you'll perform an activity. Each activity is different, but most involve critical thinking, brainstorming, group discussions, writing, and class presentations. Finally, you'll go beyond by answering questions about real-world relevance, scientific techniques/history, and more, all related to the content in this chapter. Are you ready? Let's go!” but there are no activities for students to design or engage in beyond written responses and group discussion regarding the physical world.
- The “wet labs” only include only a few opportunities for students to participate in the engineering design process or productive struggle. For example, many of the labs include data collection and analysis but only require students to “discuss” upon completion. In the lab Unit 5: Smart Biology In the Lab | Nitrogen In the Soil, there are no clear directives regarding what students should observe or what data they should record. The rigor of these labs does not fully engage students with the material.

# Smart Biology Texas

## Indicator 5.1

Materials promote students' use of evidence to develop, communicate, and evaluate explanations and solutions.

| | | |
|---|---|---|
| 1 | Materials prompt students to use evidence to support their hypotheses and claims. | PM |
| 2 | Materials include embedded opportunities to develop and utilize scientific vocabulary in context. | PM |
| 3 | Materials integrate argumentation and discourse throughout to support students' development of content knowledge and skills as appropriate for the concept and course. | PM |
| 4 | Materials provide opportunities for students to construct and present developmentally appropriate written and verbal arguments that justify explanations to phenomena and/or solutions to problems using evidence acquired from learning experiences. | PM |

## Partial Meets | Score 2/4

The materials partially meet the criteria for this indicator. Materials promote some students' use of evidence to develop, communicate, and evaluate explanations and solutions.

Materials prompt students to use some evidence to support their hypotheses and claims. Materials include some embedded opportunities to develop and utilize scientific vocabulary in context. Materials integrate some argumentation and discourse throughout to support students' development of content knowledge and skills as appropriate for the concept and course. Materials provide some opportunities for students to construct and present developmentally appropriate written and verbal arguments that justify explanations to phenomena and/or solutions to problems using evidence acquired from learning experiences.

Evidence includes but is not limited to:

Materials prompt students to use evidence to support their hypotheses and claims.

- Although partial opportunities are provided to use evidence to support student hypotheses and claims, such as short-answer or "Go Beyond" activities, the materials do not provide student guidance for how to use evidence to support their hypotheses and claims and do not provide data-driven activities allowing students to engage in high-level thinking or productive struggle There is supplementary material added to laboratory opportunities, but they do not directly call for students to use evidence to support a claim, and currently, these additions are not available for each unit. New supports are also highly structured, systematically guiding students to a conclusion in the pre-lab questions and introductory material before even beginning the investigation. For example, each of the APPLY activities in the GO BEYOND section at the end of each chapter is specifically designed for students to develop their answers independently, share their answers with supporting evidence to a small group, and collaborate with their small group to present a consensus answer to the class. For instance, the APPLY activity for Chapter 19 prompts students to answer one of the following questions: "1. Design and draw a hypothetical ecosystem that includes at least four different species and includes

mutualism, predation, and herbivory. 2. Compare and contrast two different species that differ significantly with respect to the trade-offs between survival and reproduction. How can these two different species adopt very different strategies yet both be successful?" Another example is in the Chapter 12 Go Beyond activity, where students are asked to choose to answer questions to predict what would happen if Mendel's pea plant genes were linked or to create a real-world example showing the difference between incomplete and complete dominance. However, the students are not directly asked to make a hypothesis nor specifically asked to provide evidence for their claims.

- Lab activities, while present, do not extend student thinking to using evidence to support claims. For example, students are given a lab to measure genetic inheritance in pea plants themselves but are only asked to compare genetic outcomes with the predicted outcomes and not to hypothesize about why those results may be different. Labs do not include a SEP-driven, inquiry-based approach, where the process of formulating a hypothesis is overly vague and not connected to an evidence-based process of reasoning. This is most apparent in the Conclusion/Post-Lab/Analysis section, where questions are superficial in nature ("What is the most interesting thing you learned from this experiment?," "If you could continue this experiment, which two types of cells would you like to compare next, and why?") and do not engage students in constructing explanations, developing and using models or evaluating and communicating information.
- Supporting activities and assessments only provide factual and/or surface-level exploration of unit content and don't require interpretation of evidence using authentic data. For example, in APPLY: Activity for Chapter 17, students summarize the chapter by creating a simple, hypothetical tree-of-life and "sharing out" with classmates instead of providing real-world scenarios that require applying evidence to innovative solutions. Also, in each of the Go Beyond modules, students are prompted to use evidence to support their claims. However, there is a lack of guidance that explains to students how to use the evidence. For example, The Apply activity for Chapter 11 asks students to select one of the following questions to answer. "Question 1. Draw an image that shows visually how multicellular organisms grow through the growth and division of their cells, while for single-celled organisms, growth occurs simply by an increase in the size of the single cell. Question 2. If crossover and the independent assortment of chromosomes did not occur, generation after generation, explain what we would expect to see with regard to heritable traits in humans." Students then take a few minutes (as assigned by their teacher) to analyze, research, and draft notes and ideas for a possible answer. Guidance for the use of any evidence students may have obtained earlier in the chapter is not referenced.

Materials include embedded opportunities to develop and utilize scientific vocabulary in context.

- Each module (such as Module 1 in Chapter 1) presents new vocabulary followed by an end-of-module quiz that assesses student knowledge of some vocabulary. For example, within the Chapter 11 GoBeyond assessment, students are asked about the difference between genotype and phenotype. The other explanatory question provided does rely on the correct usage of vocabulary words in order to match the correct answer. However, supporting activities and assessments only provide factual and/or surface-level exploration of unit content and do not require interpretation of evidence using authentic data. There is a lack of guidance that explains to students how to use the evidence. Guidance for use of any evidence students may have obtained earlier in the chapter is not referenced. For example, in Chapter 1, students are given a glossary of terms used throughout the modules as a refresher on the

important vocabulary of the chapter. These terms, however, are not defined in this glossary and are not highlighted or mentioned as important within other parts of the chapter.

- While the Apply and Go Beyond sections in the last module of each chapter occasionally provide opportunities for students to apply scientific vocabulary within extension activities related to the chapter, there is no direct guidance provided to ensure explicit vocabulary support. For example, the Apply activity for Chapter 10 has students researching real-world examples of DNA replication or the consequences of mitosis going wrong. While students come to a consensus on their discussions, there is no support highlighting vocabulary acquisition. Also, in the second question in the Apply section of Chapter 19, students are asked to include examples of mutualism, predation, and herbivory in a model ecosystem. However, the product does not contain a pre-teach section or opportunities for students to explore new terms and definitions prior to beginning the text. The product does not contain opportunities for students to explore new terms and definitions prior to beginning the text.
- The material does include images that correspond to vocabulary terms. For example, there is a glossary of terms for Chapter 1 on the subatomic world. Also, the figures of images each have a caption that describes the related vocabulary.

Materials integrate argumentation and discourse throughout to support students' development of content knowledge and skills as appropriate for the concept and course.

- Some of the activities (such as the Chapter 20 Activity) in the Practicing Science Ourselves with SEPs document provide opportunities for students to engage in the practice of argumentation and discourse. However, there is minimal guidance on how to engage in argumentation in the instructions, which read as follows: "Each half should then present their argument to the other side, one at a time. Once both sides have heard and understand each other's arguments, take about 10 minutes to argue and discuss each point while trying to determine which points are valid. Remember to be polite and respectful." There is no guidance for developing an argument or evaluating the other group's argument validity.
- Some of the Apply activities (such as the APPLY activity for Chapter 11) found in the last module of each chapter provide opportunities for students to engage in the practice of argumentation and discourse. However, there is minimal guidance on how to evaluate arguments in the instructions, which read as follows: "Each group will be given the opportunity of presenting their group findings. Each group will be evaluated by their peers as well as their teacher on criteria such as: content, supportive arguments, clarity of presentation (including tone of voice and engagement), visualizations (quality, clarity, and relevance), and organization." There is no guidance provided for how students should evaluate their peers' arguments.
- The Go Beyond activities invite students to engage in discourse within the materials and present their arguments for their answers. However, most of these activities are short-answer questions, similar to chapter comprehension questions, and do not allow for authentic, activity-based opportunities to fully engage with course content. Most activities are short-answer questions, similar to chapter comprehension questions, and do not allow for authentic, activity-based opportunities to fully engage with course content. For example, in Chapter 9, the students are asked to pick a question about protein synthesis and then grouped based on the question that they picked. They write their answers individually and then are encouraged to discuss their answers for the best explanation.
- Assessment resources that provide opportunities for students to read, think, write, and act as a scientist would be more effective if they included embedded tasks that are SEP-based, requiring

students to argue, defend, debate, etc., their findings. For example, the Practicing Science Ourselves activity for Chapter 14 covers preparing for an argument and engaging in an argument for evidence. While there are directions provided, they provide only some of the clarity students need to be successful. This example reads: “3. Preparing for an argument. To address this question, each group should divide in half. One half of the group will argue that this new discovery has little effect on our understanding of evolution, while the other half will argue that this one discovery disproves the entire evolutionary theory. Each half should take a few minutes (as determined by your teacher) to discuss the relevant points of the argument based on all of the evidence that we've learned throughout this chapter and prepare a written summary. Point form notes will suffice.” “4. Engage in an argument from evidence. Each half should then present their argument to the other side, one at a time. Once both sides have heard and understand each other’s arguments, take about 10 minutes to argue and discuss each point while trying to determine which points are valid. Remember to be polite and respectful." While the added wet labs for each chapter are designed as a culminating process for students to show what they learned, there isn't a strong emphasis on how to engage in a meaningful argumentation.

Materials provide opportunities for students to construct and present developmentally appropriate written and verbal arguments that justify explanations to phenomena and/or solutions to problems using evidence acquired from learning experiences.

- Some of the “Practicing Science Ourselves” with SEPs activities provide opportunities for students to justify explanations of phenomena and solutions to problems using written and verbal arguments. However, there is minimal guidance for students to construct and present verbal or written arguments in the instructions. One example reads as follows: “Each half should take a few minutes (as determined by your teacher) to discuss the relevant points of the argument, based on all of the evidence that we've learned throughout the chapter, and prepare a written summary. Point form notes will suffice. Each half should then present their argument to the other side, one at a time. Once both sides have heard and understand each other's arguments, take about 10 minutes to argue and discuss each point while trying to determine which points are valid. Remember to be polite and respectful.” There is no guidance for obtaining and incorporating evidence into the argument, writing a claim, or receiving feedback to revise their claim. In this activity, one group is right, and one group is wrong.
- One example reads as follows: “Take the next few minutes (as assigned by your teacher) to prepare, as a group, a short 5-10 minute presentation that includes visualizations (which could be drawings on a paper or on the chalkboard/whiteboard). Present your question, your reasoning and interpretation, and your conclusion in front of the class, as a group. This means planning ahead of time who will speak and when. It is recommended that each group member take a turn to speak. Do not forget to rehearse your presentation.” There are no specific criteria provided for any question in the APPLY sections, as the instructions are generalized for all APPLY sections.
- Some of the Practicing Science Ourselves with SEPs activities (such as the Chapter 14 Activity) in the document provide opportunities for students to justify explanations of phenomena and solutions to problems using written and verbal arguments. However, there is minimal guidance for students to construct and present a verbal or written argument in the instructions. One example reads as follows: “Each half should take a few minutes (as determined by your teacher) to discuss the relevant points of the argument, based on all of the evidence that we've learned throughout the chapter, and prepare a written summary. Point form notes will suffice. Each half

should then present their argument to the other side, one at a time. Once both sides have heard and understand each other's arguments, take about 10 minutes to argue and discuss each point while trying to determine which points are valid. Remember to be polite and respectful." There is no guidance for obtaining and incorporating evidence into the argument, writing a claim, and receiving feedback to revise their claim; one group is right, and one group is wrong.

- Experimental activities provide opportunities for students to construct and present developmentally appropriate content but do not provide guidance on how to evaluate and justify their arguments. For example, in an experiment simulating natural selection in peppered moths, students are tasked with creating and completing the simulation themselves. When the experiment is over, students are then led in a discussion on how environmental changes. However, there are no criteria to measure or assess these arguments. Within this same simulation, the students do not have to justify the "how" of this phenomenon or make predictions about the phenomenon. They are encouraged to relate the process to real-world examples; however, it is already a phenomenon that has occurred in the real world. This is also the only experiment within the resources that provide analysis questions.
- The lab activities include some opportunities for students to construct and present verbal and written arguments and include instructions for setting up the investigation and recording observations, but they fall short of interpreting data and presenting a hypothesis. There is also no explicit guidance on how students should acquire evidence from their learning experiences. For example, the wet lab for Unit 5 on "Nitrogen in the Soil" provides the following guidance for teachers, "Teaching tips: It's recommended to provide students with an introduction to the nitrogen cycle (and atomic cycles in general) before beginning. Encourage students to think critically about the experiment they're about to perform as well as the results (whether expected or unexpected) they obtain." However, there is no reference for the criteria students should use to develop their arguments.

# Indicator 5.2

Materials provide teacher guidance to support student reasoning and communication skills.

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|---|---|---|
| 1 | Materials provide teacher guidance on anticipating student responses and the use of questioning to deepen student thinking. | PM |
| 2 | Materials include teacher guidance on how to scaffold and support students' development and use of scientific vocabulary in context. | DNM |
| 3 | Materials provide teacher guidance on preparing for student discourse and supporting students in using evidence to construct written and verbal claims. | PM |
| 4 | Materials support and guide teachers in facilitating the sharing of students' thinking and finding solutions. | DNM |

## Partial Meets | Score 2/4

The materials partially meet the criteria for this indicator. Materials provide some teacher guidance to support student reasoning and communication skills.

Materials provide some teacher guidance on anticipating student responses and the use of questioning to deepen student thinking. Materials do not include teacher guidance on how to scaffold and support students' development and use of scientific vocabulary in context. Materials provide some teacher guidance on preparing for student discourse and supporting students in using evidence to construct written and verbal claims. Materials do not support and guide teachers in facilitating the sharing of students' thinking and finding solutions.

Evidence includes but is not limited to:

Materials provide teacher guidance on anticipating student responses and the use of questioning to deepen student thinking.

- The teacher guide provides an answer key to each Short Answer Question, Go Beyond, and Practicing Science Ourselves section in the Answer Keys & Teaching Tips section but does not provide direction to teachers on anticipatory responses of students or potential approaches to deepen student thinking. For instance, the Go Beyond: Scientific Techniques and Experiments section for Chapter 7 contains the following question: "If we take several flasks, each with the same amount of yeast cells at the bottom but with different amounts of sugar, and seal the top of each flask with a balloon, we can see that the flasks produce different amounts of gas. Why is this?" The answer key states: "the flasks with more sugar produce more gas. This gas is $CO_2$, and it is the waste product of aerobic respiration performed by the yeast cells in the flask." Besides the answer being provided, no other possible student responses, teacher responses to possible student responses, or supports for teachers to deepen student thinking through questioning are provided.
- The Practicing Science Ourselves document provides teaching tips for each Practicing Science Ourselves activity. For instance, the Practicing Science Ourselves activity (titled "Questioning Evolution") for Chapter 14 prompts students to consider the possibility of the existence of an *ele-raffe* (elephant and giraffe hybrid) and its implication on scientists' understanding of evolution - the provided teaching tip states, "There is no right answer to this question. On the

one hand, an ele-raffe should not exist because elephants and giraffes evolved from a common ancestor (one did not evolve into another). On the other hand, there are so many other lines of evidence that mitigate this new discovery. It's important to have students understand that our understanding of evolution is not based on one single piece of evidence." While this teaching tip provides limited student responses ("so many other lines of evidence"), there are no specific teacher responses included to possible student responses (the only response provided is that "it's important to have students understand that our understanding of evolution is not based on one single piece of evidence"), and no supports for teachers to deepen student thinking through questioning.

- The teacher edition provides a surface-level overview of the content and instructional sequencing. The teacher guide does include a section titled Teaching Difficult Concepts which addresses potential student misunderstandings and misconceptions. Each example within this section contains an overview of the potential confusion/misconception and suggested teaching tip(s) to mitigate. For instance, the section for Unit 2, Chapter 8, describes a potential student misconception as "Animal cells have mitochondria and plant cells have chloroplasts." Suggested teaching tips for addressing this potential misconception include an emphasis on the necessity of the mitochondria in plant cells to break down food that is produced through photosynthesis, which is carried out by the chloroplast.
- The Assess section in the last module of each unit includes questions and answers in the teacher's edition. For example, in Chapter 9, from Genes to Proteins, the following guidance is provided for teachers, "1. There is a lot of DNA in a eukaryotic cell nucleus. How does this DNA not get tangled? Answer: histones and other DNA packaging proteins package the DNA in an organized manner. 2. What are the mRNA processing events that take place in eukaryotic cells? Answer: addition of a 5' cap, splicing of exons, and the addition of a poly(A) tail. 3. There are 20 different types of amino acids but only 4 types of nucleotides. How does one translate to the other? Answer: each amino acid is coded by one or more codons. A codon consists of three consecutive nucleotides." While answers are provided to the few Assess questions in the modules, there is no guidance provided for teachers to build on student thinking or to deepen their thinking through questioning. Also, in the Chapter 13 GoBeyond: Assess activity, students are asked three different questions about the concept of evolution. One question is, "Why do harmful mutations not spread throughout a population?" There is only one accepted answer and there are no questions for teachers to follow up with for students and deepen their thinking.

Materials include teacher guidance on how to scaffold and support students' development and use of scientific vocabulary in context.

- The table of contents and Additional Notes section of the teacher guide provides an overview of each Unit that contains a unit summary, features, and a list of chapters, modules, and lessons. However, there is no vocabulary preview, vocabulary prioritization, or vocabulary support explicitly provided in the Unit Overview. For example, while the Overview places emphasis on the accurate, realistic 3D animations contained in the materials, there is a lack of connection between the vocabulary in the context of the concepts being studied.
- Each chapter, module, and lesson within the curriculum lacks a comprehensive list of defined vocabulary for the relevant section. While lessons may provide videos, figures, or interactives that visualize possible vocabulary terms, they lack any vocabulary support, such as a Vocabulary in Context sidebar and scaffolds to implement vocabulary use within classroom activities. For

example, Chapter 9 (From Genes to Proteins), Module 3, provides videos and images that illustrate the process of DNA transcription but does not provide vocabulary lists or supports for DNA transcription. Also, in the Chapter 4 Apply part of the Go Beyond module, students are given the option to explain structure and function relationships found within the real world. While this is presented as an extension of enzyme structure, it does not give students an opportunity to practice any of the chapter vocabulary in any context. Finally, within Chapter 1, Module 3, there is actually a glossary of key terms present. However, it is more of a word bank, as there are no definitions for these words with no direct practicing of those words.

- The Lesson Implementation Guide does not provide teachers with scaffolding and support in developing authentic development of EB students' use of scientific vocabulary. For example, in Chapter 8 | Plants Make Glucose for Everyone, Module 4 | Chloroplasts are Sugar Manufacturing Plants, there are multiple engaging illustrations that are clearly labeled with relevant terms aligned to the text. However, there is no pre-teaching of vocabulary, checks for understanding, or differentiated opportunities for various learners.

Materials provide teacher guidance on preparing for student discourse and supporting students in using evidence to construct written and verbal claims.

- The Apply section at the end of each chapter establishes norms for implementing student discourse: 2. Step to be done in a small group: Form a group of 2-4 peers who have all chosen to answer the same question. Name a group note-taker and group leader. Take the next few minutes (as assigned by your teacher) to allow all participants to share their written ideas with the rest of the group. Each member should explain the reasoning for their conclusion. 3. After everyone has had a chance to share their thoughts, take a few minutes (as assigned by your teacher) to discuss all of the different ideas that were shared in order to come to a collective group conclusion. 4. Take the next few minutes (as assigned by your teacher) to prepare, as a group, a short 5-10 minute presentation that includes visualizations (which could be drawings on paper or on the chalkboard/whiteboard). Present your question, your reasoning and interpretation, and your conclusion in front of the class, as a group. This means planning ahead of time who will speak and when. It is recommended that each group member take a turn to speak. Do not forget to rehearse your presentation.“However, there is no specific teacher guidance for supporting student discourse and use of evidence in constructing verbal and written claims while students are completing the activity.” Additionally, there is no teacher guidance for providing feedback on student discourse within the activity. All that is stated is, “Each group will be given the opportunity of presenting their group findings. Each group will be evaluated by their peers as well as their teacher on criteria such as: content, supportive arguments, clarity of presentation (including tone of voice and engagement), visualizations (quality, clarity, and relevance), and organization.” Also, within the Chapter 15 Apply section, students are given the option to assess what they think are the two most important events in Earth's history and why. This is an invitation that gives some structure to students as they are asked to begin their work alone and then group up based on the question they chose and discuss their answers. Though the students are invited into discourse, there are no teacher resources for fostering a community that encourages evidence-based discourse, nor are there supports built in to provide feedback to students.
- Some Practicing Science Ourselves activities include opportunities for students to engage in discourse. Each activity contains opportunities for peer input and for creating and establishing norms. For instance, the Practicing Science Ourselves activity (Is Climate Change Real?) for Chapter 20 asks students to consider their personal beliefs about the existence of human-

caused climate change, collect several peer-reviewed articles that support their belief, and present their arguments to other students within groups or whole class discussion. However, the materials do not provide specific teacher guidance for giving feedback on student discourse and using evidence to construct claims. The only guidance for developing claims is found in the instructions for evaluating information, which states, "Read through each of the articles. How reliable does this information seem to you? What are your reasons for thinking that?"

- The materials do not provide proper guidance to teachers for fostering interactive discourse and supporting linkages between evidence and claims in the classroom in any format. Teachers can watch the overview videos provided for the students, but there is no teacher support for facilitating the sharing of students finding solutions specific to the learning content. For example, in Chapter 6 | Understanding Chemical Energy, Module 2 | Chemical Energy in Theory, students review content through text and images but only provide teachers with partial directives for stimulating conversations around evidence as it supports claims and conclusions. Also, when reviewing the teacher guide, chapter Short Answer and Going Beyond questions provide only surface-level assessment of comprehension and do not explicitly require students to use evidence to support their written and verbal claims.

Materials support and guide teachers in facilitating the sharing of students' thinking and finding solutions.

- The Answer Keys & Teaching Tips section of the teacher guide provides the correct answer for each activity within the Short Answer Questions, Go Beyond, and Practicing Science Ourselves sections, but this section does not contain any exemplars for the Apply sections. Additionally, there are no teaching tips for facilitating the sharing of students' finding solutions for the Apply sections, which are discussion-based. For example, in Chapter 18, short answer questions are single-word responses and do not fully explore student thinking and/or reasoning.
- Some Practicing Science Ourselves activities include opportunities for students to engage verbally in discourse. For instance, the Practicing Science Ourselves activity (Is Climate Change Real?) for Chapter 20 asks students to consider their personal beliefs about the existence of human-caused climate change, collect several peer-reviewed articles that support their belief, and present their arguments to other students within groups or whole class discussion. However, the materials do not provide exemplars or teacher support for facilitating the sharing of students' finding solutions, such as feedback or rubrics.
- There is no evidence that teachers have support in guiding various modes of discourse in lab activities. For example, any discussion of a lab is limited to one or two questions, and the only instructions present are "discuss..." However, there is no teacher guidance on facilitating any discussion or guidelines for preventing misconceptions or assessing the discussion.
- The Overview details the assessments being found as quizzes throughout each module but does not provide teacher support, such as exemplars to show students how to facilitate their thinking in written form or to support the teacher with designing a rubric for the presentation students create. For example, chapter quizzes, such as the quiz for Chapter 6, Understanding Chemical Energy, and Module 2, Chemical Energy in Theory, provide for only multiple choice responses. This does not provide a complete formative assessment for teachers, providing only limited data on student misconceptions.

# Smart Biology Texas

## Indicator 6.1

Materials include a variety of TEKS-aligned and developmentally appropriate assessment tools.

| | | |
|---|---|---|
| 1 | Materials include a range of diagnostic, formative, and summative assessments to assess student learning in a variety of formats. | DNM |
| 2 | Materials assess all student expectations over the breadth of the course and indicate which student expectations are being assessed in each assessment. | DNM |
| 3 | Materials include assessments that integrate scientific concepts and science and engineering practices. | PM |
| 4 | Materials include assessments that require students to apply knowledge and skills to novel contexts. | M |

## Partial Meets | Score 1/2

The materials partially meet the criteria for this indicator. Materials include some variety of TEKS-aligned and developmentally appropriate assessment tools.

Materials do not include a range of diagnostic, formative, and summative assessments to assess student learning in a variety of formats. Materials do not assess all student expectations over the breadth of the course and indicate which student expectations are being assessed in each assessment. Materials include some assessments that integrate scientific concepts and science and engineering practices. Materials include assessments that require students to apply knowledge and skills to novel contexts.

Evidence includes but is not limited to:

Materials include a range of diagnostic, formative, and summative assessments to assess student learning in a variety of formats.

- Each module contains a quiz that students complete at the end in the form of questions from the Go Beyond resource. This is the only form of formative assessment in the materials; there are no other kinds of formative assessments (such as modeling, calculations, discussion prompts, etc.) used in the materials. For instance, Chapter 7, Module 1 presents students with an overview of cellular respiration; while students complete a quiz at the end of the module, there are no other forms of built-in assessment used in the materials to measure student learning and determine the next steps for instruction.
- The materials do not contain any forms of informal assessment (such as bell ringers, exit tickets, think-pair-shares, checks for understanding, etc.) that give teachers feedback on student learning in the moment so that they can modify instructional approaches. [-so that teachers can modify instruction.
- Appropriately rigorous formative and summative assessments are lacking in the materials, providing teachers with little guidance on how to alter instruction or provide productive remediation techniques. Mastery requirements are not explicitly outlined, and the modalities for demonstrating comprehension are limited in terms of format. For example, in Chapter 15: A Whole Lot of Time, Module 1, Getting Ready for the Hike, module review questions only address rote memorization and do not reflect the rigor of STAAR testing standards. Also, while the

Making Connections document shows how each chapter is connected to each other, there is no specific anticipation guide or pre-assessment framework to support teachers with presenting an accurate diagnostic assessment for students.

- Each chapter ends with the last module of assess and apply questions, but the format is limited to the same product of discussion and class presentation each time. For example, after answering three questions on DNA, students select between two questions to conduct their research and present to the class, "Question 1. Explain what would happen if ribosomes were present in the nucleus instead of in the cytosol. Question 2. Draw the cycle of events, including transcription, translation, and degradation, from the point of view of a single amino acid."

Materials assess all student expectations over the breadth of the course and indicate which student expectations are being assessed in each assessment.

- The Pacing Guide in the Teacher Guide references TEKS that are covered during each week of instruction, and the Pacing Guide is organized by units (for instance, Unit 1 is covered in weeks 1 through 9). However, the materials do not indicate what content each of the listed TEKS contains, and the TEKS are incorrectly labeled. As materials are not aligned with the TEKS, there is no way to tell if the materials are assessing all student expectations.
- The Pacing Guide in the Teacher Guide states, "Assessment tools and activities are located at the end of each of the 20 chapters, in modules titled 'Assess, Apply Your Knowledge and Go Beyond!' Even though they are located at the end of every chapter, teachers can use these activities in a different sequence, as they see fit." While the Apply Your Knowledge and Go Beyond sections serve as assessments within each chapter, these sections lack any TEKS correlations within the activity.
- The scope and sequence is included in the teacher materials, but it is also not aligned to the TEKS as they are written on TEA's website. It has a column for TEKS but incorrectly identifies them, so there is no stated evidence of alignment between the TEKS and the assessments.
- Assessments do not fully evaluate student sensemaking and provide limited feedback for teachers in terms of altering instructional approaches. For example, in the complex topic of Chapter 17, Macroevolution of Species and Biological Diversity, Module 2, Speciation and the Origin of Species, the assessment tool provides a limited number of multiple choice questions that do not completely evaluate student mastery of the fundamental processes of evolution. More-descriptive questioning would reveal common misunderstandings and allow teachers to adjust to targeted instruction.

Materials include assessments that integrate scientific concepts and science and engineering practices.

- The materials include "Practicing Science Ourselves" and lab investigation resources, where students can look at scientific situations and are asked to collect data, make a hypothesis, and analyze the data by making comparisons. However, the first student is supposed to be asking questions, not the material. the item simply asks questions. However, the students eventually do end up creating solutions for the problem, and the teacher is encouraged to accept all answers. For example, the Practicing Science Ourselves for Chapter 12 allows students to use mathematical computational thinking while analyzing and interpreting data when determining genotypes of fruit flies.
- The materials partially assess students through the implementation of science and engineering practices in the Go Beyond documents. Here, there are extension opportunities for students to apply knowledge, mostly in a qualitative format, using analogies. For example, in Chapter 7,

students are prompted to compare the following question: "How is the flow of protons through ATP synthase similar to a fan powered by a battery?" This encourages students to construct explanations.

- Each chapter includes performance tasks that allow teachers to assess student progress and/or mastery using the SEPs. For example, in Chapter 13: Practicing Science Ourselves, Questioning Evolution, students think like scientists and engage in productive sensemaking on the process of evolution, using human eye structures as the basis for investigation. Student products include developing and using models and engaging in evidence-driven argumentation. Also, the Practicing Science Ourselves activity for Chapter 13 (Questioning Evolution) prompts students to use practices such as "developing and using models" and "engaging in an argument from evidence" in order to explain how the human eye evolved one step at a time. However, removing one of its parts leads to a non-functional structure. Finally, the Practicing Science Ourselves activity for Chapter 17 (Where Are All the Marsupials?) prompts students to use practices such as "constructing explanations and designing solutions" in order to explain why marsupials are found almost exclusively in Australia and South America.

Materials include assessments that require students to apply knowledge and skills to novel contexts.

- The material provides extension opportunities for students to apply recently acquired knowledge skills to new contexts. For example, in the teacher guide Go Beyond section for Chapter 6, students reflect on the relationship between the atoms in an O2 molecule and an equally-matched game of tug-of-war. Students are encouraged to identify the relationship between the two scenarios, then apply that connection to a third, unique situation; that of the oxygen and hydrogen atoms in a water molecule. Also, the Go Beyond: Techniques and Experiments section for Chapter 8 prompts students with the following situation: "If we let a plant grow with a light source directly above it, the plant will grow straight up. However, if we then move the light source to the side, the plant will start to grow or orient its leaves to the side, towards the light. Why does this occur?" Students must apply their knowledge of photosynthesis in order to answer this question. Finally, in the GoBeyond Chapter 5 Apply section, students are asked to create a hypothetical cellular pathway using what they have already learned. While entirely hypothetical, these are new and unfamiliar situations where students have to apply their knowledge.
- Demonstration of student learning is assessed through various activities in the "Practicing Science Ourselves" supplementary materials. Most tasks are scenario-based and ask students to transfer newly acquired knowledge from the text and labs to unique problem-solving case studies. For example, in Chapter 17, Practicing Science Ourselves, Where Are All the Marsupials?, students use their understanding of the macroevolution of species to modern-day adaptation in New Zealand and Australia.
- The materials contain opportunities for students to apply acquired knowledge and skills to real-world problems. For example, the Go Beyond real-world connection question for Chapter 19 asks students about the pattern of human development distributed by a satellite image of the Nile River. Also, the Go Beyond document for Techniques and Experiments for Chapter 16 allows students to calculate a genotype frequency using the Hardy-Weinberg equilibrium. Finally, the Go Beyond: Real-World Relevance section for Chapter 9 presents students with a photo of a calico cat. Students are prompted with the question, "Given what we know about X chromosome inactivation, how do you think this relates to the different patches of color on this cat?" Students must apply their knowledge of X chromosome inactivation in order to answer the question.

# Indicator 6.2

Materials include guidance that explains how to analyze and respond to data from assessment tools.

| | | |
|---|---|---|
| 1 | Materials include information and/or resources that provide guidance for evaluating student responses. | PM |
| 2 | Materials support teachers' analysis of assessment data with guidance and direction to respond to individual students' needs, in all areas of science, based on measures of student progress appropriate for the developmental level. | DNM |
| 3 | Assessment tools yield relevant information for teachers to use when planning instruction, intervention, and extension. | DNM |
| 4 | Materials provide a variety of resources and teacher guidance on how to leverage different activities to respond to student data. | DNM |

## Partial Meets | Score 1/2

The materials partially meet the criteria for the indicator. Materials include some guidance that explains how to analyze and respond to data from assessment tools.

Materials include some guidance that explains materials include some information and/or resources that provide guidance for evaluating student responses. Materials do not support teachers' analysis of assessment data with guidance and direction to respond to individual students' needs, in all areas of science, based on measures of student progress appropriate for the developmental level. Assessment tools do not yield relevant information for teachers to use when planning instruction, intervention, and extension. Materials do not provide a variety of resources and teacher guidance on how to leverage different activities to respond to student data and on how to analyze and respond to data from assessment tools.

The Evidence includes but is not limited to:

Materials include information and/or resources that provide guidance for evaluating student responses.

- The Teacher Guide contains a section titled Answer Keys & Teaching Tips that provides an answer key for each of the Short Answer Questions and Assess and Go Beyond activities. These three evaluative components include suggested responses, allowing teachers to assess student responses. For instance, the answer key for Chapter 9's Go Beyond: Scientific Techniques and Experiments section provides the following question and answer: "When Francis Crick first proposed the idea of the central dogma in 1957, there were no experimental results to back his claim. Today, more than 60 years later, a countless number of experiments over the past decades have shown that his theory was correct. What does the central dogma have to say about the flow of information between DNA, RNA, and proteins? Answer: information can pass from DNA to RNA, from RNA to protein, and even from RNA to DNA, but never from protein to DNA or RNA." Also, the following content is stated for Chapter 12, Question 3, " What is the difference between incomplete dominance and codominance? Answer: in incomplete dominance, the trait appears as a combination between the two allele combinations. In codominance, both traits are expressed together." However, while the materials provide answers to the questions, there are not any rubrics or other resources that guide teachers in

evaluating the responses that students provide. There are also no rubrics to help assess student learning for the free response items, such as in the Apply section.
- All modules include multiple-choice quizzes that informally assess student understanding. Most questions only partially probe student comprehension. More short-answer and inquiry-based questioning would aid in more completely assessing and evaluating student responses.

Materials support teachers' analysis of assessment data with guidance and direction to respond to individual students' needs, in all areas of science, based on measures of student progress appropriate for the developmental level.

- While the materials contain a section of the Teacher Guide titled Answer Keys & Teacher Tips, the materials do not contain any documents that provide guidance for analyzing or interpreting data that is gained from relevant assessments. The teacher guide also contains common misconceptions about each topic presented and where to locate them in the material, but there are few materials to help teachers address student misconceptions besides telling teachers to "show the video" to the class.
- The materials contain quizzes for students to complete at the end of each module within a chapter. Quiz scores are logged under a tab titled “My Quiz” on the online platform's dashboard. However, there are no resources for making this data easy to analyze and interpret, such as color coding scores based on mastery, charting progress over time, or showing performance patterns.
- While there are multiple sources of evaluative feedback in the materials, explicit guidance on how to differentiate learning is absent. For example, in each chapter quiz, there is an embedded multiple-choice question. For example, in Chapter 17, Macroevolution of Species and Biological Diversity Module 1, What is a Species? the chapter quiz only provides summative results but does not provide suggestions for how to reteach, alter or expand on course content. These data lack instructional opportunities for teachers to pivot and implement alternate learning methods.
- The labs are roughly outlined in the instructional materials, with the intention of engaging students in the content. Evaluative responses are missing, however. In particular, the 'Practicing Science Ourselves' activities provide opportunities for students to collect, analyze, and interpret data but do not offer any resources or support for teachers that explain how to analyze or interpret the data. For example, in "Practicing Science Ourselves," Chapter 17 Practicing Science Ourselves, Where Are All the Marsupials? key questions and suggested connections are included in the answer key, but additional strategies to address student misconceptions are not addressed.

Assessment tools yield relevant information for teachers to use when planning instruction, intervention, and extension.

- The Course Content section of the Teacher Guide states that teachers should "adapt the course content for students experiencing more difficulties, as well as assign extra/optional material for higher performing students." Despite this statement, nothing in these materials provides guidance for how to use assessments as a tool to guide adapting course content for students experiencing more difficulties through differentiation. The only support for differentiation included in the teacher guide is the statement that teachers are welcome to adapt the course with additional materials for students who need an extension and those who have difficulties.

- The resources include some variety of checkpoints for understanding. This occurs in embedded multiple-choice quizzes, "Go Beyond" extension questions, and lab-based activities. However, there is no guidance for using the resources to plan for differentiated instruction, such as grouping students based on concepts that need to be retaught or providing opportunities for whole-class review or reteaching. For example, while the content in the Go Beyond sections is designed for students to stretch their thinking, the materials lack an assessment tool for teachers to reference when interpreting data to plan for core instruction.
- The Pacing Guide only includes a suggested sequence of implementation for teachers. It does not include alternative opportunities for teachers to accelerate, reteach or revise instructional methods based on student assessments or feedback.

Materials provide a variety of resources and teacher guidance on how to leverage different activities to respond to student data.

- Each lesson within a module contains a video that presents the content that is discussed within the lesson. For instance, the video for Chapter 9, Module 3, Lesson 1 discusses the process of transcription within protein synthesis. Despite this, there are no further resources, such as student practice questions, for struggling students to use in reteaching concepts. The only reteaching suggestion provided to teachers is to have students redo the module when they receive an unsatisfactory grade. There are suggestions with Assess short answers for the teacher to guide students when they have a possible wrong answer. For example, " How would you describe the relationship between cells and life?" There is a correct answer and possible incorrect or alternative answers. This is followed by teacher guidance to help clarify misconceptions.
- The Apply section at the end of each chapter promotes students working in groups based on which question the student answered ("Form a group of 2-4 peers who have all chosen to answer the same question"). However, the section does not provide teacher guidance for responding to performance data, such as grouping students based on assessment performance throughout the chapter.
- The quiz assessments are designed to integrate into a school's LMS as a way to track growth. These are the only assignments that do so; other assignments do not. While data for understanding is included in chapter quizzes; however, there are no clear-cut directives on how teachers should address misunderstandings. For example, the multiple-choice assessments in each chapter provide a summary of correct/incorrect student results, but there is no explicit guidance on how to leverage activities to meet the needs of diverse learners based on the data.
- The interactive labs include multiple opportunities to experience hands-on learning. However, evaluative data for teachers is summative (not formative) and provides little guidance for modifying learning based on this data.
- The 'Practicing Science Ourselves' activities connect the SEPs to some of the science content, but there is a lack of guidance for the teacher on how to respond to student performance. For example, there are no documents that guide teachers on how to form small groups, address gaps in learning, or alternate assignments for struggling students.

# Smart Biology Texas

## Indicator 6.3

Assessments are clear and easy to understand.

| | | |
|---|---|---|
| 1 | Assessments contain items that are scientifically accurate, avoid bias, and are free from errors. | M |
| 2 | Assessment tools use clear pictures and graphics that are developmentally appropriate. | PM |
| 3 | Materials provide guidance to ensure consistent and accurate administration of assessment tools. | DNM |
| 4 | Materials include guidance to offer accommodations for assessment tools that allow students to demonstrate mastery of knowledge and skills aligned to learning goals. | DNM |

## Partial Meets | Score 1/2

The materials partially meet the criteria for the indicator. Assessments are sometimes clear and easy to understand.

Assessments contain items that are scientifically accurate, avoid bias, and are free from errors. Assessment tools use clear pictures and graphics that are sometimes developmentally appropriate. Materials do not provide guidance to ensure consistent and accurate administration of assessment tools. Materials do not include guidance to offer accommodations for assessment tools that allow students to demonstrate mastery of knowledge and skills aligned to learning goals.

Evidence includes but is not limited to:

Assessments contain items that are scientifically accurate, avoid bias, and are free from errors.

- Assessments include items that align with taught objectives and present concepts in a scientifically accurate manner. For instance, Question 2 in the Assess section from Chapter 6 states the following: "How do photoautotrophs and heterotrophs differ? Answer: photoautotrophs acquire their energy from the sun, whereas heterotrophs acquire their energy from consuming other organisms." For example, the Assess questions for Chapter 9 on the growing cell are: "There is a lot of DNA in a eukaryotic cell nucleus. How does this DNA not get tangled? What are the mRNA processing events that take place in eukaryotic cells? and There are 20 different types of amino acids but only four types of nucleotides. How does one translate to the other?" Answers are correct and scientifically accurate.
- Assessments include items that are free from errors. For instance, Question 1 in the Assess section from Chapter 7 states, "How much ATP is consumed and produced during glycolysis for one glucose molecule? How much net ATP is produced per glucose molecule? Answer: 2 ATPs are consumed, and 4 are produced for a net yield of 2." Also, the answers provided in the assessment of the GoBeyond module of chapter 8 are all correct.
- All assessments are free from bias in their questioning and in the answers. For example, in Chapter 16, Microevolution of Evolving Populations, Module 1, The Evolution of Populations unit quiz, these multiple choice questions are reflective of the course content and are auto-corrected; questions also focus on the chapter material and are worded in a way that is gender and ethnically neutral. Also, the addendum labs are written in an inclusive format: not only are they structured using inclusive vocabulary (gender-neutral pronouns, using "the student or the

/student), they avoid using over-generalized ethnic identifiers, allowing all students to put themselves as first-person learners.

Assessment tools use clear pictures and graphics that are developmentally appropriate.

- Some of the Go Beyond sections in the final module of each chapter contain questions with clear, developmentally appropriate pictures and graphics that help students build content knowledge. For instance, the Go Beyond: Techniques and Experiments section for Chapter 8 contains an image of two plants in separate containers that are growing in different directions, but both are growing towards a light source. The section provides the following information and question: "If we let a plant grow with a light source directly above it, the plant will grow straight up. However if we then move the light source to the side, the plant will start to grow or orient its leaves to the side, towards the light. Why does this occur? Answer: the leaves of a plant occupy a large surface area over which photosynthesis takes place, so plants attempt to maximize the exposure of their leaves to light." Images are clear and developmentally appropriate.
- While the end-of-module quizzes can serve as a form of assessment for content learned throughout the module, there are no pictures or graphics in the quizzes. Students do get opportunities to interact with some of the images during the lesson text, but developmentally appropriate 3D images need to be added to the assessments since students are expected to identify them to understand the content. For example, there are realistic images of atoms and cells in Chapter 1 during the lesson text, but the 'Assess' questions do not reference any images. Also, one of the questions in the Chapter 12, Module 4 quiz states, "Flower color in snapdragons is an example of... " This question has no associated image - students would have to memorize the answer from the text. An image could be inserted here to build students' association of the example with the content knowledge. Finally, in Chapter 13, Life Evolves Module 3, Mutations, Fluidity, and Diversity Come From Mistakes, all questions are written as true/false or multiple choice and could include infographics for students to interpret. For example, the question "Mutations typically occur during (choose the best one)" offers responses that are entirely written as multiple-choice sentences. Other options could be illustrative choices that show the various stages of mitosis rather than simplified wording.
- While the images included are visually stimulating computer-generated images of detailed and complex structures, they are often extraneous and distracting to the student. For example, Lesson 2 of Module 3 in Chapter 6 contains detailed structures of chlorophyll as part of how they capture light. However, they are not required or needed within the TEKS and are distracting to the lesson of how the electron transport chain begins photosynthesis.
- The assessments embedded in the hands-on labs contain no illustrations and do not explicitly ask students to plot, graph, or illustrate their results for deeper understanding. For example, in Unit 2, Smart Biology In the Lab, Cellular Respiration in Action, students are asked to observe and measure expansion levels of sandwich baggies based on sugar type but lack a summative task that could include synthesizing information into a cohesive data table, or graphing (bar, scatter plot, etc.) results to reinforce learning. Additionally, labs are missing illustrations that demonstrate experimental set-up; for visual learners, descriptions that are exclusively provided in text or written format and can be challenging, especially for those with dyslexia, emerging bilinguals, lower-Lexile students, etc.

## Materials provide guidance to ensure consistent and accurate administration of assessment tools.

- While the Teacher Guide provides an answer key in the Answer Keys & Teaching Tips section to each Assess and Go Beyond section within the curriculum, the materials fail to include scoring procedures or an example of a scored performance assessment with an explanation for each of its components. For instance, the Answer Keys & Teaching Tips section provides the following information for the Chapter 9, Go Beyond, Scientific Techniques and Experiments section: "When Francis Crick first proposed the idea of the central dogma in 1957, there were no experimental results to back his claim. Today, more than 60 years later, a countless number of experiments over the past decades have shown that his theory was correct. What does the central dogma have to say about the flow of information between DNA, RNA, and proteins? Answer: Information can pass from DNA to RNA, from RNA to protein, and even from RNA to DNA, but never from protein to DNA or RNA." While the correct answer is provided, there are no scoring guidelines provided for this performance task. The "Go Beyond" section includes only one short answer response from each unit. Additionally, these questions are framed in such a way as to assess only factually superficial information that can be acquired through memorization. Lastly, the "Go Beyond" section does not provide guidance to teachers on a 'way forward' for incorrect answers, such as options for reteaching, differentiation, or modification of lesson plans.
- While the Apply section from the last module of each chapter provides guidance for the length of time for each step of the assessment, there is no teacher guidance for scoring student products. The teacher eText for each Apply section states the following under number 5: "Each group will be given the opportunity of presenting their group findings. Each group will be evaluated by their peers as well as their teacher on criteria such as: content, supportive arguments, clarity of presentation (including tone of voice and engagement), visualizations (quality, clarity, and relevance), and organization." There are no guidelines for scoring these criteria provided in the teaching materials.
- The teacher resources provide little to no guidance on timing and strategies for implementing assessment tools. In the instruction manual, the materials acknowledge that "Self-Assessment & Evaluation Assessments have been elaborated to provide students opportunities to evaluate their own learning process via quizzes and activities/projects." However, there is little included on how students should evaluate their own progress or how to adapt/reteach misconceptions.
- While the teacher overview mentions end-of-module auto-graded quizzes and end-of-chapter questions, there is no other guidance provided for teachers to consistently and accurately administer the assessments. Scoring for these quizzes is automatic, as they are multiple choice questions or true/false questions. The correct answers for the quizzes are not given to teachers. Instead, the answers are "available upon request," according to the teacher guide on page 64. For example, students take a ten-question multiple-choice/true-false quiz on Ecology. Upon completion, the quiz shows students their scores and whether they got the right or wrong answer. There isn't any other guidance provided for the teacher.

## Materials include guidance to offer accommodations for assessment tools that allow students to demonstrate mastery of knowledge and skills aligned to learning goals.

- The Assess section in the final module of each chapter always contains three generalized questions and cannot be modified or differentiated. For instance, the Assess section for Chapter 7 contains the following three questions: "1. How much ATP is consumed and how much is produced during glycolysis, for one glucose molecule? How much net ATP is produced per

glucose molecule? 2. Why do electrons move through the ETC? 3. How does a high concentration of protons lead to the production of ATP?" There are no options in the teacher edition to modify or differentiate these questions according to student needs. For instance, questions cannot be removed/modified to increase support for students using a modified curriculum.

- The end-of-module quizzes found in each module do not contain options for text-to-speech to aid students with accommodations, although they do offer closed captioning for the videos. There are no options to use speech-to-text software and no indication it will work with the Ipad's accessibility features, such as switches. The multiple choice/true-false quizzes in each module allow auto-grading, but they do not allow differentiation for students that need an accommodation of fewer or varied questions or items requiring short answers. Additionally, these embedded assessments are not offered in any other language except English, with no guidance to teachers on how to adapt materials for those students needing accommodations.
- The labs do not give a clear definition to teachers of what demonstrates mastery (sample response, exemplars, rubrics, etc.). Additionally, lab materials are not differentiated to provide common accommodations (chunking, shortened reading, translated texts, Lexile differentiation, etc.) This makes it difficult for teachers to discern the root of student misunderstandings: without accommodations, teachers can't distinguish the cause of student errors, confusion regarding the content, or assessments that are not fit for purpose. For example, in Lab Unit 5, Smart Biology In the Lab,  Nitrogen In the Soil, the instructions are written in a way that is not entirely clear, especially for lower-Lexile readers and emerging bilinguals. There is also a glossary included for keywords such as “inoculate” and “contamination.”

# Smart Biology Texas

## Indicator 7.1

Materials include guidance, scaffolds, supports, and extensions that maximize student learning potential.

| | | |
|---|---|---|
| 1 | Materials provide recommended targeted instruction and activities to scaffold learning for students who have not yet achieved mastery. | DNM |
| 2 | Materials provide enrichment activities for all levels of learners. | DNM |
| 3 | Materials provide scaffolds and guidance for just-in-time learning acceleration for all students. | DNM |

## Does Not Meet | Score 0/2

The materials do not meet the criteria for this indicator. Materials include little guidance, scaffolds, supports, and extensions that maximize student learning potential.

Materials do not provide recommended targeted instruction and activities to scaffold learning for students who have not yet achieved mastery. Materials do not provide enrichment activities for all levels of learners. Materials do not provide scaffolds and guidance for just-in-time learning acceleration for all students.

Evidence includes but is not limited to:

Materials provide recommended targeted instruction and activities to scaffold learning for students who have not yet achieved mastery.

- There is an assessment quiz at the end of each module; however, these quizzes do not provide teachers with any additional support for students who do not achieve mastery. For instance, the assessment quiz at the end of Chapter 2, Module 1, contains 25 questions related to the content of covalent bonding. There is little support for learners who have not yet mastered the content knowledge, including but not limited to additional lessons, scaffolds for note-taking, formative assessments, additional practice, and remediation. Students are also unable to reflect on their results. The material does not define "mastery" for each unit, so teachers cannot evaluate which students need remedial or targeted instruction. Formative assessments embedded in each module only contain surface/factual questions that do not reflect the TEKS rigor.
- While students are provided with a "digital notebook" that can be accessed through the Create Note button in each module, there are no scaffolds or supports to aid the diverse learning needs of students. The notebook lacks support, including, but not limited to, graphic organizers, chunking information, vocabulary scaffolds, sentence stems, and providing scaffolding questions.
- Differentiation measures are not found within the teacher's guide for struggling students or for advanced students who need more advanced items to complete or work on. The materials do not provide guidance for differentiating activities; however, explanations are present to support the illustrations. For example, in Chapter 3, Module 1, the figure on molecular motion reads, " Figure 1. Everything on Earth is heated by the sun. The sun’s heat causes all molecules to vibrate and move around in a seemingly random manner. The image of the sun in the background of this image is a real x-ray image of our sun."

# Smart Biology Texas

## Materials provide enrichment activities for all levels of learners.

- Each chapter contains various activities titled "GO BEYOND" that are found in the last module of the chapter. According to the teacher guide, "Smart Biology provides students with enrichment activities via the Go Beyond section to stimulate creativity and motivation. Teachers are welcome to assign these activities according to students' needs and capacity." However, there is no additional teacher support for implementing the enrichment activities and meeting the learning needs of all students. Some of the “GO BEYOND" content includes an additional question for students to ponder, but does not have an activity for students to engage in. For example, the Scientific History question for Chapter 3 on the molecular structure of macromolecules asks students to name one big surprise that researchers discovered when they solved the first protein structure in 1958. There are no accompanying clarifications or connections to the information learned throughout the lesson.
- Each chapter contains a section titled Apply that is found in the last module of the chapter. The APPLY section contains two potential questions that students can choose to answer. First, students reflect individually; then, students collaborate in groups to develop a model or written presentation. For instance, the APPLY section in Chapter 12 challenges students to answer one of the two following questions: How would Mendel's results differ if the genes he studied were linked? What is an example in our everyday world that is conceptually similar to the difference between codominance and incomplete dominance? Teachers and students are provided with identical instructions; teachers are given no additional important instructions for implementing the activity.
- The materials do not include suggested readings or suggested projects that encourage students to make connections to their learning. Materials provide videos and 3D images for students to see and various experiments for students to complete. However, student choice, interest, or ability is not differentiated between assignments. None of these experiments contain scaffolds and do not allow students to extend their knowledge beyond the lab. All experiments are confirmation labs in nature.
- Although the table of contents includes a color-coded sequence (and A, B, C designation for suggested implementation), the sequencing is not differentiated for all levels of learners. For example, "Practicing Science Ourselves with SEPs is a stand-alone document that does not account for emerging bilinguals (EB), SpEd students, etc. This means new or pre-service teachers would need to adjust the wording to make it appropriate for all students.

## Materials provide scaffolds and guidance for just-in-time learning acceleration for all students.

- The Pacing Guide that is provided in the teacher materials contains an outline of the chapters and modules that should be covered during each week of instruction. The final page of the Pacing Guide states, "Assessment tools and activities are located at the end of each of the 20 chapters, in modules titled 'Assess, Apply Your Knowledge and Go Beyond!' Even though they are located at the end of every chapter, teachers can use these activities in a different sequence as they see fit." However, there is no guidance for teachers to provide accelerated instruction to students. The material provides "Extensional Opportunities” (GO BEYOND!), but opportunities are limited to a shortened series of Q&A. It does not include task-based or non-factual enrichment for accelerated students.
- Each module, such as Chapter 12, Module 2, contains the same general sequence: lessons containing a video, figures, and text for students to read. There is no teacher support for

implementing various instructional scaffolds, including but not limited to checks for understanding, immediate and specific feedback, goal-setting, self-monitoring, and prompts and cues to aid students who are stuck on a particular task and unsure of how to proceed. While the instructions for implementing the videos do suggest that teachers pause each video to answer or ask questions, the only explicit guidance to teachers for differentiation is to ask struggling students to repeat the module if they are stuck.

- The instructional guide states that teachers are meant to be a guide, and the modules are meant to be more independent. As the only formative assessment available are quizzes, this can make it hard for a teacher to know if or how a student is struggling
- The teacher materials are identical to the student materials, except they have suggested answers for a few of the Assess questions in the last module of each chapter. Therefore, there aren't any prompts or cues in the materials to support the teacher with developing recommendations for just-in-time scaffolds.
- The materials do not include recommendations for scientific experimentation rooted in SEPs or challenging activities that extend beyond the regular curriculum. For example, the Go Beyond is Tier 1 instruction that lacks rigor for advancement beyond grade-level achievement.

# Smart Biology Texas

## Indicator 7.2

Materials include a variety of research-based instructional methods that appeal to a variety of learning interests and needs.

| | | |
|---|---|---|
| 1 | Materials include a variety of developmentally appropriate instructional approaches to engage students in the mastery of the content. | PM |
| 2 | Materials consistently support flexible grouping (e.g., whole group, small group, partners, one-on-one). | PM |
| 3 | Materials consistently support multiple types of practices (e.g., modeled, guided, collaborative, independent) and provide guidance and structures to achieve effective implementation. | PM |
| 4 | Materials represent a diversity of communities in the images and information about people and places. | PM |

## Partial Meets | Score 1/2

The materials partially meet the criteria for this indicator. Materials include some research-based instructional methods that appeal to a variety of learning interests and needs.

Materials include a variety of developmentally appropriate instructional approaches to engage students in the mastery of the content. Materials consistently support flexible grouping (e.g., whole group, small group, partners, one-on-one). Materials consistently support multiple types of practices (e.g., modeled, guided, collaborative, independent) and provide guidance and structures to achieve effective implementation. Materials represent some diversity of communities in the images and information about people and places.

Evidence includes but is not limited to:

Materials include a variety of developmentally appropriate instructional approaches to engage students in the mastery of the content.

- Each module (and most lessons) within a chapter contains a video at the beginning of the module that introduces the content that will be learned throughout the unit and may even activate prior knowledge from previous units. The text for the module only contains the script of the video for the module. For instance, the introductory video from Chapter 19, Module 1, Lesson 1, introduces the concept of the hierarchical levels of ecology, which are explored throughout the chapter. In Lesson 1 of Module 4 of Chapter 8, students are given a video on the Calvin cycle. The text below is a script of that video for students to read. The accompanying images are from the video and showcase the detailed structure of the electron transport chain. While the materials start with a short video clip that provides an overview of the chapter and then quizzes after the text, there isn't a variety of developmentally appropriate activities for each unit. Instead, every unit follows the same format. For example, Unit 1, Module 1 starts with a 2-minute video describing the subatomic world. Each of the four lessons has images with captions and text, and then the module concludes with a quiz.

- Each chapter includes connections to the real world through the GO BEYOND sections in the final module of the chapter. The GO BEYOND: Real-World Relevance sections are especially useful in linking students' content knowledge to real-world applications. For instance, the GO BEYOND: Real-World Relevance section for Chapter 14 (The Evidence for Evolution) asks students to consider which fruits or vegetables may not have undergone artificial selection. Some of the units have a career exploration paragraph as well. Chapter 5 has an image of a scientist and three sentences that describe cell and molecular biologists. While this variety is available, it is inconsistent for every chapter and doesn't provide the developmental rigor for Biology students from one chapter to another.
- While students are given experiments to explore and complete, they are not asked to analyze most of them, and they are not authentic. Instead, they are labs that can model phenomena or are confirmation labs.
- The materials contain a variety of implementation strategies for their product, which are color-coded and alphabetized (A, B, C), allowing some flexibility for teaching. However, there is no guidance on what constitutes "mastery," requiring teachers to produce their own formative assessment products.

Materials consistently support flexible grouping (e.g., whole group, small group, partners, one-on-one).

- Each APPLY section that can be found in the final module of each chapter provides opportunities for independent work and discussions with small groups and the whole class. The instructions are laid out in each APPLY section. For instance, the APPLY section for Chapter 16 poses the following two questions that students can choose to answer: What is an example of microevolution that we might observe in the environment around us, and what do you think might be causing it? Is it directional, disruptive, or stabilizing, and why do you think that might be? Design and execute an experiment that simulates a bottleneck effect. For example, you could use colored marbles or objects. Similarly, the APPLY section for Chapter 1 poses the following two questions that students can choose to answer: How would our lives be different if electron shells 2 and up only held a maximum of 6 electrons rather than 8? Why do everyday objects appear solid despite the incredible amount of empty space between subatomic particles?
- Students begin by generating an answer independently. After a few minutes, students work in groups with students who have chosen to answer the same question. The small groups share their ideas and develop a written presentation or model to answer the question. Finally, the small groups present their answer to the whole class, where they will be evaluated based on a variety of criteria such as "content, supportive arguments, clarity of presentation, visualizations, and organization."
- For example, in lesson 1 of module 4 of chapter 8, students are given a video on the Calvin cycle. The text below is a script of that video for students to read. The accompanying images are from the video and showcase the detailed structure of the electron transport chain. Another example is Unit 1, Module 1, which starts with a 2-minute video describing the subatomic world. Each of the four lessons has images with captions and text, then the module concludes with a quiz.
- While students are given experiments to explore and complete, they are not asked to analyze most of them, and they are not authentic. Instead, they are labs that can model phenomena or are confirmation labs.
- The materials contain a variety of implementation strategies for their product, which are color-coded and alphabetized (A, B, C), allowing some flexibility for teaching. However, there is no

guidance on what constitutes "mastery," requiring teachers to produce their own formative assessment products.

Materials consistently support multiple types of practices (e.g., modeled, guided, collaborative, independent) and provide guidance and structures to achieve effective implementation.

- The materials provide mainly independent student work through the online textbook portal. Students are expected to complete each module within a chapter independently, and then they complete a quiz at the end of the module that acts as a self-assessment of mastery. For instance, Chapter 1, Module 1, contains four lessons and an end-of-module quiz. Also, the quiz at the end of Module 2 in Chapter 4 has six questions on protein integrity. The quiz shows students their scores and the correct answers as soon as they submit it. While this provides useful data for teachers, there is no guidance or structure for the effective implementation of multiple types of practice opportunities for students.
- In the APPLY section, students first select a prompt to research independently. Then, they work in small groups to discuss their findings. After agreeing on one response, students work collaboratively to build a presentation to share with the class. The class rates each group's presentations. In Chapter 5, students can pick between drawing a simple representation of a eukaryotic cell or designing a hypothetical signal transduction pathway.
- Each ASSESS activity (found in the last module of a chapter) contains identical instructions for both teachers and students. This includes group presentation scoring guidelines, which are described as follows: "content, supportive arguments, clarity of presentation (including tone of voice and engagement), visualizations (quality, clarity, and relevance), and organization." There is no rubric to guide teacher scoring of the group presentation.
- There are no instructional differentiation methods given to teachers besides the presentation of videos in each module and a text explanation of each video. Individual lessons in the materials interface are not specifically written for group work or pairs, but teachers do have the discretion to modify assigned chapters to accommodate student collaboration—for example, Module 2, Interactions Between Atoms, 2. Non-Covalent Bonds could easily be assigned as a read-aloud or think-pair-share, even if the publisher has not explicitly written the instructions as such. Also, in the experiment for chapter 13, teachers are encouraged to assist students to develop an argument for or against a question in evolution. Labs do not specifically identify instructions for student groupings, which allows teachers to decide how activities will be executed. For example, Unit 1: Smart Biology In the Lab, Comparing Plant Cells with a Microscope: Activity can be accomplished as individuals, in pairs, or in a small group setting.

Materials represent a diversity of communities in the images and information about people and places.

- The Assess, Apply Your Knowledge, and GO BEYOND modules found at the end of each chapter contain a picture highlighting male and female students from a diversity of races and ethnicities. For example, Figure 1 in Chapter 15, Module 1, Lesson 2, contains images from a diversity of cultures, including Romans, Greeks, Egyptians, Chinese, Sumerians, and Babylonians. Also, several, but not all, GO BEYOND activities contain a career connection demonstrating the multiple people who might need to use this knowledge for their careers. For example, the scientific history example in chapter 2 asks students about Sir Isaac Newton's contribution to science. Then, in Chapter 5, the career connection image includes a male and female scientist looking through microscopes.

- While there are diverse images presented on the GO BEYOND site, there is very little evidence that they present student material that is diverse. For example, in Chapter 9, GO BEYOND: Science History, students are asked about the contributions of Rosalind Franklin. However, the majority of history presented is not of the contributions of a more diverse crowd.
- The materials accurately represent historical contributions related to the content. But only partially emphasizes scientists from diverse backgrounds (ethnicity, race, and culture). For example, in Chapter 9, The Growing Cell, From Genes to Proteins Module 2, DNA, The Blueprints of Life, there are no explicit references to minority or underrepresented communities (Rosalind Franklin) and their contributions.

# Smart Biology Texas

## Indicator 7.3

Materials include listening, speaking, reading, and writing supports to assist emergent bilingual students in meeting course-level science content expectations.

| | | |
|---|---|---|
| 1 | Materials include guidance for linguistic accommodations (communicated, sequenced, and scaffolded) commensurate with various levels of English language proficiency as defined by the ELPS. | DNM |
| 2 | Materials encourage strategic use of students' first language as a means to linguistic, affective, cognitive, and academic development in English. | DNM |

## Does Not Meet | Score 0/2

The materials do not meet the criteria for this indicator. Materials do not include sufficient listening, speaking, reading, and writing supports to assist emergent bilingual students in meeting course-level science content expectations.

Materials do not include guidance for linguistic accommodations (communicated, sequenced, and scaffolded) commensurate with various levels of English language proficiency as defined by the ELPS. Materials do not encourage strategic use of students' first language as a means to linguistic, affective, cognitive, and academic development in English.

Evidence includes but is not limited to:

Materials include guidance for linguistic accommodations (communicated, sequenced, and scaffolded) commensurate with various levels of English language proficiency as defined by the ELPS.

- The only reference to English language proficiency is a list of ELPS correlations for each chapter in the Pacing Guide. The pacing guide lists ELPS indicators for each unit but does not provide differentiated options for EB students at various levels of L2 development. It lacks scaffolding and support to meet learners where they are in L2 acquisition and building content knowledge and skills. Also, while the ELPS that are listed on the Pacing Guide and TEKS Alignment document number and Roman numeral combinations, the verbiage or correlations to the standards are not found in the materials.
- Laboratory experiments that are laid out in the Laboratories document do not contain step-by-step processes paired with images that serve as linguistic accommodations for English language learners.
- While the teacher materials do provide relevant ELPS to the material that is taught that week, they are all listed by week with no differentiation between which ELPS are which. For example, in Chapter 11, Go Beyond, there are no language supports to help students build up their explanations of why cells are different from each other. Any written or spoken answer is meant to be compared to the answer guide with no support put in to help differentiate how a student might respond. The Lesson Implementation Guide is linked to the pacing guide, but the pacing and output opportunities are designed exclusively for the typical English-L1 student. The Teacher's Guide includes a list of possible confusions and misconceptions for each chapter in a

section called "Teaching Difficult Concepts," but there is no explicit mention of strategies to support English Learners.

Materials encourage strategic use of students' first language as a means to linguistic, affective, cognitive, and academic development in English.

- The teaching text in each module within a chapter is solely presented in English, with no provided opportunities for translation into other languages or scaffolds (such as cognates) to aid student incorporation of their first language. For example, while the Pacing Guide acts as a lesson plan by giving teachers an overview of the chapters that should be completed in a given week, along with potential corresponding ELPS, there is no support for language transfer or references to a glossary. In addition, although the pacing guide lists some ELPS indicators for each unit, there is no instructional guidance for implementation. Materials lack differentiated output opportunities for EB's to demonstrate proficiency through scaffolding of their first language.
- The Student Edition materials (textbook, labs, and other embedded resources) do not include accommodated versions for EB. For example, Module 4, Assess, Apply Your Knowledge, and Go Beyond! (Chapter 17) (SE) is presented in only one English-first format, with no differentiated options. There are no languages offered in the materials other than English. Students are encouraged to use English only, and the material is only presented in English.
- Support activities and resources do not support content development and acquisition by EB students. For example, each lesson begins with a video of the content, Teachers can adjust video speed (bottom right corner of the video) but are unable to translate content for EB students to support their transfer of knowledge from their native language into English. In another example, while the Go Beyond section has activities designed to push students' thinking, there isn't any guidance for students to use cognates, glossaries, or any other tips for transferring knowledge from their native language to the English language.

# Smart Biology Texas

## Indicator 7.4

Materials provide guidance on fostering connections between home and school.

| | | |
|---|---|---|
| 1 | Materials provide information to be shared with students and caregivers about the design of the program. | M |
| 2 | Materials provide information to be shared with caregivers for how they can help reinforce student learning and development. | DNM |
| 3 | Materials include information to guide teacher communications with caregivers. | DNM |

## Partial Meets | Score 1/2

The materials partially meet the criteria for this indicator. Materials provide some guidance on fostering connections between home and school.

Materials provide information to be shared with students and caregivers about the design of the program. Materials do not provide information to be shared with caregivers for how they can help reinforce student learning and development. Materials do not include information to guide teacher communications with caregivers.

Evidence includes but is not limited to:

Materials provide information to be shared with students and caregivers about the design of the program.

- The Table of Contents found in the student edition provides a summary of the unit, relevant "features," and chapter overviews that include the names of modules and lessons. For instance, Unit 1 (From Atoms to Cells: Starting Small to Understand the Big) in the Table of Contents contains a summary with the following topic sentence: "In this unit, we focus on understanding the physical components that make up cells." Unit 1 in the Table of Contents also contains features such as "one continuous learning journey from atoms to cells," "strong emphasis on understanding rather than memorizing," and "the structure/function relationship: 'show, don't tell'." Finally, Unit 1 in the Table of Contents contains the names of the five chapters and all modules/lessons contained in each chapter.
- The Product Overview states that the "See, Interact, Understand BIOLOGY - Texas is an Animated Textbook with a highly visual approach to understanding biology and a long overdue alternative to the traditional textbook. By witnessing these incredible visualizations and interacting with our 3D interactive structures, students can truly understand biology." It comes with brightly colored pictures that relate to the content and structure of the course to get the point across, as well as using words. The overview gives the format of an example lesson: Animated Lesson Video, Lesson Text, 3D Interactive Structures, Quizzes and Assessment, Activities, Go Beyond, Take Notes, and Peer-to-Peer Questions to stimulate collaborative learning. The "Not Your Ordinary Textbook" section of the overview discusses the various design features of the program. These features include "accurate, realistic, 3D animations," "high quality, accurate figures," "real photos," "live videos," and "interactive structures."

- The Teacher Guide details the overall structure of the course and the goals for the course. A generalized overview of resources and implementation strategies is provided and also includes a summary of topics covered, as well as implementation strategies for teachers.
- The Realize Parent Support document serves as an instructional guide for caregivers using the materials by including a description of which Smart Biology Resources should be implemented and how they are presented.

## Materials provide information to be shared with caregivers for how they can help reinforce student learning and development.

- The Go Beyond, Real-World Relevance sections (such as the one found in Chapter 18: "Earth's atmosphere is composed of mostly nitrogen gas, which reflects blue light. As we transition from night to day, this blue light starts to become visible. Why is the sky blue? Now you know! Next time you look up at the blue sky, know that you're looking at nitrogen gas in our atmosphere.") contain activities related to science in the world around us. However, there are no opportunities provided in the materials to provide resources to caregivers to reinforce these real-world connections.
- The pacing guide shows the sequence of the chapters and modules with their correlating concepts, a proposed scope and sequence for associated materials that can be shared with caregivers, but there are no resources specifically designed for the caregiver to support with reinforcing student learning and developments. For example, the Pacing Guide provides information about chapters and modules, scientific concepts, TEKS, ELPS, and 3D interactive structures that are relevant for each week but does not provide relevant enrichment or remediation activities that caregivers may use to reinforce student learning and development. Also, all materials are only found in English and are not on easily translated documents.
- The experiments listed within the labs are heavily involved and require lab materials and resources that probably could not be done at home.
- The teacher guide provides a limited set of surface-level questions to check for student understanding; however, these suggestions do not reflect the deepening of student knowledge and are limited to in-classroom assessment, not including caregiver-inclusive learning.

## Materials include information to guide teacher communications with caregivers.

- The Teacher Guide only contains content regarding extensional opportunities through the "Go Beyond" and "Short Answer" questions; this document does not provide caregivers with adequate communication about resources or interventions differentiated for student needs. For example, in the General Overview section of the teacher guide, subsections related to "About This Product," "Suggestions on How to Use this Course Material," "Concept Development," "Note-Taking," and "Assessment and Knowledge Application Tools" are provided. However, the General Overview section does not contain teacher guidance for communicating with caregivers, such as information on engaging caregivers as partners in learning and offering suggestions for establishing a relationship.
- While the online platform for the materials contains a section titled "My Quizzes" in which caretakers may see their child's progress, guidance is not provided for teachers through templates or other resources to share progress or guidance regarding levels of understanding with caregivers.

- The materials are not inclusive of the families of EB learners. There are no translations of the website readily available and no guides for teachers on how to guide parents to the website or use it.

# Smart Biology Texas

## Indicator 8.1

Materials include year-long plans with practice and review opportunities that support instruction.

| | | |
|---|---|---|
| 1 | Materials are accompanied by a TEKS-aligned scope and sequence outlining the order in which knowledge and skills are taught and built in the course materials. | DNM |
| 2 | Materials provide clear teacher guidance for facilitating student-made connections across core concepts and scientific and engineering practices. | DNM |
| 3 | Materials provide review and practice of knowledge and skills spiraled throughout the year to support mastery and retention. | PM |

## Partial Meets | Score 1/2

The materials partially meet the criteria for this indicator. Materials include some year-long plans with practice and review opportunities that support instruction.

Materials are not accompanied by a TEKS-aligned scope and sequence outlining the order in which knowledge and skills are taught and built into the course materials. Materials do not provide clear teacher guidance for facilitating student-made connections across core concepts and scientific and engineering practices. Materials provide some review and practice of knowledge and skills spiraled throughout the year to support mastery and retention.

Evidence includes but is not limited to:

Materials are accompanied by a TEKS-aligned scope and sequence outlining the order in which knowledge and skills are taught and built in the course materials.

- The Table of Contents includes a progression of units and lessons within each unit. TEKS are not included in the Table of Contents and are generally referred to inaccurately (do not match the content).
- The materials contain a suggested scope and sequence listed in the Teacher Guide. The scope and sequence consists of chapter order and the lessons within them. TEKS references are present in the Pacing Guide document, but are inaccurate and are not aligned correctly with the stated standards. The TEKS that are given are not the TEKS for the topic they are incorrect.
- The scope and sequence recommends pacing of the teacher guide that aligns with grading cycles of the school year. Units are sequenced in the order in which knowledge and skills are acquired (micro to macro level). The recommended schedule for teaching is as follows:
    - 1 chapter = approx 1.5/2 weeks of teaching for traditional schedules
    - 1 chapter = approx .75/1 week of teaching for block schedules
- The introduction to the scope and sequence states, "We have created our content in a way to provide students opportunities to make connections between core concepts and scientific/engineering practices by introducing biology concepts from simple to complex. Therefore, we suggest teaching this course in the following order. However, teachers are welcome to build their own sequence of learning objectives." Connections are not made between core concepts and SEPs.
- Materials include a Pacing Guide and TEKS Alignment section within the materials. The table includes the chapter and modules, SEPS, TEKS, ELSP, and 3D Interactive Structures and Labs. For

example, in Unit 1, Week 1, students study Atoms to Cells, TEKS listed are 1.D.i, 3.B.i, 3.B.ii, 3.B.iii, 3.B.iv, 3.B.v, 3.B.vi, 3.B.vii, 3.B.viii for modules 0-4. SEPS included are atoms, isotopes, periodic table, protons, neutrons, nucleus, charge, neutrality, electron shells, and elements. However, the TEKS are not the correct ones for units and this is throughout the product.

Materials provide clear teacher guidance for facilitating student-made connections across core concepts and scientific and engineering practices.

- Teachers are provided with sections titled "GO BEYOND: Scientific Techniques and Experiments" in each unit, as seen in the teacher guide. While these sections promote connection-making for students, teachers are not given clear guidance for facilitating these connections.
- Suggested order of material implementation allows for student sensemaking but does not connect to scientific and engineering practices
- There is no guidance for what a Go Beyond looks like and how to engage students. For example, within the Unit 1 Go Beyond, students are tasked with figuring out which professions use a microscope. There are no instructions for teachers within the document for teachers to facilitate connections with students.
- For example, Unit 2 contains a section titled "Go Beyond: Techniques and Experiments for C2" that challenges students to connect Rutherford's gold foil experiment to the structure of an atom. While students are encouraged to make connections across core concepts and SEPs, teachers are not provided any guidance to facilitate these connections beyond chapter correlations. .
- The introduction for Chapter 1, Module 1 states, "Moreover, instead of having students memorize various components and concepts, we explain the underlying ‘why’ questions that many students naturally think about, so they can genuinely understand." While the transfer of skills is mentioned, there isn't any clear guidance for teachers to facilitate student-made connections.

Materials provide review and practice of knowledge and skills spiraled throughout the year to support mastery and retention.

- According to the Product Overview provided by the vendor, the suggested scope and sequence does seem to build upon itself by introducing atoms, then molecules, then cells. Another example in Unit 3, Chapter 9, the concept of nucleotide structure, which was first addressed in Unit 1, is revisited in order to support mastery of concepts related to genetics. Upon completion of the chapter, a quiz assesses the concepts of nucleotide structure and chemical bonds and interactions that were reviewed during the chapter, but there is no practice for the content prior to taking the quiz that is provided in the materials.
- While the Go Beyond assessment and the embedded chapter quizzes provide some form of assessment within the materials, there are no connections made across units for students. However, the quizzes are chapter-specific, with very few topics from previous material brought back in. For example, in Unit 1, Chapter 3, the concepts of hydrophilic and hydrophobic are addressed. These concepts are reviewed in Unit 1, Chapter 4 (Proteins) but are not revisited throughout the year. There are some interactive images in addition to the 3D images, but there are no student tasks that include the application of previously taught content or skills.
- Student materials are embedded with self-assessment quizzes, short answer responses, and Go Beyond extensional opportunities for each unit. This allows students to practice, review and retain knowledge.

# Smart Biology Texas

## Indicator 8.2

Materials include classroom implementation support for teachers and administrators.

| | | |
|---|---|---|
| 1 | Materials provide teacher guidance and recommendations for use of all materials, including text, embedded technology, enrichment activities, research-based instructional strategies, and scaffolds to support and enhance student learning. | M |
| 2 | Materials include standards correlations, including cross-content standards, that explain the standards within the context of the course. | PM |
| 3 | Materials include a comprehensive list of all equipment and supplies needed to support instructional activities. | PM |
| 4 | Materials include guidance for safety practices, including the course-appropriate use of safety equipment during investigations. | M |

## Partial Meets | Score 1/2

The materials partially meet the criteria for this indicator. Materials include some classroom implementation support for teachers and administrators.

Materials provide teacher guidance and recommendations for use of all materials, including text, embedded technology, enrichment activities, research-based instructional strategies, and scaffolds to support and enhance student learning. Materials include some standards correlations, including cross-content standards, that explain the standards within the context of the course. Materials include a comprehensive list of all some equipment and supplies needed to support instructional activities. Materials include guidance for safety practices, including the course-appropriate use of safety equipment during investigations.

Evidence includes but is not limited to:

Materials provide teacher guidance and recommendations for use of all materials, including text, embedded technology, enrichment activities, research-based instructional strategies, and scaffolds to support and enhance student learning.

- The new scope and sequence includes implementation and pacing guidance as well as content extensions. The content is organized in an easy-to-follow fashion. For example, the table of contents is neatly organized into units, and those units have chapters and lessons, culminating in Go Beyond sections that have the same structure for all chapters.
- The Smart Biology teacher guide includes logical scope and sequence and a description of products and details of how they should be implemented. The teacher guide gives appropriate instructional guidance.
- The teacher instructions include detailed guidance for implementation, including labs, activities, pacing, and differentiation. Color codes guide teachers as to which modules are critical, important, and supplementary. A generalized unit outline is only presented for Unit 1.
- The landing dashboard has the teacher editions for each unit, followed by the student editions for each unit. The dashboard shows the modules and corresponding lessons in order. The teacher edition starts with a summary of the unit, followed by a sample video and realistic animations. The last module for each unit contains the "Assess, Apply Your Knowledge, and Go

Beyond" components. This module also includes materials for real-world relevance, scientific history, techniques and experiments, and career connections.

- Materials include a section at the end of each unit titled "Apply Activity," which provides a scaffold for teachers to facilitate formal or informal assessment. For example, the "Apply Activity" for Chapter 10 (The Dividing Cell|Completing the Cell Cycle) provides an opportunity for students to answer a question through steps including individual analysis and small-group reflection.
- Materials also include a section at the end of each unit titled "Go Beyond," which serves as student enrichment opportunities. For example, the Go Beyond activity at the end of Unit 10 (The Dividing Cell|Completing the Cell Cycle) challenges students to connect DNA replication to moving a zipper. Scaffolding and enrichment activities deepen this lesson for all learners.

Materials include standards correlations, including cross-content standards, that explain the standards within the context of the course.

- The teacher and student guides include introductory videos, related images, and text but do not reference reading, writing, calculations, or problem-solving.
- Both student and teacher editions of materials provide lists but lack correlation and specific alignment to TEKS Standards or SEPs. For example, Chapter 13, Life Evolves, Module 1, Introduction to Evolution, describes how the unit is sequenced with prior and future learning but does not explicitly state which standards the content addresses.
- The teacher guide gives an overview of unit and lesson titles, but no TEKS, ELPS, science and engineering practices, or cross-content standards are referenced. Cross-content standards for ELA, Math, and Social Studies are not provided in sidebar support in teacher guides to lessons. As there are no content TEKS, there are no cross-content TEKS within the website.
- The teacher guide includes logical scope and sequence and description of products but does not contain TEKS standards correlations, science and engineering principles, or cross-content alignment of materials. The materials do not include science standards correlations for units, lessons, or activities within the context of the grade level or course in teacher guidance documents or online resources. There are no TEKS to be found within the site.
- The chapters are organized from micro to macro. Within each chapter, there are several modules. Each module is then broken down into multiple lessons that build on each other. For example, the Apply activity for Chapter 4 in the student materials requires students to choose an item in their everyday world and explain its structure/function relationship. Students are presenting their questioning, reasoning and interpretation, and conclusions in groups. Then, each group evaluates their peers on criteria such as content, supportive arguments, tone of voice, engagement, relevance, and organization.

Materials include a comprehensive list of all equipment and supplies needed to support instructional activities.

- The materials are primarily digital but also include "wet" labs. There are ancillary supply lists that are provided to teachers. For example, all necessary videos, figures, photos, and interactive images are provided and labeled in the materials, such as in Chapter 1, Module 1 (Going Subatomic).
- While there is no supply list explicitly provided, the website is designed to be 100% virtual, so no supplies are needed beyond a strong wireless connection.

- The application portions of the modules include prompts for students to research and analyze. Hands-on practice opportunities exist but are not explicitly aligned to the SEPs. The materials contain descriptive wet labs and a comprehensive list of supplies that are needed for each lab. Students are provided an index of visuals but no other materials.
- Smart Biology materials are 100% digital. The materials contain descriptive wet labs, including comprehensive lists of supplies that are needed for each lab.

Materials include guidance for safety practices, including the course-appropriate use of safety equipment during investigations.

- As this material is online, this bullet does not necessarily apply to this material. There are comprehensive safety guides and support for grade-appropriate use of safety equipment and procedures in the materials.
- The teacher guides and student materials have videos, images, and texts that provide learning opportunities for students as well as wet labs and detailed materials lists.
- Student materials include videos, figures, photos, and interactive images, along with assessments. Laboratory investigations are performed, and safety practices are referenced appropriately.

# Smart Biology Texas

## Indicator 8.3

Materials provide implementation guidance to meet variability in program design and scheduling.

| | | |
|---|---|---|
| 1 | Materials support scheduling considerations and include guidance and recommendations on required time for lessons and activities. | PM |
| 2 | Materials guide strategic implementation without disrupting the sequence of content that must be taught in a specific order following a developmental progression. | M |
| 3 | Materials designated for the course are flexible and can be completed in one school year. | PM |

## Partial Meets | Score 1/2

The material partially meets the criteria for this indicator. Materials provide some implementation guidance to meet variability in program design and scheduling.

Materials support some scheduling considerations and do not include guidance and recommendations on required time for lessons and activities. Materials guide strategic implementation without disrupting the sequence of content that must be taught in a specific order following a developmental progression. Materials designated for the course are somewhat flexible and can be completed in one school year.

Evidence includes but is not limited to:

Materials support scheduling considerations and include guidance and recommendations on required time for lessons and activities.

- The suggested timeframe for materials is to spend 1.5 to 2 weeks per chapter. This is roughly 36 weeks, which follows the traditional school calendar. There are some options to speed up or slow down in a given course based on the level of differentiation that the teacher wants. There is also no consideration for different scheduling formats, such as period or block schedules.
- While there is some guidance for the number of class periods required to cover some content, there is no mention of the amount of minutes or class periods required to cover individual modules. For example, there is no guidance for pacing, but the teacher guide states, "BIOLOGY Texas has been elaborated to provide students with a comprehensive course which on 'average' can be done in one school year, (please see 'Scope and Sequence'). Teachers have the flexibility of adapting and/or assigning only mandatory- required course material based on students' needs and capacity."
- Individual units do not contain timing for lesson components. While there are overall suggested timelines for themes and "wet" labs, the units do not contain the class time required for each activity. For example, Chapter 20, Module 2 does not describe how each activity should be timed.
- For example, the teacher guide suggests that teachers should allot 1.5 to 2 weeks of instruction for Chapter 10 (The Dividing Cell|Completing the Cell Cycle), but there are no recommendations for the timing of individual lessons within the chapter.
- The product overview gives an example of one of 80 lessons, outlining each component of the lesson. However, it does not list the timing for each component (text, 3D interactives, quizzes, assessments, etc.)

# Smart Biology Texas

## Materials guide strategic implementation without disrupting the sequence of content that must be taught in a specific order following a developmental progression.

- Materials delineate the order of units to ensure students learn about precursor concepts first. For example, students learn about the formation of hydrogen bonds (Chapter 2, Module 2) before learning about how hydrogen bonds are integral in forming a DNA double helix (Chapter 9, Module 2).
- The materials also provide guidance about the flexibility of the placement of specific units. Implementation guidance for teachers gives recommendations for adjusting the order without sacrificing developmental progression in situations where local contexts require a change to the order of units.
- Materials group together items based on recurring themes and ideas. For example, there are five units: From Atoms to Cells, Photosynthesis and Respiration, Genetics, Evolution, and Ecology. From Atoms to Cells groups lessons based on biochemistry and cell structure. Photosynthesis and Respiration groups lessons based on photosynthesis and cellular respiration. Genetics groups lessons based on gene expression and the cell cycle. Evolution groups lessons based on change over time (both individual and in populations). Ecology groups lessons based on the physical world and different levels of ecological organization.
- The suggested sequence is a sequence that is designed to build an understanding of students from microscopic structures to macroscopic organisms and ecosystems. There is no single specific order that a teacher should follow, as the units can be presented in any order and still make sense. The units are organized into several related chapters.
- Smart Biology table of contents outlines unit themes and related chapter contents. It does include contingencies for non-traditional school years or variations in district scope and sequence.

## Materials designated for the course are flexible and can be completed in one school year.

- The table of contents provides a scope and sequence that adds up to 36 weeks, which is roughly the length of the school year. Provision for extension activities for students that get ahead is included, but there are no recommendations for how students might catch up if needed.
- Smart Biology table of contents outlines unit themes and related chapter contents. It does include contingencies for non-traditional school years or variations in district scope and sequence.
- The table of contents gives evidence that the materials include lessons and activities for a full year of instruction. The units can be reasonably implemented within the time constraints of a school year, based on the modules within each chapter for all five units.
- The teacher guide recommends that teachers use 1.5 to 2 weeks of instruction per unit, meaning that the entire curriculum can be implemented in 24-32 weeks. It also states that "teachers are welcome to build their own sequence of learning objectives." The teacher guide provides guidance for alternate sequences and extending or condensing units, but not individual modules.

Smart Biology materials give general guidance for the sequence of product implementation, with overall progression moving from micro to macro.The teacher guide specifically addresses daily and period time frame flexibility for unit sequencing but not for individual modules. For example, while the resource mentions teachers have the flexibility to customize the sequence and duration of the materials, it does

not provide teacher guidance on how to make adjustments to extend or condense modules in the event that scheduling allows for additional instruction or needs to be shortened due to lack of time.

# Smart Biology Texas

## Indicator 9.1

The visual design of materials is clear and easy to understand.

| | | |
|---|---|---|
| 1 | Materials include an appropriate amount of white space and a design that supports and does not distract from student learning. | No |
| 2 | Materials embed age-appropriate pictures and graphics that support student learning and engagement without being visually distracting. | No |
| 3 | Materials include digital components that are free of technical errors. | Yes |

## Not Scored

The visual design of materials is somewhat clear and easy to understand.

Materials include some appropriate amount of white space and a design that supports and does not distract from some student learning. Materials do not embed age-appropriate pictures and graphics that support student learning and engagement without being visually distracting. Materials include digital components that are free of technical errors.

Evidence includes but is not limited to:

Materials include an appropriate amount of white space and a design that supports and does not distract from student learning.

- Student digital materials have content organized in a logical progression. Materials contain clear and concise titles denoting module components such as relevant video and audio, figures, text, and interactives. For example, Module 1 for Chapter 6 has three very different images side by side immediately underneath the title. After two paragraphs of text, a video takes up almost the entire screen. Right after the video, there are two additional figures and a caption to describe them. Finally, the lesson concludes with three paragraphs of text that were the transcripts of the video.
- Materials are delineated into manageable "chunks" for student comprehension. For example, in Chapter 17, Macroevolution of Species and Biological Diversity, Module 1, What is a Species? there is little separation between headings, text, and illustrations in the student text. White space between headers and thematic text somewhat distracts student engagement and limits student feelings of being overwhelmed or confused.
- Laboratory documents contain appropriate images and headings. between sections of the lab to separate the sections of the lab. Ideally, each student experience would have a visual 'flow,' guiding students through each investigation.

Materials embed age-appropriate pictures and graphics that support student learning and engagement without being visually distracting.

- The videos and pictures include relevant material, but there is a focus on the structure of molecules and atoms that students are not required to learn at this age. For example, Chapter 9, Module 2, Lesson 1 contains images and interactives that depict the structures of DNA and RNA,

including references to standards-based content, such as the structure of a nucleotide and the shape of the DNA and RNA molecules, that may be beyond the scope of the average high school student. Similarly, the image of a cut-away view inside a neuronal axon is beyond the rigor of the TEKS and will add confusion to some learners.

- The graphics in the material are visually engaging and highly detailed. Pictures are clips of the video material and are all computer-generated. However, the complexity of infographics exceeds the scope of academic biology. For example, in Chapter 6, Understanding Chemical Energy, Module 3, Chemical Energy in Real Life, the illustrations are poorly labeled/captioned and contain visually engaging but complicated graphics that are misaligned with Biology TEKS. Also, in Chapter 18: The Physical World, Module 1, What Ecology Really Means, the font is smaller than appropriate for the average reader, and the "Accurate, Realistic Animations" are small thumbnails that are unlabeled and difficult to see and hard to read; while there is an image caption-key, it is complex. It includes 15 different photos and limited descriptions of their relevance.

Materials include digital components that are free of technical errors.

- The materials are free of spelling and grammatical errors. For instance, Chapter 1, Module 1, Lesson 1, states, "If you've ever wondered about the purpose of life, you may first want to take a step back and ask, what is life? The answer is actually quite simple: Life is cells. Any entity that is alive is called an organism, and all organisms are made of cells. Whether it be a unicellular organism composed of only a single cell like bacteria or protists or a multicellular organism composed of many cells like plants, insects, and animals, all life is made of cells." No errors are noted. Another example is the introduction to food webs, which states, "The sun is not only responsible for establishing the abiotic environmental patterns of temperature, precipitation, and wind around the Earth but also for powering all life on Earth by providing energy to the primary producers in every food web. In fact, at the level of ecology, the sustainability of life can be boiled down to two phenomena: the flow of energy from the sun through the trophic levels of life and the cycling of the atoms and molecules that make up this life. In this module, we will examine the flow of energy, and in the next module, we'll learn about the cycling of atoms."
- The materials are free from incorrect information and do not contain any factual errors. For instance, the Answer Keys & Teaching Tips section contains the following question/answer prompt for Chapter 2, Go Beyond, Real-World Relevance section, "In the food industry, the term organic refers to healthy. However, in biology and chemistry, the term organic refers to any carbon-based molecule. Therefore, when studying biology, all biological molecules are organic, healthy or unhealthy, safe or toxic. What are some other examples of organic molecules that we might not typically think of as being organic? Answer: any other molecule that contains carbon, except for carbon dioxide, which is usually not considered to be organic." This section is free of errors in answering.
- All embedded links in the materials appear to work. The "Practicing Science Ourselves" resource and the student laboratory guide, as well as links to ancillary materials, are all correct and functional. Materials are error-free and accurately reflect course content.

# Smart Biology Texas

## Indicator 9.2

Materials are intentionally designed to engage and support student learning with the integration of digital technology.

| | | |
|---|---|---|
| 1 | Materials integrate digital technology and tools that support student learning and engagement. | No |
| 2 | Materials integrate digital technology in ways that support student engagement with the science and engineering practices and course-specific content. | No |
| 3 | Materials integrate digital technology that provides opportunities for teachers and/or students to collaborate. | No |
| 4 | Materials integrate digital technology that is compatible with a variety of learning management systems. | No |

## Not Scored

Materials are not intentionally designed to engage and support student learning with the integration of digital technology.

Materials do not integrate digital technology and tools that support student learning and engagement. Materials do not integrate digital technology in ways that support student engagement with the science and engineering practices and course-specific content. Materials do not integrate digital technology that provides opportunities for teachers and/or students to collaborate. Materials do not integrate digital technology that is compatible with a variety of learning management systems.

Evidence includes but is not limited to:

Materials integrate digital technology and tools that support student learning and engagement.

- The digital materials include videos, figures, and interactives that enhance learning, but the Teacher Guide does not provide guidance for using these materials to enhance learning, such as suggestions for timing and pacing or ways to assist students with making observations. For instance, the teacher guide offers the following suggestion for using 3D interactive structures: "Some lessons include 3D interactive structures that allow students to become familiar with important cell and molecular structures by manipulating these structures in 3D space." Also, the digital materials include videos, figures, and interactives that enhance learning, but the teacher guide does not provide guidance for using these materials in whole groups, small groups, or individual settings. For instance, the Teacher Guide offers the following suggestion for using the digital materials in alternative groupings: "In the classroom, the role of the teacher could alternate between being a learning coach providing additional explanations where needed while letting students go through the materials in a self-discovery manner, versus providing explicit teaching to the whole class for the more difficult concepts using and demonstrating the course material."
- The modules come with a note-taking feature that students can use to help them keep track of their thoughts and can export as a PDF to create a notebook. However, the notes are not embedded near the reading material and are not easy to sort through. There are also no

embedded tools such as variable font size, text-to-speech, dictionaries, or highlighting capabilities to help students understand the content.

- The materials are designed to be fully online, with the exception of lab investigations. The videos used do have a text beneath them that is a written script of the material presented in the video. However, the videos are not interactive and do not contain any information that is directly assessed later in the content. For example, in Chapter 4, Macromolecular Machines, Proteins, Module 1, How to Build a Macromolecular Machine, Hierarchical Levels of Protein Structure, there is one image defined as an "Interactive Structure: Protein Visualization;" however, animation does not work unless launched into fullscreen mode. Animation does not show the entire structure when manipulated. This may be the result of a browser error.
- Most materials are simply written text, embedded images, and unit quizzes. For example, the Smart Biology Teacher Guide explicitly outlines digital opportunities, which are limited to those offered in the textbook and provide little student engagement. (Smart Biology "Laboratories" and "Making Connections" are separate, hard-copy documents.) The technology replaces the print instead of enhancing it.

Materials integrate digital technology in ways that support student engagement with the science and engineering practices and course-specific content.

- While the digital materials include interactives for students to engage with course content, there are no opportunities for students to utilize interactives to explore specific science and engineering practices. For instance, while Chapter 9 Module 3 provides interactives detailing the structures of proteins relevant to the process of transcription, there are no opportunities for students to utilize science and engineering practices in exploring specific details of how these proteins perform transcription. Also, in the Smart Biology lab Unit 1: Smart Biology In the Lab, Comparing Plant Cells with a Microscope, there are "analysis questions," which encompass simple recording of observations and comparing images from both slides and do not give students the opportunity to utilize the SEPs as the activity is just comparing images  There is not student learning opportunities embedded for pedagogical processes.
- While students have opportunities to engage with content and science and engineering practices in the Apply section at the end of each chapter, there are no opportunities to obtain, evaluate, or communicate information using digital tools. For instance, the instructions read: "Take the next few minutes (as assigned by your teacher) to prepare, as a group, a short 5-10 minute presentation that includes visualizations (which could be drawings on a paper or the chalkboard/whiteboard).". Unit quizzes embedded in each Smart Biology unit are digital but entirely multiple choice and lack images and illustrations or interactive opportunities for evaluative purposes. The rigor of these questions does not allow students to demonstrate their awareness or mastery of science and engineering practices.
- Within the "Practicing Science Ourselves" resource, the students are encouraged to form hypotheses and design a lab experiment, which is SEP-based. However, they do not include any interactive simulations or models for students to explore scientific and engineering practices in a virtual environment. These tasks are meant to be performed in person and are not supported digitally. They also do not offer instructions for converting to a digital platform.

# Smart Biology Texas

## Materials integrate digital technology that provides opportunities for teachers and/or students to collaborate.

- The online platform contains a peer-to-peer discussion board that "allows students and teachers to ask or answer each other's questions." However, this discussion board feature is for optional use, and there are no other opportunities for digital student-to-student collaboration that are provided on the online platform.
- Each lesson within a module contains a "Have a Question?" text box at the bottom, through which students can submit questions or comments to the teacher. However, there are no other opportunities, such as video conferencing, virtual tutoring sessions, or providing a virtual whiteboard, for teachers to collaborate with students. For example, in the materials for Chapter 1, The Subatomic World, The Building Blocks of Atoms, Module 1, Going Subatomic, there is one “Have a Question?” writing opportunity for students, which is at the bottom of the page. This is the only means by which students and teachers are able to collaborate.
- Non-digital collaboration opportunities in the materials are also limited. For example, in the recently submitted lab investigations document, Unit 2 Smart Biology In the Lab, Cellular Respiration in Action activity is suggested to be explored in teams but does not contain suggestions on how teams should be selected (especially for EM, SPED, etc.) or how to incorporate a digital component to meet expectations from the rubric. Also, the GoBeyond assessment allows students to be grouped based on a question they picked. However, those materials are not digital but are meant to be used in person.
- While teachers can see the results of students' auto-graded quizzes, there is no digital technology to support student-to-teacher collaboration on assessments, and the grading system does not allow teacher feedback on student work.

## Materials integrate digital technology that is compatible with a variety of learning management systems.

- It is unclear if the online platform is accessible and compatible with all devices, such as PCs, iPads, Chromebooks, Apple computers, and smartphones. The website remains the same on mobile devices, but the images get compressed and must be zoomed in for a student to see.
- Internet service is required to access all materials, as the materials are fully digital. The materials are not downloadable and available without internet access. There is also no information detailing system requirements for Internet browsers.
- There is some evidence presented that this material will integrate into a commonly used school LMS like Canvas or Google Classroom. The "Lesson and Implementation Guide" provides a generalized/suggested scope and sequence of materials but does not include details on how to implement with LMS platforms.

# Smart Biology Texas

## Indicator 9.3

Digital technology and online components are developmentally and course-appropriate and provide support for learning.

| | | |
|---|---|---|
| 1 | Digital technology and online components are developmentally appropriate for the course and align with the scope and approach to science knowledge and skills progression. | No |
| 2 | Materials provide teacher guidance for the use of embedded technology to support and enhance student learning. | No |
| 3 | Materials are available to parents and caregivers to support student engagement with digital technology and online components. | No |

## Not Scored

Digital technology and online components are not developmentally and course-appropriate and do not provide support for learning.

Digital technology and online components are not developmentally appropriate for the course and do not align with the scope and approach to science knowledge and skills progression. Materials do not provide teacher guidance for the use of embedded technology to support and enhance student learning. Materials are not available to parents and caregivers to support student engagement with digital technology and online components.

Evidence includes but is not limited to:

Digital technology and online components are developmentally appropriate for the course and align with the scope and approach to science knowledge and skills progression.

- The Pacing Guide in the Teacher Guide provides a set progression of content and lists the 3D interactive structures that correlate with the science concepts covered each week. For example, during week 1, where atoms, isotopes, and the periodic table are learned, there are 3D structures of neurons, kinesin, and microtubules. However, the guide lacks live hyperlinks to materials that facilitate ease of use and planning. Additionally, the Pacing Guide does not provide an editable copy that teachers may use for flexibility in planning.
- Digital materials are not developmentally appropriate for learners; infographics are typically too complex, with few labels and unclear captions. Additionally, these materials only tangentially address unit concepts and are not TEKS-aligned, which can lead to student misunderstandings. For example, in Chapter 5, The Cellular World, A Manifestation of the Macromolecular World Module 2, Machines Do All the Work So Cells Produce Machines, the initial three photos are not explicitly tied to unit content, and the six images in Figure 2 do not directly tie to cell components.
- The scope and sequence provided to teachers is a generalized document that is only tangentially linked to TEKS and SEP standards. It provides little implementation guidance or developmentally appropriate lists of activities for students. For example, the only TEKS mentioned is at the end of the Teacher Guide and is listed in an incorrect format, leading one to Grade 3 TEKS instead of Biology.

# Smart Biology Texas

## Materials provide teacher guidance for the use of embedded technology to support and enhance student learning.

- The teacher materials include a Narrated Orientation Video that provides instructions for accessing the online platform and navigating the various online features such as units, chapters, modules, lessons, and assessments. However, the orientation video states that the only difference between the student and teacher editions is that the teacher edition contains answers to some questions. The table of contents provides a partial order of implementation, but the text itself (and embedded illustrations, videos, and quizzes) can be confusing. The relationship between components isn't clear.
- The Teacher Guide does not provide clear guidance for best practices for using embedded technology for differentiating instruction. Only general guidance for using embedded technology for differentiating instruction is found in the Course Content section of the Teacher Guide, which states, "Adapt the course content for students experiencing more difficulties, as well as assign extra/optional material for higher performing students." The materials do not provide specific guidance for differentiating outside of removing/adding materials at the teacher's discretion. The Teacher Guide also provides only a sample 'flow' of digital products and does not provide detailed instructions on how to use them to maximize student learning or troubleshoot when there are system errors.
- The materials provide a one-page document about the components of the materials but not how to use them. The only directions teachers are given are on pg. 12, with instructions such as "1. Ensure the average student's progress through the material at an appropriate pace so as to cover the required course material by the end of the term." This is not appropriate guidance for teachers, as it does not suggest a means as to how to accomplish that goal.

## Materials are available to parents and caregivers to support student engagement with digital technology and online components.

- The materials do not provide a letter with tips for families for how to support appropriate student engagement with digital and online components. The Course Content portion of the Teacher Guide states, "Students should be encouraged to review daily at home the lessons and notes taken on any given day," but it does not include ways to encourage family/caregiver support in reviewing content.
- The online platform only includes a teacher edition and a student edition; there are no opportunities in the student edition for families and caregivers to support students through links to information about science objectives, at-home extensions, related inquiry projects, websites for student research, or online videos demonstrating investigations and experiments to support student progress at home. No materials exist that mention parents or caregivers within the entire 110 pages of the Teacher Guide. Also, no materials exist in the student edition that mentions parents or caregivers that instruct the usage of online technology in an age-appropriate manner. Parent/caregiver support is absent from this product.
- The materials include a narrated orientation video designed for the teacher; however, there is no resource similar to this for caregivers.