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It is the goal of ***STEMscopes*** to provide an inquiry-based curriculum, which incorporates the research-based, constructivist phases of the BSCS 5E Instructional Model (Bybee et al., 2006), the Key Findings from the National Research Council's report *How People Learn* (2000), the Texas Essential Knowledge and Skills (TEKS) (TEA, 2010), and an additional level of support for English Language Proficiency Standards (ELPS) (TEA, 2007) and Response to Intervention (RtI) (NASDSE, 2010) implementation for teachers as they meet the needs of all students in their classrooms. Within the development and delivery of the 5E+IA STEMscopes 2.0 science curriculum model, teachers are provided a sequenced pathway, resources and support for meeting the needs of all students in all K-12 science classrooms.

The development of the *STEMscopes 5E+IA* model in the delivery of science online curriculum takes into account the research of the National Research Council in their publications *How People Learn (2000) and How Students Learn Science in the Classroom* (2005). The three key findings are:

1. Students come to the classroom with preconceptions about how the world works. If their initial understanding is not engaged, they may fail to grasp the new concepts and information that are taught, or they may learn them for purposes of a test but revert to their preconceptions outside the classroom.
2. To develop competence in an area of inquiry, students must (a) have a deep foundation of factual knowledge, (b) understand facts and ideas in the context of a conceptual framework, and (c) organize knowledge in ways that facilitate retrieval and application.
3. A "metacognitive" approach to instruction can help students learn to take control of their own learning by defining learning goals and monitoring their progress in achieving them. (NRC, 2000)

The BSCS 5E Instructional Model is an effective way to engage students in learning. "Developed in the 1980s, the 5E Model consists of five phases: engagement, exploration, explanation, elaboration, and evaluation. Each phase has a specific function and contributes to the teacher's coherent instruction and to the learners' formulation of a better understanding of scientific concepts." (Bybee et al., 2006) Using sequences of lessons that incorporate student-centered, hands-on investigations is designed to challenge current conceptions and provide time and opportunities for reconstruction to occur can assist students' construction of knowledge.

The 5E Instructional Model and the additional Intervention and Acceleration (+IA) within the resources provide teachers, additional opportunities to identify and close the gaps in student content knowledge that lead to achievement gains, as well as provide enrichment activities for other content areas linked to science content. Resources and strategies to meet the ELPS and RtI are integrated throughout all phases of the 5E model. *Spanish versions* of all student materials are provided in Grades K-5 and the science content resource, *STEMscopedia,* is available K-12 in Spanish, for students and parents.

The 5E+IA model provides for teacher-choice built into seven stages that also provides an overview of the TEKS development (broken into units called Scopes):

- **Essentials** - In preparing for instruction in the content of the TEKS using the context of the 5E+IA model, instructional essentials include not only a *Pre-Assessment* to guide instruction but also resources such as:
  - *Key Concepts and Fundamental Questions*
  - *Teacher Background Knowledge*
  - *Standards Correlations* showing how this TEKS is related to all other standards for the grade level and content.
  - *Materials List* providing a calculated list of materials for the number of students served
  - *Scope Summary* – A summary of the resources provided for delivery of this specific TEKS. Suggesting an easy-to-follow instructional pathway as an overview of the scope.
  - *Answer Keys* – to all the rubrics, questions, formative and summative assessments.
  - *TEKS Unwrapped* – Dissecting the TEKS into learning targets and the implications for instruction

- **Engage** - provides a hook as an invitation into learning about a scientific concept. Through student responses to this engaging introduction many student misconceptions are revealed and noted.
    - Teacher Instructions and student materials for the activity
    - Additional *Starters* are provided for subsequent days to re-engage learners in the lesson
- **Explore** is the heart of inquiry-based instruction. It provides an opportunity for teams of students to use collaborative skills and prior knowledge to explore a concept through hands-on experiences.
    - Collaborative grouping is needed
    - Encouragement to ask questions and form questions that can be investigated
    - Developing use of appropriate and scientific vocabulary to explain observations.
- **Explain** is a sequence of experiences that guide students to explain what they understand about the scientific concept explored earlier. The embedded best practices guide students towards a more in-depth understanding. Differentiation, Response to Intervention and the needs of the English Language Learner through the ELPS are met through a variety of resources, such as:
    - Vocabulary development through *Picture Vocabulary* and interactive *Scope Vocabulary Games*
    - *Question Prompts* that increase in complexity based on Bloom's Taxonomy,
    - Presentation of student's findings and conceptual understanding,
    - *Discourse* using scientific explanations, and
    - *STEMscopedia* – a text-based reference to be used by students and parents to learn more about the science concept is provided in both English and Spanish in K-12.
    - *Spanish versions* of all student materials in grades K-5
- **Elaborate** builds students' understanding of the science concept through the integration of mathematics, reading, within each science module. Expand provides opportunities for all student to intertwine their science knowledge and skills with other standards-based content in tightly aligned tasks.
    - *Next Step Inquiry* – Providing science investigation ideas and framework for Descriptive, Comparative and Experimental Design related to the concepts being investigated.
    - *Reading Science* on three Lexile reading levels
    - *Math Connections* on grade-level math, differentiated for learner's ability level
    - *Books on Topic* – providing a list of associated trade books
    - *Web Surfing Science* and *Engineering Connections* – add to the resources available to expand learning more abut the science concept.
- **Evaluate** provides both the teacher and the student a means to assess the student's ability to utilize the science content.
    - Assessment through argumentation in the form of *Writing Science*
    - Summative *Post Assessments* use standards-based multiple-choice items,
    - *Open-ended Responses* questions to reveal the depth of student understanding, and
    - *Concept Builders* as a performance tasks.

In addition to the engaging and enriching resources are provided to augment the 5E Instructional Model with the addition of Intervention (I) and Acceleration (A) to the 5E.

- **Intervention** is sometimes required for the student who was unable to grasp the concept the first time it was introduced. This phase of the instructional model provides the teacher with a
    - *Intervention to Guided Practice* - small group instruction to revisit the concept in another way,
    - *Cloze-ing on Science* as a means to revisit vocabulary for concept mastery and
    - *Concept Attainment Quiz* as a means to check for mastery after intervention.
- **Acceleration** in the 5E+IA provides resources for the teacher to incorporate science into two additional engaging and concept specific tasks, which challenge students to look at science from another perspective.
    - *Problem-based Learning Science* – using real-life scenarios to solve science-based problems, and
    - *Science Art* – creating a visual art form that reinforces the science concept of the Scope.

The 5E+IA Model for STEMscopes: 2.0 Curriculum Development

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The research-based, teacher-tested, TEKS-aligned, and technology-blended science curriculum provided through the 5E+IA model in *STEMscopes* is supported through embedded Professional Development. STEMcoach™ provides in-the-moment instructional ideas and professional support for implementation of the inquiry-based pedagogy that the Texas Essential Knowledge and Skills (TEKS) standards advocate. Without changing how science looks in the classroom, implementation of any science instructional resource will be frustrating for both teachers and students. STEMcoach™ provides resources in many formats to meet the instructional and science content needs of teachers. Various professional support formats include videos, Frequently-Asked-Questions (FAQ), webinars, implementation training and coaching.

STEMscopes is a tightly and 100% TEKS aligned, online curriculum, which provides a complete, coherent, and supported pathway for the academic success of students using an enhanced 5E instructional model. Through the 5E+IA curriculum model, teachers are given choice and success in meeting the varied academic and learning needs of the students in their science classrooms.

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