

Mission of Argument-Driven Inquiry

Our mission at Argument-Driven Inquiry (ADI) is to promote effective science teaching through the development of high-quality instructional materials. The use of high-quality instructional materials and effective teaching approaches will allow all students to become proficient in science. To support our mission, ADI instructional materials require a different approach to teaching than instructional materials available to teachers in the past. We believe a new, different approach is required if all students in Texas are to become proficient in science.

Why a New Approach to Teaching Science is Necessary

There are several reasons that students require and deserve new approaches to teaching and learning science. First, the new Texas Essential Knowledge and Skills (TEKS) for grades K-8 require a new approach to teaching science. The inclusion of engineering practices and recurring themes alongside scientific knowledge in the TEKS necessitates new approaches to teaching science. Students are also asked to use scientific ideas to explain phenomenon occurring in the world around them, as opposed to just memorizing isolated scientific facts.

Second, traditional approaches to teaching science have misrepresented how science is done and who gets to do science. There is no single scientific method, for example. Additionally, traditional approaches to teaching science have often provided different opportunities to learn for some students. This has resulted in many girls, students from diverse socioeconomic backgrounds, and students with special needs being excluded from participating in and learning science.

Third, over the past 10 years, Texas students' science achievement has decreased on national assessments of educational progress. In other words, students in Texas are performing worse on measures of science learning than they were a decade ago. Current approaches used in Texas classrooms are not leading to the outcomes students deserve.

Finally, and most importantly, the world today is much different than it was 30, 20, or even 10 years ago. If the world is different, and will continue to change, then our students deserve a science education that is different from how science was taught 30 years ago. Current approaches are designed to prepare students for the world 30 years ago as opposed to 30 years from now. All students in Texas deserve a science education designed to prepare them for the future, not the past.

ADI Core Beliefs

In response to the need for new approaches to teaching science, ADI has developed high quality instructional materials that support all students developing science proficiency. The development of our materials is informed by core beliefs about science, students, teachers, teaching, and learning. These core beliefs are:

1. As defined by the TEKS, science is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." Students who are scientifically proficient are able to use scientific knowledge to understand phenomena they observe and to make predictions about natural and human designed systems.
2. All students can master the TEKS when given fair opportunities to learn.

3. Learning experiences should help students understand the world around them. To authentically represent the world, some learning experiences may be most effective by providing students opportunities to extend their learning via topics related to, but not explicitly stated in, the grade-level TEKS. All students can engage with these topics too.
4. Effective science materials have embedded supports and extensions for students with unique needs. Students do not need to be segregated into high, middle, and low “groups” with different learning experiences for each group to be successful. All students deserve, and need, experiences doing science.
5. Teachers are knowledgeable professionals capable of making in-the-moment decisions on how to support their students. Teachers and students benefit from broad curricular guidance that is flexible to accommodate the unique students in a class. Heavily prescribed lessons prevent teachers from responding to students’ natural curiosity and often turn students off from science.

Texas Resource Review

At ADI, we value and respect the Texas Resource Review process to ensure districts have access to as much information about the available instructional materials as possible. We also welcome the feedback provided by the team of reviewers and thank them for the opportunity to revise and strengthen aspects of our program.

There are, however, areas where we respectfully disagree with the scores and comments provided by the team reviewing our materials. Below, we share comments from the review that ADI disagrees with. We also provide a description of our beliefs that lead us to disagree with the comments included in the review. Finally, we briefly describe how the ADI materials do meet the indicator, just in a different way than traditional instructional materials. Because the same team reviewed our materials for grades 3, 4 and 5, and the scores for each indicator were the same for all three grades, we decided to present one response encompassing the grade band.

Indicator 3.1: Materials are designed to build knowledge systematically, coherently, and accurately.

Disagreement 1: The goals of science teaching and learning

Comment ADI disagrees with: “For example, in Unit 1, Properties of Matter, the investigations require the students to plan and conduct investigations on various properties of matter, but they do not bring together the abstract idea regarding how to compare and contrast objects based on multiple properties of matter” (5th grade review).

ADI belief informing our approach to this indicator: Learning experiences should help students understand the world around them. Concrete examples and phenomenon provide motivational anchors and a reason for students to use the ideas and practices of science. While abstraction is welcome, it is not the central aim of ADI materials. Nor is abstraction an aim of science proficiency as defined by the TEKS.

ADI materials: Each investigation begins with a phenomenon that students subsequently investigate. During an investigation, students present evidence to support their explanations and predictions. Through the investigative process, students also learn the facts, theories, laws, and ideas of science alongside the practices scientists use to investigate the world.

Phenomena are purposefully selected to give students an opportunity to use ideas and practices as tools to understand the world. Learning experiences build upon each other, leading students to understand and explain increasingly complex phenomenon. In the unit referenced in the above quote, the first investigation leads students to understand and explain phenomenon associated with melting. The final investigation in this unit asks students to explain why a can of coke sinks in water while a can of diet coke floats. This phenomenon requires students to use knowledge from their prior investigations during the unit to fully explain the coke/diet coke phenomenon.

Disagreement 2: The inclusion of topics not explicitly mentioned in the TEKS

Comment ADI Disagrees with: However, in Unit 4, students are introduced to eclipses not included in the 3rd-grade standards" (3rd grade review).

ADI belief informing our approach to this indicator: All students are capable of learning about the world around them. The world students experience is not limited to only those concepts included in the TEKS. Furthermore, engaging phenomenon serve as an anchor for instruction and provide a need to learn the ideas and concepts within the TEKS. Students should be given opportunities to learn about the world, including in instances where including such ideas enhances students learning about the concepts that are included in the TEKS.

ADI materials: Our materials utilize engaging phenomenon to anchor instruction. Sometimes, the most appropriate or engaging phenomenon is not explicitly mentioned in the grade level TEKS. In the above comment on eclipses, there is either a solar or lunar eclipse over parts of Texas every academic year for the next decade. Because students are likely to view these eclipses, we felt using eclipses as an anchoring phenomenon was a great way to get students to understand the solar system. To be clear, the mastery requirements for the above referenced lesson do not require students explain how or why eclipses occur. Instead, the occurrence of an eclipse provides a gateway to learning and using other ideas that are included in the TEKS.

Disagreement 3: Scripting teacher dialogue

Comment ADI Disagrees with: "Questions that are provided within the lesson under the pushpin or lightbulb icons are often routine (offered in all of the lessons) or limited in scope and not leading to higher-level thinking and deeper conceptual understanding" (4th grade review). Note: the pushpin and lightbulb icon provide lesson plans and tips for teaching to teachers.

ADI belief informing our approach to this indicator: Teachers are knowledgeable professionals capable of making in-the-moment decisions on how to support their students. Teachers are knowledgeable and capable of crafting effective questions for their students. Teachers need broad guidance that is flexible enough such that the teacher can adapt instruction to the unique needs of their students. Scripted questions often result in teachers being hamstrung in responding to students' needs and interests. Scripted questions also often constrain the space of "right" answers, serving as a gatekeeper to who gets access to science. Scripted, gate keeper questions also discourage student creativity, turning many students off from science.

ADI materials: The teacher supports provided by the ADI materials are flexible for teachers to adapt to the unique group of students they work with. The teacher lesson plans and tips for each investigation provide broad guidance that knowledgeable and skilled teachers can use when teaching. With respect to the issue of providing questions for teachers, our general

questions are written to provide a starting point for a conversation between the teacher and student(s). This is important—our questions are designed to engage students in conversation (as opposed to eliciting a single correct answer). We believe teachers are capable of responding to the ideas their students have in ways that meet the learning needs of the student or students they are conversing with.

With respect to questions being used in multiple investigations, research on how students learn (including research on ADI) has shown these questions are high-leverage questions. In other words, they lead to more robust refinement of ideas than more scripted questions. These questions also can elicit more sophisticated responses as students' scientific proficiency increases. For the ADI team, repeated use high-leverage, open-ended questions are a better approach than designing scripted questions for each lesson.

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.

Disagreement 1: The inclusion of topics not explicitly mentioned in the TEKS

Comment ADI Disagrees with: “The materials are sometimes not grade-level appropriate. For example, the Earth-Space Science: Rock Classification and the Rock Cycle lesson introduces metamorphic and igneous rocks and the process whereby earth materials are “recycled” in the rock cycle. This is not a grade 5 student expectation. Instead, it is grade-level appropriate for grade 6 with TEKS 6.10C” (5th grade review).

Comment ADI Disagrees with: “These inclusions of concepts that are not grade-level appropriate within the scientific texts impair students' ability to focus on grade-level appropriate content and develop an understanding of the concepts for grade 5” (5th grade review).

ADI belief informing our approach to this indicator: All students are capable of learning about the world around them. The world students experience is not limited to only those concepts included in the TEKS. Students should be given opportunities to learn about the world, including in instances where including such ideas enhance students learning about the concepts that are included in the TEKS. In fact, the inclusion of ideas not in the TEKS may make those ideas contained in the TEKS easier to learn.

ADI materials: As mentioned above, ADI will incorporate additional ideas to enhance student learning. Sometimes, the inclusion of additional ideas from the next grade level will actually make it easier to master the current grade level student expectations. As such, ADI materials favor engaging students in understanding the world around them as opposed to a narrow focus on only the grade level expectations.

In reference to the rock cycle lesson, the student expectation included in the TEKS states students are expected to “model and describe the processes that led to the formation of sedimentary rocks.” Sedimentary rocks are made from other rocks, including igneous and metamorphic rocks. Identifying sedimentary rocks without also naming other types of rocks will confuse students. While some sedimentary rocks are made from other sedimentary rocks, other sedimentary rocks are not. How should a teacher respond if a student inquires about the

other rocks? We believe all students are capable of learning about igneous and metamorphic rocks and learning about these two types of rocks enhances their ability to model and describe the processes leading to the formation of sedimentary rock. To be clear, we do not assess students on igneous or metamorphic rocks, as students are not expected to be assessed about these rocks in 5th grade. However, all students are capable of learning about igneous and metamorphic in 5th grade.

Indicator 7.1: Materials include guidance, scaffolds, supports, and extensions that maximize student learning potential.

Disagreement 1: Helping all students master the TEKS and become proficient in science

Comment ADI Disagrees with: “However, the materials do not provide additional resources for targeted instruction, differentiation, and enrichment activities for all levels of learners to support students who have not yet achieved mastery” (3rd grade review).

ADI belief informing our approach to this indicator: All students are capable of learning science. Students have unique needs, and effective science materials have embedded supports and extensions for students with unique needs. Students do not need to be segregated into high, middle, and low “groups” with different learning experiences for each group to be successful. All students deserve, and need, experiences doing science.

ADI materials: Our materials engage all students in explaining and understanding the same phenomenon. Our materials are designed to provide a low floor to entry and a high ceiling of outcomes so students at all levels of prior science knowledge can understand and explain the same phenomenon. Students ready for more in-depth exploration have room to do so during the same activities as students who need to focus on mastering the grade-level expectation. For example, when creating a plan for their investigation, students can be given different graphic organizers based upon their prior learning with the topic. For students who are more knowledgeable in a specific area, teachers can use a different graphic organizer. These graphic organizers are built with subtle differences to ensure all students are engaged in productive struggle. Importantly, all students are given a fair opportunity to explain the same phenomenon.

Disagreement 2: Providing enrichment opportunities for some students

Comment ADI Disagrees with: “Materials do not suggest engaging enrichment activities (e.g., virtual field trips, game-based concept review games, service learning projects, problem-solving exercises, simulations, real world scenarios, etc.) to encourage further exploration of science concepts” (5th grade).

ADI belief informing our approach to this indicator: The best way to learn science is through learning experiences grounded in real-world phenomenon and scenarios. All students can learn about and through real-world phenomenon because all students live in the real world. High-quality materials are purposefully built such that enrichment opportunities naturally arise during the lesson. Too often, enrichment is used as a euphemism for “more engaging learning activity for the advanced students.” For ADI, all students need engaging learning activities, because science is best learned when students have a need to use scientific ideas to explain phenomena.

ADI materials: All TEKS are taught through investigation into a real-world phenomenon, and all students investigate the same phenomenon. For example, in the 5th grade investigation “Best Way to Feed Your Phone” students learn TEKS surrounding fossil fuels, production of energy, and the management of energy resources through the phenomenon of charging (i.e., feeding) a cell phone. All students benefit from the engaging, real-world scenario of charging a cell phone, and this lesson is not restricted to only those students already at an elevated level of proficiency.

The low-floor/high-ceiling nature of our investigations provides natural avenues for all students to extend their learning (i.e. enrichment opportunities). For those students who are ready for more in-depth or complex ideas, teachers have the flexibility to allow students to investigate further into the phenomenon. Students are given opportunities to ask their own questions related to the anchoring phenomenon and can then answer their own questions. This provides an intrinsic motivation to learn because students’ own curiosity will be addressed.

Disagreement 3: Helping students who need the most support

Comment ADI Disagrees with: “Materials do not ensure that teachers can target instruction to develop precursor skills necessary to access grade-level content as required for just-in-time learning acceleration” (4th grade review).

ADI belief informing our approach to this indicator: Basic skills are best learned when students have a reason to learn. Basic skills are also best learned when they are used to understand and explain phenomenon. Students who need additional support to master grade level expectations are those students who most benefit from developing basic skills concurrent to understanding and explaining phenomenon.

ADI materials: Instead of pulling students out who have yet to demonstrate mastery on basic skills, we provide a need for students to use these skills to understand the world around them. If students are still developing knowledge and skills in mathematics, for example, science investigations provide a context in which to use and further develop mathematics knowledge and skills. This learning experience supports students in using and deepening their basic skills alongside learning the science content at the heart of the lesson.