Scientific Thinking and Reasoning Standards (STARS)

Florida students are expected to engage with science through the Scientific Thinking and Reasoning Standards (STARS). These standards are written in clear language so all stakeholders can understand them and students can use them as self-monitoring tools. The STARS promote deeper learning and understanding of science. The clarifications are included to guide teachers in the integration of the STARS within science instruction.

SC.K12.STR.1.1 *Actively participate in the practice of science.*

Scientists who actively participate in the practice of science:

- Generate questions that are testable, focused, and relevant to scientific investigations.
- Recognize that scientific knowledge is based on both making observations and developing inferences based on those observations.
- Use scientific inquiry to formulate investigations, collect and evaluate data, look for possible patterns, and carry out experiments.
- Determine effective means to communicate key evidence or knowledge through models, visual illustrations, or written descriptions.
- Engage in collaborative scientific inquiry to evaluate evidence and develop evidence-based explanations.
- Understand that the process of science frequently does not correspond to the traditional portrayal of the scientific method.

Clarifications:

Teachers who encourage students to participate actively in science:

- Facilitate classroom environments involving questioning, planning investigations, and conducting experiments.
- Provide collaborative learning environments.
- Foster student-led inquiry.
- Provide opportunities to engage in real-world problems and develop viable solutions.

SC.K12.STR.2.1 *Engage in innovative, creative thinking to enrich how science concepts are understood and communicated.*

Scientists who engage in innovative, creative thinking:

- Take ownership of learning and apply scientific knowledge in new and innovative ways.
- Explore real-world problems through curiosity and generate innovative solutions.
- Explore science topics in depth and communicate understanding creatively.

Clarifications:

Teachers who encourage students to engage in innovative, creative thinking:

- Allow students to synthesize information and communicate understanding creatively.
- Build complexity gradually to encourage creative risk-taking.
- Prioritize exploration, ownership, and deep engagement.

SC.K12.STR.3.1 *Approach problem-solving with a balance of open-mindedness to possible solutions and skepticism of initial data.*

Scientists who approach problem-solving with balance:

- Discuss scientific questions and consider multiple perspectives.
- Critically evaluate evidence and defend conclusions.
- Use models, simulations, and real-world investigations.
- Identify questions outside the boundaries of scientific investigation better addressed through other ways of knowing such as art, philosophy, and religion.
- Avoid selective use of evidence.
- Use a holistic problem-solving approach.

Clarifications:

Teachers who encourage students to approach problem-solving with a balance:

- Foster environments where students generate questions.
- Engage students with observable phenomena.
- Ask students to make predictions and justify reasoning.
- Emphasize questioning as a core component of inquiry.
- Encourage skepticism of initial data and assumptions.
- Require students to gather and evaluate evidence.

SC.K12.STR.4.1 *Know the elements and applications of scientific theories and laws.*

Scientists who know the elements and applications of scientific theories and laws:

- Recognize differences and relationships among theories and laws.
- Use authentic sources.
- Apply theories and laws to inquiry.
- Recognize competing interpretations in scientific development.

Clarifications:

Teachers who encourage students to know the elements and applications of scientific theories and laws:

- Connect content to scientific theories and laws.
- Introduce historical examples.
- Support understanding of the relationships and distinctions between scientific theories and laws.

SC.K12.STR.5.1 *Assess scientific knowledge based upon empirical evidence.*

Scientists who assess scientific knowledge based on evidence:

- Ground understanding in empirical evidence.
- Remain open to new ideas.
- Check validity of evidence and accuracy of data.
- Understand the importance of replication.
- Recognize some phenomena cannot be explained through empirical evidence.

Clarifications:

Teachers who encourage students to assess scientific knowledge based on evidence:

- Provide opportunities to question the validity of evidence.
- Provide opportunities for students to evaluate the quality, reliability, and validity of evidence.
- Challenge students to be flexible in thinking.

SC.K12.STR.6.1 *Apply science to solve practical problems in real-world scenarios.*

Scientists who apply science to real-world problems:

- Investigate authentic problems.
- Explore scientific principles and evaluate evidence.
- Create practical solutions and consider trade-offs.

Clarifications:

Teachers who encourage students to apply science to real-world problems:

- Provide inquiry-based problem-solving opportunities.
- Use authentic examples.
- Transform abstract concepts into meaningful experiences.
- Reinforce scientific literacy and life skills.

SC.K12.STR.7.1 *Communicate scientific understanding through clear, accurate, and evidence-based technical writing.*

Scientists who communicate through technical writing:

- Use scientific vocabulary accurately.
- Organize information logically.
- Distinguish among observations, inferences, claims, evidence, and reasoning.
- Support conclusions with evidence.
- Use tables, graphs, diagrams, and models effectively.
- Revise written work based on evidence and feedback.
- Adapt communication for different audiences while maintaining scientific accuracy.

Clarifications:

Teachers who encourage students to communicate through technical writing:

- Provide opportunities for scientific writing.
- Model precise scientific language.
- Teach distinctions among claims, evidence, and opinions.
- Encourage revision.
- Integrate visuals into scientific communication.

SC.K12.STR.8.1 ***Engage in complex engineering challenges through application of interdisciplinary knowledge, integration of appropriate technology, and use of divergent and convergent thinking.***

Scientists and engineers:

- Identify problems, needs, and constraints.
- Brainstorm and compare solutions.
- Use the engineering design process.
- Apply science, mathematics, and technology.
- Share designs and results.
- Understand that improvement requires iteration.

Clarifications:

Teachers who encourage students to engage in challenges as scientists and engineers:

- Give students meaningful problems.
- Provide opportunities to test and improve ideas.
- Encourage creativity and persistence.
- Model consideration of constraints and trade-offs.
- Guide reflection.

SC.K12.STR.9.1 ***Evaluate, test, and refine engineering solutions using evidence, data, and design criteria.***

Scientists and engineers:

- Test solutions using measurable criteria.
- Collect and analyze data.
- Identify strengths and limitations.
- Compare multiple solutions.
- Modify designs based on evidence.
- Recognize iterative improvement.

Clarifications:

Teachers who encourage students to evaluate, test, and refine engineering solutions:

- Provide opportunities to test prototypes.
- Engage students in data analysis.
- Encourage evidence-based redesign.
- Help students evaluate trade-offs.
- Foster reflection.

SC.K12.STR.10.1 ***Apply ethical reasoning when conducting scientific investigations and evaluating the impact of science and technology.***

Scientists who apply ethical reasoning:

- Conduct investigations honestly and responsibly.
- Report methods and results truthfully.
- Recognize the importance of transparency and integrity.
- Consider impacts on society and the environment.
- Evaluate benefits and risks.
- Respect living organisms and natural systems.
- Recognize the role of ethics in scientific decisions.

Clarifications:

Teachers who encourage students to apply ethical reasoning:

- Foster discussions about responsible conduct.
- Evaluate societal and environmental impacts.
- Emphasize honesty in data collection and reporting.
- Encourage evaluation of scientific issues using evidence, ethical principles, and consideration of multiple stakeholder perspectives.
- Model ethical decision-making.

SC.K12.STR.11.1 ***Recognize the historical roots of scientific discoveries to appreciate the significance of current scientific advancements and their impact on our understanding of the natural world.***

Scientists who recognize historical roots:

- Understand that scientific knowledge develops through observation, investigation, and refinement.
- Recognize that models and explanations change with new evidence.
- Examine contributions from scientists, engineers, inventors, and cultures.
- Analyze how technologies expand discovery.
- Recognize that discoveries are built upon previous work.
- Understand the role of debate and competing ideas.
- Analyze relationships among science, society, and technology.

Clarifications:

Teachers who encourage students to recognize historical roots:

- Integrate historical examples.
- Analyze how evidence contributed to scientific progress.
- Connect concepts to discoveries and inventions.
- Examine interactions between science and society.
- Emphasize science as a dynamic process.