

Senior 2, Cluster 0: Overall Skills and Attitudes

Overview

Cluster 0 comprises nine categories of specific learning outcomes that describe the skills and attitudes* involved in scientific inquiry and the decision-making process for STSE issues. In Grades 5 to 8, students develop scientific inquiry through the development of an hypothesis/prediction, the identification and treatment of variables, and the formation of conclusions. Students begin to make decisions based on scientific facts and refine their decision-making skills as they progress through the grades, gradually becoming more independent. Students also acquire key attitudes, an initial awareness of the nature of science, and other skills related to research, communication, the use of information technology, and cooperative learning.

In Senior 1 and 2, students continue to use scientific inquiry as an important process in their science learning, but also recognize that STSE issues require a more sophisticated treatment through the decision-making process. This process has been delineated in the Cluster 0 specific learning outcomes.

* Cluster 0, Overall Skills and Attitudes, specific learning outcomes for this grade are presented as a chart (separate attachment). The purpose of this chart is to provide a full grade overview of skills and attitudes that need to be achieved.

Teachers should select appropriate contexts to introduce and reinforce scientific inquiry, the decision-making process, and positive attitudes within the thematic clusters (Clusters 1 to 4) over the course of the school year. For example, students will use the decision-making process as they examine an STSE issue related to safe driving conditions in Cluster 3. To assist in planning and to facilitate curricular integration, many specific learning outcomes within this cluster are accompanied by links to specific learning outcomes in other subject areas, specifically English language arts (ELA) and mathematics (Math). There are also links to *Technology As a Foundation Skill Area* (TFS).

Students will...

	Scientific Inquiry	STSE Issues
Initiating	S2-0-1a Propose questions that could be tested experimentally. GLO: C2 (ELA: S2: 3.1.2)	S2-0-1c Identify STSE issues which could be addressed. GLO: C4
	S2-0-1b Select and justify various methods for finding the answers to specific questions. GLO: C2 (Math: S1: A-1)	S2-0-1d Identify stakeholders and initiate research related to an STSE issue. GLO: C4 (ELA: S2: 3.1.2)

	Scientific Inquiry	STSE Issues
Researching	<p>S2-0-2a Select and integrate information obtained from a variety of sources. Include: print, electronic, specialists, other resource people. GLO: C2, C4, C6 TFS: 1.3.2, 4.3.4 (ELA: S2: 3.1.4, 3.2.4; Math: S1-B-1, 2)</p> <p>S2-0-2b Evaluate the reliability, bias, and usefulness of information. GLO: C2, C4, C5, C8 TFS: 2.2.2, 4.3.4 (ELA: S2: 3.2.3, 3.3.3)</p> <p>S2-0-2c Summarize and record information in a variety of forms. Include: paraphrasing, quoting relevant facts and opinions, proper referencing of sources. GLO: C2, C4, C6 TFS: 2.3.1, 4.3.4 (ELA: S2: 3.3.2; MATH: S2-AMA C-1)</p>	
		<p>S2-0-2d Review effects of past decisions and various perspectives related to an STSE issue. Examples: <i>environmentalist and industry group positions on fossil fuel emissions...</i> GLO: B1, C4 TFS: 1.3.2, 4.3.4 (ELA: S2: 3.2.2)</p>

	Scientific Inquiry	STSE Issues
Planning	<p>S2-0-3a State a testable hypothesis or prediction based on background data or on observed events. GLO: C2</p> <p>S2-0-3b Identify probable mathematical relationships between variables. Examples: <i>relationship between braking distance, velocity, and friction...</i> GLO: C2 (MATH: S2-AMA H-3, CMA F-3[11], PCA H-1,2)</p> <p>S2-0-3c Plan an experiment to answer a specific scientific question. Include: materials, variables, controls, methods, safety considerations. GLO: C1, C2</p>	<p>S2-0-3d Summarize relevant data and consolidate existing arguments and positions related to an STSE issue. GLO: C4 TFS: 2.3.1, 4.3.4 (ELA: S2: 1.2.1, 3.3.1, 3.3.2)</p> <p>S2-0-3e Determine criteria for the evaluation of an STSE decision. Examples: <i>scientific merit; technological feasibility; social, cultural, economic, and political factors; safety; cost; sustainability...</i> GLO: B5, C1, C3, C4</p> <p>S2-0-3f Formulate and develop options which could lead to an STSE decision. GLO: C4</p>

	Scientific Inquiry	STSE Issues
Implementing a Plan	<p>S2-0-4a Carry out procedures that comprise a fair test. Include: controlling variables, repeating experiments to increase accuracy and reliability of results. GLO: C1, C2 TFS: 1.3.1 (MATH: S2-AMA H-1, 2, CMA F3[11])</p> <p>S2-0-4b Demonstrate work habits that ensure personal safety, the safety of others, as well as consideration for the environment. Include: knowledge and use of relevant safety precautions, WHMIS regulations, and emergency equipment. GLO: B3, B5, C1, C2</p> <p>S2-0-4c Interpret relevant WHMIS regulations. Include: symbols, labels, Material Safety Data Sheets (MSDS). GLO: C1, C2</p>	<p>S2-0-4d Use various methods for anticipating the impacts of different options. <i>Examples: test run, partial implementation, simulation, debate...</i> GLO: C4, C5, C6, C7</p>
	<p>S2-0-4e Work cooperatively with group members to carry out a plan, and troubleshoot problems as they arise. GLO: C2, C4, C7 (ELA: S2: 3.1.3, 5.2.1)</p> <p>S2-0-4f Assume the responsibilities of various roles within a group and evaluate which roles are most appropriate for given tasks. GLO: C2, C4, C7 (ELA: S2: 3.1.3, 5.2.1)</p>	

	Scientific Inquiry	STSE Issues
Observing, Measuring, Recording	<p>S2-0-5a Select and use appropriate methods and tools for collecting data or information. GLO: C2 TFS: 1.3.1 (MATH: S2-AMA: H-1, CMA: F-3,1, PCA: H-3)</p> <p>S2-0-5b Estimate and measure accurately using Système International (SI) and other standard units. Include: SI conversions. GLO: C2 (MATH: S2-AMA: H-2, CMA: D-1)</p> <p>S2-0-5c Record, organize, and display data using an appropriate format. Include: labelled diagrams, graphs, multimedia. GLO: C2, C5 TFS: 1.3.1, 3.2.2 (ELA: S2: 4.4.1; MATH: S2-AMA B-5, 6, D-1, 2, F-1, A-1)</p>	<p>S2-0-5d Evaluate, using pre-determined criteria, different STSE options leading to a possible decision. Include: scientific merit; technological feasibility; social, cultural, economic, and political factors; safety; cost; sustainability. GLO: B5, C1, C3, C4 TFS: 1.3.2, 3.2.3 (ELA: S2: 3.3.3)</p>

	Scientific Inquiry	STSE Issues
Analyzing and Interpreting	<p>S2-0-6a Interpret patterns and trends in data, and infer and explain relationships. GLO: C2, C5 TFS: 1.3.1, 3.3.1 (ELA: S2: 3.3.1; MATH: S2: AMA J-2, CMA D-5, F-2, H-4)</p> <p>S2-0-6b Identify and suggest explanations for discrepancies in data. <i>Examples: sources of error...</i> GLO: C2 (ELA: S2: 3.3.4)</p> <p>S2-0-6c Evaluate the original plan for an investigation and suggest improvements. <i>Examples: identify strengths and weaknesses of data collection methods used...</i> GLO: C2, C5</p>	<p>S2-0-6d Adjust STSE options as required once their potential effects become evident. GLO: C3, C4, C5, C8</p>

	Scientific Inquiry	STSE Issues
Concluding and Applying	<p>S2-0-7a Draw a conclusion that explains the results of an investigation. Include: cause and effect relationships, alternative explanations, supporting or rejecting the hypothesis or prediction. GLO: C2, C5, C8 (ELA: S2: 3.3.4; MATH: S2: AMA J-3, CMA F-2, PCA H-4)</p>	<p>S2-0-7b Select the best option and determine a course of action to implement an STSE decision. GLO: B5, C4 (ELA: S2: 3.3.4)</p> <p>S2-0-7c Implement an STSE decision and evaluate its effects. GLO: B5, C4, C5, C8</p> <p>S2-0-7d Reflect on the process used to arrive at or to implement an STSE decision, and suggest improvements. GLO: C4, C5 (ELA: S2: 5.2.4)</p>
	<p>S2-0-7e Reflect on prior knowledge and experiences to develop new understanding. GLO: C2, C3, C4 (ELA: S2: 4.2.2)</p>	

	Scientific Inquiry	STSE Issues
Reflecting on Science and Technology	S2-0-8a Distinguish between science and technology. Include: purpose, procedures, products. GLO: A3	
	S2-0-8b Explain the importance of using precise language in science and technology. GLO: A2, A3, C2, C3 (ELA: S2: 4.3.1)	
	S2-0-8c Describe examples of how scientific knowledge has evolved in light of new evidence, and the role of technology in this evolution. GLO: A2, A5	
	S2-0-8d Describe examples of how technologies have evolved in response to changing needs and scientific advances. GLO: A5	
	S2-0-8e Discuss how peoples of various cultures have contributed to the development of science and technology. GLO: A4, A5	
	S2-0-8f Relate personal activities and possible career choices to specific science disciplines. GLO: B4	
	S2-0-8g Discuss social and environmental effects of past scientific and technological endeavours. Include: major shifts in scientific world views, unintended consequences. GLO: B1	

	Scientific Inquiry	STSE Issues
Demonstrating Scientific and Technological Attitudes and Habits of Mind	S2-0-9a Appreciate and respect that science and technology have evolved from different views held by women and men from a variety of societies and cultural backgrounds. GLO: A4	
	S2-0-9b Express interest in a broad scope of science- and technology-related fields and issues. GLO: B4	
	S2-0-9c Demonstrate confidence in their ability to carry out investigations in science and to address STSE issues. GLO: C2, C4, C5	
	S2-0-9d Value skepticism, honesty, accuracy, precision, perseverance, and open-mindedness as scientific and technological habits of mind. GLO: C2, C3, C4, C5	
	S2-0-9e Be sensitive and responsible in maintaining a balance between the needs of humans and a sustainable environment. GLO: B5, C4	
	S2-0-9f Demonstrate personal involvement and be proactive with respect to STSE issues. GLO: B5, C4	

Notes