



Spotlight on Science Skills Grade 3

February 2017

Acknowledgements

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- Development Team:
 - Judson Waye – ASD-N
 - Adam Hayward – ASD-N

- NB Department of Education and Early Childhood Development
 - Kathy Hildebrand, Cathy Martin, Martha McClure
Learning Specialists, Science and Mathematics

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Objective

The Atlantic provinces' science curriculum is guided by the vision that all students will have an opportunity to develop scientific literacy.

“Scientific literacy is an evolving combination of the science-related attitudes, skills, and knowledge that students need to develop inquiry, problem-solving, and decision-making abilities, to become lifelong learners, and to maintain a sense of wonder about the world around them.” (*Foundation for the Atlantic Canada Science Curriculum*, page 11)

The *Spotlight on Science Skills* series of documents:

- Clusters the existing Atlantic Canada skill outcomes into nine scientific practices (questioning, predicting/hypothesizing, variables, experimental design, collecting data/observations, organizing/displaying data, analyzing data, making conclusions, applying learning).
- Provides educators with an elaboration of the scientific practice including explanations of specialized terminology. It indicates what students have learned in previous grades and what the focus is for learning in the current grade.
- Provides a list of achievement indicators with an accompanying rubric for each scientific practice to further clarify expectations and guide educators in determining whether their students have met the outcome.

Overview of Outcomes

GCO: Plan & Perform (PP) - Ask questions, make predictions about objects and events. Develop a plan for fair tests to investigate those questions. Conduct investigations about their environment. Work collaboratively to carry out science-related activities.

SCO: PP1 - Propose testable questions

SCO: PP2 - State a prediction and hypothesis

SCO: PP3 - Identify and describe variables

SCO: PP4 - Plan investigations

SCO: PP5 - Conduct investigations

GCO: Analyze & Explain (AE) - Interpret findings from investigations using appropriate methods. Communicate ideas and results.

SCO: AE1 - Classify, organize and display data

SCO: AE2 - Analyze data patterns

SCO: AE3 - Draw conclusions

SCO: AE4 - Apply learning

GCO: Plan & Perform (PP) - Ask questions, make predictions about objects and events. Develop a plan for fair tests to investigate those questions. Conduct investigations about their environment. Work collaboratively to carry out science-related activities.

SCO: PP1 - Propose testable questions

Scope and Sequence of Outcomes

Grades K-3	Grades 4-6
200-1 Ask Questions that lead to the exploration and investigating	204-1 Propose questions to investigate and practical problems to solve
200-2 Identify problems to be solved	
	204-2 Rephrase questions in a testable form

Elaboration

Guiding Questions:

- *What do I want my students to learn?*
- *What do I want my students to understand and be able to do?*

At Grade 3, the focus is not on creating testable questions. Rather, students should be focused on writing a good question. The key to a good question in science is to have the subject of the question be a variable that can be tested. In Grade 4, students will learn to take a good initial science question and rephrase it in a **testable form**.

Grade 3	Grade 4 Testable Question
Should plants be watered every week?	Will my plant grow taller if it watered once or twice per week?
Will the plant grow better if watered once or twice per week?	

Connection to Communication

- Communicate questions, ideas, and intentions while conducting their explorations
- Respond to the ideas and actions of others in constructing their own understanding
- Respond to the ideas and actions of others and acknowledge their ideas and contributions

Good science questions do not have answers that are opinions. Questions leading to a simple “yes/no” answer generally are not useful for scientific investigations. “Yes/no” questions can be reworded into a more useful form.

Before	After
Should plants be watered?	Should plants be watered once or twice per week?

Achievement Indicators

Guiding Questions:

- *What evidence will I look for to know that learning occurred?*
- *What should students demonstrate to show their understanding of the Scientific Process Skill?*

Use the following set of indicators as a guide to determine whether students have met the corresponding specific outcome.

- i. Write questions using language that suggest an investigation (by identifying the variable to test).

Achievement Rubric

	Excelling - 4	Meeting - 3	Approaching - 2	Working Below - 1
Scientific Question	Write a scientific question in a testable form that includes what is measured and observed as well as the variable that is being tested	Write a scientific question that includes the variable to test	Write a question that has a yes/no answer; does not indicate what variable is being tested	Any other answer

GCO: Plan & Perform (PP) - Ask questions, make predictions about objects and events. Develop a plan for fair tests to investigate those questions. Conduct investigations about their environment. Work collaboratively to carry out science-related activities.

SCO: PP2 - State a prediction and a hypothesis

Scope and Sequence of Outcomes

Grades K-3	Grades 4-6
200-3 Make predictions, based on an observed pattern	204-3 State a prediction and a hypothesis based on an observed pattern of events

Elaboration

Guiding Questions:

- *What do I want my students to learn?*
- *What do I want my students to understand and be able to do?*

In the elementary grades, students are expected to make predictions. The term hypothesis will be introduced in middle school.

A scientific **prediction** is related to the question. When students are asked to make a prediction in response to a problem or question, they should be using what they already understand about the subject to explain their prediction.

For example:

- Question: Will adding fertilizer make grass grow bigger?
- Possible predictions:
 - I predict that adding fertilizer will make grass grow bigger, because when my dad added it, the flowers grew big.
 - I predict that adding fertilizer will make grass grow bigger, because when we put it on our class beans they grew tall.

A prediction is never considered right or wrong. Results will always be expected or unexpected. The conclusion, supported by experimental results, does not have to match the prediction.

It is important to note that students in Grade 3 will have limited actual scientific understanding. When students state personal understanding, they should be encouraged to be as specific as possible in their reasoning. For many topics, students may have very limited or no personal experiences to draw on. Providing common experiences for students through activities such as explorations, demonstrations, and/or videos is helpful.

Depending on the context, **estimation** is a skill that can enhance the ability to make an accurate scientific prediction. Estimation is a strategy for determining approximate values or quantities, usually by referring to benchmarks or using referents, or for determining the reasonableness of calculated values. Based on the grade level standards (cross-curricular with Math), students should use estimation strategies where appropriate.

Connection to Communication

- Communicate questions, ideas, and intentions while conducting their explorations
- Respond to the ideas and actions of others in constructing their own understanding
- Respond to the ideas and actions of others and acknowledge their ideas and contributions

Achievement Indicators

Guiding Questions:

- *What evidence will I look for to know that learning occurred?*
- *What should students demonstrate to show their understanding of the Scientific Process Skill?*

Use the following set of indicators as a guide to determine whether students have met the corresponding specific outcome.

- i. Write prediction statements that are testable; though variables may be general and not specific enough to measure (e.g., better, worse).
- ii. Write prediction statements with a reason, based on an observed pattern (may come from personal experiences outside school).

Achievement Rubric

	Excelling - 4	Meeting - 3	Approaching - 2	Working Below - 1
Prediction	Make predictions relevant to question with a rationale supported by scientific learning (independently and consistently)	Make a prediction which is: <ul style="list-style-type: none"> - relevant to the question - testable - includes a reason, usually based on personal scientific experiences or knowledge 	Make a prediction, including a reason, which may be relevant, but is not clearly expressed	Make a prediction, but the reason is missing or irrelevant <hr/> Any other answer

GCO: Plan & Perform (PP) - Ask questions, make predictions about objects and events. Develop a plan for fair tests to investigate those questions. Conduct investigations about their environment. Work collaboratively to carry out science-related activities.

SCO: PP3 - Identify and describe variables

Scope and Sequence of Outcomes

Grades K-3	Grades 4-6
<i>A foundational idea that is implied in the question, prediction, and experimental design outcomes</i>	204-4 Define objects and events in their investigations
	204-5 Identify and control major variables in investigations

Elaboration

Guiding Questions:

- *What do I want my students to learn?*
- *What do I want my students to understand and be able to do?*

Students will be introduced to the concept that **variables** are an element in many scientific investigations. Even though there is no defined outcome from Kindergarten to Grade 3, students should still be introduced to the concept of a variable. A **variable** is an attribute that can vary (e.g., be high or low). A typical example of a variable would be temperature. It changes, going higher or lower based on external conditions.

The focus of this section is the identification of variables to ensure a **fair test**. In practice, a fair test means identical procedures must be performed where only one variable is changed at a time. At Grade 3, it is not expected that all variables be controlled to make a true fair test. Rather, students should understand that a test should be as fair as possible and that “variables” need to be accounted for. So the primary goal in Grade 3 is that students get introduced to controlling major variables in an investigation.

Starting in Grade 4, students will be introduced formally to:

- Variables that are kept constant (controlled)
- Variable that is purposely changed (independent)
- Variable that is observed or measured (dependent)

Connection to Communication

- Communicate questions, ideas, and intentions while conducting their explorations
- Respond to the ideas and actions of others in constructing their own understanding
- Respond to the ideas and actions of others and acknowledge their ideas and contributions

Achievement Indicators

Guiding Questions:

- *What evidence will I look for to know that learning occurred?*
- *What should students demonstrate to show their understanding of the Scientific Process Skill?*

Use the following set of indicators as a guide to determine whether students have met the corresponding specific outcome.

- i. Identify major variables that are relevant to the investigation.
- ii. Ensure a fair test by controlling the most relevant variables.

Achievement Rubric

	Excelling - 4	Meeting - 3	Approaching - 2	Working Below - 1
Variables	Select all relevant variables to control, test, and measure or observe (independently and consistently)	Identify and control most relevant variables for a fair test	Control variables that are not relevant to the investigation for a fair test	Any other answer

GCO: Plan & Perform (PP) - Ask questions, make predictions about objects and events. Develop a plan for fair tests to investigate those questions. Conduct investigations about their environment. Work collaboratively to carry out science-related activities.

SCO: PP4 - Plan investigations

Scope and Sequence of Outcomes

Grades K-3	Grades 4-6
200-4 Select and use materials to carry out their own explorations	204-6 Identify various methods for finding answers to given problems, and ultimately select one that is appropriate
200-5 Identify materials and suggest a plan for how they will be used	204-7 Plan a set of steps to solve a practical problem and carry out a fair test of a science-related idea
	204-8 Identify appropriate tools, instruments, and materials to complete their investigations
201-7 identify and use a variety of sources of science information and ideas	205-8 Identify and use a variety of sources and technologies to gather pertinent information

Elaboration

Guiding Questions:

- *What do I want my students to learn?*
- *What do I want my students to understand and be able to do?*

In Grade 3, students start to explore the idea of fair test. Grade 4 focuses on designing a fair test. In this grade students need to be able to write a step-by-step plan of what needs to be done to conduct the investigation. Science expectations should be consistent with the language arts standards for procedural writing.

Grade 3 Language Arts Reading and Writing Standards

Form: Instructions/Procedures

Purpose: to tell how to do something

Goal or aim- identifies by title or opening statement **Materials/ingredients** – lists materials **Method/process** – includes key steps in order with some relevant details focusing on how and when

Conclusion or Evaluation – concludes abruptly and may include an evaluation (*make sure ice cream is frozen before you eat it!*)

Special Features

- May include illustrations, diagrams or labels
- Numbered-steps or words showing sequence (first, next, then)
- Point form or full sentences starting with sequence or action words
- Present tense
- May be written in second person (you take out...)

Connection to Communication

- Communicate procedures and results, using drawings, demonstrations, and written or oral descriptions
- Respond to the ideas and actions of others in constructing their own understanding
- Respond to the ideas and actions of others and acknowledge their ideas and contributions

A point of emphasis should be that when the procedures are presented to the reader, they should be able to replicate the investigation based on the described steps.

Achievement Indicators

Guiding Questions:

- *What evidence will I look for to know that learning occurred?*
- *What should students demonstrate to show their understanding of the Scientific Process Skill?*

Use the following set of indicators as a guide to determine whether students have met the corresponding specific outcome.

- i. Identify appropriate equipment and materials for an investigation.
- ii. Explain how the investigation will be set up to control major variables.
- iii. Describe what will be measured or observed, and how and when this will be recorded.
- iv. Explain the steps of the procedure with enough detail that someone else could repeat the investigation in the same way.

Achievement Rubric

	Excelling - 4	Meeting - 3	Approaching - 2	Working Below - 1
Plan an investigation	Perform all of the following independently and consistently :	Perform <u>most or all</u> of the following:	Perform <u>some</u> of the following or need support:	Any other answer
	Identify appropriate equipment and materials for an investigation			
	Explain how the investigation will be set up to control major variables			
	Describe what will be measured or observed, and how and when this will be recorded			
	Explain the steps of the procedure with enough detail that someone else could repeat the investigation in the same way			

GCO: Plan & Perform (PP) - Ask questions, make predictions about objects and events. Develop a plan for fair tests to investigate those questions. Conduct investigations about their environment. Work collaboratively to carry out science-related activities.

SCO: PP5 - Conduct investigations

Scope and Sequence of Outcomes

Grades K-3	Grades 4-6
201-4 Observe, using one or a combination of the senses	205-5 Make observations and collect information relevant to a given question or problem
201-5 Make and record relevant observations and measurements, using written language, pictures, and charts	205-7 Record observations using a single word, notes in point form, sentences, and simple diagrams and charts

Elaboration

Guiding Questions:

- *What do I want my students to learn?*
- *What do I want my students to understand and be able to do?*

The goal for Grade 3 is to introduce students to recording **relevant** observations based on the question. Too often students either under-record observations by taking for granted what they are seeing or they over-record observations and record everything in tiny detail and do not focus on relevant items.

Students should be taught to realize that their observations and/or measurements need to be directly related to their question.

Students are expected to accurately record what is observed even when results differ from what is expected. It is important that students understand that they should suspend judgment during data collection and record results honestly.

Results from investigations are never right or wrong. They are described as expected or unexpected. Unexpected results still convey important information.

In Grade 3 mathematics, students learn about measuring length in centimetres and metres (SS3), mass in grams and kilograms (SS4), and the passage of time in seconds, minutes, hours, days, months, weeks, and years (SS1/SS2). Students have not been introduced to decimal numbers, so measurements should be recorded to the nearest unit. Students have experience measuring capacity with non-standard units from Grade 1 (e.g., filling cups or other containers). Millilitres and litres are part of the Grade 5 mathematics curriculum.

Students are also expected to follow and carry out procedures safely (both teacher-directed and student-designed) using appropriate materials and tools effectively (refer to *Science Safety Guidelines* document).

Connection to Communication

- Communicate procedures and results, drawings, demonstrations, and written or oral descriptions
- Respond to the ideas and actions of others in constructing their own understanding
- Respond to the ideas and actions of others and acknowledge their ideas and contributions
- Ensure safety of self and others

Achievement Indicators

Guiding Questions:

- *What evidence will I look for to know that learning occurred?*
- *What should students demonstrate to show their understanding of the Scientific Process Skill?*

Use the following set of indicators as a guide to determine whether students have met the corresponding specific outcome.

- i. Set up investigation and follow the procedures as they are described.
- ii. Collect measurements and/or observations relevant to the question being tested and record it honestly.
- iii. Record data with labels and in an organized manner.
- iv. Follow safety procedures when using materials and equipment.

Achievement Rubric

	Excelling - 4	Meeting - 3	Approaching - 2	Working Below - 1
Conduct investigations	Follow the procedures as they are described (independently and consistently)	Follow the procedures as they are described	Follow the procedures sometimes or needs support	Any other answer
	Collect measurements and/or observations relevant to the question being tested and recorded honestly (independently and consistently)	Collect measurements and/or observations relevant to the question being tested and recorded honestly	Collect measurements and/or observations that are not all relevant to the question being tested; needs support	
	Record data with labels and in an organized manner (independently and consistently)		Label and organize data appropriately sometimes	
			Demonstrate reluctance to record observations contrary to predictions	
Follow safety procedures				

GCO: Analyze & Explain (AE) - Interpret findings from investigations using appropriate methods. Communicate ideas and results.

SCO: AE1 - Classify, organize and display data

Scope and Sequence of Outcomes

Grades K-3	Grades 4-6
202-1 Use personal observations when asked to describe characteristics of materials and objects studied	206-1 Classify according to several attributes and create a chart or diagram that shows the method of classification
202-2 Place materials and objects in a sequence or in groups according to one or more attributes	
202-3 Identify the most useful method of sorting for a specific purpose	
204-4 Construct and label concrete-object graphs, pictographs, or bar graphs	206-2 Compile and display data, by hand or by computer, in a variety of formats including frequency tallies, tables, and bar graphs

Elaboration

Guiding Questions:

- *What do I want my students to learn?*
- *What do I want my students to understand and be able to do?*

Once data is collected, it is important to organize the information to help analyze it. There are two types of data: qualitative and quantitative.

Qualitative Data - Data that can be observed, but not measured. It usually describes characteristics or qualities. Examples include: colour, odour, texture, appearance, or data that is described by category (e.g., the colour of the sky).

Organizing qualitative data: In Grade 3, students need to be able to identify important characteristics that distinguish or are in common across a variety of objects or organisms. It is expected that this information would be organized and displayed (e.g., chart, list).

“In Grade 2, students need to build on their prior experiences to sort objects and shapes using two attributes. If students find it difficult to sort by two attributes at the same time, they may find it helpful to sort by one attribute and combine two of the sorted groups.” (NB Mathematics Grade 2 Curriculum, p.70)

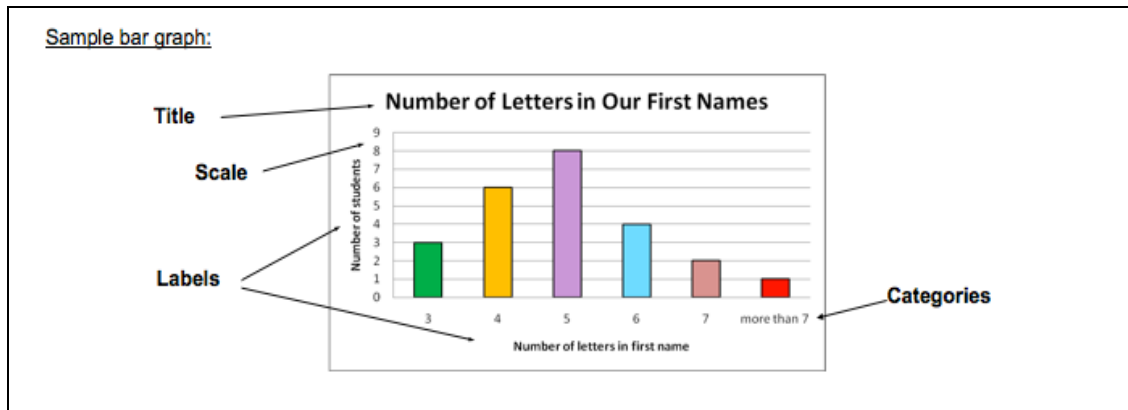
Quantitative Data - Data that can be measured; numbers with unit of measurement are recorded. Examples include: length, height, area, volume, mass (weight), speed, time, temperature, humidity, sound level, cost, age.

Connection to Communication

- Communicate procedures and results, using drawings, demonstrations, and written or oral descriptions

Organizing quantitative data: Students need to be able to take number-based data and display it in an appropriate format. The focus is taking raw data and creating charts or graphs (concrete object graphs, pictographs, or single bar graphs) that are appropriate to the data. Refer to the mathematics curriculum for the expectations at each grade level.

Sample of expectations for a single bar graph in Grade 3



“In elementary school, students are expected to develop an understanding of graphs and how graphs communicate information. Bar graphs use the lengths or heights of bars to represent quantities. This is an extension of the Grade 2 outcome, where students created concrete graphs using models such as linking cubes. In Grade 3, it is helpful for students to work on grid paper to ensure the squares are all equal in size. Bar graphs can be constructed as vertical and horizontal displays. It is important for their displays to include labels and a title. Bar graphs in Grade 3 should be limited to a one-to-one correspondence (i.e., the number scale uses 1, 2, 3, etc., and not multiples of 2, 5, 10, etc.).” (NB Mathematics Grade 3 Curriculum, p. 98)

Achievement Indicators

Guiding Questions:

- *What evidence will I look for to know that learning occurred?*
- *What should students demonstrate to show their understanding of the Scientific Process Skill?*

Use the following set of indicators as a guide to determine whether students have met the corresponding specific outcome.

- Classify according to characteristics that are the same or different among objects or organisms to sequence and sort them.
- Organize and display information about characteristics appropriately (e.g., tally marks, list, chart, line plot, single bar graph).
- Use graphs:
 - Plot data accurately;
 - Include a title and appropriate labels and one-to-one scale.
- Use charts:
 - Display information clearly and accurately;
 - Include a title, columns and rows labelled as appropriate;
 - Include units if applicable.

Achievement Rubric

	Excelling - 4	Meeting - 3	Approaching - 2	Working Below - 1
Classify by characteristics	Classify according to characteristics (more than one) that are the same or different among objects or organisms (independently and consistently)	Classify according to characteristics (one or more) that are the same or different among objects or organisms to sequence and sort	Classify according to characteristic (one) that is the same or different among objects or organisms (inconsistently or with support)	Any other answer
Compile and display data	Include all appropriate titles and labels in charts and graphs; information is plotted clearly and accurately (independently and consistently) Use many-to-one number scale (e.g., 2s,5s,10s)	Include all appropriate titles and labels in charts and graphs (variables are on the correct axis) Information is plotted clearly and accurately Use one-to-one number scale	Make minor error in the labels; data or information is plotted accurately	Any other answer

GCO: Analyze & Explain (AE) - Interpret findings from investigations using appropriate methods. Communicate ideas and results.

SCO: AE2 - Analyze data patterns

Scope and Sequence of Outcomes

Grades K-3	Grades 4-6
202-5 Identify and suggest explanations for patterns and discrepancies in observed objects and events	206-3 Identify and suggest explanations for patterns and discrepancies in data

Elaboration

Guiding Questions:

- *What do I want my students to learn?*
- *What do I want my students to understand and be able to do?*

Interpreting and analyzing data is a critical-thinking process used by scientific researchers to review the data gathered in the course of an investigation. Drawing conclusions is a separate outcome, though it is expected that both outcomes would be learned together.

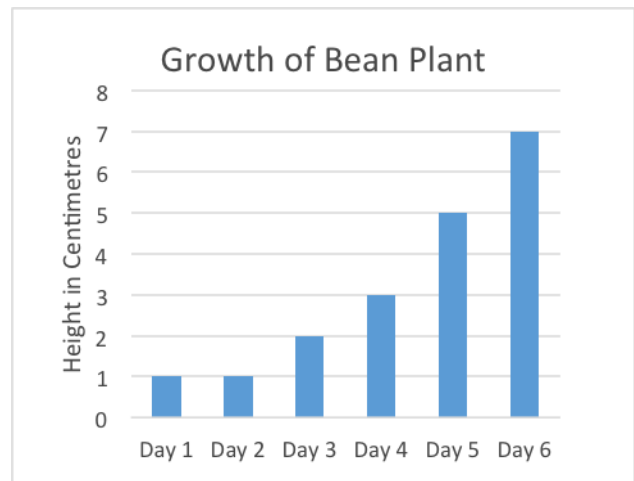
Connection to Communication

- Communicate procedures and results, using drawings, demonstrations, and written or oral descriptions

In Grade 3, students should be able to identify simple **patterns and trends** in data. Students should be able to describe the **relationship** the pattern/trend indicates.

As students progress into higher grade levels, they should be able to include a greater degree of detail in their analysis.

The chart below provides an example of this based on the data in the “Growth of Bean Plant” graph.



Grade 3	Grade 4	Grade 5
The bean plant is getting taller as the days go by.	The bean plant is getting taller faster as it gets bigger.	The bean plant is growing taller faster as it gets bigger; 1 cm a day between Days 2 and 4 and 2 cm a day between Days 4 and 6.

Regardless of the type of data, students should be able to identify a **discrepancy** within the data. A discrepancy is a value or observation that deviates from the standard or norm. Discrepant data do not fall within the observed pattern and can usually be explained by measurement error or lack of control of variables. It is important to record all data. However,

discrepant data can be ignored when describing overall patterns or trends. Students are expected to suggest a reasonable explanation(s) when they identify discrepancies.

Achievement Indicators

Guiding Questions:

- *What evidence will I look for to know that learning occurred?*
- *What should students demonstrate to show their understanding of the Scientific Process Skill?*

Use the following set of indicators as a guide to determine whether students have met the corresponding specific outcome.

- i. Identify and explain a general pattern, trend, and/or relationship in data.
- ii. Identify a discrepancy in data and suggest an explanation for these.

Achievement Rubric

	Excelling - 4	Meeting - 3	Approaching - 2	Working Below - 1
Analyze data	Identify and explain a pattern, trend, and/or relationship (independently and consistently)	Identify and explain a pattern, trend, and/or relationship	Identify and explain a pattern, trend, and/or relationship, but it is not clear or is overly simplified	Any other answer
	Identify a discrepancy and suggest an explanation (independently and consistently)	Identify a discrepancy and suggest an explanation	Identify a discrepancy, but is unable to suggest an explanation	Any other answer

GCO: Analyze & Explain (AE) - Interpret findings from investigations using appropriate methods. Communicate ideas and results.

SCO: AE3 - Draw conclusions

Scope and Sequence of Outcomes

Grades K-3	Grades 4-6
202-7 Propose an answer to an initial question or problem and draw a simple conclusion based on observations or research	206-5 Draw a conclusion, based on evidence gathered through research and observation, that answers an initial question
202-8 Compare and evaluate personally constructed objects with respect to their form and function	206-6 Suggest improvements to a design or constructed object
	206-7 Evaluate personally constructed devices with respect to safety, reliability, function, appearance, and efficient use of materials

Elaboration

Guiding Questions:

- *What do I want my students to learn?*
- *What do I want my students to understand and be able to do?*

Students should use information from readings, previous learning, prior knowledge, and evidence gained through investigation to draw conclusions.

To make simple **conclusions** means that students are able make a statement based upon logic and the evidence that is available. Whether the original prediction is supported or refuted is not a measure of success or failure, since scientific knowledge is advanced by either result.

Where possible, students should compare the results of their investigation to those of others and recognize that the results may vary. Students should be able to suggest an explanation for variation in results. Comparison of findings to those of similar investigations can add depth to the conclusion.

The conclusion:

- should be framed around the initial question that was tested. As the student looks at the data, they should ask: “Did what I change make a difference?”
- must express whether the prediction is supported based on the results. Whether the prediction is supported or not, the findings are valid and are not considered “wrong”.
- could include a statement on whether the investigation was a fair test and suggest improvements to their experimental design (in Grade 3, it is expected that they discuss these ideas).

Connection to Communication

- Communicate procedures and results, using drawings, demonstrations, and written or oral descriptions
- Respond to the ideas and actions of others in constructing their own understanding
- Respond to the ideas and actions of others and acknowledge their ideas and contributions

Achievement Indicators

Guiding Questions:

- *What evidence will I look for to know that learning occurred?*
- *What should students demonstrate to show their understanding of the Scientific Process Skill?*

Use the following set of indicators as a guide to determine whether students have met the corresponding specific outcome.

- i. Make a simple conclusion that answers the initial question.
- ii. Indicate whether the prediction is supported.
- iii. Justify the conclusion by providing evidence from what has been learned.
- iv. Discuss and reflect on the methods and results of the investigation.

Achievement Rubric

	Excelling - 4	Meeting - 3	Approaching - 2	Working Below - 1
Draw conclusions	<p>Make a more detailed conclusion that answers the initial question</p> <p>Include suggestions to improve experimental design</p>	<p>Make a simple conclusion that answers the initial question</p> <p>Indicate whether the prediction is supported</p> <p>Justify the conclusion by providing evidence</p>	<p>Restate only the recorded results and observations in the conclusion</p>	<p>Any other answer</p>

GCO: Analyze & Explain (AE) - Interpret findings from investigations using appropriate methods. Communicate ideas and results.

SCO: AE4 - Apply learning

Scope and Sequence of Outcomes

Grades K-3	Grades 4-6
202-6 Distinguish between useful and not useful information when answering a science question	206-4 Evaluate the usefulness of different information sources in answering a given question
	206-8 identify potential applications of findings
202-9 Identify new questions that arise from what was learned	206-9 Identify new questions or problems that arise from what was learned

Elaboration

Guiding Questions:

- *What do I want my students to learn?*
- *What do I want my students to understand and be able to do?*

To apply their learning, students need to engage in **critical thinking**, including evaluating information and conceptualizing new questions or problems to investigate.

Students need to be provided with opportunities to **discuss and reflect** to help synthesize what they have learned. This will allow them to explore other perspectives and evaluate their own and other’s thinking and explanations in terms of plausibility and scientific evidence. Question prompts such as the following can help in this process.

- What would happen if...?
- Based on what you know, how would you explain...?
- Can you think of another way...?
- How could you change (improve)...?
- What do you think of...?
- What would you recommend...?
- How would you justify...?
- Why was it better that...?
- Do you agree with...?

Connection to Communication

- Respond to the ideas and actions of others in constructing their own understanding
- Respond to the ideas and actions of others and acknowledge their ideas and contributions

Students should be engaged in **metacognition** which is, put simply, thinking about one’s thinking. The burden of learning does not fall on the teacher alone. Students need to be aware of what they need to do to learn, to self-monitor.

To help develop skills in metacognition, students should be given opportunities to:

- connect new knowledge to prior knowledge;
- self-assess by, for example, explaining their thinking to others through discussions or journal writing;
- test their ideas by, for example, designing follow-up investigations or solutions to a problem.

Achievement Indicators

Guiding Questions:

- *What evidence will I look for to know that learning occurred?*
- *What should students demonstrate to show their understanding of the Scientific Process Skill?*

Use the following set of indicators as a guide to determine whether students have met the corresponding specific outcome.

- i. Extend what has been learned to develop new questions and problems to investigate.
- ii. Apply what has been learned to other situations beyond the classroom.
- iii. Do basic research and evaluate the sources of information for relevancy and reliability.

Achievement Rubric:

	Excelling - 4	Meeting - 3	Approaching - 2	Working Below - 1
Apply Learning	Demonstrate evidence of critical thinking beyond the expectations for this grade level based on the criteria below	Demonstrate evidence of critical thinking appropriate for this grade level based on the criteria below	Demonstrates evidence of critical thinking slightly below this grade level based on the criteria below	Any other answer
	Extend learning to develop new questions and problems to investigate			
	Apply what has been learned to other situations beyond the classroom			
	Evaluate the sources of information for relevancy and reliability			

