LESSON LEARNED

Focus: Interpreting Data Represented in Tables and Graphs

Nova Scotia Assessment: Mathematics Grade 3

“For learners to succeed, teachers must assess students’ individual abilities and characteristics and choose appropriate and effective instructional strategies accordingly.”
– Helene J. Sherman

NOVA SCOTIA

Purpose of this Document

This Lessons Learned document was developed based on an analysis of the Item Description Reports for the Nova Scotia Assessment: Mathematics in Grade 3 (NSA-M3). This document is intended to support all classroom teachers at grades Primary – 3, and administrators at the school, region, and provincial levels. The focus of the document is to help educators work through the process of taking in the information provided by the data analysis and see how it can inform lesson design and assessment in the classroom.

It is suggested that school teams make use of this resource in concert with their school's Item Description Report provided by the Department of Education and Early Childhood Development to all regional centres for education. These reports include student achievement data at the school, regional centre, and provincial level for all questions appearing on the Mathematics in Grade 3 Assessment. By analyzing their own performance on groupings of questions dealing with similar outcomes, schools can identify areas of strength and areas where changes in instruction and/or assessment might be made. This process is designed to foster continued discussions, explorations, and support for mathematics focus at the classroom, school, regional centre, and provincial levels that are all based on valid and reliable data.

This document specifically addresses some of the areas that students across the province found challenging based on provincial assessment data. It is essential that teachers consider assessment evidence from a variety of sources to inform the next steps most appropriate for their students. Effective classroom instruction and assessment strategies are responsive to the individual learners within a classroom.

This document highlights those outcomes where students seem to require additional support. It provides some information about student performance on the assessment in addition to suggested classroom instruction strategies. Sample assessment items are included for each topic explored.

Overview of the Nova Scotia Assessment: Mathematics in Grade 3

Nova Scotia Assessments are large-scale assessments that provide reliable data about how well all students in the province are learning the mathematics curricula. It is different from many standardized tests in that all questions are written by Nova Scotia teachers to align with curriculum outcomes and the results reflect a snapshot of how well students are learning these outcomes. These results can be counted on to provide a good picture of how well students are learning curriculum outcomes within schools, regions and in the province. Since the assessments are based on the Nova Scotia curriculum, and are developed by Nova Scotia teachers, results can be used to determine whether the curriculum, approaches to teaching and allocation of resources are effective. Furthermore, because individual student results are available, these, in conjunction with other classroom assessment evidence, help classroom teachers understand what each student has under control and identify next steps to inform instruction.

The assessment provides information about mathematics for each student and complements assessment data collected in the classroom. This assessment is administered at the end of Grade 3. It is designed to provide detailed information for every student in the province regarding their progress in achieving a selection of mathematics curriculum outcomes at the end of Grade 3. Information from this assessment can be used by teachers to inform their instruction and next steps in providing support and intervention for their students.

Lessons Learned Overview

Provincial assessments and examinations generate information that teachers can use to help inform classroom instruction and assessment. Following the analysis of each assessment or examination, patterns and trends are identified. These include areas of strength and areas for growth. The Lessons Learned documents specifically highlight concepts where growth is still needed.

There are four areas that have been identified as the areas of focus for this Lessons Learned document. They are:

- Solving whole number addition and subtraction questions in context.
- Measuring and estimating length.
- Identifying and sorting irregular polygons.
- Interpreting data represented in tables and graphs.

This section specifically addresses interpreting data represented in tables and graphs. It begins with an overview of the student errors and misconceptions identified through the provincial assessment. These include:

- Common attributes
- Interpreting graphical texts

Strategies are then outlined that are designed to enhance student comprehension, drawing from researched best practices. The strategies emphasize the integration of essential models, tools, and interconnections to facilitate the transition between concrete, pictorial, and abstract representations of concepts, highlighted by the importance of deliberate planning and purposeful questioning. To support both assessment and instruction, sample lesson activities are presented alongside a series of cognitive-level questions, providing educators with ideas for addressing knowledge gaps and fostering strategic reasoning and problem-solving skills. Each section culminates with a selection of print and online resources, as well as recommended manipulatives to support professional learning and student understanding of that topic.

Interpreting Data Represented in Tables and Graphs

Alignment to previous Outcomes	Related Outcome
2SP02: Students will be expected to construct and interpret concrete graphs and pictographs to solve problems.	**3SP02:** Students will be expected to construct, label, and interpret bar graphs to solve problems.

What conclusions can be drawn from the NSA: Mathematics in Grade 3?

Students were challenged in determining necessary information to include on graphs and when reading information from tally charts, line plots and bar graphs. Students also need to develop the skill of interpreting graphs, answering questions, and drawing conclusions from tally charts, line plots and bar graphs.

Why is this an area of need and how can we support students?

Common Attributes

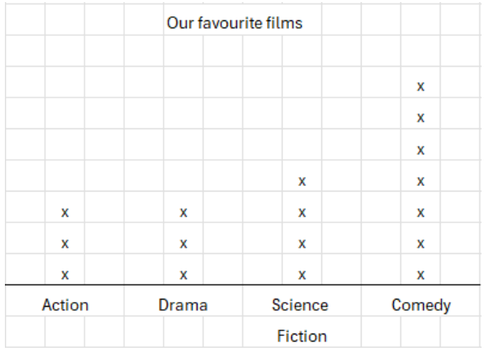
Misconceptions/Errors in Student Work

A common misconception or error that many students make is concerning the common attributes of line plots, horizontal bar graphs, pictographs, and vertical bar graphs with the same given set of data.

Students sometimes do not connect attributes between representations; there could be different titles, different use of the horizontal axis, and different labels.

For example, while the representations below show the same data, they are presented in slightly different ways, and students may see this as different data and different results. Any missing labels may also go unnoticed.

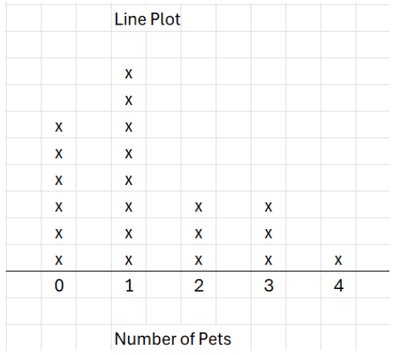
Movie Types	Number of students
Action	|||
Comedy	𝍸 ||
Drama	|||
Science Fiction	||||



The attributes that are commonly forgotten to identify include a title and labels on axes or items.

Possible Next Steps in the Classroom

Students should be encouraged to collect, organize, and record their data using a tally system, line plots, charts, and lists to answer questions relevant to their everyday life.



Provide students with opportunities to use tally marks and lists to keep track of information as they collect it outside of math class.

Provide students with opportunities to organize data on a line plot(s) (first using grid paper). A line plot provides a bridge from tally charts to bar graphs.

Ensure students include a title or heading and labels on constructed charts and graphs to inform the reader about the meaning of the data.

More importantly, provide opportunities for students to analyze graphical texts presented in different ways and found in different sources. Draw students' attention to how difficult it is to make sense of information when titles or labels are not provided, such as in the line plot pictured.

Encourage discussions about how data is presented in different ways. Data talks can be used as short classroom discussion to help students develop data literacy. It is similar in structure to a number talk, but instead of numbers, students are shown a data visual.

Activities to Support Lesson Planning

Incorporating data talks into classroom instruction supports not only data literacy, but also encourages critical thinking, communication, and relevance to real-world contexts. In a data talk, the focus of learning and discussion is around a presentation of data. The discussions can cover a wide range of skills, including analysis, visualization, interpretation, and decision-making where students are sharing findings, insights, and best practices related to managing and utilizing data effectively. Data talks provide opportunities for students to voice their opinions and perspectives based on evidence. This empowers them to take ownership of their learning and contribute meaningfully to discussions. Teachers can use data talks to assess student understanding and tailor instruction accordingly. They can identify misconceptions, address gaps in knowledge, and provide targeted support to individual students. Below are a couple of examples of how data talks can be used in the classroom.

Grade 2

Mode of transport	Number of students
Bus	𝍸𝍸 ||||
Car	𝍸 |||
Walking	𝍸𝍸 ||
Bicycle	𝍸 ||

Mode of transport	Number of students
Bus	☺☺☺☺☺☺☺☺☺☺☺☺☺☺☺
Car	☺☺☺☺☺☺☺☺
Walking	☺☺☺☺☺☺☺☺☺☺☺☺
Bicycle	☺☺☺☺☺☺

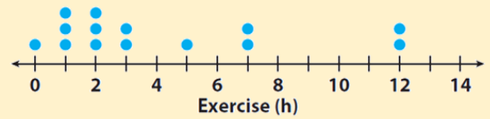
Key: ☺ Represents children

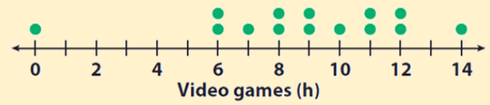
Show students the information presented above. Have them think about what they are seeing by using the following question prompts.

Question Prompts:
Knowledge: What do you notice?
Application: What is going on in this data visualization? How do the data presentations compare?
Analysis: What makes it easy / difficult to read the information presented in the graph? What would you change to make it better?

Use student responses to co-create success criteria and have them recreate the graph based on their input.

Grade 3





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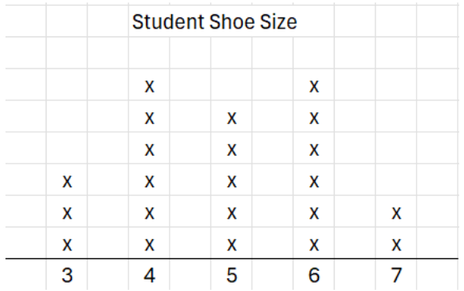
Use student responses to co-create success criteria and have them recreate the graph based on their input.

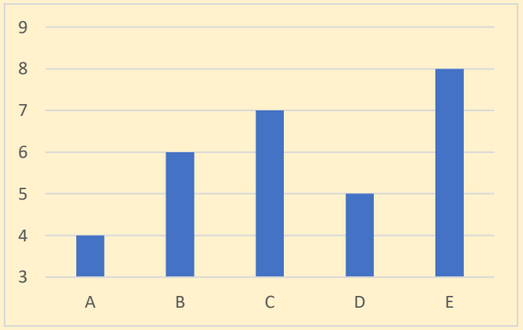
Interpretating Graphical Texts

Misconceptions/Errors in Student Work	Possible Next Steps in the Classroom
The difficulty with bar graphs, whether horizontal or vertical, is that students interpret data from the wrong bar on the graph. Therefore, when asked to answer questions concerning the bar graph data, it is not correct. For example, on the provincial assessment, although students did well when working with line plots, they did make errors when reading or counting the X's to draw conclusions. For example:  *What conclusion can be drawn from this line plot?* • *There are more students with size 5 shoes, then size 4 shoes. (students select the larger shoe size rather than the amount)* • *There are more students with size 7 shoes, then size 3 shoes. (students select the larger shoe size rather than the amount)* • *There are fewer students with size 6 shoes, then size 7 shoes. (students select the smaller shoe size rather than the amount)* • *There are just as many students with size 4 shoes, as students with size 6 shoes. (correct answer)*	As discussed through data talks, students need opportunities and experiences to interpret information collected, organized, and displayed in various ways like tally charts, charts, line plots and bar graphs. They need to be encouraged to ask or write questions that go beyond simplistic reading of a graph. Both literal and inferential comprehension questions need to be asked. Students should be provided with opportunities to discuss the information obtained from a display of data and be encouraged to work together to formulate questions that can be answered by other students using the data. Examples, include presenting students with vertical and horizontal bar graphs that represent two different sets of data and discuss the similarities and differences found between the two bar graphs, such as title, axes, and labels for the axes, numerical scale, and bars. Have students draw conclusions from the information presented in graphs. They should be encouraged to ask questions that go beyond simplistic reading of a graph. Teachers should ask both literal and inferential comprehension questions, such as: • What can you tell about _____ by looking at this graph? • How many more/less than …? • Based on the information presented in the graph, what other conclusions can you make? • Why do you think _____? Encourage data talks to pique students' curiosity and encourage question asking, and to help them understand and "read" the data-filled world in which they live.

Activities to Support Lesson Planning

Further data talk examples that can be leveraged to focus on how students are interpreting the data and drawing appropriate conclusions including inferring.

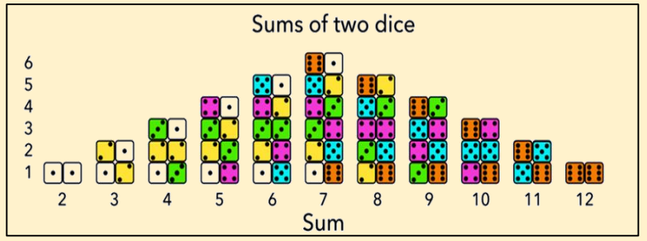
Grade 2



Question Prompts:
Knowledge: What do you notice?
Application: What conclusions can you make about the data?
Analysis: What makes it easy / difficult to read the information presented in the graph? What would you change to make it better?

Use student responses to co-create success criteria and have them recreate the graph based on their input.

Grade 3

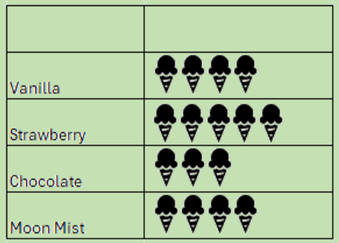
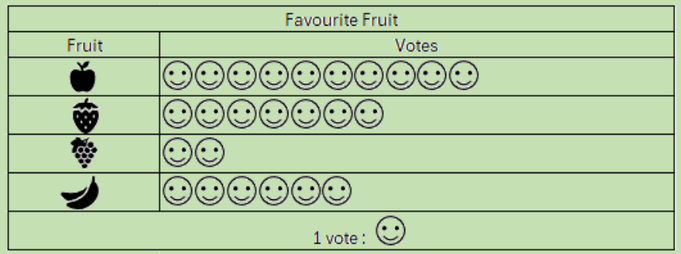
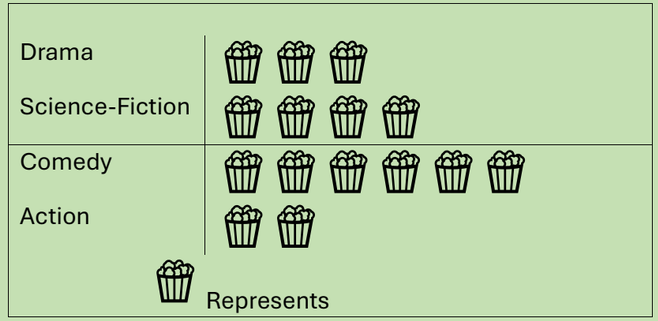


*Youcubed.org

Question Prompts:
Knowledge: What do you notice?
Application: What conclusions can you make about the data?
Analysis: What makes it easy / difficult to read the information presented in the graph? Why do you think the data was presented this way?

Use student responses to co-create success criteria and have them recreate the graph based on their input.

What are some sample questions to help support assessment?

Cognitive Level	Grade 2	Grade 3
Knowledge	Use the following 2 pictographs to identify what attributes are needed when presenting information this way? What are your success criteria for creating a pictograph?   Create a people graph to show the number of people with long sleeves and the number of people with short sleeves.	What information should be included when constructing a bar graph to make sure the reader understands the data being presented? The following pictograph was constructed to present the collected data. What is missing from the pictograph? 

Application

The following pictograph was constructed to present the collected data. Some errors were made.

Drama	🍿🍿🍿
Science-Fiction	🍿🍿🍿🍿
Comedy	🍿🍿🍿🍿🍿🍿
Action	🍿🍿
🍿 Represents 1 film	

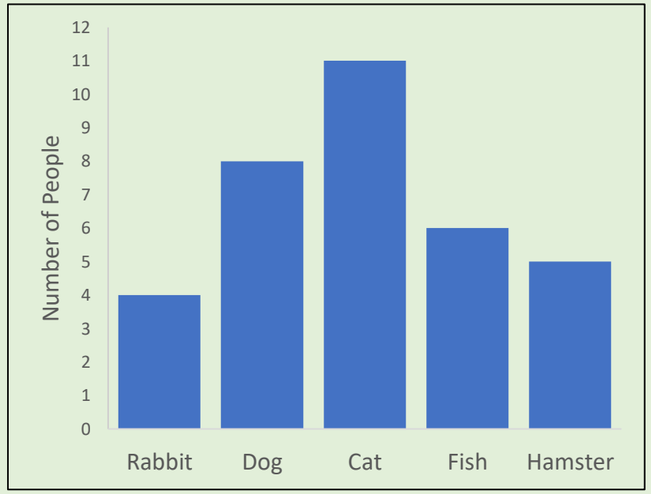
What are the errors?

I asked the Grade 2 students about their favourite season. This pictograph shows the results of the survey.

Favourite Season of Grade 3 Students	
Summer	☀☀☀☀☀☀☀☀☀☀☀☀
Fall	☀☀☀☀☀☀☀☀
Winter	☀☀☀☀☀
Spring	☀☀☀☀☀☀☀☀☀
☀ Represents 1 student	

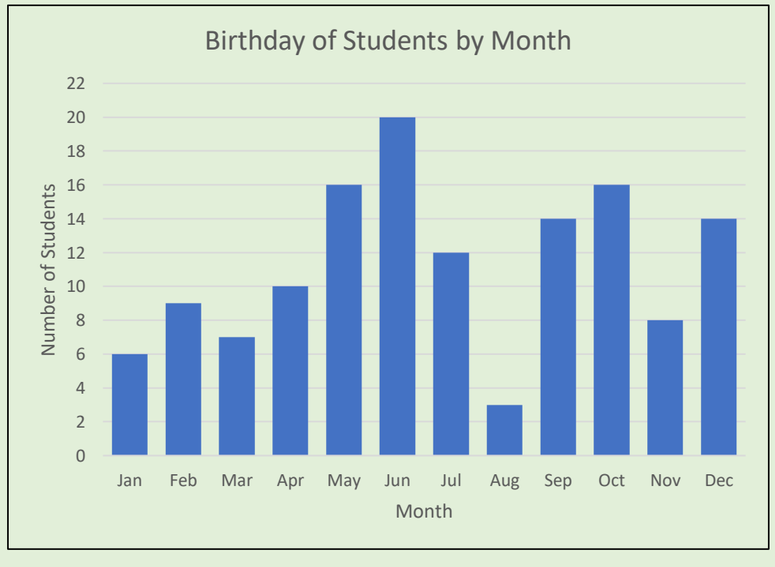
What conclusions can you make about the graph?

The following bar graph was constructed. Some errors were made.



What are the errors?

What conclusions can you make about the graph?



Analysis

When would a tally chart be useful and when would a pictograph be useful to show your data? When would they both be useful and when would only one be useful?

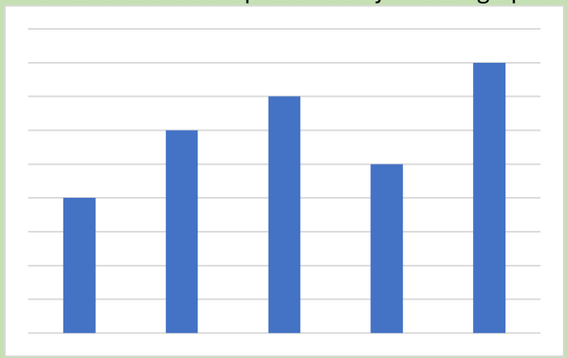
One pictograph shows the number of letters written by students. Another pictograph shows the number of books read by students. If 18 books have been read this week, which pictograph is which and why? How would you fix the pictographs to make them better at showing the data?

Monday	
Tuesday	
Wednesday	
Thursday	
Friday	
Saturday	

Monday	
Tuesday	
Wednesday	
Thursday	
Friday	
Saturday	
Sunday	

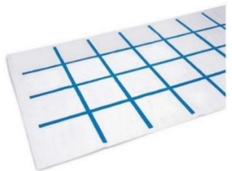
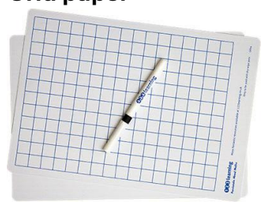
When would a bar graph be useful and when would a pictograph be useful to show your data? When would they both be useful and when would only one be useful?

What data could be represented by this bar graph?



Supporting Resources

Manipulatives and Models to Support Learning

Graphing mat or a learning carpet	Linking cubes	Counters	Square tiles	Grid paper	Stickers or Stamps
					

Print and Electronic Resources

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