

# Contents

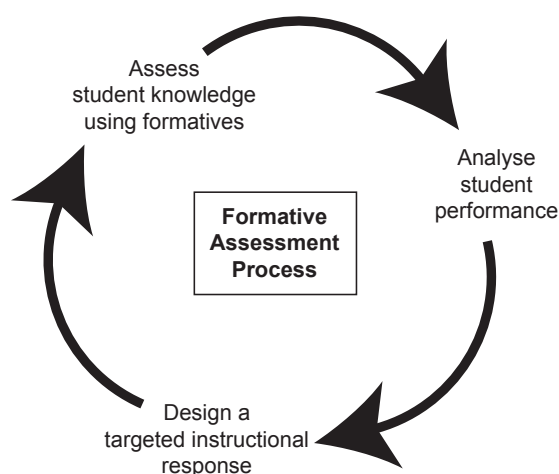
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## What Is Formative Assessment?

Formative assessment drives mathematics instruction and is a key component in *Response to Intervention*. It is the process by which evidence of students' understanding is used by teachers to adjust instructional practice (Popham, 2008). As practitioners, we routinely monitor student performance on specific outcomes and learning goals. Formative assessments are employed to measure student performance so as to provide a targeted instructional response. Monitoring student learning through formative assessments provides a gauge, pinpointing where students are on the pathway of acquiring new knowledge. Their performance on these assessments provides work samples to analyse. The samples enable us to see where students are in comparison to where they need to be to meet learning goals. Only through this process, are we equipped to provide an effective and meaningful instructional response. Without formative assessment, lesson planning is focused solely on curriculum with little regard for students' explicit academic needs.

## How Does Formative Assessment Impact Student Achievement?

Effective formative assessment occurs simultaneously with instruction for the purpose of improving students' knowledge and performance in mathematics. When formative assessment is implemented properly, students learn what is being taught to a substantially greater degree (Black & Wiliam, 1998). When we provide feedback to students as a result of formative assessment, it is the most powerful factor in enhancing student achievement (Hattie & Jaeger, 1998). The National Mathematics Advisory Panel (2008) recommends regular use of formative assessment so that instruction can be adapted based on student progress. "Teachers' regular use of formative assessment improves their students' learning, especially if teachers have additional guidance on using the assessment to design and individualize instruction" (2008, p. xxiii). This book provides such guidance for teachers through a three-phase format of assessment, analysis and response as illustrated below.



As practitioners, we experience tremendous pressure to “cover” the curriculum in a timely manner. Unfortunately, this sometimes translates to a practice of teaching *curriculum* rather than

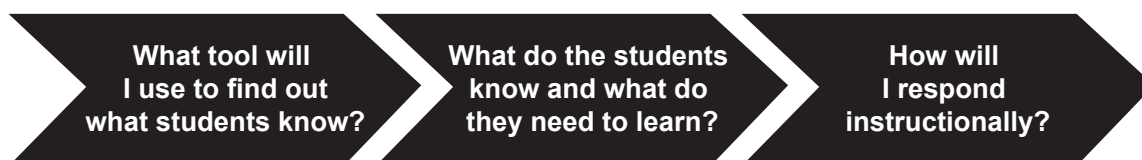
of teaching *children*. Teaching and learning form a dynamic alliance that is reliant on the interactions between teachers and students. These interactions serve as feedback to teachers and inform next steps for instruction designed to advance learning. To efficiently and effectively teach children, we must understand what they already know in order to plan meaningful next steps.

We have heard teachers lament about this process and become overwhelmed at the prospect of providing differentiated instruction for individual students. Advocating an individualised instructional program is neither realistic nor appropriate for most classroom teachers. All students are entitled to instruction designed to meet their identified needs, but this does not have to translate into a one-on-one instructional setting. Students can be grouped according to similar instructional needs. When analysing student understanding of a maths concept for an entire class, patterns and trends emerge and students' needs are often revealed in clusters. There may be times when we need to work with an individual student to reteach a concept or clear up a misconception; however, often there is a small group of students for whom the data show similar academic needs.

## How Is This Book Organised?

*Using Formative Assessment to Drive Mathematics Instruction* contains seven chapters. This, the first chapter, identifies the purpose and intentions of the book by describing formative assessment and highlighting the impact of the process on student performance. Chapters 2 to 6 outline a process for the use of formative assessment to inform instruction. Each of these chapters addresses one of five content areas in mathematics: number and operations; algebraic thinking; geometry; measurement; and data analysis and probability. Within each content area, key mathematics concepts are highlighted. Chapter 7 is a brief conclusion with final comments regarding the formative assessment process.

The formative assessment process in Chapters 2 to 6 is presented in a three-page format for each highlighted skill or concept. Each of the three pages is designed to answer the following questions regarding student performance and mathematics instruction:



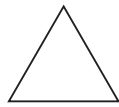
The formative assessments, student work samples and suggested activities are provided for each mathematics concept to help teachers respond to these questions when planning instruction. Each is a deliberate step towards implementing effective mathematics instruction.

The **first** page in the three-page design illustrates a common sample of a *Traditional Formative Assessment* that one might find in a textbook or teacher resource (see Figure 1). Just below the assessment item is a *Limitations* note cautioning about potential shortcomings of the traditional

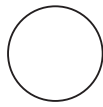
Algebraic Thinking: Repeating Patterns

**Traditional Formative Assessment**

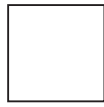
What is next in the pattern?    \_\_\_\_\_



1



2



3

*Limitations:* The unit in this repeating pattern is actually unknown because it is not repeated.

**Enhanced Formative Assessment**

Note: This assessment can be modelled with objects or completed on paper.


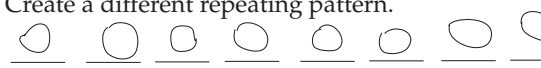



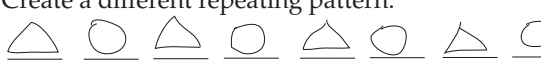


Continue the repeating pattern.




Create a different repeating pattern.



**Algebraic Thinking: Repeating Patterns**

<p style="text-align: center;">Alex</p> <p>Continue the repeating pattern.</p>  <p>Create a different repeating pattern.</p> 	<p style="text-align: center;">Brittany</p> <p>Continue the repeating pattern.</p>  <p>Create a different repeating pattern.</p> 
<p>Alex uses his one-to-one correspondence skills to accurately draw a shape on each line. He uses one of the shapes (circle) from the pattern unit. Alex does not continue or create a different pattern correctly because he uses only circles.</p> <p>Instructional Focus: <b>Rebuild</b></p>	<p>Cleverly, Brittany incorporates the line into her drawings of squares in the pattern. She accurately continues the pattern. Brittany does not create a different pattern; she uses the original pattern.</p> <p>Instructional Focus: <b>Core 1</b></p>
<p style="text-align: center;">Cindy</p> <p>Continue the repeating pattern.</p>  <p>Create a different repeating pattern.</p> 	<p style="text-align: center;">Dominic</p> <p>Continue the repeating pattern.</p>  <p>Create a different repeating pattern.</p> 
<p>Cindy continues and accurately creates a different AB pattern using the correct shapes. She is ready to learn about more complex patterns.</p> <p>Instructional Focus: <b>Core 2</b></p>	<p>Dominic accurately continues the pattern. He moves beyond AB patterns by creating a complex ABB pattern.</p> <p>Instructional Focus: <b>Challenge</b></p>

Algebraic Thinking: Repeating Patterns

		Rebuild Focus	Core 1 Focus	Core 2 Focus	Challenge Focus
		Colour Patterns	Shape Patterns	Patterns with Bears	Xs and Os
<b>Goal</b>	<b>Goal</b>	Continue and describe basic repeating patterns	Create and translate basic repeating patterns	Continue and describe more complex repeating patterns	Create and translate more complex repeating patterns
	<b>Materials</b>	<ul style="list-style-type: none"> <li>◆ Colour cubes</li> <li>◆ Sentence strip</li> </ul>	<ul style="list-style-type: none"> <li>◆ Pattern blocks</li> <li>◆ Crayons</li> <li>◆ Paper</li> </ul>	<ul style="list-style-type: none"> <li>◆ Coloured counting bears</li> </ul>	<ul style="list-style-type: none"> <li>◆ Pattern blocks</li> <li>◆ Dry erase boards and markers</li> </ul>
<b>Suggested Activity Directions</b>	<b>Suggested Activity Directions</b>	<p>Show students a pile of cubes (2 colours). Ask students to sort the cubes by colour. Demonstrate how to make a pattern by taking one cube at a time from alternating piles and lining the cubes up. Say each colour as the pattern is made. After the repeating unit has been revealed several times, ask students which colour comes next and why. Encourage students to create their own colour patterns with the cubes in the same manner. If appropriate, students draw the patterns they created on sentence strip.</p> 	<p>Use pattern blocks to create a repeating AB pattern for students to examine. Demonstrate how to create the same type of pattern with different pattern blocks by matching one pattern block to another (e.g. hexagons matched to trapezoids and squares matched to triangles). Encourage students to try translating the AB pattern with different pattern blocks. When students are ready, introduce translating an AB pattern into a colour pattern created with crayons. If appropriate, ask students to illustrate patterns.</p>	<p>Make a repeating ABB pattern with the coloured counting bears. Ask students to examine the pattern and describe which colour bear comes next. Provide time for students to use counting bears to make ABB patterns. Students ask one another which bear comes next in the pattern. Introduce using the same colour bear in different positions (e.g. up, down, down, up, down, down). If students are ready, continue other types of repeating patterns (e.g. AAB, ABC, AABB, ABBB).</p>	<p>Show students a repeating pattern such as AAB with pattern blocks. Demonstrate how to translate the pattern using Xs and Os written on a dry erase board. Discuss how both patterns are alike. Try other types of patterns with the pattern blocks. Ask students to translate the patterns into patterns with Xs and Os. Invite students to think of other ways to translate the patterns (using different symbols).</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>XXOXXOXXO</p> </div>
	<b>Questions to Assess</b>	<ul style="list-style-type: none"> <li>◆ Which colour cube comes next?</li> <li>◆ What is the repeating pattern core?</li> <li>◆ How can you describe the repeating pattern?</li> </ul>	<ul style="list-style-type: none"> <li>◆ How many things are in the core of this repeating pattern?</li> <li>◆ How can you translate this pattern?</li> </ul>	<ul style="list-style-type: none"> <li>◆ How do you know this is a pattern?</li> <li>◆ How many different things are in the pattern core?</li> </ul>	<ul style="list-style-type: none"> <li>◆ How can you compare the patterns?</li> <li>◆ What makes these patterns the same?</li> </ul>