# Assessment-Informed Instruction: Numeracy

## INTRODUCTION

High-impact teaching strategies (HITS), also referred to as high-leverage practices, are core pedagogical practices that help students understand content while also supporting their social-emotional development.[1] These teaching practices can demonstrably impact student learning outcomes in both literacy and numeracy.[2]

This mini-guide, one in a series, sheds light on how teachers can apply the high-impact teaching strategy of assessment-informed instruction in their numeracy lessons.

## HOW TO USE THIS GUIDE

This guide is meant for those who support teacher professional development at the school level. Depending on the local context and approach to professional development, this role can be played by coaches, community of practice leaders, teacher-facilitators, lead teachers, trainers, and Ministry of Education staff working with teachers. As part of a wider professional development approach, this guide can be a tool to target teachers' use of proven strategies to improve student learning in numeracy.

Teacher professional development has various modalities, ranging from pre-service courses to one-on-one coaching and mentoring to teacher-led communities of practice. This guide is intended to support professional discussions across a variety of contexts: in-school coaching, communities of practice, and pre- or in-service training. Teachers and coaches can use the guide as part of an individualized professional development plan; teacher-facilitators can use it to drive discussion on high-impact strategies as part of a community of practice; and pre-service designers can incorporate it into their curriculum for teacher training. Finally, this mini-guide reflects the incremental progression that teachers follow in their professional growth.

This mini-guide for Assessment-Informed Instruction in Numeracy, along with the others in the series, reflects the strategy domains and the HITS presented in the following table.

Finally, when adapting the content and use of this mini-guide to the local educational context, it can be integrated into a structured pedagogy program already in place. The mini-guide can be linked directly to the curriculum and teaching and learning materials, and supported through the existing professional development model.

1 Ball & Forzani (2010).
2 Ambrose et al. (2010); Danielson (2022); Rosenshine (2012).

| HIGH-IMPACT TEACHING STRATEGIES (HITS) | | | | |
|---|---|---|---|---|
| **Strategy domains** | | **Tier 1: Basic strategies** | **Tier 2: Developing strategies** *(built upon Tier 1 strategies)* | **Tier 3: Advanced strategies** *(built upon Tier 1 and 2 strategies)* |
| **Learning Environment** | | Teacher establishes clear **rules and routines** to support learning and create a positive learning environment. | Teacher uses and supports **positive interactions** in the classroom (teacher-student and student-student). | Teacher organizes students to work in **pairs and small groups** to enhance collaboration, to build teamwork, and to promote a sense of belonging. |
| **Student Engagement in Learning** | | Teacher gives all students, including pairs/small groups, **regular time for the practice of new skills**.* | Teacher uses **questioning** to build and deepen student understanding of new content. | Teacher plans for the strategic use of **partner and small-group work** for collaborative learning activities.** |
| **Knowledge Progression and Connections** | | Teacher plans with and states the **lesson objective** and links new content to **students' background** (prior knowledge). | Teacher provides a **daily review** and links content to **previous learning**. | Teacher purposefully **sequences** lesson objectives and **adjusts the teaching sequence** as needed. |
| **Assessment-Informed Instruction** | | Teacher routinely **monitors learning** by checking for understanding during instruction and giving actionable feedback to students. | Teacher **modifies content and instructional strategies** based on evidence of learning collected through formative assessment. | Teacher provides **differentiated instruction and remediation** to address learning gaps. |
| **Instructional Approach** | **Numeracy** | Teacher **provides explicit models and explanations** of math concepts and skills, followed by **student practice** of modeled skills. | Teacher uses questioning and other **interactive approaches to build student understanding** when **modeling and explaining** math concepts and skills. *Modeling/explanation is followed by student practice.* | Teacher provides **opportunities for students to explore** concepts and then **draws on their ideas when modeling and explaining** concepts and their application. |
| | **Literacy** | Teacher provides **explicit models and explanations** of new skills and concepts, followed by **student practice** of modeled skills. | Teacher **adds activities** to **construct meaning (or build knowledge)** together with students. | Teacher gives students **opportunities to apply skills in meaningful ways**. |

Notes:
*Tier 1: Teacher groups students to engage all children in the learning activity, especially when materials are being shared.

**Tier 3: Teacher purposefully groups students to engage all children through homogenous or heterogenous grouping. Homogenous grouping can be used with students working at a similar, medium level to learn at a higher level together. Heterogeneous grouping is used to provide peer support to students who may be struggling with new content and skills.

Recognizing that professional development is most effective when it is focused and incremental, this guide proposes a progressive approach to supporting teachers in their professional development. A collection of strategies across three tiers is shown in the table. Professional development activities that support teachers, especially those working in low- and middle-income countries, in mastering the specific strategies listed under Tier 1 are likely to result in improved instruction and learning outcomes. As teachers master the basic strategies of Tier 1 and move toward the more "advanced" Tiers 2 and 3 in each category, they will be empowered with a full set of strategies to reach and support more students. The progression of tiers is not meant to be fixed or rigid. Teachers may be using strategies from multiple tiers in a single domain. The goal is to use the progression to tailor support for teachers by meeting them where they are in their professional practice. The strategies described in the tiers can be used to identify the best one to start with and focus on with teachers. Using the tiers this way will also prevent overwhelming teachers with a long list of strategies to introduce into their teaching. Over time (as measured in years, as opposed to weeks or months), a professional development program that follows a tiered approach can help teachers move toward more depth of instructional mastery (higher tiers) and significantly improve the quality of their teaching, which will ultimately help more students develop a deeper understanding and mastery of foundational literacy and numeracy skills and concepts.

It is important to note that not all teachers will start at Tier 1. Depending on the teacher's level of experience and familiarity with implementing the strategies, she may start at Tier 2 or even Tier 3. Furthermore, a teacher starting at Tier 2 within the Learning Environment domain may start at Tier 1 in the Knowledge Progression domain; this type of variation and personalization is a key component of this guide and reflects each teacher's individual journey within classroom practice. Each guide includes a decision tree that includes helpful questions about teacher practices and the learning environment to help you decide on how best to work with the teachers you support.

**DOMAIN:**

# Assessment-Informed Instruction for Numeracy

REFLECT

**What type of assessment strategies do you see teachers using in the classroom?**

## WHY DOES IT MATTER?

Using assessment to inform instruction is a necessary approach for improving the quality of teaching; increasing accountability for student learning; and ensuring more equitable improvements in performance. When used constructively, assessment can help teachers understand whether and which students are achieving learning outcomes and help facilitate higher-quality instruction by providing time-sensitive information on student progress.

Assessment-informed instruction refers to the activities undertaken by teachers—and sometimes students, head teachers, and coaches—that provide timely information to track progress and modify subsequent teaching and learning activities. Both formative and summative assessments can be used to inform instruction, depending on whether the purpose is to determine the extent to which learning goals were reached (assessment of learning) or to inform the best path for achieving learning goals (assessment for learning).

Assessment-informed instruction centers on the effectiveness of the teacher's pace and practice and, when used to its full potential, can help identify the strengths and gaps in learning for each child, thereby helping teachers teach better. The most important component of assessment-informed instruction, and perhaps the most challenging, is supporting teachers in taking specific actions in response to the information generated through assessment. This is essential because it is the piece of the puzzle that can influence teaching and learning for the better. When teachers see their use of assessment to inform instruction help their students, they may in turn value and apply these practices more.

> Read more about assessment-informed instruction in the Science of Teaching How-to Guides here.

## WHERE TO START?

As mentioned earlier, **not all teachers will start on the same tier of strategies for a given domain**. The decision tree below is designed to help meet the teacher where they are and support them to implement these strategies at their own pace. There are three different boxes for each domain with prompts to help guide decisions as to which strategy teachers – in individual coaching sessions, in communities of practice, or in pre- and in-service training - should try and how to determine when a teacher is ready to implement a new strategy from the next tier. The strategies are color coded: Tier 1 strategies are listed in green, Tier 2 in blue, and Tier 3 in purple. However, it is important to remember and to convey to teachers that the strategies are not meant to be a checklist; it takes time to implement new ideas, and teachers may have to work on a strategy over several days, weeks, or months before feeling confident in using them and before students start benefiting from them.

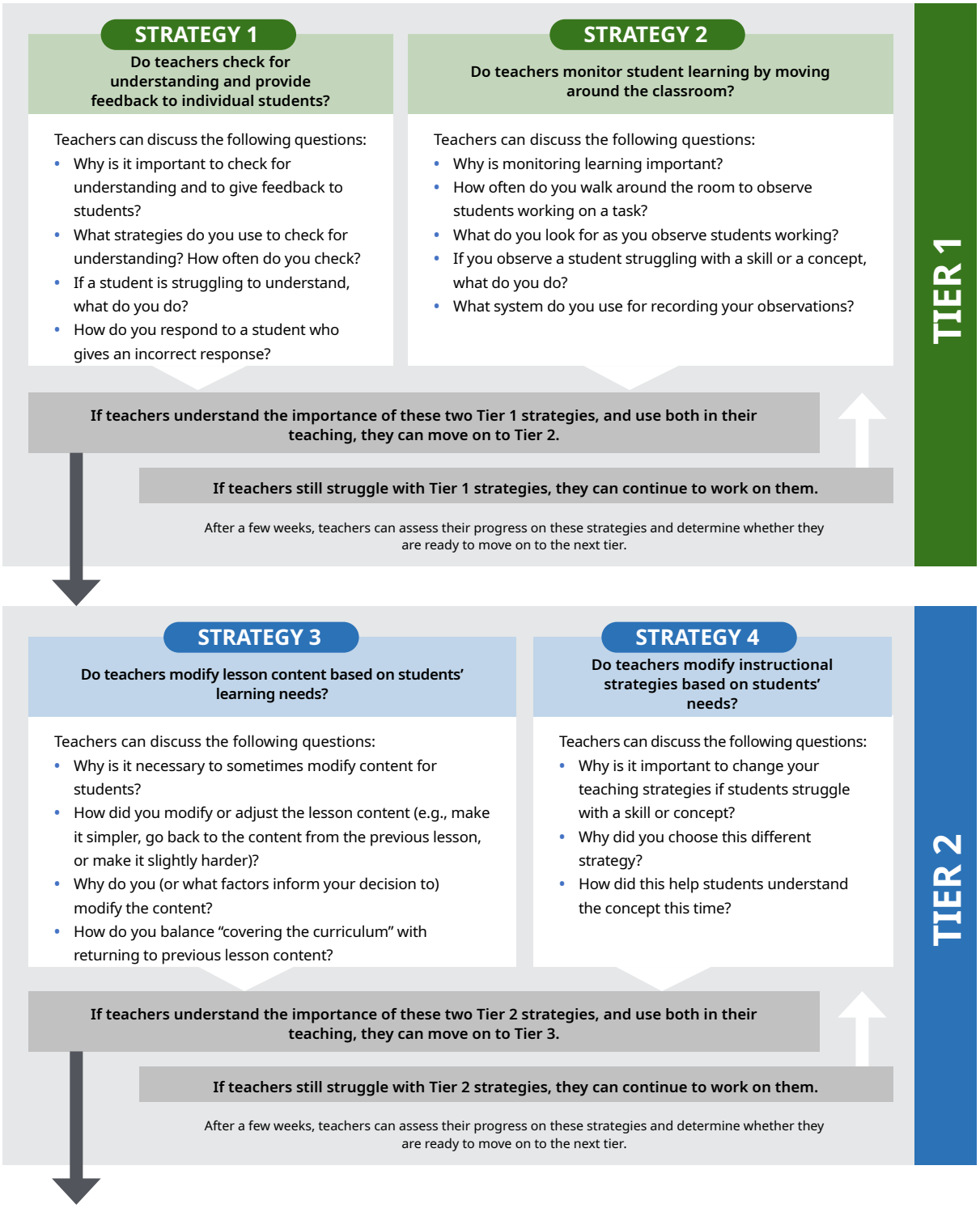
### Decision Tree

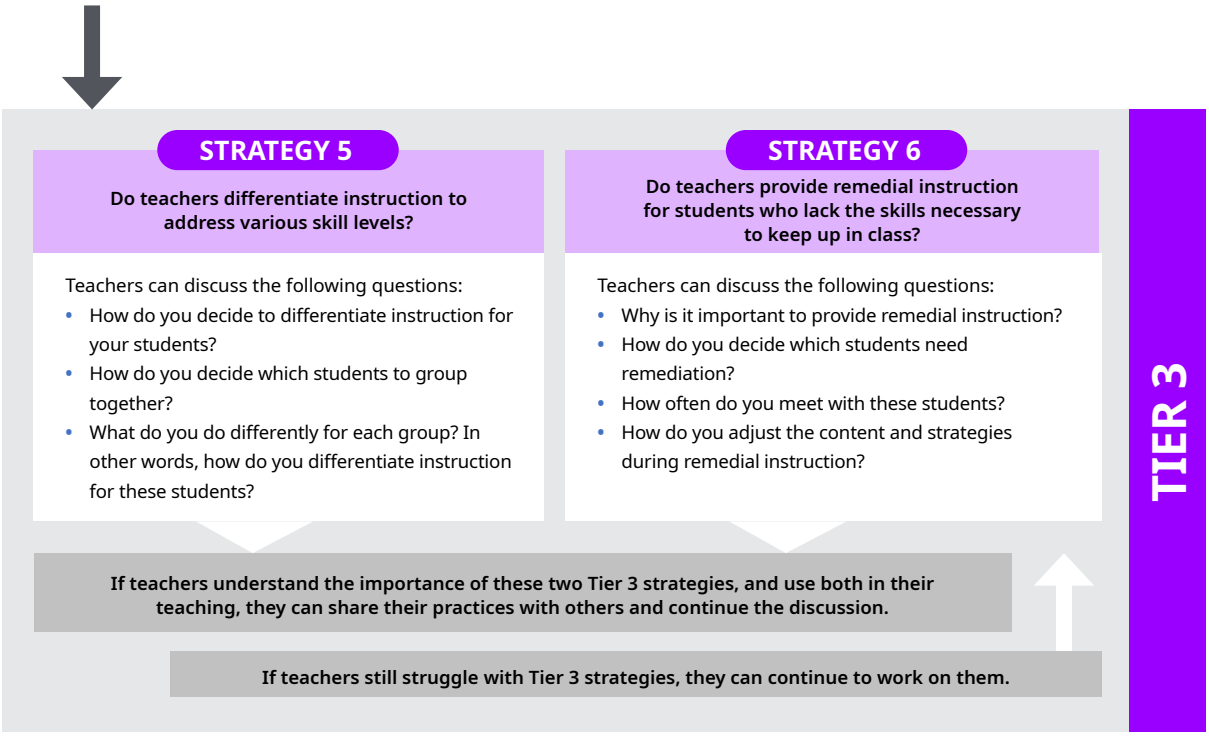
The decision tree below can help teachers identify which strategies to begin with and help those who support their professional development focus their support. Starting with Box 1, teachers can

discuss the questions listed to check whether they already implement that strategy. As they proceed through the subsequent boxes in the decision tree, when they reach a strategy that is new to them or they believe needs improvement, teachers work on the strategy noted in that box. The section after the decision tree provides sample activities and approaches for each strategy. Additional strategies offered by teachers should be welcomed.

Teachers and those who support them can also gauge what type of strategies they use in the classroom by discussing questions such as the following:

- How do you know if students have understood the content you are teaching? What strategy helps you gather this information?
- How often do you observe individuals or groups of students working on a problem?
- Do you have a system of recording notes on each student's progress in math? Tell me about it.
- How do you assist students who struggle with a concept?






## STRATEGIES FOR THE MATH CLASSROOM

The strategies below can be used with students across the early primary grades and adapted for the upper grades. Teachers may need to adjust the strategy from the way it is described to work with a specific grade or group of children. The strategies in this mini-guide are written with the classroom teacher in mind, even though, in most cases, coaches or teacher learning facilitators will be the ones sharing the strategies with teachers. Whether it is providing printed handouts or discussing the strategies together, the coach can decide the best way to share them with teachers.

Each of the strategies corresponds to one of three tiers:

**Green: TIER 1**
**Blue: TIER 2**
**Purple: TIER 3**

## TIER 1: Teacher routinely monitors learning by checking for understanding during instruction and giving actionable feedback to students.

### Strategy 1 – Checking for Understanding and Giving Feedback

Checking for understanding is an integral part of teaching and learning. There are many ways to check for understanding: asking questions, observing students as they work in groups or independently, using written responses such as exit slips, and so on. Importantly, teachers must give students actionable feedback after checking for understanding.

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| 1. | During a math lesson, pause after explaining and modeling a new concept. Ask a few questions to determine whether students understood your explanation. For example, after you have taught a lesson on comparing numbers, and students have heard you explain and model the concept a few different ways over the course of a few days, vary the questions asked to quickly assess their understanding:<br>• *Which number is bigger: 5 or 6?*<br>• *Can you give me an example of a number that is bigger than 3?*<br>• *Can you show me on your fingers a number that is smaller than 2?* |

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| **2.** | To ensure that students understand the concept deeply, you can probe further. Some questions you can ask include:<br>• *Can you explain what I said in your own words?*<br>• *Does someone want to add to what Mansoor said?*<br>• *How do you know that 6 is bigger than 5?*<br>• *Can you show me that 6 is bigger than 5?* |
| **3.** | When asking questions, it is important to provide enough time (at least three to five seconds) for students to think about the question and to choose questions that are appropriately challenging and focus on the lesson that is being taught. |
| **4.** | If a student responds incorrectly, or the response needs more clarification, probe with additional questions. For example, you can ask, *Can you tell me why you think that?* or *Could you explain that again?* |
| **5.** | It is important to not chastise, ignore, or make fun of students for an incorrect response and to correct any other children who do. If a student responds incorrectly, it is likely that other students also do not know the correct answer; use incorrect responses as an opportunity to learn. You can say, *Does someone else have a response to the question?* or *Can you show us how you found that answer?* The student may correct themselves, or you may help them find the mistake.<br>It is important to make sure that the correct answer is provided (if there is one correct answer), whether by the student working through with help, by another student, or by you. |
| **6.** | If certain students continue to struggle, make a note of this and create a plan to provide additional targeted support. |

## Strategy 2 – Monitoring Student Learning

This strategy has a dual purpose: (1) to check that students understand the new skill or learning task and (2) to provide on-the-spot support. This is best done by moving around the room, observing students as they work. Remember to avoid standing at the front of the classroom throughout the entire lesson and to move around the classroom to monitor learning and offer immediate support.

**1.** Create a checklist to document your observations as you move around the room and observe students working. You can use a notebook to track your observations or a sheet of paper attached to a clipboard. Using different clipboards for different subjects can make it easier to document and review your observations.

**2.** Create a checklist with columns for dates and individual student names. Include a heading for the concept that you are teaching. Your checklist might look something like this:

| Unit: Identifying coins | Mon. 01/01 | Tues. 01/02 | Wed. 01/03 | Thurs. 01/04 | Fri. 01/05 |
|---|---|---|---|---|---|
| Azza | | | | | |
| Marziya | | | | | |
| Shodi | | | | | |
| Tabreez | | | | | |
| Yacoub | | | | | |

**3.** During a lesson, as you walk around and observe students working independently or in small groups, make notations on the clipboard. You can use a notation like this: ✔**+** for students who are progressing well with no mistakes, ✔for students who are progressing with a few mistakes, and **–** for students who are struggling. For example:

| Unit: Money | 12/01 Mon | 12/02 Tues | 12/03 Wed | 12/04 Thurs | 12/05 Fri |
|---|---|---|---|---|---|
| Azza | ✓ | ✓ | ✓+ | ✓+ | ✓+ |
| Marziya | ✓ | ✓ | - | - | - |
| Shodi | ✓ | ✓ | ✓ | ✓ | ✓ |
| Tabreez | ✓+ | ✓+ | ✓+ | ✓+ | ✓+ |
| Yacoub | - | - | ✓ | ✓ | ✓ |

| Strategy 2 – Monitoring Student Learning | |
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| 4. | As the class continues to work, help students who need support. For example, for students who are progressing with a few mistakes, ask them to explain their thinking and then guide them as they correct the error that they made. |
| 5. | Don't forget about students who are progressing well with no mistakes. Stop by their desk and encourage them to continue working well. Consider providing them with more challenging tasks. |
| 6. | If you observe a few students struggling, provide them with immediate, targeted support. However, if many students struggle with the new skill or concept, you may need to model and explain the concept again to the whole group. |
| 7. | At the end of the week, review your notes from the math lessons you have taught and make a plan for the type of feedback and support you will give to individual students who are struggling. |

## TIER 2: Teacher modifies content and instructional strategies based on evidence of learning collected through formative assessment.

| Strategy 3 – Modifying Content | |
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| Making time to review information that you have collected on a checklist, noting trends in student performance, and then consulting resources such as the textbook (both this year's and the preceding and following years' textbooks) to modify content is essential for improved learning. The strategy below will help you use student data to make changes to your teaching content to better support students. | |
| 1. | Every few weeks, make it a habit to review the data you have collected on your checklist or in your notebook for each student. Note how many students struggled with a particular skill or concept. If more than one-third of students are struggling, you will need to simplify the content. |
| 2. | You can use the same teaching strategy planned but with simpler content. For example, when teaching coins and their values, rather than teaching five different coins and their denominations, teach one or two coins at a time. Add the other coins after students have mastered these coins. |
| 3. | Walk around and observe students as they work. Use your checklist to make notes on who is progressing well and who needs additional support. |
| 4. | Based on your observations of the lesson using the modified content, you can decide whether you need to adjust or further simplify the content or use a different instructional approach, described in the next strategy. |

| Strategy 4 – Modifying Instructional Strategies | |
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| Sometimes, making modifications to content is not enough to support students who struggle. It may be necessary to use a different instructional strategy to help some students access learning. Consult resources, such as the textbook (both the current year's and the preceding and following years' textbooks), and discuss other evidence-based strategies in a community of practice. | |
| 1. | Planning for modifying instructional strategies takes time and attention. After you have made changes to the instructional content and notice that students continue to struggle, you may need to incorporate some different instructional strategies such as using different models to show the concept, more hands-on work with manipulatives, and pair work to support students who are still struggling. |

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| **2.** | For example, when teaching about money, if many students did not understand the different denominations of coins, there are two adjustments that can be made. First, have students work in pairs (a strong student with a weaker one), which supports learning. Second, build on the concept using concrete, physical materials. Return to the coins of various denominations used in your lesson. Provide a collection of coins to each small group, along with a sheet of paper with the coin values printed on them. Do a simple matching exercise where students put the actual coin on the correct value. |
| **3.** | Walk around and take observation notes as students do the activity. If all students are progressing well, give them another activity using the same materials. Ask them to line up the coins, from the coin with the smallest value to the coin with the highest value. |
| **4.** | Based on your observations of the pair work, you can decide whether you will need to differentiate the subsequent lessons for certain students, provide remediation for some students, or progress to the next lesson. |

## TIER 3: Teacher provides differentiated instruction and remediation to address learning gaps.

### Strategy 5 – Differentiated Teaching

As you observe students working, provide feedback, and modify instruction and strategies, you will have noticed that some students continue to struggle with some skills and concepts. Providing differentiated instruction—that is, tailoring instruction to meet individual students' learning needs—is necessary to support each student at their specific skill levels. Differentiation is beneficial because it provides opportunities for students to work at their own pace, build on their strengths, and address specific areas of weakness. It also allows you to target support and scaffold learning for individual students.

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| **1.** | Consult your student progress checklist or observation notes to group students according to skill level and need areas and adjust your plans for the lesson. For example, during a unit on measurement, some children may be able to compare lengths using a tape measure. However, a small group of students may still struggle with using and reading a tape measure. |
| **2.** | Tell the class they will be working on different tasks and even different skills so that everyone understands and so that the differentiated instruction runs smoothly. |
| **3.** | For example, in a unit on measurement where you are teaching students to (1) understand measurement by comparison and (2) measure length indirectly, you can create an assessment that includes six different types of questions at varying levels of difficulty on the two topics but where students need only answer three questions out of the six. They can respond to all questions, but they are required to respond only to three. Giving students choice in which questions they respond to builds accountability, allows them to work at their own pace, and builds on their strengths. It also allows you to address areas of weakness.<br>For example, you can ask the following questions (in order of difficulty):<br>• *Can you identify something in the classroom that is taller than you? Draw it here.*<br>• *Can you identify something in the classroom that is shorter than you? Draw it here.*<br>• *Line up the following items according to their height, from shortest to tallest.*<br>  <br>• *Use an object to measure the side of the desk. How long is it? What object did you use to measure the desk?*<br>• *Use an object to measure the side of your book. How long is it? What object did you use to measure the book?*<br>• *Which is longer: the book or the desk? How do you know for sure?* |
| **4.** | Reassessing each group will inform your next lessons on measurement with the class. |
| **5.** | To meet and support each student where they are, differentiated instruction should become part of your instruction. |

## Strategy 6 – Remediation

Remediation refers to additional support given to students who are falling behind because they have not yet mastered more basic skills. This short-term intervention is designed to help students master foundational concepts necessary to progress to catch up and succeed during classroom instruction. (See the Science of Teaching How-to Guide on Remediation.) Remediation can occur in after-school math clubs, one-on-one or small-group tutoring with the classroom teacher or a math coach after school hours, or during the school day. It is important to have a specific plan for remediation, including frequency, duration, and what specific skills or concepts will be taught. Remember that students who master the foundational skills of reading in the lower grades will continue to make positive academic gains.

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| **1.** | Take time to plan for remedial instruction. Discuss with your school leaders and make decisions about:<br>• when and where the remedial lessons will take place.<br>• who will provide remediation.<br>• how often in a week students will receive remediation.<br>• how to ensure ongoing communication with other teachers or parents. |
| **2.** | Plan remedial lesson content focusing on learning gaps identified during the weekly lessons. |
| **3.** | Remedial lessons should focus on target skills that children need to be successful in the classroom and should provide time to practice these competences. You should establish a positive and supportive remedial classroom atmosphere to encourage and motivate students. It is also important to plan for and offer children multiple opportunities to practice target skills individually, in pairs, or in small groups. |
| **4.** | Keep close track of student progress and reassess students regularly. Modify the activities, groupings, and content based on student needs. |
| **5.** | Celebrate all student participation and progress; this category of students needs a lot of encouragement to remain motivated. |

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