# UNIVERSAL DESIGN FOR LEARNING AND *MATHLINKS*

## UNIVERSAL DESIGN FOR LEARNING

Universal Design for Learning (UDL) is a framework to improve and optimize teaching and learning for ALL students (CAST, 2018). It's three main principles are to (1) provide multiple means of engagement, (2) provide multiple means of representation, and (3) provide multiple means of action and expression. Here are some examples of how these principles are built into the *MathLinks* design.

| | UDL Principles | *MathLinks* Examples |
|---|---|---|
| **Provide Multiple Means of Engagement** | Learners differ in the ways in which they can be engaged to learn. Teachers should devise lessons that motivate students while answering the question: *Why do I need to learn this?*<br>• Provide options for recruiting interest<br>• Provide options for sustaining effort and persistence<br>• Provide options for self-regulation | **Opening Problems** launch unique problems in ways that challenge students to think differently about the mathematics. (SP)<br><br>**Nonroutine Problems**, **Tasks**, **Projects**, and **Technology Activities** offer a variety of games, puzzles, and contexts to for sustained learning. (PR)<br><br>**Monitor Your Progress**, a self-monitoring tool for lesson objectives, and **Packet Reflection** give students tools for self-assessment. (SP) |
| **Provide Multiple Means of Representation** | Learners differ in the ways that they perceive and understand information that is presented to them. Teachers should devise lessons that allow students opportunities to learn concepts in multiple ways while answering the question: *What do I need to learn?*<br>• Provide options presenting and receiving the information<br>• Provide options for language, mathematical expressions, and symbols<br>• Provide options for comprehension | Guided instruction options appear with **Lesson Notes**, **Slide Decks**, and **Slide Deck Alternatives**. (TE)<br><br>Graphic organizers highlight patterns, structural features, and relationships. (SP)<br><br>The program emphasizes mathematical representations with pictures, numbers, symbols, or words. (SP, TE)<br><br>A **Word Bank**, **Vocabulary Review**, and **Student Resources** support academic language development. (SP) |
| **Provide Multiple Means of Action and Expression** | Learners differ in the ways that they respond in a learning environment and express what they know. Teachers should provide a variety of ways for students to show their knowledge while answering the question: *How can I show what I know and don't yet understand?*<br>• Provide options for physical action<br>• Provide options for expression and communication<br>• Provide options for executive functions | Card sorts and manipulatives help kinesthetic learners show what they know. (SP, PR)<br><br>**Review** section activities are appropriate as formative assessment. For example, with **Poster Problems** students move around the room, work together to solve problems, critique reasoning of others. (SP)<br><br>Structured workspace helps students stay organized and on task. **Monitor Your Progress** and **Packet Reflection** give students tools to self-assess academic progress. (SP) |

Components cited: Student Packets (SP) Teacher Edition (TE) Packet Resources (PR)

## STRATEGIES TO SUPPORT SPECIAL POPULATIONS IN *MATHLINKS*

Classrooms typically include students with different learning styles and needs. In addition to incorporating principles for UDL when creating MathLinks, the team gave additional focus to strategies that would support special populations. Synthesized from the work of Echeveria (2009), Moskowitz (2013), Sliva (2003), Lambert (2016, 2020) and others, these strategies center around four main principles: (1) Know your learner, (2) Increase academic language through mathematics, (3) Increase comprehensible input, and (4) Promote student interaction. Here are some examples of how these principles are built into the *MathLinks* design. Examples of their applications to specific lessons are located in the Front of each TE section. Note that strategies essential to the academic success of English learners are noted with a star (*).

| | Strategy | *MathLinks* Feature |
|---|---|---|
| **Know your Learner** | • Understand student attributes that support or interfere with learning.<br>• Determine preferred learning and interaction styles.<br>• Assess student knowledge of prerequisite mathematics content.<br>• Check for understanding continuously.<br>• Provide differentiation opportunities for intervention or enrichment to reach more learners.<br>• Encourage students to write about their attitudes and feelings towards math.<br>• Use contexts that link to students' cultures.* | Use **Getting Started** and **Spiral Review** to assess prerequisite skills and retention of new knowledge. **Monitor Your Progress** and **Packet Reflection** give students self-assessment tools as well. (SP)<br><br>Journal suggestions are referenced. (TE)<br><br>Look at **Essential Skills** and **Nonroutine Problems** for intervention and enrichment. Many **Projects** offer opportunities to tailor instruction to student needs and cultures. **Quizzes** provide traditional methods for assessment, and the **Extra Problem Bank** provides extra practice when needed. (PR)<br><br>For those who need it, **Skill Boosters** are designed to fill gaps in knowledge without losing pace on grade level work. (GR) |
| **Increase Academic Language through Mathematics** | • Provide opportunities for students to read, write, or speak about their mathematical learning.<br>• Explain the academic vocabulary needed to access mathematical ideas, providing both examples and non-examples.<br>• Use strategically organized groups that attend to language needs.*<br>• Use rich mathematical contexts and sophisticated language to help ELs progress in their linguistic development.*<br>• Use cognates and root words (when appropriate) to link new math terms to students' background knowledge.* | **Word Bank**, **Vocabulary Review**, and **Student Resources** support academic language development. (SP).<br><br>Suggestions for **Journals** and **Using the *MathLinks Rubric*** offer opportunities for students to analyze their own work and critique the reasoning of others. (TE, GR)<br><br>Grouping suggestions for activities provide opportunities for teacher-student and student-student interactions. (TE)<br><br>At least one **Slide Deck** from each packet includes a "critique student thinking" opportunity, which prompts for reading, writing, and speaking about math. (TE)<br><br>**Math Talks** provide opportunities for mathematical reasoning, using different strategies, and making connections between concepts. (PR) |

Components cited: Student Packet (SP) Teacher Edition (TE) Packet Resources (PR) General resources (GR)

| | Strategy | *MathLinks* Feature |
|---|---|---|
| **Increase Comprehensible Input** | • Link concepts to past learning.<br>• Make concepts meaningful through hands-on activities, visuals, demonstrations, and color-coding.<br>• Use a think-aloud strategy to model appropriate thinking processes and academic language use.<br>• Use graphic organizers to help students record information and data, see patterns, and generalize them.<br>• Use multiple representations (pictures, numbers, symbols, words, contexts) of math ideas to create meaning and make connections.<br>• Simplify written instructions, rephrase explanations for concepts, and supplement with verbal and visual clues.*<br>• Strategically sequence problems and scaffold explorations and activities to give students access to more complex language structures.* | **Getting Started** reviews or previews important concepts for a lesson. Structured workspace that includes graphic organizers and sentence starters highlight patterns, multiple representations, and relationships, as it helps students stay organized. (PR)<br><br>**Reproducibles** (e.g. card sorts, puzzles) and easily accessible **Materials** (e.g. counters, colored pencils) provide options for instruction. (TE)<br><br>**Slide decks** and **Slide Deck Alternatives** frequently provide options for lesson delivery. (TE) |
| **Promote Student Interaction** | • Use flexible group configurations that support content objectives.<br>• Use strategies and activities that promote teacher/student and student/student interactions (e.g. think-pair-share, poster problem).<br>• Encourage elaborate responses through questioning.<br>• Allow processing time and appropriate wait time, recognizing the importance of the different requirements for speaking, reading, and writing in a new language.*<br>• Allow alternative methods to express mathematical ideas (e.g., visuals, students' first language)* | **Review** activities promote engagement and interaction. For example, **Poster Problems** provide opportunities to solve problems and share ideas in small group settings. (SP)<br><br>**Lesson Notes** provide specific suggestions for teacher/teacher and teacher/ student interactions. (TE)<br><br>**Activity Routines** (e.g. Poster Problems, Big Square Puzzles, Four-In-A Row Games, Match and Compare Sorts) are typically found in **Review, Essential Skills, Math Talks, or Nonroutine Problems.** They are designed to encourage interaction and communication using varied grouping configurations. (GR, SP, PR)<br><br>Prompts in the TE for **Journals** and **Using the MathLinks Rubric** give students opportunities to take ownership of a formative assessment. (SP, TE, GR) |

Components cited: Student Packet (SP) Teacher Edition (TE) Packet Resources (PR) Other Resources (GR)

# THE BIG PICTURE: UDL and *MATHLINKS* STRATEGIES

The three Universal Design for Learning principles and the four *MathLinks* Strategies for Special Populations are seamlessly built into the *MathLinks* design. Educators can use this program with confidence, knowing that it was designed to create interest in the beauty and utility of mathematics and lead to access and success for more students.