



# **Stackable Instructionally- embedded Portable Science (SIPS) Assessments Project**

## **Grade 8 Science**

### **Unit 4: Differentiation Strategies and Resources**

#### **Providing Solutions to Problems Using Simple Wave Properties**

**August 2023**

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## SIPS Grade 8 Unit 4 Differentiation Strategies and Resources

“Universal Design for Learning (UDL) is a framework to improve and optimize teaching and learning for all people based on scientific insights into how humans learn.” (CAST, 2022). Taking time to reflect on prior instruction when planning for accessible, differentiated, and culturally responsive instruction for diverse learners and culturally diverse classrooms serves to identify ways to improve future instructional practices. The [UDL Guidelines](#) provide a framework for this reflection. The guidelines include three principles, Multiple Means of Engagement, Multiple Means of Representation, and Multiple Means of Action & Expression as ways to focus on variety and flexibility in instructional practices.



Multiple Means of Engagement



Multiple Means of Representation




Multiple Means of Action & Expression

By examining instruction and instructional materials through the lens of each of these principles, we can identify and thus reduce or remove barriers to diverse learners. Accommodations typically reserved for students receiving special education, students who have a 504 plan, and English Learners can be made available to all students using the UDL principles, thus allowing all students to benefit from the accommodations.

This document provides strategies and examples for each UDL principle to support the design and delivery of accessible instruction and learning opportunities for all students aligned to the SIPS Grade 8 Unit 4 Instructional Framework.

### Multiple Means of Engagement

Providing Multiple Means of Engagement (e.g., allowing choices, authentic scenarios, varying demands, and clear goals), broadens the opportunities for gaining and sustaining students’ interest and cognitive engagement in learning the content.

 <b>Multiple Means of Engagement</b> “Emotions drive our cognition, including our attention, memory, and planning/executive functions.” (Hartmann & Posey, 2020)	
Strategies	Examples
Provide choices.	<ul style="list-style-type: none"> <li>Explore students’ experiences and interests in science through short inventories and interviews.</li> <li>Allow students to choose how they model sound or light waves (e.g., drawing, cutting and pasting, using objects, etc.).</li> </ul>
Allow ownership of parts of instructional tasks.	<ul style="list-style-type: none"> <li>Provide students with a checklist of steps needed to complete a task.</li> <li>Allow students who are using a text-to-speech feature to choose the speed and the</li> </ul>



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Strategies	Examples
	<p>voice for which they are most comfortable, possibly one from their culture.</p> <ul style="list-style-type: none"><li>• Provide several options for students to practice the science vocabulary terms (e.g., pair with illustrations that describe the term, flashcards, create a song about each, etc.).</li><li>• Resources: <a href="#">Natural Reader</a>, <a href="#">Tips for Educators of ELLs: Teaching Vocabulary in Grades 4-12</a>, <a href="#">How to Teach ESL Vocabulary: Top Methods for Introducing New Words</a></li></ul>
Make work authentic and relevant.	<ul style="list-style-type: none"><li>• Provide the ultimate goal through a broad overview of the unit including how they will use the knowledge to engineer solutions to a challenge(s)/problem(s) that a student their age who has sensitivities to light or sound will face.</li><li>• Connect the sound waves to music and art by watching videos showing how sound affects water and light changes colors.</li><li>• Discuss how color light filters work in photography or videography and demonstrate if available.</li><li>• Experiment with color light filters using cellophane paper.</li><li>• Resources: <a href="#">Amazing Water &amp; Sound Experiment #2</a>, <a href="#">Make photo filters with everyday objects</a>, <a href="#">Night to Day – Farm Time Lapse</a></li></ul>
Provide safety and reduce distractions	<ul style="list-style-type: none"><li>• Provide a variety of ways in which students can ask questions or seek assistance (e.g., individually, small group, asking a peer, etc.).</li><li>• Allow students to wear noise-canceling headphones to reduce distractions and overstimulation.</li><li>• Offer opportunities for students to share in a way that is comfortable given their culture and family dynamics (e.g., Some cultures find talking over each other as normal while others wait for complete silence before contributing; some are comfortable with</li></ul>



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Strategies	Examples
	<p>directness or do not have the language level to be polite. Eye contact varies by culture.)</p> <ul style="list-style-type: none"><li>• Be aware of sensory issues when experimenting with sounds and light.</li></ul>
Present clear and important goals and objectives.	<ul style="list-style-type: none"><li>• Help students set personal goals for a lesson, task, or activity.</li><li>• Explain scientific terms along with the goals so that students understand what they are working towards.</li><li>• Resources: <a href="#">Goal Setting for Students: Nurturing a Growth Mindset</a></li></ul>
Provide different levels of support and scaffolds.	<ul style="list-style-type: none"><li>• Provide options for students to choose from when completing work (e.g., possible ideas to include in the design specifications for solving the hypothetical problem).</li><li>• Incorporate accommodations and scaffolding into tasks for everyone. Some students may be able to complete a multiple-step task with no support, while other students may need verbal or visual cues to complete each step.</li><li>• Resources: <a href="#">Task Analysis Worksheets</a></li></ul>
Encourage collaboration with partners and in groups.	<ul style="list-style-type: none"><li>• Be clear about the purpose and expectations of cooperative group activities (e.g., the task, student roles, expectation of contribution, freedom to share information within and across groups, cooperative and not competitive, etc.).</li><li>• Be intentional about how groups are formed so that they include a variety of students (e.g., race, national origin, socioeconomic status, disability, etc.).</li><li>• Ensure everyone has the means to contribute. For some this might be to assign a role that matches their strengths, it might be to provide needed vocabulary on their <a href="#">AAC</a> system, and for some, it might be to reduce the size of the group and allow options for seating (e.g., exercise ball).</li></ul>



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Strategies	Examples
Support self-reflection and evaluation.	<ul style="list-style-type: none"> <li>• Provide support to help with transitions (e.g., a task list, a personal checklist, a visual timer, etc.).</li> <li>• Work with individual students to set personal goals and create an evaluation sheet for self-monitoring.</li> <li>• Provide visual tools to foster independence, prepare students for the next activity, break tasks into smaller steps, and aid transition.</li> <li>• Resources: <a href="#">The Autism Helper: Self-Monitoring</a></li> </ul>
Encourage communication about frustrations and guide self-management of the frustrations.	<ul style="list-style-type: none"> <li>• Provide a means for students to express frustration or attention fatigue in productive ways to avoid disruption (e.g., a symbol to request a break, the opportunity to sit alone for a few minutes, etc.).</li> <li>• Develop a plan with an individual student for managing disruptive or distracting behaviors and support the student in monitoring the plan (e.g., Develop a discrete signal (e.g., tap on student’s desk) to alert the student to initiate the pan (e.g., counting backward from 20.).</li> <li>• Resources: <a href="#">What Are Break Cards and How Do I Use Them?</a>, <a href="#">(Printable) Break Cards: How to Use Break Card Visuals at Home, School, and Special Education</a></li> </ul>

### Multiple Means of Representation

Providing Multiple Means of Representation (e.g., variety of presentation modes, clarifying vocabulary, activating background knowledge) allows for students to receive and comprehend the content.



### Multiple Means of Representation

“Representation is the process of collecting and presenting information to students in a way that students can understand, engage with and learn from.” (Novak, 2021)

Strategies	Examples
Use flexible ways to present information.	<ul style="list-style-type: none"> <li>• Present anchor phenomenon in multiple ways (e.g., underwater photograph, pencil in a glass of water, GoPro/sound in air and water).</li> </ul>



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Strategies	Examples
	<ul style="list-style-type: none"><li>• Provide visual examples of sounds when students are investigating sounds.</li><li>• Present example models of sound and light waves using multimedia so it can easily be enlarged, increase contrast between text and the background, described using alternative text, etc.</li><li>• Tactually enhance materials.</li><li>• Wait time between a question and a person’s reply varies across cultures. Therefore, during brainstorming activities or classroom discussions, be aware of this and ensure everyone has the opportunity to contribute.</li><li>• Describe light to students who are blind or have a visual impairment (e.g., There is a glass half-filled with water. We have a pencil that is straight. When we put the pencil in the water, it looks like it bends in the water.) and provide a tactile example when feasible (e.g., a raised line outline of glass, the water line, and the pencil in the water).</li><li>• Describe colors to all students, including students who are blind or have a visual impairment, and why something is the color it is in relationship to light.</li><li>• Resources: <a href="#">Signal Generator</a>, <a href="#">Tutorials for Sound Exploration</a>, <a href="#">Exploring Waves through Sound</a>, <a href="#">Communication and Language Strategies for Science Inquiry Classroom (Part 2)</a>, <a href="#">Design Principles for Tactile Graphics</a>, <a href="#">Blind people can’t see color but understand it the same way as sighted people</a></li></ul>
Describe the meaning of vocabulary and symbols.	<ul style="list-style-type: none"><li>• Frontload vocabulary using a word wall or a glossary for science and academic terms such as reflected, absorbed, transmitted, refracted, medium, etc.</li><li>• Pair vocabulary (e.g., vibration, medium, wavelength, refraction, reflection, etc.) by using pictures or diagrams.</li><li>• Speak slowly and clearly combined with gestures or acting out words, phrases, and directions to</li></ul>



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“Representation is the process of collecting and presenting information to students in a way that students can understand, engage with and learn from.” (Novak, 2021)

Strategies	Examples
	<p>help English Learners and students develop science vocabulary.</p> <ul style="list-style-type: none"><li>Describe the meaning, “You can see through something transparent.” vs. a formal definition, “transmitting light; able to be seen through with clarity.”</li><li>Resources: <a href="#">Vocabulary.com</a>, <a href="#">Text Project Word Pictures: Sounds</a>,</li></ul>
Explain the structure of graphs, charts, diagrams, models, etc.	<ul style="list-style-type: none"><li>Create example models, graphs, and charts using tactile graphics.</li><li>Directly teach the purpose of arrows in a model.</li><li>Resource: <a href="#">The Importance of Arrows in Science</a></li></ul>
Provide support for decoding written text and symbols.	<ul style="list-style-type: none"><li>Provide multiple ways for students to access written text (e.g., peers reading to each other, text-to-speech reader, audio versions, etc.).</li><li>Provide age-appropriate, below-grade-level articles related to sound and light.</li><li>Resources: <a href="#">Read Aloud: A Text to Speech Voice Reader</a>, <a href="#">Natural Reader</a>, <a href="#">Wave Reflection, Absorption &amp; Transmittance – Reading Material</a>, <a href="#">5.50 Sources of Visible Light</a>, <a href="#">Sound Energy (adapted book)</a>, <a href="#">Prism</a></li></ul>
Support language acquisition (e.g., English Learners, AAC users, ASL users)	<ul style="list-style-type: none"><li>Connect dominant language (e.g., English) with first language (e.g., Spanish).</li><li>Have a student respond using the dominant language and then translate it into English.</li><li>Check understanding of content and not on sentence structure and grammar.</li><li>Ensure that the needed vocabulary is in a student’s <a href="#">AAC</a> system.</li><li>Resources: <a href="#">Supporting ELL Success with STEAM and Hands-On Learning (Part 2)</a>, <a href="#">Getting to Know your ELLs: Six Steps for Success</a>, <a href="#">Signing Math and Science Dictionaries</a></li></ul>
Supply or activate background knowledge.	<ul style="list-style-type: none"><li>Provide information about waves using simple texts, pictures, and/or videos.</li><li>Provide students with background information on light and sound.</li><li>Resources: <a href="#">All About Light</a></li></ul>



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Strategies	Examples
Emphasize key information.	<ul style="list-style-type: none"><li>• Use graphic organizers, outlines, underline or highlight key information in print materials, etc.</li><li>• Create a QR code and place it on science posters, worksheets, study cards, etc. that will link to a specific online resource.</li><li>• Resources: <a href="#">Free Graphic Organizers</a>, <a href="#">Best Free QR Code Sites for Teachers</a></li></ul>
Provide models and scaffolds to aid in comprehension.	<ul style="list-style-type: none"><li>• Provide different types and colors of plastic (e.g., colored cellophane, lens from reading glasses, clear plastic sheet, frosted plastic sheet) and pictures of real-life use (e.g., camera light filter, stained glass windows, sunglasses, shower stall, windows, etc.) so students can look through them and then match the plastic to the picture or sort by different uses.</li><li>• Provide sentence frames or prompts to support student responses.</li><li>• Provide opportunities for partner talks to allow students to build confidence in their knowledge and speaking before sharing with the class.</li><li>• Resources: <a href="#">Scaffolds to Support English Language Learners in Writing and Discussion</a>, <a href="#">Mini Schedules</a>, <a href="#">Using Visual Schedules to Support Students with Autism</a></li></ul>
Support transfer and generalization of skills and knowledge.	<ul style="list-style-type: none"><li>• Include opportunities to review and practice prior knowledge and skills along with new knowledge and skills.</li><li>• Make explicit connections between concepts of sound and light waves and their properties using a concept map.</li><li>• Resources: <a href="#">Free Concept Map Templates</a></li></ul>

### Multiple Means of Action & Expression

Providing Multiple Means of Action & Expression (e.g., a variety of methods to respond to instruction, and a variety of ways to interact with the instructional materials) helps students to use their strengths and abilities to access the instructional materials and express what they understand.





### Multiple Means of Action and Expression

“By divorcing the presentation mode from the learning, all learners can find a way to apply what they’ve learned and demonstrate proficiency.” (Hogle, 2018)

Strategies	Examples
Provide options for accessing instructional activities and materials.	<ul style="list-style-type: none"><li>• Provide time for students to write down their driving questions before having the group share to allow students to write the question first in their primary language and to allow for differences in processing time.</li><li>• Provide tactile models or have students create tactile models illustrating features of waves.</li><li>• Ensure that videos are captioned, audio description is provided for video content, and alternative text for pictures.</li><li>• Provide tactile examples showing the properties of light.</li><li>• Allow for differences in rate, timing, speed, and range of motion (e.g., Allow enough time for all students to process the question and formulate their responses; Allow enough time for all students to move from one activity to the next, or to perform a task.).</li><li>• Resources: <a href="#">Features of Waves Using Wikki Stix</a>, <a href="#">Use Live Caption in Chrome</a>, <a href="#">How Does Light Travel?</a>, <a href="#">Diagram Center – General Guidelines (alternative text)</a></li></ul>
Vary the ways for students to respond to questions or a task.	<ul style="list-style-type: none"><li>• Allow students to enter data regarding wavelength and frequency online to create graphs using standard or adapted keyboards.</li><li>• Provide a variety of ways in which students can “write” to describe a sound-based phenomenon (e.g., traditional form of writing, using sentence starters, using pictures, etc.).</li><li>• Allow students to use a variety of ways to create a model (e.g., drawing, pictures, objects).</li><li>• Allow students to use their preferred mode of communication to respond to questions and present information (e.g., writing in dominant language and then transcribing into second language, provide in writing, using <a href="#">AAC</a>, etc.).</li></ul>



### Multiple Means of Action and Expression

“By divorcing the presentation mode from the learning, all learners can find a way to apply what they’ve learned and demonstrate proficiency.” (Hogle, 2018)

Strategies	Examples
	<ul style="list-style-type: none"><li>• Ask questions that only require one-word responses or a physical response (e.g., pointing, gesturing, matching, sorting) for students who are developing language or just learning English.</li><li>• Resources: <a href="#">Power-Assisted Writing for Science: Developing Expository Writing in a Multimedia Environment</a>, <a href="#">Better Living Through Technology – Keyboards for People with Disabilities</a>, <a href="#">Pathways to Reading to Learning for Students with Cognitive Challenges</a>.</li></ul>
Use technology or assistive technology (AT) to broaden access to instructional materials.	<ul style="list-style-type: none"><li>• Allow students to use an online wave speed calculator or provide the formula on the board.</li><li>• Allow students to create the diagram of their ray mode of light digitally using an online program, as slide program (e.g., PowerPoint, Google Sheets), etc.</li><li>• Enhance 2-D models by adding tactile feedback (e.g., using Wikki Stix®).</li><li>• Have students be actively involved in presentations by using adapted mouse to advance slides, AAC system to orally share information, an ASL interpreter to share information, etc.</li><li>• Provide low tech tools such as pencil grips, page turners, reading guide/strips, slant board, tactile ruler, manipulatives, etc.</li><li>• Resources: <a href="#">Wave Speed Calculator</a>; <a href="#">Mouse Alternatives</a>, <a href="#">The Use of Wikki Stix Within the Classroom</a>, <a href="#">Creating Large Print and Tactile Graphs</a>; <a href="#">DIY Reading Strips</a>, <a href="#">5 Benefits of a Slant Board for Writing</a>, <a href="#">Clusive™: An Accessible, Digital Reading Platform</a>, <a href="#">8 Examples of Assistive Technology and Adaptive Tools</a></li></ul>
Provide varied levels of support and practice.	<ul style="list-style-type: none"><li>• Model how to create a light ray model, allowing students to follow the steps to create their model.</li></ul>



### Multiple Means of Action and Expression

“By divorcing the presentation mode from the learning, all learners can find a way to apply what they’ve learned and demonstrate proficiency.” (Hogle, 2018)

Strategies	Examples
	<ul style="list-style-type: none"><li>• Make use of technology such as spellcheckers, word prediction software, and text-to-speech software.</li><li>• Set bookmarks to specific pages for students to find information.</li><li>• Provide differentiated homework or seatwork that still practice the key concepts of the assignment (e.g., some students complete sentence starters as opposed to writing paragraphs).</li></ul>
Support planning and strategy skills.	<ul style="list-style-type: none"><li>• Include prompts to check their thinking and strategy for solving a task.</li><li>• Check in with students to see if they understand the task and if they need support to understand a concept.</li><li>• Model a think-aloud to solve a problem or think through a task.</li></ul>
Provide supports to help with managing information and resources.	<ul style="list-style-type: none"><li>• Provide the option, as available, for students to conduct initial research in their first language.</li><li>• Bookmark key online resources.</li><li>• Create a digital resource document that includes the topic paired with graphics.</li><li>• Link to specific part of a web page.</li><li>• Slip a page from a book, magazine, or worksheet into a plastic page protector and circle highlight the key section.</li><li>• Resources: <a href="#">3+ Digital Resources for Your Classroom</a>, <a href="#">How to Link to a Specific Part of A Webpage &amp; Share It</a>, <a href="#">Share pages with a QR Code</a></li></ul>

## Resources

1. [UDL: Action & Expression \(cast.org\)](https://udlguidelines.cast.org/action-expression)  
[https://udlguidelines.cast.org/action-expression]
2. [Design for Each and Every Learner: Universal Design for Learning Modules | Design for Each and Every Learner: Universal Design for Learning Modules | Institute on Community Integration Publications \(umn.edu\)](https://publications.ici.umn.edu/ties/universal-design-for-learning-modules/design-for-each-and-every-learner)  
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