



Stackable Instructionally- embedded Portable Science (SIPS) Assessments Project

Grade 8 Science

Unit 2: Differentiation Strategies and Resources

Gravity and Motion of Objects in the Solar System

May 2023

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SIPS Grade 8 Unit 2 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 2 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.

 Multiple Means of Engagement “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"> Allow students to choose the way in which they model gravitational forces (e.g., drawing, cutting and pasting, animation, using objects, etc.). Have students collect information on issues that are important and relevant to them and their culture.



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Strategies	Examples
	<ul style="list-style-type: none">• Explore students’ experiences and interests in science through short inventories and interviews.
Allow ownership of parts of instructional tasks.	<ul style="list-style-type: none">• Have students set their own goals (academic or behavioral) that work towards the goals and objectives of the unit.• Have students identify and choose sources to locate information on gravitational forces, the Milky Way galaxy, and objects that orbit the sun.• Encourage students to provide suggestions for projects based on what they are learning.• Provide several options for students to practice the science vocabulary terms (e.g., use terms in a story, create a song about each, pair with illustrations that describe the term) and how to present what they did (e.g., perform live, record and share, with photos, written format, orally share).
Make the work authentic and relevant.	<ul style="list-style-type: none">• Explain the goal in clear and simple terms and connect it to a real-world application (e.g., the position of the sun and resulting seasonal effects in the area where students live as well as those of students who have lived elsewhere).• Present the goal and objectives in multiple ways (e.g., write on the whiteboard, read aloud, included on handouts).• Highlight a diverse group of scientists and their roles (e.g., incorporate in presentation, show videos, wall posters, etc.).• Resources: Ten Black Scientists that Science Teachers Should Know About, Disabilities Don’t Stop These Experts in Science and Tech, 20 Immigrants & Refugee Scientists Who Made America Greater (Part 1)
Provide safety and reduce distractions.	<ul style="list-style-type: none">• Provide a variety of ways in which students can ask a question or seek help (e.g., individually, small group, asking a peer, etc.).



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Strategies	Examples
	<ul style="list-style-type: none">• 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 directness or do not have the language level to be polite. Some respond respectfully using facial movements. Eye contact varies by culture.).• Allow students to wear noise-canceling headphones during individual work.• Resources: Cultural Differences in the Classroom, 10 Sites for Creating Backchannel
Present clear and important goals and objectives.	<ul style="list-style-type: none">• Have students write goals into simple I can statements (e.g., I can construct a model of a two-body system showing the attractive forces and their impact on the motion of the two objects relative to one another.).• Explain scientific terms along with the goals so that students understand what they are working towards.
Provide a different level of support and scaffolds.	<ul style="list-style-type: none">• Incorporate accommodations and supports 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.• Provide graphics along with the direction steps.
Encourage collaboration with partners and in groups.	<ul style="list-style-type: none">• Be intentional about how groups are formed so that they include a variety of students (e.g., race, national origin, socioeconomic status, disability, etc.).• Be aware that some cultures value working as a community while others value individualism, therefore providing choices when feasible.• Ensure everyone has the means to contribute. For some this might be to assign a




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Strategies	Examples
	<p>role that matches their strengths, for some, it might be to provide needed vocabulary on their AAC system, and for some, it might be to reduce the size of the group and allow options for seating (e.g., exercise ball).</p> <ul style="list-style-type: none">• Have a collaborative group work on a fun activity with the teacher modeling how to provide support to a student with a disability.• Resources: Successfully Using Communication Practices in the Inclusive Class
Support self-reflection and evaluation.	<ul style="list-style-type: none">• Provide a variety of ways to reflect and evaluate.• Have students use a self-reflection chart on which individual students can monitor his/her progress. Include ancillary behaviors such as asking questions, contributing to the group, and asking for help. Remind students to use the chart routinely.• Provide visual tools to foster independence, prepare students for the next activity, break tasks into smaller steps, and aid transition.• Resources: Visual tools to Support Behavior, Self-regulation & Independence; The Autism Helper: Self-Monitoring
Encourage communication about frustrations and guide self-management of the frustrations.	<ul style="list-style-type: none">• When students show signs of frustration such as withdrawing or exhibiting distracting behaviors, encourage them to communicate what is frustrating them and what they think might help. For some students, this might require a simple chart that includes symbols to indicate how they feel and options for dealing with the frustrations (e.g., I need a break. I need help. I need to work alone. etc.).

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 a flexible way to present information.	<ul style="list-style-type: none"> • Present example models of the path of a solar eclipse across the Earth’s surface using multimedia so it can easily be enlarged; increase contrast between text and the background; describe using alternative text, etc. • Create example models, graphs, and charts using tactile graphics. • Display a chart showing the Claim, Evidence, and Reasoning (CER) model. • Resources: Design Principles for Tactile Graphics, Tactile Graphics ; One Small Step: A Multi-sensory Tour of Our Solar System; This Is a Film About the James Webb Space Telescope
Provide information in a variety of ways.	<ul style="list-style-type: none"> • Have students collect information (e.g., gravitational forces, the relationship of the amount of solar energy in terms of the Earth’s position within its orbit around the sun, that our solar system includes multiple types of objects that orbit the sun, etc.) in multiple ways such as grade-level science magazine, lower grade-level science magazine, book, internet, wall chart, video, etc. • Provide models in various forms (e.g., 2-D, 3-D, with and without color, etc.). • Resources: Sun-Earth-Moon-System Model; Read About the Gravitational Forces Between Objects; Eclipse
Describe the meaning of vocabulary and symbols.	<ul style="list-style-type: none"> • Create a word wall or a glossary for science and academic terms such as force, orbit, eclipse, gravity, satellite, elliptical orbit, etc. • Describe meaning vs. a formal definition. For example, “To orbit is to follow a circular or elliptical path around a central body. Usually, a



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Strategies	Examples
	<p>planet, moon, or satellite is described as orbiting.” Vocabulary.com.</p> <ul style="list-style-type: none">• Pair vocabulary words with pictures.• Resources: Vocabulary.com; TextProject Word Pictures; The Science Penguin, 10 Ideas To Teach Science Vocabulary
Explain the structure of graphs, charts, diagrams, models, etc.	<ul style="list-style-type: none">• Before having students construct a model (e.g., showing how the masses of interacting objects affect the gravitational forces between those objects), describe and make an anchor chart describing key components of a model.• Demonstrate how to graph.• Resources: We Are Teachers – 20 Graphing Activities for Kids That Really Raise the Bar (focus on the different mediums to create graphs); Beakers and Ink – 5 Easy Tips to Make a Graph in Science
Provide support for decoding of written text and symbols.	<ul style="list-style-type: none">• Have peers read to each other, read aloud to the class, provide an audio version, provide a summarized version, etc.• Digitize text and have students use a screen reader.
Connect dominant language (e.g., English) with first languages (e.g., Spanish).	<ul style="list-style-type: none">• Have a student respond using the first language and then translate it into English.• Check understanding of content and not on sentence structure and grammar.• Resources: Supporting ELL Success with STEAM and Hands-On Learning (Part 2), Getting to Know your ELLs: Six Steps for Success
Supply or activate background knowledge.	<ul style="list-style-type: none">• Show a short video on the solar system to support students to make links between what they already know about matter to the new goals.• To allow students to share and make connections with their personal and cultural experiences with the night sky, solar eclipses, seasonal changes, etc.• Resources: What is the Solar System?




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
Emphasize key information.	<ul style="list-style-type: none">• Use graphic organizers, outlines, underline or highlight key information in print materials, etc.• Create a QR code and place it on a science poster, worksheet, study card, etc. that will link to a specific online resource.• Resources: Best Free QR Code Site for Teachers, Corgi – Digital Graphic Organizers for Building Higher-order Thinking Skills
Provide models and scaffolds to aid in comprehension.	<ul style="list-style-type: none">• Provide a variety of explicit prompts for each step or chunk of activity (e.g., verbal, visual steps, checklist, checklist paired with graphics, tactile steps.).• Resources: Mini Schedules, Using Mini Schedules and Task Organizers to Help Students with ASD in Classroom Settings
Support transfer and generalization of skills and knowledge.	<ul style="list-style-type: none">• Include opportunities to review and practice prior knowledge and skills along with new knowledge and skills.• Use a variety of materials and activities to investigate gravitational forces on the human scale and the planetary scale.• Make explicit connections between concepts of mass, orbital radii, and orbital periods of objects in various solar systems (e.g., concept map).• Resource: Concept Maps

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"> • Ensure that all students can physically access and interact with all activities and materials (e.g., a table high enough to allow wheelchair access, an adaptation that allows access to print material, space to move to all areas in a classroom or lab, book holder, adapted keyboard, single switch, etc.). • Ensure access is available for students who have a hearing impairment or visual impairment, who are blind, deaf, or deaf/blind (e.g., include an audio description for video content, closed captions for video content, alternative text for graphics, preferential seating, an American Sign Language (ASL) interpreter, screen reader, enlarged text, etc.). • Place activities (e.g., moving globes next to the correct box based on the orientation of the sun’s rays) on an interactive whiteboard, bulletin board, or wall chart to allow students to more easily see, manipulate materials, write, and access using assistive technology. • 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.). • Resources: Best Practices for Creating Accessible Video for Blind and Low-Vision Viewers, Diagram Center – General Guidelines (alternative text).
Vary the ways for students to respond to questions or a task.	<ul style="list-style-type: none"> • Allow students to use a variety of ways to create a model (e.g., drawing, pictures, objects).



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">• Have students enter data online to create graphs using standard or adapted keyboards.• Provide sentence starters.• Provide a variety of ways in which students can “write” to respond to questions (e.g., a traditional form of writing, with sentence starters, using pictures, etc.).• Resources: Tactile Science Lesson: Using Play-Doh; Better Living Through Technology – Keyboards for People with Disabilities, Pathways to Reading to Learning for Students with Cognitive Challenges.
Use technology or assistive technology (AT) to broaden access to instructional materials.	<ul style="list-style-type: none">• Make use of technology such as spellcheckers, word prediction software, and text-to-speech software.• Use computer simulation/animation to demonstrate gravity, binary stars, and orbital patterns.• Provide different graphing options (e.g., enlarged, raised line, objects, digital).• Provide a graphic organizer (C-E-R) in digital format so it can be accessed using assistive technology (e.g., screen reader, speech-to-text, adaptive input devices, magnified, adjusted contrast, etc.).• Provide adaptive science tools. (e.g., talking scale, large key calculator, talking thermometer, adapted grips, etc.)• Provide a screen reader and web-based reader.• Ensure that key terms to search the internet. (e.g., science terminology) are included on a student’s AAC device and that the student has a way to independently or with minimal support access the computer (e.g., adapted mouse, adapted keyboard, enlarge screen, text to speech, etc.).



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Strategies	Examples
	<ul style="list-style-type: none">• Provide low-tech tools such as pencil grips, page-turners, reading guides/strips, slant boards, tactile rulers, manipulatives, etc.• Resources: Assistive Technology Devices: How Disabled People Use the Web; Computer Access and Adaptations; What are Accessibility Features?; Gravity and Orbits; Creating Large Print and Tactile Graphs; DIY Reading Strips, 5 Benefits of a Slant Board for Writing, Clusive™: An Accessible, Digital Reading Platform, 8 Examples of Assistive Technology and Adaptive Tools; Length Measurement – Using Tactile Markers.
Provide varied levels of support and practice.	<ul style="list-style-type: none">• Provide captions for videos.• Set bookmarks to specific pages (e.g., information on the Milky Way galaxy) for students to find information.• Resource: 7 Clever, Teacher-Tested Tech Hacks;
Support planning and strategy skills.	<ul style="list-style-type: none">• Include prompts to check their thinking and strategy for solving a task.• Model think-alouds to solve a problem or think through a task.
Provide supports to help with managing information and resources.	<ul style="list-style-type: none">• Bookmark key online resources.• Create a digital resource document that includes topics paired with graphics.• Link to a specific part of a web page.• Slip a page from a book, magazine, or worksheet into a plastic page protector and circle or highlight the key section.• Resources: How to Link to a Specific Part of a Webpage & Share It, Share pages with a QR Code

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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3. [Promoting Self-Determination Among Students With Disabilities: A Guide for Tennessee Educators \(vumc.org\)](https://vk.vumc.org/assets/files/resources/psiSelfdetermination.pdf)
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