Universal Design for Learning Applied to Science Curriculum

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http://www.montgomeryschoolsmd.org/departments/hiat
UDL is the practice of embedding flexible strategies into the curriculum during the planning process so that ALL students can access a variety of learning solutions.
UDL is built on the premise that there is no one kind of learning

- Learning differs across tasks
- Learning differs across development
- Learning differs across individuals
Learning differs across tasks
Learning differs across individuals.

Figure 25. A Neural Signature for Dyslexia:

UDL strategies for instruction are frontloaded rather than retrofitted.

- More efficient in the long run.
- Benefits more students
- More acceptable to students
Universal design for learning (UDL) is a framework for removing barriers by anticipating the needs of all students.
Universal Design and Education

- In the mid 1990’s, the concept of universal design was applied to education (www.cast.org)

  - UDL is a national initiative at this time in the educational world because the technology is available to make it happen.
Historical Context

• In 1975, PL 94-142 promoted “education for all.”
• This was huge step forward, focusing more attention on the individualized needs of students with disabilities.

• This resulted in an IEP driven curriculum that was parallel to the general education curriculum.
In special education classrooms, students made progress, but grew further behind compared to peers.

Upon graduation, this resulted in students having fewer post secondary opportunities.

IDEA focuses on access, participation AND progress in relation to peers.
We now know that....

• Special education staff can no longer work separately from general education.

• General educators and special educators need to collaborate to design good instruction with a shared understanding of standards and benchmarks.

• No single medium and method will work for all students.

• Differentiated instructional (DI) strategies as well as flexible materials benefit all students (UDL).
Is UDL only for students with IEPs?

No

UDL is a framework to support the range of learners that exist in typical classrooms.

This would include gifted students, disengaged students, ELL students, as well as, students with documented disabilities.
…harnesses the power and flexibility of modern technology.

Technology provides the flexibility needed to adjust to learner differences.
Using a curriculum that is rooted in 3 UDL principles…

<table>
<thead>
<tr>
<th>Teachers provide:</th>
<th>Students have:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Flexible ways of presenting lesson content</td>
<td>1. Options for how they learn</td>
</tr>
<tr>
<td>2. Flexible options for student engagement</td>
<td>2. Choices which will engage student interest</td>
</tr>
<tr>
<td>3. Flexible methods of expression, and assessment</td>
<td>3. Choices for how they demonstrate their learning</td>
</tr>
</tbody>
</table>
#1 Flexible ways of presenting lesson content

Options for how students learn
Traditional Book
(7th Grade)

Reading Preview

Key Concept
• What are the characteristics of animal-like, plantlike, and fungi-like protists?

Key Terms
• protist • protozoan
• pseudopod
• contractile vacuole • cilia
• symbiosis • mutualism
• algae • pigment • spore

Target Reading Skill
• Outlining As you read, make an outline about protists that you can use for review. Use the red section headings for the main topics and the blue headings for the subtopics.

What Lives in a Drop of Pond Water?
1. Use a plastic dropper to place a drop of pond water on a microscope slide.
2. Put the slide under your microscope’s low-power lens. Focus on the objects you see.
3. Find at least three different objects that you think might be organisms. Observe them for a few minutes.
4. Draw the three organisms in your notebook. Below each sketch, describe the movements or behaviors of the organism. Wash your hands thoroughly when you have finished.

Think It Over
• Observing What characteristics did you observe that made you think that each organism was alive?

Protists

I. What is a protist?
   A. Animal-like protists
   A. Protozoans with pseudopods
   B. C.

Look at the objects in Figure 1. What do they look like to you? Jewels? Beads? Stained glass ornaments? You might be surprised to learn that these beautiful, delicate structures are the walls of unicellular organisms called diatoms. Diatoms live in both fresh water and salt water and are an important food source for many marine organisms. They have been called the “jewels of the sea.”
Reading E-text with Kurzweil

A more flexible method of presentation
The euglena in the illustration at the right is a protist that can make its own food when sunlight is present.

Phytoplankton—protists that are an important link in the ocean food chain—also have the ability to use the sun's energy to make food.

In this chapter's Internet Activity, you'll see how the concentration of phytoplankton in Earth's oceans varies depending on season and location. Just click on Internet Activities at the left.

Science News topic pages provide a list of articles related to this chapter.
Using the textbook publisher’s link to an animation of a paramecium
Kingdom of Fungi

- Most are made up of many cells.
- They cannot move from place to place.
- They feed off of other organisms by absorbing nutrients from living or dead organisms (heterotrophs).
- Includes mushrooms, molds, yeast, lichen, and mildew.
Kingdom Plantae

- Most are made up of many cells (multicellular)
- They are autotrophs (they make their own food through photosynthesis)
- Included in this kingdom are mosses, ferns, and flowering plants.

Most multicellular organisms are placed in this kingdom.

In the past, many mosses were placed in this kingdom. However, this kingdom now includes most land plants.
#2 Flexible options for student engagement

Giving students choices
Traditional lab directions vs. lab directions with graphic supports

**Testable Question:** How can physical and chemical changes be distinguished from one another?
(Write your prediction in the space provided on the student resource sheet.)

**Directions - LAB STATION #1: Balloon Magic**
1. Examine the bottle and balloons. Be sure the balloon is securely sealed on the bottle.
2. Place the plastic soda bottle into the warm water bath. Let stand for 2 minutes.
3. Place the plastic soda bottle into the cold water bath for 1 minute. (If the ice has melted, you may need to add more.)
4. Record observations under Data Collection.

*If this is your last station, clean up the materials and wait for directions from the teacher.

**Directions - LAB STATION #2: Crazy Candle**
1. Use the lighter provided to light the candle.
2. Cover the candle with an upside down beaker.
3. Observe for 2-3 minutes.
4. Record observations under Data Collection.

*If this is your last station, clean up the materials and wait for directions from the teacher.

**Directions - LAB STATION #3: Shake It Up**
1. Hold the bottle with your thumb or finger over the top.
2. Gently shake the bottle 5 times.
3. Let the bottle stand while observing the contents.
4. Record observations under Data Collection.

*If this is your last station, clean up the materials and wait for directions from the teacher.

**Directions - LAB STATION #4: Tissue Tint**
1. Fill 1/3 of a 35 mm film container with water.
2. Place a piece of tissue in the container and immediately seal the container.
3. Rest the container on the desk or table-top and step back. Wait 2-3 minutes.
4. Record observations under Data Collection.

*If this is your last station, clean up the materials and wait for directions from the teacher.

**Crazy Candle**

1. Use the lighter provided to light the candle.
2. Cover the candle with an upside down beaker.
3. Observe for 2-3 minutes.
4. Record observations under Data Collection.

*If this is your last station, clean up the materials and wait for directions from the teacher.*
Biodiversity Video Segment with Closed Captions

THE DIVERSITY OF LIFE IS REMARKABLE.
Discovery streaming

Biology: The Science of Life: The Living Cell  (15:13)

Description:
Explore the structure and function of the living cell. All living things, from simple pond dwelling creatures, like these, to complex animals and plants are made from the same building blocks called cells. Cells are defined as the simplest structures that can carry out all of the activities characteristic of life. That is, can reproduce, grow and develop, respond to their surroundings, and so on. Cells are like miniature factories which use raw materials and energy to create their amazing product which is none other than life itself. Large organisms are multicellular and are made from many different cells. The cells of multicellular organisms have become specialized to perform all sorts of tasks such as those carried out by muscles and blood. In contrast, many of the smallest organisms, such as the Protist paramecia, are unicellular and possess just one cell.

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Grades: 6-8  edit

Rating:  ★★★★★
(44 ratings submitted)

Video Segments

This video is composed of 12 segments:

- Cells: The Basic Units of Life (01:49)
- Protoplasm, the Cell Membrane, and the Cell Wall (01:37)
- The Nucleus and Cytoplasm (09:18)
  - The Cytoplasm (01:14)
  - The Nucleus (01:04)

Citations

Citation (MLA)
unitedstreaming. 13 November 2007
<http://streaming.discoveryeducation.com/>

Citation (APA)
#3 Flexible methods of expression, and assessment

Options for how students demonstrate their learning
Give students a choice of tools:

Choices to express new learning:
- Paper and pencil
- MS Word
- Portable word processors (AlphaSmart/NEO)
- PowerPoint
- Windows Movie Maker
Traditional vs. added graphic supports for recording lab results (8th grade)

**Chemical and Physical Changes of Matter**

<table>
<thead>
<tr>
<th>Matter</th>
<th>Changes that can happen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree</td>
<td></td>
</tr>
<tr>
<td>Rock</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td></td>
</tr>
<tr>
<td>Air</td>
<td></td>
</tr>
</tbody>
</table>

**Data Collection**

<table>
<thead>
<tr>
<th>Physical Change</th>
<th>Rationales for your Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab Station #1</td>
<td></td>
</tr>
<tr>
<td>Lab Station #2</td>
<td></td>
</tr>
<tr>
<td>Lab Station #3</td>
<td></td>
</tr>
<tr>
<td>Lab Station #4</td>
<td></td>
</tr>
</tbody>
</table>

**Summary:**
Describe how physical and chemical changes may be distinguished. Be sure to include supporting evidence from the investigation.

**Chemical and Physical Changes of Matter**

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<tr>
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<th>Rationales (reason) for your choice</th>
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<tr>
<td>Tree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rock</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>Air</td>
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**Data Collection:**

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<td></td>
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<tr>
<td>Crazy Candle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shake it Up</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tricky Tablet</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Traditional means of assessment

1. What are the six kingdoms of organisms and what are their distinguishing features?

___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

6th Grade Science Preassessment
MCPS/HIAT/2007
Flexible means of assessment

1. What are the six kingdoms of organisms and what are their distinguishing features?

Typing instead of writing for students who need handwriting and spelling support.

MCPS/HIAT/2007
Organizer and pictures to aid recall

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>Makes own food</th>
<th>Many cells</th>
<th>Complex cells</th>
<th>Where are they found?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plants</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Animals</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Archebacteria</td>
<td>Both</td>
<td>No</td>
<td>No</td>
<td>In extreme environments</td>
</tr>
<tr>
<td>Archebacteria</td>
<td>Both</td>
<td>No</td>
<td>No</td>
<td>everywhere</td>
</tr>
</tbody>
</table>
UDL – Differentiated Instruction – and Assistive Technology – What’s the difference?

• Both DI and UDL are frameworks for instruction, but UDL is a framework that guides instructional materials as well as methods.

• UDL focuses on the flexible capacity of new media, and therefore, the use of digitized instructional materials.

• AT is concerned with individuals – UDL is concerned with all students.
How do you incorporate the principles of UDL into lesson planning?
## UDL Planning Form

Unit of Study in the MCPS Curriculum:

Grade level:

Standards:

Indicators:

**Essential Understandings:**

<table>
<thead>
<tr>
<th>Current MCPS Instructional Delivery and assignments as described in Instructional guides</th>
<th>Challenges for some students</th>
<th>UDL solutions (Methods and materials that offer multiple means of: Engagement, Presentation, Expression, Including Assessment)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Printed reading materials</td>
<td>Student cannot see small text. Student cannot decode at grade level. Student has difficulty comprehending vocabulary.</td>
<td></td>
</tr>
<tr>
<td>Lecture/whole class presentation</td>
<td>Student is distractible and misses information. Student has difficulty processing verbal information. Student has difficulty comprehending material content.</td>
<td></td>
</tr>
<tr>
<td>Writing assignment</td>
<td>Student cannot handwrite legibly. Student cannot outline and organize ideas. Student has difficulty with written language. Student struggles with spelling.</td>
<td></td>
</tr>
<tr>
<td>Current MCPS Instructional Delivery and assignments as described in Instructional guides</td>
<td>Challenges for some students</td>
<td>UDL solutions Methods and materials that offer multiple means of: Engagement</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Pre and post assessment quizzes</td>
<td>Student cannot read questions. Student cannot retrieve key content vocabulary with ease. Student needs test taking preparation.</td>
<td></td>
</tr>
<tr>
<td>Organizational skills/work habits</td>
<td>Student had difficulty understanding or sequencing tasks. Student has difficulty staying on task. Student has difficulty completing homework. Student is reluctant to ask for help.</td>
<td></td>
</tr>
<tr>
<td>Research</td>
<td>Student has difficulty with organization. Student may not be able to abstract important content.</td>
<td></td>
</tr>
<tr>
<td>Oral report</td>
<td>Student has speech difficulties. Student has difficulty presenting orally in front of peers.</td>
<td></td>
</tr>
<tr>
<td>Drawing</td>
<td>Student cannot draw to represent objects or math/science concepts</td>
<td></td>
</tr>
<tr>
<td>Group project</td>
<td>Student has difficulty interacting with peers.</td>
<td></td>
</tr>
</tbody>
</table>
The current vision.....

- School districts across the country are working toward UDL.
- MCPS, like other districts, is making a commitment to move toward UDL.
Stepping forward….

Opportunities

• Increase awareness of UDL principles.
• Make a commitment as a school to make curriculum materials more flexible.
• School collaboration to shift to a more universally designed curriculum.
• Examine computer availability and lab scheduling at your school.
Stepping forward....

- Self-education to learn to create flexible, digital materials.
- In-school and out-of-school training on the tools available at your school.
- Use the Web to locate curriculum specific digital materials.
- Build an a personal and school inventory of digital materials.
What resources are available to you to move toward UDL?

- E-TIPS: Educators using Technology to Improve the Performance of Students
- In-School Project-Based Training
- Textbook publisher resources on line