



Universal Design for Learning and Math

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CAST.org: UDL

Universal Design for Learning

Recognition Networks

The "what" of learning



How we gather facts and categorize what we see, hear, and read. Identifying letters, words, or an author's style are recognition tasks.

Strategic Networks

The "how" of learning



Planning and performing tasks. How we organize and express our ideas. Writing an essay or solving a math problem are strategic tasks.

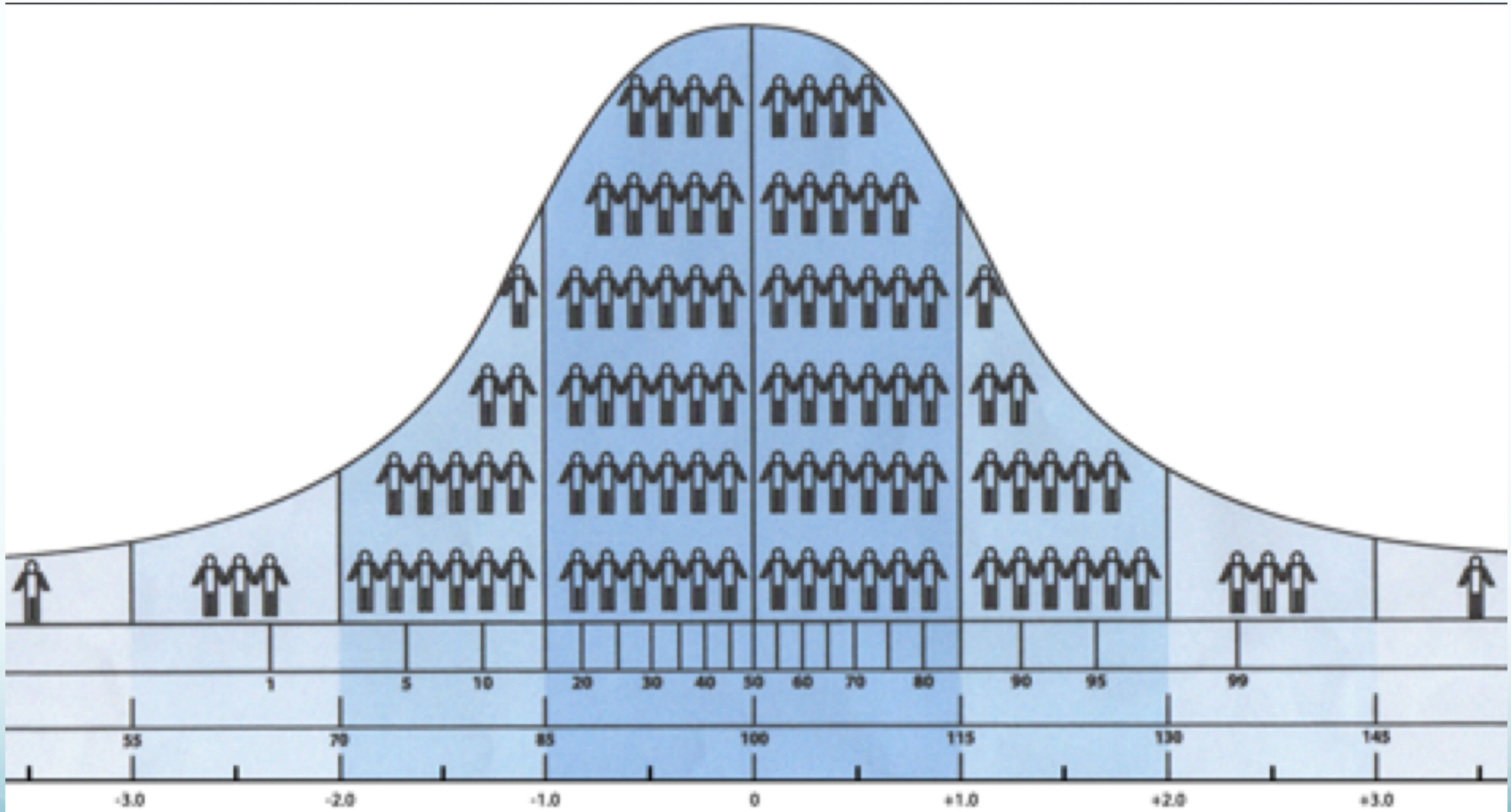
Affective Networks

The "why" of learning

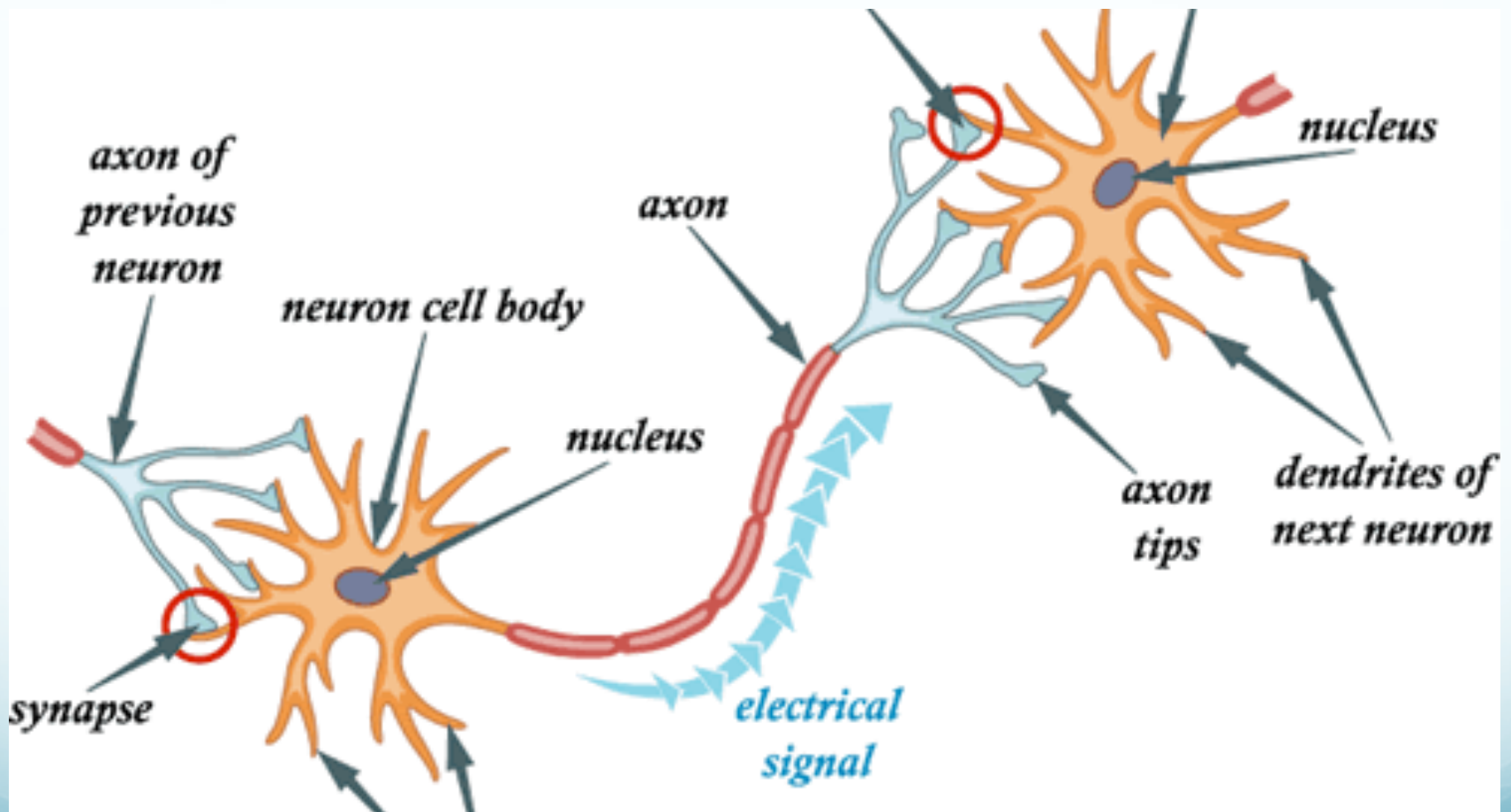


How learners get engaged and stay motivated. How they are challenged, excited, or interested. These are affective dimensions.

Neurodiversity



The Learning Brain



UDL Guidelines

Three primary principles guide UDL—and provide structure for the Guidelines:

To learn more, click on one of the Guidelines below.

I. Provide Multiple Means of Representation

Perception

Language, expressions, and symbols

Comprehension

II. Provide Multiple Means of Action and Expression

Physical action

Expression and communication

Executive function

III. Provide Multiple Means of Engagement

Recruiting interest

Sustaining effort and persistence

Self-regulation

<http://www.udlcenter.org/aboutudl/udlguidelines>

Perception

- Offer ways of customizing the display of information
 - Font size/type and contrast
 - Timing and rate of audio/video
- Offer alternatives for audio information
 - Speech to text software
 - Transcripts of videos/audio articles, bulleted lists
 - Touch equivalents (manipulatives)
 - Visual/emotional description
- Offer alternatives for visual information
 - Descriptions of visual information
 - Audio clips or cues
 - Touch equivalents



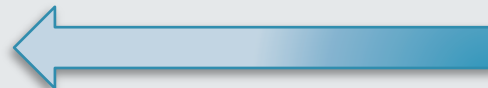
✓ Checkpoint 1.1 Offer ways of customizing the display of information

In print materials, the display of information is fixed and permanent. In properly prepared digital materials, the display of the same information is very malleable and customizable. For example, a call-out box of background information may be displayed in a different location, or enlarged, or emphasized by the use of color, or deleted entirely. Such malleability provides options for increasing the perceptual clarity and salience of information for a wide range of learners and adjustments for preferences of others. While these customizations are difficult with print materials. They are commonly available automatically in digital materials, though it cannot be assumed that because it is digital it is accessible as many digital materials are equally inaccessible. Educators and learners should work together to attain the best match of features to learning needs.

Tell Me More!

- Display information in a flexible format so that the following perceptual features can be varied:
 - The size of text, images, graphs, tables, or other visual content
 - The contrast between background and text or image
 - The color used for information or emphasis
 - The volume or rate of speech or sound
 - The speed or timing of video, animation, sound, simulations, etc.
 - The layout of visual or other elements
 - The font used for print materials

 [Checkpoint 1.1: View examples and resources](#)



Get Evidence!

 [Checkpoint 1.1: View the latest evidence & scholarly research](#)

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➤ Checkpoint 1.2 Offer alternatives for auditory information

Language, Expressions, and Symbols

- Clarify vocabulary and symbols
- Clarify syntax and structure
- Support decoding text, mathematical notation, and symbols
 - Text to speech, MathML
- Promote understanding across languages
 - Translated directions, links to ELL glossaries
- Illustrate through multiple media
 - Lecture, hands-on, virtual, video, all interrelated

Comprehension

- Activate or supply background knowledge
 - What are the prerequisite skills? Real life examples?
- Highlight patterns, critical features, big ideas, and relationships
 - Graphic organizers or outlines
 - Examples and nonexamples
- Guide information processing, visualization, and manipulation
 - Interactive models, graduated scaffolds, chunked information that is released sequentially
- Maximize transfer and generalization

Construct Relevance:

What is the intent of the lesson?

Thinking critically about lesson goals

4)

$$\begin{array}{r} 277 \text{ R11} \\ 29 \overline{) 7842} \\ \underline{- 50} \downarrow \\ 224 \\ \underline{- 203} \\ 212 \\ \underline{- 203} \\ 11 \end{array}$$

Modifying lesson goals

4)

$$\begin{array}{r} \boxed{270} \\ 29 \overline{) 7842} \\ \underline{- 58} \downarrow \\ 204 \downarrow \\ \underline{- 203} \downarrow \\ 12 \end{array}$$

D
M
S
B
R

Supports with the lesson goal in mind

A handwritten long division problem on grid paper. The problem is labeled '4)' on the left. The divisor is 29, and the dividend is 7842. The quotient 27 is written above the dividend. A horizontal line is drawn under the dividend. The division shows that 29 goes into 78 two times, leaving a remainder of 20, and 29 goes into 204 seven times, leaving a remainder of 2.

$$\begin{array}{r} 27 \\ 29 \overline{) 7842} \end{array}$$

29 goes into 78 2 times
That leaves 20 because
30 goes in with 18 left over.
29 goes into 204 7 times.
So that's 27.

270 R 12

$$\begin{array}{r}
 29 \overline{) 7842} \\
 \underline{- 2900} \quad 100 \\
 4942 \\
 \underline{- 2900} \quad 100 \\
 12042 \\
 \underline{- 1450} \quad 50 \\
 1092 \\
 \underline{- 580} \quad 20 \\
 12210
 \end{array}$$

4
 $\begin{array}{r} 22 \\ \times 52 \\ \hline 140 \end{array}$
 29
 $\begin{array}{r} 22 \\ \times 52 \\ \hline 58 \end{array}$

**Lesson goal
achieved?**

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Self-regulation

<http://www.udlcenter.org/aboutudl/udlguidelines>

Physical Action

- **Vary the methods for response and navigation**
 - What is the range and speed of motor action required? Think about dysgraphia.
 - Can you provide multiple ways for students to physically interact with the materials?
- Optimize access to tools and assistive technologies
 - NIMAS: database for audiobooks for the visually impaired or those with diagnosed print-based disabilities
 - Does the computer itself represent a barrier?

Expression and Communication

- Use multiple media for communication
 - Again, construct relevance. Does it matter how the student expresses what s/he has learned? Sometimes yes, sometimes no.
- Use multiple tools for construction and composition
 - Help students find tools that develop coping skills and overcome disability
- **Build fluencies with graduated levels of support for practice and performance**
 - Scaffolding to greater independence
 - Differentiated models, mentors, and feedback

<http://www.udlcenter.org/aboutudl/udlguidelines/principle2>

Executive Function

- **Guide appropriate goal-setting**
 - Increase student buy-in by helping them set personal learning goals and see the lesson goals in relation to those
- **Support planning and strategy development**
 - Embedded prompts to stop and think, turn and talk, model and explain their thinking
- **Facilitate managing information and resources**
 - Note-taking templates, graphic organizers, scaffolded worksheets
- Enhance capacity for monitoring progress
 - Basically, we want them to objectively see change over time

<http://www.udlcenter.org/aboutudl/udlguidelines/principle2>

Websites for Principle 2

- Overview Assistive Technology Tools– <http://techmatrix.org/>
- My Create, to create animations - <http://mycreateapp.com/>
- Edcanvas visual presentations - <http://www.edcanvas.com/lessons>
- Prezi visual presentations (not in powerpoint) - <http://prezi.com/>
- Bubbl.us, mind mapping - <https://bubbl.us/>
- Inspiration, mind mapping <http://www.inspiration.com/>
- Research Project Calculator - <https://rpc.elm4you.org/>
- Diigo, social bookmarking - <https://www.diigo.com/>
- Capzles, timeline making - <http://www.capzles.com/>
- Joe's Goals, goal tracking website - <http://www.joesgoals.com/>
- Echo Pen, audio notetaking pen - <http://www.livescribe.com/>

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Recruiting interest

- Optimize individual choice and autonomy
 - Giving students control over even a very small aspect of the assignment increases engagement
- Optimize relevance, value, and authenticity
 - Real world problems, as interdisciplinary as possible
- Minimize threats and distractions
 - Vary the level of risk, social demand, and sensory stimulation
 - *Math anxiety is a significant threat for many*

Sustaining Effort and Persistence

- **Heighten salience of goals and objectives**
 - Keep reminders around of the end goal of their in-class work. It's motivating and keeps them on-task.
- **Vary demands and resources to optimize challenge**
 - Kids don't work if it's too easy or too hard, so have different degrees of freedom within a class. Same assignment, different rubrics based on neurodiversity.
 - For assignments where having the same rubric is construct relevant, vary the supports and scaffolds.

Sustaining Effort and Persistence

- Foster collaboration and communication
 - No more Lord of the Flies group work! Have clear roles and responsibilities in group work, and offer the opportunity for breaks and individual work. Help students communicate when those breaks are needed.
- Increase mastery-oriented feedback
 - Focus on process!! Praise effort.
 - Carol Dweck's work on Growth Mindset vs. Entity Mindset

Self-regulation

- Promote expectations and beliefs that optimize motivation
 - **Personalized goals for prolearning behaviors**
 - NOT academic goals!!!! Self-regulatory goals.
- Facilitate personal coping skills and strategies
 - Scaffolding and feedback for managing frustration, seeking adult assistance, or coping individually
- Develop self-assessment and reflection
 - Self-assessment of prolearning behaviors: time spent on task, number of aggressive responses, etc. Use charts and rubrics for objective reference.



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