

# Universal Design for Learning (with OER) Applied to Conceptual MathFoundations for Adult Learners

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I tutor math, and design instructional materials especially for \*making sense\* of concepts instead of teaching it as a set of rules

## What is Universal Design for Learning (UDL)

Universal Design for Learning is a set of guidelines for designing inclusive accessible learning experiences from the [CAST](#) community, who are dedicated to breaking down barriers to learning. "UDL 3.0" aims to address biases and systems of exclusion, beyond the more familiar physical or technological barriers.

These are extremely applicable to the challenges presented by adults who need to develop mathematical skills at various levels.

## First Category: Engagement

- Provide multiple means of Engagement**
  - Offer choices
  - Offer options for interest
  - Offer options for effort and persistence
  - Offer options for self-regulation

Expert learners who are... Purposeful & Motivated

- ↳ Moved from last to first on the list! Good!
- ↳ Helps us perceive systematic barriers and inequities and "I can't do math" issues.
- ↳ We need to engage at first, and design the experience to teach and inspire persistence and self-regulation.
- ↳ Get surveys and stories first. Many learners think they are the only ones who are struggling as much as they are. "You can't make change either???"

## Second Category: Provide Multiple Means of Representation

- Provide multiple means of Representation**
  - Offer ways of customizing the display of information
  - Offer alternatives for auditory information
  - Offer alternatives for visual information
- Provide options for Perception**
  - Offer ways of customizing the display of information
  - Offer alternatives for auditory information
  - Offer alternatives for visual information
- Provide options for Language & Symbols**
  - Clarify vocabulary and symbols
  - Clarify syntax and structure
  - Support decoding of text, mathematical notation, and symbols
  - Promote understanding across languages
  - Illustrate through multiple media
- Provide options for Comprehension**
  - Activate or supply background knowledge
  - Highlight patterns, critical features, big ideas, and relationships
  - Guide information processing and visualization
  - Maximize transfer and generalization

Resourceful & Knowledgeable

- ↳ This does NOT mean that we need students to be able to explain the same concept in three different ways.
- ↳ I need to have different ways to represent the concept for different learners.
- ↳ Students can learn what kinds of representations work for them.
- ↳ Challenge: they need to hold up mathematically so students can apply them to more abstract or complex applications.
- ↳ Challenge: finding representations that work well across many concepts.

## Example: Subtraction lesson from "Adult Literacy Fundamentals" source

- ↳ This is from Tagami, W., & Girard, L. (2021). Adult literacy fundamentals mathematics: Book 1 (2nd ed). BCCampus. <https://opentextbc.ca/alfm1/> \*
- ↳ It has one whole image showing icons representing "taking away."
- ↳ After that, it is all symbols, without conceptual context.

## Visual/Conceptual presentation

- ↳ Starts with "taking away" the most familiar context
- ↳ Builds broader concept of relationships to parts and wholes (ongoing throughout lessons)
- ↳ Includes – with images – "how much further" and the difference between two amounts.
- ↳ Images made with [Gnu Image Manipulation Program](#)
- ↳ (in lessons, text is text, not image, for improved accessibility.)

## Conceptual Frontloading

Zero Power:  $1^0 = 1, 2^0 = 1, 3^0 = 1, 4^0 = 1$

First Power:  $0^1 = 0, 1^1 = 1, 2^1 = 2, 3^1 = 3, 4^1 = 4$

Perfect Squares:  $0^2 = 0, 1^2 = 1, 2^2 = 4, 3^2 = 9, 4^2 = 16$

Perfect Cubes:  $0^3 = 0, 1^3 = 1, 2^3 = 8, 3^3 = 27, 4^3 = 64$

Very helpful for understanding the need for common denominators.

Think "scaffolding" but focused on concepts, that extend beyond a particular kind of problem.  
[Link to videos and powerpoints](#)

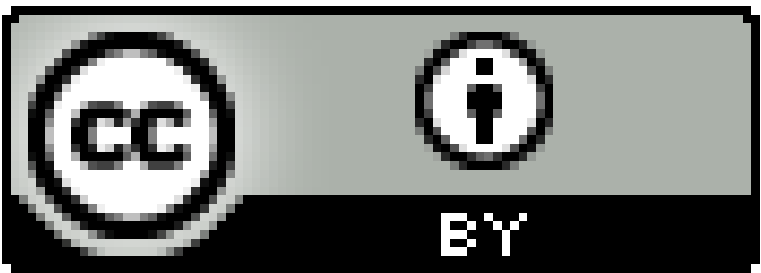
## Integers, equality and interactivity

- ↳ Number lines are good to use across many concepts; working with horizontal and vertical is helpful.
- ↳ Teaching visual-motor routines including \*why they work\* (as opposed to "cancel that!" or "move it to the other side of the equation!") can build competence and confidence. Teaching equations as a balance and having students draw a line down from the equals sign to separate the 'sides' works well.

## Third Category: Provide Multiple Means of Action and Expression, aka ASSESSMENT

MOODLE has incredible potential for experiences my learning management system can't do: questions like this with random numbers, but two possible right answers ( $4 + 9$  or  $9 + 4$ ) and Drag and Drop! (Number bars are also a great visual/conceptual tool.)  
Resourceroom.net/class is where I am trying things out. There is so much potential!

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More resources at <https://resourceroom.net/OERMath/> and <https://resourceroom.net/devmath/OER2025.html>



\*Adult Literacy Fundamentals Mathematics: Book 1 – 2nd Edition by Wendy Tagami and Liz Girard is used under a CC BY 4.0 Licence.