When educators hear the term universal design for learning (UDL), most associate it with technology (cf. Zascavage & Winterman, 2009). However, UDL is not solely about the use of technology in education (King-Sears, 2001; Orkwis & McLane, 1998; Rose & Meyer, 2000). UDL is also about the pedagogy, or instructional practices, used for students with and without disabilities.

The concept of universal design, which originated in the field of architecture in the 1970s by Ron Mace (Center for Universal Design, 1997), continues to have a major influence, particularly reflected in building structures that are now required to incorporate features (e.g., ramps, doorway widths) that enable more people with different needs to access buildings without the need to retrofit structural details (Americans with Disabilities Act of 1990, 1991). The main feature of universally designed buildings and products (whether a business or a home) is that they allow people with unique needs to independently and immediately use them "as is." Some of these features are structural (door handles instead of door knobs); others are technological (such as closed captions on television sets).

Within universal design, seven guiding principles drive the design of products and environments so that they are usable by more people, to the greatest extent possible, without the need for adaptation or specialized design (Connell et al., 1997). When educators employ these principles in the design and delivery of instruction, accommodations noted on individualized education programs (IEPs) for students with learning disabilities (LD) may more naturally occur in general education classrooms.

As applied to the educational needs of students with LD, these principles are played out in both technological and pedagogical ways. The seven guiding principles originally identified for universal design are equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, and size and space for approach and use (Connell et al., 1997). The principles are sometimes overlapping in function, as noted in the following examples.

One principle, flexibility in use, is evident when teachers design instruction that accommodates a wide range of students' preferences and abilities. For example, when the instructional goal is for students to measure the perimeter of quadrilaterals, teachers can use concrete and virtual manipulative demonstrations to show the different types of quadrilaterals with corresponding formulas. The concrete and virtual manipulative demonstrations are flexible because they provide students choices in learning, and these choices also accommodate students' needs when learning the content. However, it is not simply the use of concrete or virtual manipulatives that conveys information to students with and without LD. How teachers verbally explain the math content, concepts, and rules,
that is, the pedagogy that is used, can either clarify or confuse learners. For this example, the pairing of the virtual manipulative technology with the way teachers instruct has the potential to increase the number of learners, regardless of ability, who can more quickly learn how to measure the perimeter of quadrilaterals.

Equitable use of instructional materials can be achieved via technology, such as digital texts for students with LD. However, when the instructional material is a textbook that is not well designed in terms of how its content is organized, depicted, and sequenced, pedagogical features that increase the content's accessibility for many learners become the focus. For example, researchers who have analyzed textbooks found the content difficult to comprehend, laden with minimally related facts and information (cf. Jitendra, Deatline-Buchman, & Szesniak, 2005; Jitendra et al., 2001; van Garderen, 2006). Taking a UDL approach to textbook usage, these weakly designed features are redesigned before instruction is delivered, so that key facts are targeted and relationships among them are determined. Students with LD who have organizational issues and difficulty discerning related from unrelated information receive instruction designed to minimize such learning obstacles and maximize the probability of learning when more cohesive instruction is designed and delivered.

Perceptible information as a UDL principle refers to the use of varied ways to present and practice curriculum content, including the use of illustrations, tactile experiences, visible contrasts of essential content (i.e., "big ideas") from supporting details, and precise and clear language (such as instructions and explanations). Technology, such as virtual manipulative illustrations for mathematics instruction (Suh & Moyer, 2008) and software combining visual with written content, offers powerful ways to build accommodations needed by students with LD into the instruction received by all. The pedagogical UDL features can also be evident in how clearly verbal explanations and directions are provided, which is particularly critical for students with language learning disabilities. It is how the technology is used, in conjunction with the pedagogy of clear verbal explanations, that results in universally designed instruction that is responsive to the needs of students with LD.

Tolerance for error is probably best illustrated in software design that takes students through instructional processes when errors are made. Some software’s tolerance for error is as simple as alerting students to "try again," whereas other software is more comprehensive in providing students a reminder of the formula or steps. Consequently, errors can be learning opportunities. Similarly, educators who use individualized, immediate feedback and mediated scaffolding provide all students with beneficial pedagogical experiences of corrective and guiding feedback (Dihoff, Brosvic, Epstein, & Cook, 2004). For students with LD, these types of feedback can be critical for learning how to solve problems, complete steps, or comprehend accurately and efficiently (Ebbers & Denton, 2008; Schumaker & Deshler, 2009). Absent these pedagogical responses, their learning may not occur as quickly nor be understood as clearly.

The simple and intuitive use principle means that content is presented in ways that are straightforward and considerate of students' background knowledge, language skills, and concentration levels. For example, a listing of science terms organized by categories, perhaps using a graphic organizer, is a more straightforward way for students to discern the differences among the terms (Kim, Vaughn, Wanzek, & Wei, 2004). Engaging students in a variety of activities is a way of accommodating learners’ differences in concentration. Further, pairing new vocabulary terms with vocabulary with which students are familiar, such as pairing use and utilize, can increase students’ vocabulary skills while reducing unnecessary complexity for students who are still learning synonyms.

Low physical effort refers to designing activities and materials that are efficient and comfortable to use, so that students are not needlessly fatigued when learning. This principle can be seemingly simple, such as providing a bookmark to students who routinely lose their place in a book and subsequently miss instruction by having to spend time finding the right page. Similarly, a "high-tech" example would be providing students who have difficulty with fine-motor skills an adapted keyboard. In this example, by reducing the physical energy they have to expend in finding the desired keys, the adapted keyboard allows students to focus more of their cognitive energies on what they are writing.

Perhaps the most frequently violated principle for UDL is the size and space for approach and use. Although technology, such as PowerPoint slides and LCD projectors, may be used to depict vocabulary and graphics, teachers need to ensure that the size of the content is large enough for students seated in different areas of the room to see the content. Whether using technology or markers on chart paper, what teachers (or students) write needs to be large enough for students to see, and be presented in an uncluttered format (space) so that students can focus on the essential content. Finally, the way in which teachers instruct about the vocabulary and graphics should be clear, such as using precise language that concisely communicates the critical content.

Just as universal design in architecture is about making physical structures “smart” from the start so that retrofitting is either eliminated or less necessary (ramps were already there; doorways were already wide), making
instruction “smart” from the start includes pedagogical and technological features as different, but not necessarily separate, choices. For example, as a type of UDL, technology enables students with LD to access content in ways that accommodate their instructional needs, such as listening to chapters as electronic text while their peers are reading the chapters from print texts. However, how well students with and without disabilities comprehend from those different texts’ formats is attributed to a non-technological UDL: effective pedagogy. Consequently, UDL is not defined by or confined to technology. The technology must be combined with effective pedagogy, which can either stand alone as UDL or stand with the technology.

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