

# Maturation of Universal Design for Learning

## From Design Framework to Theory

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Instructional Design

Universal Design for Learning

UDL

Curriculum Design

Instructional Technology

*Universal Design for Learning (UDL) was conceptualized as a curriculum design framework grounded in neuroscience research addressing learner variability in the forefront of instructional design. We argue that over the past 30 years, UDL has “matured” from solely a curriculum design framework to now articulating key components characteristic of instructional-design theories. Framing UDL as an instructional-design theory further supports the mission of the Association for Educational Communications and Technology (AECT) and other instructional technology and education research professional organizations working to advance scholarship and best practices that support equitable and accessible learning and instruction.*

In this paper, we argue that over the past 30 years, Universal Design for Learning (UDL) has “matured” from solely a curriculum design framework to now embodying key components that are characteristic of instructional-design theories (as framed by Reigeluth, 1983, 1999), including methods for facilitating learning and situational variables for desired learning outcomes and instructional conditions. UDL was conceptualized in the 1990s by the Center for Applied Special Technology (CAST) as a curriculum design framework grounded in neuroscience research addressing learner variability at the forefront of instructional design (CAST, 2022). UDL, as first defined in the US Department of Education (2008) Higher Education Opportunity Act, is:

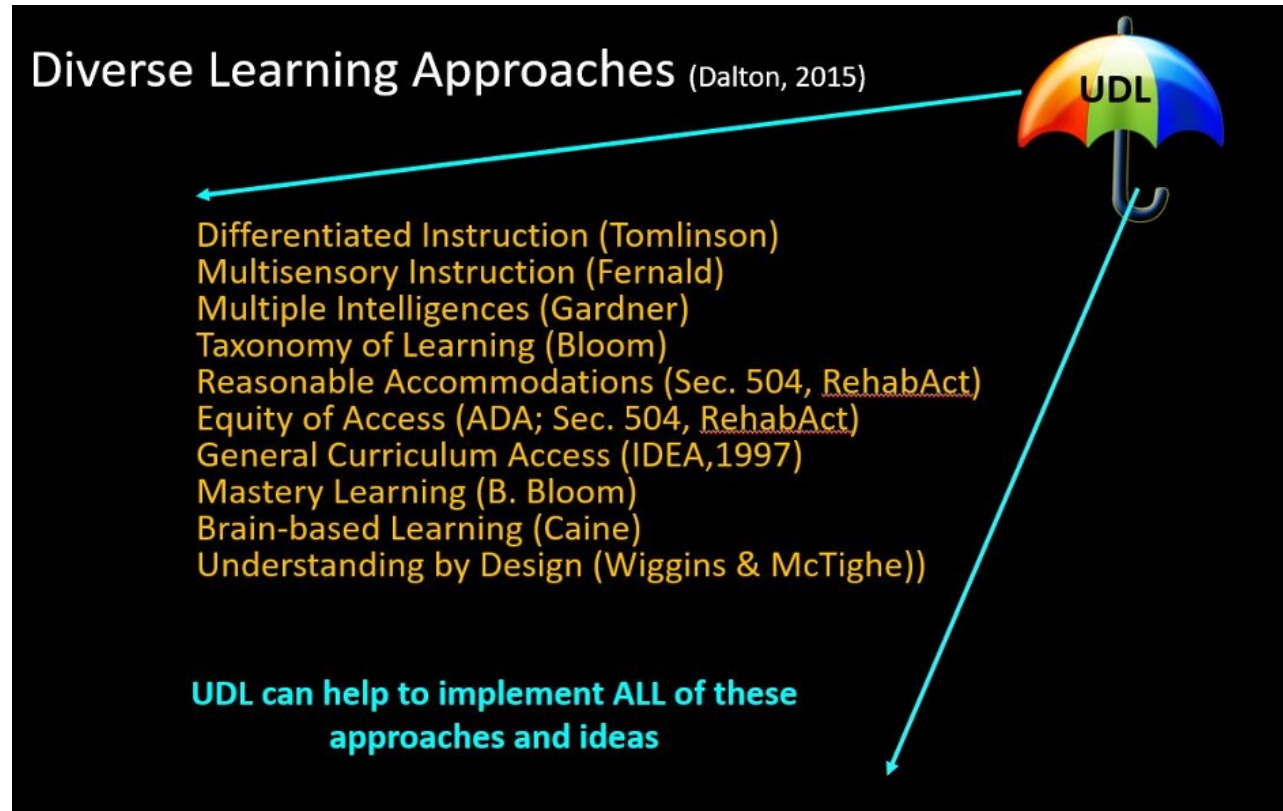
a scientifically valid framework for guiding educational practice that –(A) provides flexibility in the ways information is presented, in the ways students respond or demonstrate knowledge and skills, and in the ways students are engaged; and (B) reduces barriers in instruction, provides appropriate accommodations, supports, and challenges, and maintains high achievement expectations for all students, including students with disabilities and students who are limited English proficient.

UDL positions learner variability as the norm, and thus advises that variations of materials, methods, and assessments should be built into the design of lessons and instruction to benefit ALL students (Chita-Tegmark et al., 2012; Dalton, 2017). UDL’s strategic variation vision is carried through three core principles: (a) multiple means of engagement, (b) multiple means of representation, and (c) multiple means of action and expression (Meyer & Rose, 2005; Rose & Gravel, 2009). The principles are further articulated through nine guidelines (three for each principle) and 31 associated checkpoints. Through this organizational structure, the framework components guide the application of varied instructional methods, materials, and experiences—so that every learner can become an “expert learner.” The guidelines and checkpoints have a vertical order of progression that focuses first on education access, then the building of learning understandings, and ultimately internalization of learning strategies that lead to learner empowerment and self-

regulation. UDL also has a clear relationship with other diverse learning approaches, as depicted in Figure 1 (Dalton, 2015), through which the three core principles can be applied to support implementation of other related learning approaches.

**Figure 1**

*UDL as an Umbrella Concept to Other Diverse Learning Approaches*



With the rise of multiple universal design-related models (including UDL, as well as Universal Design [UD], Universal Design of Instruction [UDI], and Universal Instructional Design [UID]) and their implementation at scale in early stages of development, the need for further research in this area is great (Smith et al., 2019). Could a primary reason for the lack of quantifiable evidence of the value of UD-related methods in post-secondary educational settings be potentially theory-based? Thus, we propose that UDL may legitimately be viewed as an instructional-design theory and present our arguments grounded in literature that connects inclusive education, instructional design, and technology.

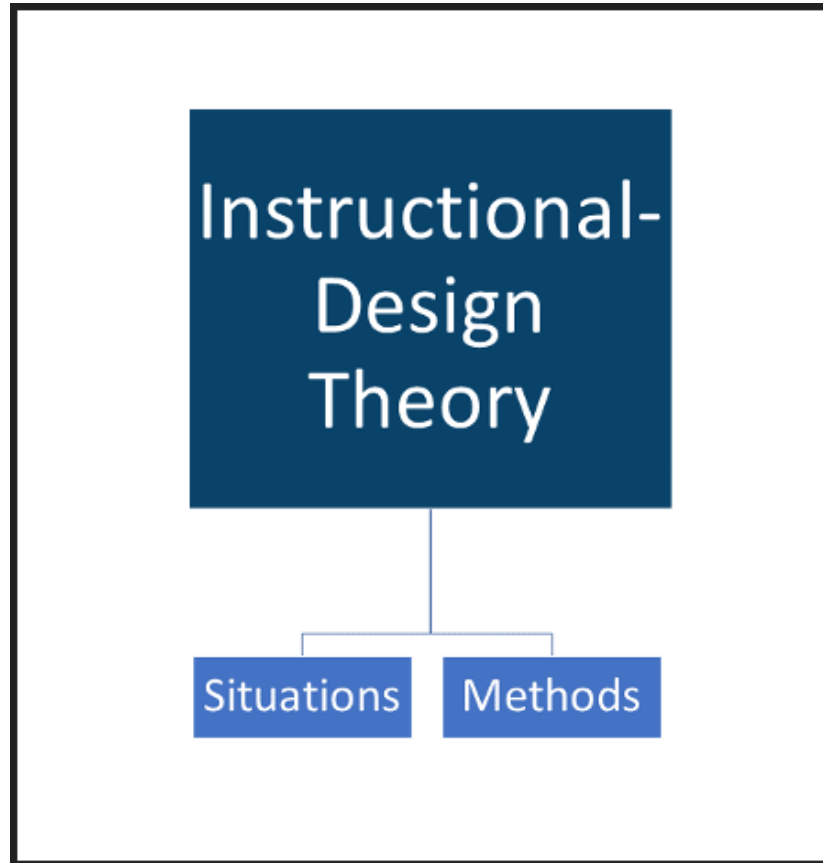
## UDL as ID Theory

A theory is “a plausible or scientifically acceptable general principle or body of principles offered to explain phenomena” (Merriam-Webster, 2022). Theories help researchers to organize information, explain events, and make predictions. Educators and researchers have long relied on theories to provide patterns for interpretation, identify commonalities among research, supply frameworks to attribute importance to variables, and interpret the larger meaning of our findings. Bringing discussion of theory into instructional design, Robert Gagne’s (1965) theory of instruction challenged the field by recognizing the differences in learning across learning domains and how these differences could be connected to design of varied ways in which content is presented and assessed. Three decades later, Reigeluth (1999) characterized instructional-design theory as “a theory that offers explicit guidance on how to better help people learn and develop” and that it must include specific instructional method variables (p. 5). These variables address methods used to support and facilitate learning in ways that are likely to result in the attainment of learning goals (see Figure 2).

Instructional-design theories place emphasis on the means to attain goals focused on learning and development and are differentiated from learning theories in that they can be broken down into component methods to assist educators. In sum, instructional-design theories are characterized as being probabilistic regarding the attainment of goals.

**Figure 2**

*Reigeluth's Components of Instructional-Design Theory*



Inclusive education scholars David Rose and Anne Meyer (2002) laid the foundation for UDL in their seminal book, *Teaching Every Student in the Digital Age: Universal Design for Learning*, calling attention to the potential of leveraging digital technology to design equitable, flexible, and responsive learning environments for all students, regardless of the nature or scope of learner variation. From an instructional design and technology perspective, we propose that UDL, which is widely identified specifically as a curriculum design framework, is actually much more than that. We view UDL as meeting both the general definition of theory and the more specific definition of instructional-design theory, offering clear guidance to help people learn.

Based on our study of Reigeluth's (1999) characteristics of instructional-design theories, we conclude that UDL indeed fulfills these characteristics by addressing method variables such as instructional strategies, instructional platforms, and learning affordances as well as situational variables that comprise desired learning outcomes and instructional conditions. UDL supports the attainment of desired outcomes by serving as a theoretical foundation that guides instructional design in ways that support how people learn and develop. UDL assists educators and their students in attainment of desired outcomes by providing a mechanism that contributes to effective and efficient instruction, as well as an ease to learning. Meyer et al. (2014) articulated some key connections of UDL theory to practice, including—

- Planning for systematic variability from the beginning of instructional design
- Expecting and appreciating learner diversity
- Facilitating optimal levels of challenge
- Building-in scaffolds to develop learning expertise, and
- Providing support for teachers in their practice and continuing development (p. 68)

## UDL in Conceptual Frameworks

UDL is increasingly being used to ground the conceptual frameworks for practice-based research, as evident in recent systematic reviews on UDL applications in various educational settings (Al-Azawei et al., 2016; Faggella-Luby et al., 2017; Ok et al., 2017; Seok et al., 2018). Studies featured within these reviews implicate UDL in terms of instructional methods variables (e.g., Basham et al., 2010; Katz, 2013; King-Sears et al., 2015) and situational environment variables (e.g., Coyne et al., 2012; Kennedy et al., 2014; Marino et al., 2014). In their synthesis of post-secondary education applications of UDL, UD, UDI, and UID, Faggella-Luby et al. (2017) report trends across 44 studies analyzed, including that (a) students and faculty value UD-related principles but may perceive their impact differently, (b) measured impacts of UD on academic outcomes for postsecondary students were very rare, and (c) faculty training and support are both beneficial and needed to implement UD models with fidelity.

Australian educational researcher, Matthew James Capp (2017) conducted a meta-analysis of empirical, peer-reviewed articles published during 2013-2016 and found 924 UDL research articles before narrowing his scope to just those with a pre-/post-test design. Across the remaining 18 studies, he concluded that the implementation of the UDL framework was found to improve the learning process for all students. However, he noted a curious limitation—many other studies may have been theoretically connected to UDL, as sometimes seems evident in an intervention’s design alignment with UDL principles and guidelines, but such theoretical connections were not necessarily clearly articulated by the authors in the resulting publications.

UDL can also be seen as grounding the conceptual frameworks for present instructional designs and interventions. For example, the *Journal of Applied Instructional Design* special issue in 2021 focused on “Designing for All: An Exploration of Universal Design for Online Learning” and featured nine articles that attempted to cross the bridge between theory and practice. In each of the studies, UDL was used as the theoretical framework (e.g., Evmenova, 2021; Higgins & Maxwell, 2021; Kilpatrick et al., 2021) or in connection with other constructs, such as active learning (Rogers & Gronseth, 2021); social learning (Gagné & Grimaldi, 2021); attention, memory, and multi-tasking (Levicky-Townley et al., 2021); and diffusion of innovation (Oyarzun et al., 2021). The authors described applications of UDL in higher education course design in an array of subject matter areas (e.g., education, geoscience, public health), as well as faculty development and workforce development. It is worthwhile to note that in these articles, UDL connections to practice are sometimes at the level of the three principles—expanding options for engagement, representation of content, and learner action and expression—and sometimes applied through mapping of individual framework checkpoints to particular aspects of course design.

## Bridging Theory to Practice

As education researchers, we need to know—what does UDL look like when it is theoretically applied to practice through strategic design and implementation of inclusive learning interventions? To go even further, how could UDL provide the theoretical framing for inquiry into more emergent educational technologies, like augmented reality (AR) learning research? Walker et al. (2017) argued for this connection between UDL theory and AR learning research, saying that AR is “uniquely positioned to support instruction within a UDL framework because the virtual objects that can be used in the AR system are flexible forms of media that can be leveraged” (p. 2). Stylianidou et al. (2020) in Cyprus and Greece carried this line of research forward in their design of a serious AR game called “Helping Nemo.” They specifically connected UDL theory to aspects of their design, development, and implementation process. Through their multimodal intervention, they targeted second-grade student learning of selected Greek language, math, and arts second-grade

content objectives. They reported findings of higher levels of student engagement and participation for all students, including bilingual students and students with and without identified disabilities.

UDL is strong in its clarity for describing methods of how strategic flexibility and learner empowerment embody inclusively designed instruction; however, there is room for growth in how to implement UDL with fidelity. Faggella-Luby et al.'s (2017) discovery of few empirical studies on the effectiveness of UD-related impact on student outcomes fits with other literature findings (McGuire, 2014; Roberts et al., 2011). Thus, considerable variability may be observed in connecting UDL theory to practice. Further, if our argument for UDL as "a theory that offers explicit guidance on how to better help people learn and develop" (Reigeluth, 1999 p. 5) is correct, then research evidence should demonstrate that the principles of this theory have associated results. The literature reviewed points to instances of initial evidence; however, much more research is needed and recommended to definitively make such a claim.

## International Implications

Interest and commitment to inclusive education and equity of access for all students has become a top priority around the world, driven by three landmark UNESCO documents. The World Declaration on Education for All (UNESCO, 1990) established that "Every person—child, youth and adult—shall be able to benefit from educational opportunities designed to meet their basic learning needs." The UNESCO (1994) Salamanca Statement & Framework for Action for learners with disabilities specifies the "fundamental right of every child to education, the uniqueness of every child's abilities and needs, [and] the importance of designing education systems to address diversity." Most recently, the UNESCO (2020) *Global Education Monitoring* report entitled "Inclusion and Education: All Means All" identifies UDL at least 16 times as a recommended approach to achieve global inclusive education. Recognition of UDL as inclusive design theory would further empower governments and universities around the world with a powerful theoretical tool to build positive and inclusive world-wide systems change.

Similar to other instructional-design theories, UDL is probabilistic, as application of its methods does not guarantee target learning outcomes but increases the probability of effective learning through its principles. The literature base that connects UDL as theory to practice is building, with examples across varied instructional contexts around the world. The spread of UDL into instructional design thinking and practice has attended to how methods integrate with educational practices and philosophies in differing cultures and available resources. Alumen (2020) reports on how UDL is being applied by Kuwaiti teachers, finding the theory to be universal and "not associated with a specific culture, but rather it is attached to the learning needs of students with and without disabilities" (p. 12). *Universal Access Through Inclusive Instructional Design: International Perspectives on UDL* (Gronseth & Dalton, 2020) features 47 chapters of UDL applications in over 15 countries (including Jamaica, Ecuador, Chile, Spain, England, Ireland, Sweden, Germany, Israel, South Africa, India, Thailand, Philippines, China, Japan, Australia, Canada, and US), highlighting widely ranging practices and outcomes. Another text focused on UDL applications in higher education, *Transforming Higher Education Through Universal Design for Learning: An International Perspective* (Bracken & Novak, 2019) includes additional discussions from authors in Norway and Brazil. UDL can even be seen in country-specific legislation such as Chile's Decree 83/2015: "Universal Design for Learning is a strategy that responds to diversity, whose goal is to maximize learning opportunities of all students, considering the broad spectrum of abilities, learning styles and preferences" (Ministerio de Educación Gobierno de Chile, 2015, p. 6). Clearly, UDL has begun to be recognized on a global scale as an effective means to support learning and instruction.

Though at the time of this writing, there are very limited empirical studies published in the Association for Educational Communications and Technology (AECT) high impact journal *Educational Technology Research & Development* (ETR&D) that specify UDL as part of the theoretical framing, Maria Santos and colleagues from Portugal are among the first with their 2017 Development section article about a digital learning environment to promote mathematical reasoning in students with Autism Spectrum Disorder (Santos et al., 2017). More such work is anticipated, as UDL researchers involved in CAST's UDL-Implementation and Research Network (UDL-IRN), the Society for Information Technology and Teacher Education (SITE)'s UDL Special Interest Group (UDL SIG), the International Society for Technology in Education (ISTE)'s Inclusive Learning Network, the INCLUDE Collaboratory, and others are working to

clarify how to measure and document UDL interventions in research. Such “growing pains” are characteristic of instructional-design theories that seek to foster education reform more broadly, as Pogrow (1996) remarks, “Reform requires technology, methodology, structure, dosages, and materials. It is far more difficult to figure out how to implement theory than it is to generate it” (p. 658). Work in this area is underway, with leaders in the field, such as Edyburn (2020), calling attention to the need for “guidelines about the dosage of a UDL intervention needed to achieve access, engagement, and success in demonstrating a learning outcome” (p. 340).

## Future Directions and Connections to the Field

AECT is an instrumental organization for those actively involved in the design of instruction and systematic approaches to learning. Recognizing UDL as an instructional-design theory further supports the organizational mission to provide international leadership by promoting scholarship and best practices in the creation, use, and management of technologies for effective teaching and learning. In doing so, it will stabilize how UDL is referenced in scholarship and support sustainable efforts to provide inclusive education on a global scale.

To realize this aim, the research base on UDL, its relationship with other learning and design theories, and its measured impact when applied as an instructional-design theory must expand. Proof of the validity and reliability of UDL as a guiding theory for positive and inclusive learning results is both needed and welcomed. Professional regional, national, and international research-focused educational organizations and centers such as ISTE, SITE, UDL-IRN, INCLUDE Collaboratory, Organisation for Economic Co-operation and Development (OECD) Centre for Educational Research and Innovation (CERI), Institute of Education Sciences (IES) National Center for Education Research (NCER), American Educational Research Association (AERA), Horizon Europe, and Erasmus+, in conjunction with research universities, need to be included in the expanded effort to build the research base on inclusive instructional design and UDL.

## Conclusion

In summary, we argue that UDL embodies an instructional-design theory in that it (a) is design-oriented, (b) addresses methods of instruction and situational factors in which those methods should be used, (c) provides more detailed component methods (through its guidelines and checkpoints), and (d) is probabilistic in creating instructional environments that are likely to meet varied learner needs. UDL supports educators and their students in the attainment of desired outcomes by providing a mechanism that contributes to greater likelihood of effective and efficient instruction as well as addressing equity and accessibility considerations.

Recognizing UDL as an instructional-design theory highlights the importance of thoughtful practice that actively engages learners; this, in turn, will likely enable researchers, practitioners, and scholars both within the AECT community and beyond to be responsive to the needs of a widely varied learner community through change that is supported by research outcomes.

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