

Universal Design for Learning: Deriving Guiding Principles from Networks that Learn

The fundamental idea behind universal design for learning (UDL) is injecting flexibility into the materials and methods used in the classroom. Where there is flexibility there is potential to maximize learning opportunities for all the students within today's diverse classrooms – including students with disabilities. However, materials and methods can be made flexible in a myriad of ways. How does a teacher select among the many options – what is it important to consider? This column addresses this question by elaborating three UDL principles that guide the process of selecting materials and methods according to individual differences in three broad learning networks that underlie three vital elements of learning: (a) recognition, (b) strategy, and (c) affect.

Learning and the Brain: the Foundation for the UDL Principles

The UDL principles take root in what for some may seem an unlikely place, the brain. Although it may not always seem like it, brain research offers enormous insight into the learning enterprise, increasingly so with the advent of techniques to image brain activity. The brain is the most powerful learning tool that students bring to the classroom, and understanding this tool helps us understand learning and learners much better. Here we provide a very basic and selective overview of learning and the brain as a foundation to the UDL principles.

Most pictures of the brain show only the tissue visible on the surface - the deeply fissured and folded gray matter called the cortex, which plays a central role in learning. What you cannot see in these pictures are the approximately 1 trillion cells within the cortex, interlinked by an astounding 10 trillion or so connections, into an incredibly dense network – not unlike a telephone or computer network.

Nested within this large network are many smaller networks, each one specialized for particular tasks. We focus on three broad networks, structurally and functionally distinguishable

but closely connected, which play an equally essential role in learning. We call these networks recognition, strategic, and affective networks. The terms reflect their respective functions, which parallel the three prerequisites for learning described by the Russian psychologist, Lev Vygotsky: (a) recognition of the information to be learned, (b) application of strategies to process that information, and (c) engagement with the learning task (Vygotsky, 1962).

Recognition networks enable us to identify and understand information and concepts because they are specialized to sense and assign meaning to patterns we see, hear, taste, touch, and smell. Strategic networks enable us to plan, execute, and self-monitor actions and skills because they are specialized to generate and oversee mental and motor patterns. Affective networks enable us to engage with learning because they are specialized to evaluate the significance of patterns and impart emotional significance to them.

To appreciate how these networks work together, consider the fairly simple act of signing a birthday card for a friend. Through recognition networks, we understand the concept of a birthday and identify the card, the pen, our hands, and our signature. Through strategic networks we set our goal of signing the card, form a plan for doing so, pick up the pen and move it to produce our signature, monitor our progress, and make small course corrections such as reducing the size of the letters should we begin to run out of space. Affective networks are responsible for the feelings we have and the thoughts we express about this friend; they also motivate us to sign the card and keep us focused on the task.

Within these recognition, strategic, and affective networks, learning capacities are even further broken down. For example, different parts of recognition networks oversee vision and audition, and different parts of strategic networks control setting goals and acting on them. Thus, as Gardner's Multiple Intelligences theory holds (Gardner, 1993), students have not one global learning capacity but many, multifaceted learning capacities.

These networks, their structures, and their roles are consistent in a general way across individuals. However, it may come as no surprise that individual brains differ substantially – as

do these networks. Because the many elements of learning are parceled out to different components of the brain, rather than being organized by the same region, individual differences can crop up in any one, any part of one, or all of the three major learning elements. Thus, differences or disabilities may be confined to one aspect of learning or affect multiple elements of learning. Moreover, a relative disability in one area may be countered by extraordinary ability in another.

This is a point that bears important implications for teaching and learning. The three learning networks—recognition, strategic, and affective – form a framework for thinking about individual strengths and weaknesses and for understanding how to minimize barriers to learning with flexible materials and methods.

The UDL Principles

Because all three networks coordinately direct learning, we cannot literally separate them as we teach. However, considering these networks individually reminds us that learning – and barriers to learning – are multifaceted. Broadly speaking, we teach students to (a) recognize essential cues and patterns, (b) master skillful strategies for action, and (c) engage in life-long learning.

Successful instruction draws on materials and methods that support and challenge students in each of these learning domains, while minimizing barriers in them brought by individual differences in recognition, strategic, and affective networks. Because no two students show the same patterns of strength, weakness, and preference within these networks and domains, minimizing barriers requires highly flexible teaching strategies and materials. No single representation, no single strategy for action, and no single means of engagement will work for all students.

Accordingly, the UDL framework consists of three overarching operative principles. Each principle aims to minimize barriers and maximize learning by flexibly accommodating individual differences in recognition, strategy, or affect respectively:

1. To support diverse recognition networks, provide multiple, flexible methods of presentation.
2. To support diverse strategic networks, provide multiple, flexible methods of expression and apprenticeship.
3. To support diverse affective networks, provide multiple, flexible options for engagement.

These three UDL principles share a common recommendation, to provide students with a wider variety of options. Universally designed buildings provide options such as stairs, ramps, and elevators that accommodate a broad spectrum of users. Universally designed curricula require a similar range of options for accommodating a broad spectrum of learners. Alternatives for accessing, using, and engaging with learning materials reduce barriers for individuals with disabilities but also enhance opportunities for everyone.

Consider the following example. Suppose ninth grade teacher Mr. Basbaum is teaching a science unit on population growth and wants to explain to his students the concept of exponential growth. He chooses to show them a chart. For some students, a chart is a great way to represent a numerical concept like this one, but for other students a chart puts up learning barriers. A student who is blind is an obvious example, but a chart may be equally problematic for students who are color blind, have trouble interpreting keys and symbols, or struggle to decipher the significance of spatial relationships between elements.

How can Mr. Basbaum alter his approach to communicate this concept successfully to all of his students? In this case, the teaching goal and the barriers in the medium relate to recognition, the learning networks addressed by the first UDL principle. Principle 1 recommends that teachers provide multiple representations of the same information. Following this recommendation, Mr. Basbaum could broaden his presentation format to also include a verbal description of the concept. A well constructed verbal description would make the key concepts accessible to a student who is blind or otherwise visually impaired or who has trouble

interpreting graphically displayed data. However, its beneficial impact could in fact be much broader because a verbal description can provide additional information not contained within the chart.

Thus, by providing two representations of the data instead of one, this teacher can provide a richer cognitive learning environment for all students. This short illustration shows how the UDL principles, by centering a teacher's thought process in the three learning networks, can guide the implementation of a flexible approach to learning and instruction.

Although this example focuses specifically on materials and methods, the UDL principles are designed to guide flexibility with all major elements of the curriculum: setting goals, selecting materials and methods to scaffold and challenge learners, and assessing progress. By rethinking these three elements of pedagogy along the lines of individual differences in recognition, strategic, and affective networks, teachers can foster more positive learning experiences for all of their students.

Conclusion

UDL challenges teachers to accommodate every student in the classroom by incorporating flexibility into their pedagogy and materials. UDL acknowledges that this is not a simple, self-evident task. On the contrary, teachers need guidance in fitting pedagogy and materials to their students. This guidance can be found in part within UDL's three principles. Inspired by new knowledge about the brain and how we learn, these principles provide an organized framework for considering learning tasks and individual differences that might impede or ease them. Appreciating the role of recognition, strategic, and affective networks in learning and individual differences in learning provides teachers with the insight they need to select alternatives that will best meet their students' needs. In future columns we will explore the insights brought by the learning brain more extensively, laying out more specific approaches to ensuring success for all students.

References

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