

CURRICULAR OPPORTUNITIES IN THE DIGITAL AGE

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EXECUTIVE SUMMARY

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Most classrooms are “curriculum centered.” They are designed around curricula whose core elements—textbooks and other print materials—are standardized or “one-size-fits-all,” as the saying goes. Of course, students are anything but uniform. As a result, teachers face inherent hurdles in meeting the individual needs of all their students, and students struggle to learn from curricula that are often inaccessible to varying degrees.

In a radical rethinking of the traditional curriculum, David H. Rose and Jenna W. Gravel consider how advances in teaching technologies enable new curricular designs that offer exciting ways to create classrooms that are student centered. The authors examine both the complexities of learning differences and the neurological variations that underlie these differences, exploding the notion that schools should focus on the mythical “average” learner. To help all students master the skills to succeed in college and careers, Rose and Gravel suggest, curricula must be as differentiated as the learners themselves. In the digital age, they find it can be, through the new field of universal design for learning (UDL).

The authors demonstrate that:

- > Advances in neuroscience reveal that the brain is highly differentiated and specialized, with a vast array of strengths and weaknesses not only among different people but also within individuals.
- > Multimedia technologies provide an encouraging foundation for student-centered learning, offering educators the ability to customize how and what we teach each student.
- > UDL’s research-based framework combines neuroscience and technology to optimize learning for every student.
- > Using the UDL guidelines, student-centered classrooms can harness the flexibility of new media to provide a diverse range of students with the multiple means of representation, expression, and engagement each needs to become a thoughtful, strategic, and motivated learner.

NEUROSCIENCE AND INDIVIDUAL DIFFERENCES

An explosion of research in neuroscience, arising from new digital imaging and analytic tools, profoundly alters our ability to understand learning and individual differences. Images of the brain in action reveal that its functions are both specialized and highly differentiated. For example, at least 20 regions of the brain specialize in vision; people process information about faces in certain regions and objects like utensils or cars in other regions.

Such findings are crucial for education because different people exhibit mind-boggling variation in strengths. From facial recognition to reading to musical ability, most brain specializations lie along a continuum. Gifted writers may struggle in math; dyslexics may excel at science; people with autism may have perfect pitch.

Individuals are complex composites of variation in a great many different capabilities; the “average” learner is a myth. A learner-centered classroom must meet the challenge of diversity—providing a curriculum that is as differentiated as the learners themselves.

THE PROMISE OF NEW TECHNOLOGIES

In most contemporary classrooms, print is the primary technology for communication and instruction. Its obvious advantages—it is an inexpensive, durable, and portable way to store information—contributed to 500 years in which it was the dominant form for teaching and learning.

Today, the disadvantages of print are equally clear. It is a fixed, standardized medium, perfect for a hypothetical group of people who are similar to one another. But print cannot adapt to meet the needs of all students. People with “print disabilities”—including reading disabilities, as well as blindness or poor vision—face severe disadvantages, as do readers to whom a text is presented in a language other than their own.

In contrast, advances in multimedia technologies provide an encouraging foundation for learning that is student centered. Innovative digital tools can help transform how and what we teach into customized lessons for all. Rather than physically printing or embedding information, new media store information by “digitizing” it as numbers. The information can be recreated as needed, and in a variety of formats—from Braille to voice to translation—for limitless numbers of people. Digital media are versatile, flexible, and malleable; they are also dynamic, changing with time. Moreover, they can be manipulated—the user can act on information, transforming it to make something new, recombining it to solve a problem, linking it to show relationships, modifying it for personal preferences.

THE UNIVERSAL DESIGN FOR LEARNING FRAMEWORK

Given the myriad ways students differ, how can educators determine the essential components of curricula that use new technologies to support student-centered approaches to learning—for all students, not just a few? Universal design for learning is a promising framework for doing that. UDL provides a structure and guidelines for making decisions about instructional designs that meet the challenge of diversity. Many options are built into UDL, based on research and practice from multiple domains within the learning sciences—education, developmental psychology, cognitive science, and cognitive neuroscience.

The theory of UDL derives in part from the broad concept of universal design, a practice that is prominent in architecture: The

goal is to engineer the built environment for the widest range of users, with multiple options for access. All U.S. architects are now legally bound to create buildings that are designed from the outset to reduce or eliminate architectural barriers for diverse groups of people. While originally conceived for individuals with disabilities, universal designs have proven to be widely beneficial. A common example is the wheelchair ramp, which is also ideal for people pushing strollers or using handcars.

Universal design for learning is part of this overall movement. Its purpose is to provide not just access to information but to ensure that the means for learning—the pedagogical goals, methods, materials, and assessments of instruction—are accessible to all.

At its simplest, UDL is based on three principles, each corresponding with one of the three broad divisions of “the learning brain”:

- 1. Provide multiple means of representation**, which corresponds with the pattern recognition and perceptual capabilities of the posterior regions of the cortex.
- 2. Provide multiple means of action and expression**, which corresponds with the motor and executive capabilities of the anterior regions of the cortex.
- 3. Provide multiple means of engagement**, which corresponds with the affective or emotional capabilities in the medial regions of the nervous system.

Nine guidelines, developed from these principles, form the foundation of UDL (see figure below). They guide educators and curriculum developers in using research-based means

UNIVERSAL DESIGN FOR LEARNING GUIDELINES



of addressing the wide range of individual differences in any classroom.

The top of each column in the figure emphasizes a basic principle of UDL. At the bottom of each column is a basic goal: students who are, each in their own way, resourceful and knowledgeable; strategic and goal directed; and purposeful and motivated. Each column, in turn, articulates guidelines for achieving each goal, as well as “checkpoints” elaborating on the guidelines.

UDL ONLINE

All that the UDL framework offers is difficult to demonstrate in print. In the Web-based version, clicking on any checkpoint brings up a box with an elaboration of the meaning and importance of the checkpoint. The Web also has links to practical examples of the options recommended and to research evidence for their efficacy. Moreover, many examples and resources cannot be even be demonstrated in print because they are natively interactive, multimedia, and “digital.”

For an interactive version of the guidelines, see <http://www.udlcenter.org/aboutudl/udlguidelines>.

REALIZING THE PROMISE OF NEW TECHNOLOGIES FOR STUDENT-CENTERED LEARNING

Based on UDL’s three principles, Rose and Gravel provide a number of examples of how student-centered classrooms can harness the flexibility of new media to provide a diverse range of students with the multiple means of representation, expression, and engagement each needs to become a thoughtful, strategic, and motivated learner.

STUDENT-CENTERED MEANS OF REPRESENTATION

Students differ widely in how they best perceive information, comprehend it, and turn it into useable knowledge. To create a curriculum that can support student-centered learning, it is critical to provide a variety of options for presenting information.

Unlike print, new media have a wide range of capabilities for presentation, from text to spoken language, to full-motion video, to 3-D graphics, to virtual reality, as well as various combinations of these formats. A format such as text can be manipulated in size, color, or form of emphasis to make it easier to see or to comprehend its main points. Text also could be transformed into entirely different modalities, such as voice, American Sign Language, Braille, or other languages.

STUDENT-CENTERED MEANS OF ACTION AND EXPRESSION

A curriculum is not student centered when all students must demonstrate what they have learned in exactly the same way. One set of options is to enable students to express themselves in a variety of media. For example, in addition to writing a paper, students in a science class could work in groups to design an animated presentation of the process of mitosis using SAM

Animation, free online software designed specifically for K-12 students and teachers.

That said, providing options in media is not the most important way to make expression more student centered. Within any medium, it is essential to provide “cognitive apprenticeship” so that the thinking process becomes visible. Then the needs of early learners can be calibrated and adjusted as their skills improve, and they can move gradually with support toward independence. Cognitive apprenticeships aid not just early learners but also advanced learners. For example, modeling is one of the most effective techniques for teaching a new skill or strategy. For schools, videos modeling various skills—public speaking, scientific inquiry, painting, social skills—can be embedded in almost any digital medium. This can also be done easily for different levels of learner, a differentiation almost impossible to achieve in print.

Guided practice with graduated scaffolding is another key aspect of effective teaching. Well-designed digital media offer a broad palate of learning supports and challenges that can be fine tuned for each individual. For example, Literacy by Design, a technology-based approach to literacy instruction, uses UDL principles to reach young students with significant cognitive disabilities. Its online design encompasses a range of scaffolds (e.g., a multimedia glossary; videos and photo essays that supply background knowledge; prompts to apply specific reading comprehension strategies). Research indicates significant gains by users on reading comprehension tests and for specific comprehension skills.

Skill development requires timely and relevant feedback. New technologies can provide ongoing assessment data, carefully monitor student progress, and offer relevant, challenging feedback. Teachers can use the data to make instruction more strategic, knowledgeable, and motivating for all.

STUDENT-CENTERED MEANS OF ENGAGEMENT

One of print’s biggest limitations is its inability to adjust to the level of frustration, boredom, challenge, or threat a task presents to the individual learner. The same chapter in a book may bore one student, terrify another, bewilder a third—and therefore engage none of them.

New media, by contrast, can provide a rich, interactive panoply of resources for recruiting interest, sustaining effort, and building self-regulation. For example, students seeking to learn about orangutans can take a “virtual field trip” via webcam to the San Diego Zoo. Those doing an extended study of a subject can participate in apprentice communities of practice far beyond their school through a tool like ePals, a free online service enabling students all over the world to connect and share experiences. And digital technologies can adjust the level and type of feedback individuals receive, helping each responds to feedback, develop self-assessment and reflection skills, and gradually become more independent.

CAVEATS ABOUT DIGITAL TECHNOLOGIES

While digital technologies have numerous advantages over print, they have limits as well.

- > **Poorly conceived tools:** The usefulness of digital tools depends on their design, which must provide both broad access and learning supports. Poorly conceived digital learning tools give the illusion of progress when in fact they simply replicate print versions; this is the case when scanning a printed document into a digital version.
- > **The digital divide:** Many families still lack access to essential technology. According to a Pew Research Center report, 87 percent of U.S. households making more than \$75,000 a year have Internet access at home, compared with only 40 percent of households making less than \$30,000 a year.
- > **Cost:** New media can be expensive, especially when modernizing the technological infrastructure of whole schools or districts. The short-term cost can be daunting, despite the long-term costs of not implementing change—creating a generation of high school graduates unprepared for college and careers.
- > **Professional development:** Simply acquiring technology does not make learning student centered. We must prepare teachers to employ new media to support student learning.

Finally, technologies are not good at the “emotional work” of the classroom, which is ultimately about building and enhancing relationships. Computers and online tools and programs are not equipped to do this profoundly human work. That responsibility lies in the hands, heart, and mind of the classroom teacher. What universally designed materials can do is to provide the supportive tools that enhance a teacher’s ability to excel.

STATE OF THE ART

The education landscape is slowly beginning to shift toward embracing the framework of UDL as a basis for student-centered learning. Its proponents are laying the necessary groundwork, in the realms of public policy, state and district initiatives, market models, and classroom practices.

Ultimately, what will separate new curricula from old is that they will reflect a new ecology for learning. That new ecology will put students at the center of the learning environment. And all students will not only learn, each in their own way; they also will teach because every curriculum will not only teach, it will also learn. In so doing, we will create an optimal ecology for learning, one in which the paths to learning are rich and diverse enough for *all* our students.

Students at the Center synthesizes existing research on key components of student-centered approaches to learning. The papers that launch this project renew attention to the importance of engaging each student in acquiring the skills, knowledge, and expertise needed for success in college and a career. *Students at the Center* is supported generously by funds from the Nellie Mae Education Foundation.

To download *Curricular Opportunities in the Digital Age* and all papers in the *Students at the Center* series, go to the project website: www.studentsatthecenter.org



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