A COMPREHENSIVE APPROACH TO RTI: EMBEDDING UNIVERSAL DESIGN FOR LEARNING AND TECHNOLOGY

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Abstract. **Response to intervention (RtI) provides tiered levels of supports to all students and allows for increasingly more intensive and individualized instruction. Similarly, universal design for learning (UDL) addresses needs of students by proactively planning for instructional, environmental, and technology supports to allow all students to effectively access and engage in instruction. Although these two frameworks are widely accepted as structures for supporting students with diverse learning needs, the relationship between them has not been adequately developed. This article describes how an ecological RtI framework that integrates scientifically based instructional strategies, proactive instructional design, and purposeful technology use can provide a more seamless support system for all students.**

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Now more than ever, the field of education, including special education, is being called on to educate and provide meaningful outcomes for all students, regardless of disability or learning need. Highlighting this call to action, the Individuals with Disabilities Education Act of 2004 (IDEA) conceptualized response to intervention (RtI) as a means to achieving high-quality instruction for all students and, as needed, provide more intensive and structured intervention to ensure that students attain success both academically and behaviorally. As a framework, RtI moved away from the practice of allowing students to continually fail prior to receiving more support and intervention. This proactive approach to providing services for all students was a specific intent of the law following recommendations by key groups (e.g., President's Commission on Special Education).

Since first launched, RtI practices have become more common and widely implemented. A recent report (Spectrum K12, 2010) indicated that 43 states have RtI practices written into state rules, and over 60% of school districts use some level of RtI implementation. Although the research literature continues to include discussions on differing approaches to RtI implementation (e.g., Fuchs, Fuchs, & Stecker, 2010; Marston, 2005), specific interventions and results (e.g., Klingner & Edwards, 2006), and how to approach eligibility within RtI practices (e.g., Fuchs et al., 2010), it is clear that there is substantial research demonstrating the effectiveness of RtI (e.g., Burns, Appleton, & Stehouwer, 2005). Moreover, the RtI concepts and practices are unmistakably reflected in Institute for Educational Practice Guides for reading and mathe-

matics instruction (Gersten et al., 2009; Gersten et al., 2008).

Having an established literature base on RtI is important to understand various perspectives, move the field forward, and provide guidance for implementation. To date, there is a lack of literature on a wider ecological approach to RtI that considers the merit of instructional strategies as well as variables such as purposeful instructional design and technology to support all learners. Through the use of UDL and technology, schools can provide more accessible, meaningful, and engaging learning environments for all students, especially those with diverse learning needs (Rose & Meyer, 2002).

The purpose of this article is to introduce an ecological framework of RtI that incorporates UDL and purposeful technology use with evidence-based strategies to support the needs of all students. After establishing a common foundation to develop the framework that embeds the needed ecological elements, we introduce the ecological RtI framework and provide considerations for adoption and implementation. Finally, we discuss how this framework has implications for practice, personnel preparation, research, and policy.

ESTABLISHING A FOUNDATION

As a leading organization in the field, the National Association of State Directors of Special Education (Batsche et al., 2005) defines RtI as "the practice of providing high quality instruction and intervention matched to student need, monitoring progress frequently to make decisions about changes in instruction, and applying child response data to important educational decisions" (p. 3). This definition provides a basic understanding of RtI by focusing on instruction, and highlights the importance of how other variables (e.g., educational decisions) beyond instruction are necessary to support students' success. It is these other variables that need to be more thoroughly identified in an ecological model.

From the onset, thought must be given to current policy within general and special education. For instance, both No Child Left Behind (NCLB; 2001) and IDEA (2004) provide language regarding accelerating students' progress on state standards and using scientifically based instruction for reading and mathematics. Once a student has been identified with a disability, IDEA provides further language to consider the supports and specialized instruction needed to enhance the student's present level of academic achievement and functional performance (PLAAFP) in the least restrictive environment (LRE).

Both laws clearly set a foundation for providing high-quality instruction and examining instructional contexts. For instance, within IDEA, school teams are to focus on PLAAFP using evidence-based practices that provide accessible and high-quality learning environments that support meaningful educational benefit (Yell, 2006). Moreover, intensity of services, or a student's program, that supports success is not defined by location or place; in fact, all students are to receive services in the LRE (IDEA, 2004). Given this understanding, all supports must be taken into consideration when making decision of intensity of services and LRE (Yell, 2006).

From this foundation in law, we propose that RtI and UDL share some common purposes and features that are consistent with these requirements. First, both RtI and UDL share the common purpose of providing a comprehensive system focused on proactive research-based practices aimed at providing meaningful educational outcomes for all students. Second, RtI and UDL, from our perspective, share an ecological approach focused on creating an effective system for instruction and intervention. This includes implementation of the UDL principles, which use both evidence-based strategies and modern technology to support learning. Third, both RtI and UDL make specific use of a problem-solving process that is premised on data-based decision making. Problem solving is a hallmark of both approaches at the system level (districtwide, schoolwide) as well as within grade-level teaching teams and student-focused problem-solving teams. Using performance data, initial problem solving is focused on creating instructional environments where all students can be successful. For students who do not respond to initial instructional designs, problem solving addresses the newfound variables and develops solutions to more intensive or individualized problems.

Thus, the purpose of this ecological RtI framework is not to designate students as responders and nonresponders, but to design environments and solutions for all students. Moreover, within this framework, it is important to understand that intensity does not equal place or location. As it aligns with LRE, students may require intense support or intervention and remain in a general education environment. For example, a student may be successfully responding to what is considered "intensive" support by having access to a device, such as a laptop, that provides support for text-to-speech. The student's level is not designated simply by the laptop.

EMBEDDING INSTRUCTIONAL DESIGN AND TECHNOLOGY

The field has long recognized the importance of physically accessible environments. However, little attention has been paid to learning environments that are accessible to all learners. Such learning environments require a focus on design, strategy, and technology. For instance, empirical research has found that through proactive instructional design and the use of modern technology, the learning environment can become more accessible to a number of learners. For example, through a number of empirical studies, Mayer (2009)

demonstrated that student learning can be enhanced by utilizing specific multimedia design principles within digital environments. Similarly, in a study focusing on Science Technology, Engineering, and Mathematics (STEM) education and individuals with disabilities, Schneps, O'Keeffe, Heffner-Wong, and Sonnert (in press) demonstrated how a simple interface design on a widely utilized technology could provide more accessible content-based text for all students, especially those with learning disabilities (LD). In another empirical study, Boyle et al. (2003) showed that students with high-incidence disabilities who used either an audio textbook or an audio textbook with a strategy were better able to demonstrate content acquisition than students who used a regular textbook.

Similar to the process of making physical environments more accessible, developing accessible learning environments requires work across the system to support the needs of diverse learners. These environmental considerations are based on proactive problem solving and design focused on maintaining a flexible curriculum (national, state, district), providing needed access to usable modern instructional tools (developers, state, district, school), encouraging multiple authentic measures of success (national, state, district, teacher), utilizing purposeful backwards design-based instructional planning (school, teacher), and being implemented with fidelity (teacher). Currently, UDL (Center for Applied Special Technology [CAST], 2008; Rose & Meyer, 2002) is the most comprehensive instructional design framework for implementing this type of accessible environment.

As highlighted by the National Center on Universal Design for Learning (2009), UDL is supported by a substantial amount of empirical research. As a framework, UDL is based on the premise that learning environments should include curriculum, instruction, and instructional materials that are accessible to as many students as possible, including both students who are low and high performing. This level of accessibility is accomplished through the use of proactive instructional design, instructional strategies, and technology to support multiple means of knowledge representation, engagement, and expression of understanding (Rose & Meyer, 2002). The legal definition of UDL may be found in the Higher Education Opportunity Act (HEOA) of 2008:

> The term Universal Design for Learning means 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. (HEOA, 2008, 122 STAT.3088)

By definition, UDL is concentrated on proactively overcoming barriers that inhibit students from being successful and maintaining high levels of achievement. From this stance, UDL plays a crucial role within the proactive practice of RtI.

As noted, technology is fundamental to implementing a UDL instructional design. Thus, integrating UDL into an ecological RtI framework requires greater understanding of how technology may be used to support student learning. In this context, it is important to consider how technology can support learning at all tiers of instruction and intervention. For instance, whereas multiple technologies should be accessible and purposefully used during core instruction (tier 1), as students require additional support (tiers 2 and 3), both instructional intervention and technology should be used in a more individualized and persistent manner.

Within special education, UDL has a symbiotic relationship with assistive technology (AT). Both UDL and AT work to overcome barriers, provide access, and support participation for students with disabilities (Rose, Hasselbring, Stahl, & Zabala, 2005). Like UDL, AT has been defined in federal law. According to IDEA (2004), assistive technology was defined as "any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of a child with a disability" with the exception of a medical device that has been surgically implanted (20 U.S.C. 1401(1)).

Although both UDL and AT rely on problem solving, AT is more clearly focused on locating a solution for an individual student (particularly a student with a disability) than on proactively overcoming and supporting the needs of all students. The function of AT is essential for individuals with disabilities, yet the legal definition of AT also has consequences for use within an ecological RtI framework. Moreover, utilization of AT is also tied to the perceptions of the field.

Unfortunately, AT has been commonly overlooked for individuals with mild to moderate disabilities (Edyburn, 2000). In fact, although more national data are needed to draw more definitive conclusions, Quinn, Behrmann, Mastriopieri, and Chung (2009) found AT use in schools to be low overall, but especially low for students with high-incidence disabilities in general education environments. In fact, Quinn et al. found increased AT use and considerations associated with students in more restrictive environments. Assistive technology remains one of the most widely overlooked and neglected components on the IEP (Lowrey & Basham, 2010); yet, when appropriately paired, AT can provide students with greater accessibil-

ity, success, and independence. The current limited view of AT neglects the importance of technology as a critical support for students, especially for students with mild disabilities.

Promoting the idea that the functional purpose of AT has benefits beyond individuals with disabilities, Edyburn (2004) dissected the legal definition of AT. Based on this review, Edyburn supported merging the actual functions of UDL, instructional technology, and AT. In this functional view, Edyburn (2004) promoted the idea of thinking about AT as simply "technology-enhanced performance" (p. 20).

This view encourages us to expand our understanding of the value of technology in supporting student needs and consider the purposeful nature of how we utilize technology to enhance our performance. For instance, many people use eye glasses or contact lenses to see clearly, use e-mail to communicate with multiple people throughout the day, and use devices such as smart phones to do a multitude of tasks, such as finding locations on maps, listening to audio books, taking and sharing pictures, sending text messages, and making phone calls. For some people, these technologies provide necessary access; for others, these same technologies offer increased performance and efficiency.

This functional view of "how" technology can purposefully be used to support human performance is pedagogically important for educating all students, especially those with diverse learning needs, whether they are low or high performers. Moreover, realizing the merits of technology as a purposeful part of instructional design, whether used proactively with all students or reactively based on performance data of a group of students or a single student, is essential to an ecological RtI model. This broader view of technology, which encompasses UDL-based instructional design, AT solutions, and high-quality instruction, is necessary to support all students, across the tiers of instruction and intervention.

Core Premise of an RtI Ecological Framework

As discussed in the previous section, RtI and UDL (along with AT) share a common framework – both are premised on the use of a comprehensive, multi-tiered system that focuses on a solid core of practices, with supplemental interventions and strategies building upon this core. This multi-tiered system for RtI has origins in the public health literature (Caplan, 1964; Gordon, 1983). Basically, the system is based on three tiers, focused on the concept of prevention at various levels – primary, secondary, and tertiary.

The first tier is based on a solid foundation of prevention to incorporate practices across a wider population aimed at preventing the occurrence of a public health issue for most individuals (e.g., providing clean water, promoting lifestyle changes). In education, this translates to the use of a solid core of scientifically based or research-based instruction for academics and behavior. The second tier in public health is called "secondary prevention," and focuses on early detection and providing immediate, research-based intervention to those determined to be at risk for a public health issue (e.g., smoking cessation, changing diet and exercise for those at risk for diabetes or high blood pressure). The educational application is for targeted, research-based interventions, delivered in a rapid response to students in need of supplemental intervention. The third tier in public health is called "tertiary prevention," and includes the most intensive treatments delivered to those who have already developed a health problem in order to mitigate the effects (e.g., heart stents). In education, the concept is similar – the most intensive interventions are provided to students who need them, based on assessments and their performance data.

This tiered framework also has been in use for positive behavior and intervention support (PBIS) (Sugai & Horner, 2002, 2006). In PBIS, these same tiers are applied to provide preventive, research-based practices to promote positive behavior for all students, with increasing intensity tiers of additional and targeted research-based interventions and environmental supports for students whose behavior indicates more support is needed.

Focused on purpose, the primary feature of the ecological framework, similar to RtI and UDL (and PBIS), is *prevention*. Through core practices of purposeful instructional design, high-quality implementation of instructional strategies, and use of technology, the aim is to prevent the occurrence of problems for most students. This preventive focus contrasts with previous reactive approaches, characterized within the special education literature as "wait to fail" (i.e., waiting for a discrepancy or a referral before providing intervention) (Donovan & Cross, 2002; President's Commission on Excellence in Special Education, 2002). The intentional use of schoolwide practices across a comprehensive system of instruction, intervention, and technology supports provides a structure that spans three tiers.

Using this ecological approach, the tiers of instruction and intervention are designed to meet the needs of *all* learners, including students with disabilities, those with no identified disabilities, those who would benefit from enrichment, and students who are English Language Learners (ELLs). In this comprehensive approach, RtI is not merely used as an alternative approach to intervention prior to a referral or an alternative approach to determination of special education eligibility. Rather, tiers of instruction and intervention are designed dis-

trict- and schoolwide to facilitate effective instructional structures and supports to promote positive academic and behavioral outcomes for all students.

In an ecological approach to RtI, tiers are characterized by increasing intensity and individualization of strategies, practices, supports, technology solutions, and personnel. Tiers, therefore, are not seen as a place (i.e., tier 1 is not "general education," tier 2 is not "compensatory education," and tier 3 is not "special education"). This distinction of how tiers are defined varies across descriptions of RtI approaches and was addressed by Christ, Burns, and Ysseldyke (2005). We agree with their conceptualization of a comprehensive framework; thus, an ecological approach to RtI focuses on a comprehensive approach for supporting students with broader considerations of accessible and engaging instructional design and technology use rather than simply a new or different way to categorize or label students. This conception of an ecological RtI framework allows for supports to be flexible and transitional. For example, a student without identified disabilities who is at risk for failure in a particular subject may require intensive tier 3 instruction and support technologies to help him or her succeed.

Operationalizing an Ecological RtI Framework

Operationalizing the working elements of the RtI framework is important for conceptualizing how to move toward adoption and implementation. In this section, we begin to discuss the vision for what an ecological framework looks like in practice.

Tiers of instruction and intervention. As just described, a key component of an ecological RtI framework is a shared structure of tiers with research-based core practices focused on instruction (tier 1), supplemental and targeted small-group intervention (tier 2), and more intensive, individualized intervention (tier 3). RtI implementation focuses on tiers of instruction and intervention organized within an integrated system, and primarily emphasizes core instruction and intervention in reading, math, and behavior (Gersten et al., 2008; Gersten et al., 2009).

Within the tiers, UDL integration provides the foundation for design of the learning environment and core instructional practices. This foundation is supported through proactive design, strategies, and technology. For instance, using a process of backwards design (Wiggins & McTighe, 2005), which focuses instruction on the end goals of specific knowledge and skills as well as "big ideas" we want students to acquire, UDL provides the core building block for how instruction takes place and how practices such as differentiation are formed. Thus, if the goal of instruction is to help students better understand expository text, tier 1 supports will include specific reading comprehension strategies embedded within the core curriculum and provide for principles of UDL through instruction and technology supports. As we move to tiers 2 and 3, the UDL remains; however, supplemental and individualized supports (including technology solutions) become more focused on smaller groups of students or individualized students' needs. In our example, tier 2 supports may consist of more intensive reading strategy instruction with additional levels of progress monitoring and perhaps widely available text-to-speech support.

A key idea in providing additional supports is that the system must be designed proactively to be responsive to learners and to provide supports (interventions, strategies, technologies) automatically as students need them. This is done by providing rapid response, avoiding the reactive "wait to fail" approach that characterized past practices. Similar to other tiered approaches such as PBIS (Sugai & Horner, 2002), this ecological approach requires schoolwide use of data and data-based decision-making teams. It allows for schoolwide, classroomwide, small-group, and individualized design and delivery of interventions so there is a comprehensive, seamless system for supporting progress of all students.

A data-based decision making and problem-solving approach. The focus on using data for all decisions and the explicit use of a problem-solving model across and within tiers are hallmarks of RtI approaches (Batsche et al., 2005). Although UDL is less explicit in terms of data-based decision making, Edyburn (2010) clearly articulates that UDL is about problem solving and understanding instructional design for diverse learners. Such an understanding of instructional design must engage around using data to make decisions.

A key feature across an ecological RtI framework is the use of *student response data as well as environmental data* within the decision-making process. Direct assessment of student skills and performance as well as teacher adherence (or fidelity) to design are key to making instructional decisions; however, looking at student performance without also considering the influence of the formative environment fails to take an ecological approach. That is, elements of the environment that may directly affect student performance should be considered within the problem-solving process.

For example, within student behavior, the field uses functional behavior assessments and analyses to consider variables associated with behavior (IDEA, 2004). These processes in turn influence problem solving for student behavior. Similar considerations should be made with technology in the learning environment. In fact, simplistic models for gathering and making decisions with technology exist. The works of Edyburn (2006a, 2006b) and the similar approaches of Parette,

Peterson-Karlan, Wojcik, and Bardi (2007) provide effective models for assessing the influence of technology on student learning. Although these models focus on data collection between a single student's performance and technology, there is no reason why they could not be expanded to look at larger groups. This type of scaling up would be aligned with the work within PBIS that expands the basic concepts of FBA to the system level for whole-school data collection and decision making.

Scientifically based instruction, intervention, and practices. The use of scientifically based practices is inherently important in law as well as in an ecological framework. Considerations must be made of implementation of these practices across the tiers. Teams must also consider research-based practices that have been shown to be effective across multiple fields of practice, including psychology, instructional design, and technology. As mentioned, Mayer (2009), Schneps et al. (in press), and Boyle et al. (2003) provide excellent examples of how technology can be used within scientifically based practice. Across the tiers, teams should consider localized data in conjunction with up-to-date research databases to help problem solve and develop solutions. After a decision is made to use a scientifically based practice, procedural adherence or fidelity measures are then important for measuring and evaluating the fidelity of implementation. Teams should avoid being constrained to the use of a set of practices. The central focus should be on using a data-based decision-making model to enhance progress and learning for all students, including those with disabilities and diverse learning needs, both low and high performers.

Universal screening, progress monitoring, and assessment. Although there is less explicit discussion of universal screening and progress monitoring in the UDL literature than in the RtI literature, we believe that the concepts are shared across the two frameworks and should be used within an ecological RtI framework. In RtI, universal screening is a core component within the prevention approach; that is, there must be an assessment system in place to screen all students in order to (a) assess the effectiveness of core instruction and supports in meeting the needs of most students (typically defined as at least 80% of students on whatever is being measured) and (b) identify those who are in need of more intensive intervention. Although Basham and Gardner (2010) have discussed the need for and design of a UDL measurement instrument, more work is needed relative to measuring this instructional design framework. Moreover, RtI screening and assessment must consider how to incorporate the core principles of UDL.

Family involvement. Consistent with an ecological/systems approach, we believe that intentionally involving families within the comprehensive system of instruction and intervention is critical to successful implementation of these approaches for all students. Too often, family and parent involvement is not explicitly discussed within RtI or UDL approaches.

We see family involvement as following the intensity dimension; that is, schools engage families in schoolwide practices at tier 1 in a preventive and differentiated way, and progressively involve parents in collaboration and decision making as interventions intensify. By intentionally involving parents in this way, schools are engaging in best practices for parent involvement, preventing problems, and remaining consistent with legal requirements for providing parents information and data on progress on interventions, as included in special education law.

DESCRIPTION OF TIERS ACROSS RTI AND UDL

Figure 1 depicts the proposed three-tier ecological model of RtI. Within this framework, as students require increasing levels of supports, the focus on UDL as well as instructional best practices remains consistent. However, the use of AT begins to take a more primary role. For example, in tier 1 reading instruction, instruction would include differentiation in reading level, embedded whole-class reading comprehension strategies, and possible use of digital text (provides multiple options for accessibility). Tier 2 may include continued differentiation in reading levels, more explicit, small-group reading comprehension instruction, and inclusion of text-to-speech software to accompany the digital text. Within tier 2, consideration of more individualized technology supports also begins to take shape. For instance, if data can be used to determine that a simple but more individualized text-to-speech option can be used to support a student, it should be done (e.g., individualized technology-enhanced practice). This prevents student failure and could be beneficial to the school because it circumvents the need for more concentrated effort of personnel and resources at tier 3. Finally, if students require tier 3 supports while UDL proactive design remains in place, a focused effort is made toward more intensive individualized supports, including, but not limited to, more complex assistive technology. For instance, a student could require a software system that includes individualization for vocabulary supports, text-to-speech, and comprehension supports.

Tier 1: Core Instructional Practices

Across both RtI and UDL frameworks, a primary feature is a solid core of scientifically based curriculum and instruction, which includes differentiated instruction

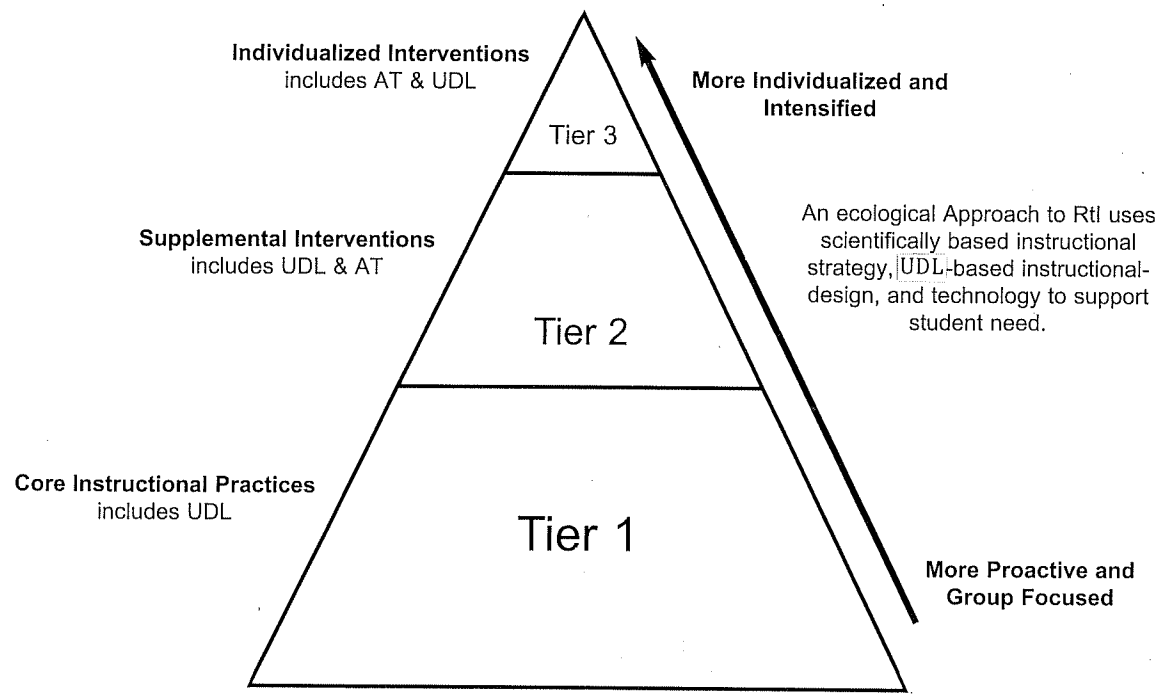
and UDL principles, intentionally designed to meet the learning and behavior support needs of all students. Effective instruction consists of methods to differentiate instruction to ensure that all students are challenged to meet learning goals, whether they are on target to meet standards, are in need of more support, or are exceeding standards.

Effective differentiation involves more than providing instruction in different formats. In differentiation and UDL, there are common learning goals, but also flexibility in the learning process (use of time, materials, grouping, assessment practices, instructional methods). An important feature of this framework is the use of ongoing assessment of student needs related to instruction, technology, and other instructional supports to plan instruction that is matched to data on student performance and needs.

The criterion for success used across most RtI frameworks, premised on the prevention focus of tier 1, is that core instructional practices are effective for at least 80% of all students, with no achievement gaps for subgroups of students (i.e., NCLB subgroups). If assessments show that fewer than 80% of students demonstrate mastery of the skill or if subgroups of students show significant achievement gaps, then the focus of efforts is to intensify, differentiate, and strengthen core instructional practices to the level needed to support the learning/performance of most students. In schools that have a large number of students with intensive learning needs (e.g., not meeting proficiency on state tests), core classroom-based instruction must be intensified and differentiated. In this situation, it is not feasible to "move" large percentages of students to tier 2 interventions; rather, features of more intensive intervention should be built into the core classroom instruction.

Research-based approaches to implementing tiers for reading and math are described in practice guides from

Figure 1. An ecological RtI model that embeds UDL and AT.



the Institute for Educational Science (Gersten et al., 2008; Gersten et al., 2009). Providing this solid core of practices, including UDL principles, is important, in that research has demonstrated, for the domain of reading, that implementation of research-based practices results in positive outcomes for most students, preventing the need for more intensive intervention (Vaughn, Wanzek, Woodruff, & Linan-Thompson, 2007). Finally, effective core practices at tier 1 use a system of schoolwide supports for implementation. A comprehensive system to support effective practices across tiers includes the use of teaming at all levels (districtwide team for planning and implementation support, schoolwide team for data-based decision making and instructional planning, grade-level teams for instructional planning, and flexible grouping, based on student progress data), and use of high-quality professional development, such as imbedded support and coaching, to support teachers to use research-based instruction and strategies (Fixsen, Naoom, Blasé, Friedman, & Wallace, 2005).

Tier 2: Supplemental, More Targeted Interventions

A key feature of tier 2 is that the system of instruction and intervention is designed to provide rapid delivery of more intensive, research-based interventions and practices automatically to students who are not making adequate progress with core instructional practices alone. Tier 2 also offers differentiation and targeted instruction to students who can benefit from acceleration, not just those experiencing difficulty. The recommended standard is to provide supplemental, targeted interventions and strategies for no more than 15% of all students. It is important to emphasize again that tier 2 is not defined by the location (general education, special education) or the person delivering the intervention (classroom teacher, special education teacher, gifted teacher) but by the intensity of the intervention, strategy, or technology.

In both RtI and UDL frameworks, interventions aim to increase students' skills and knowledge by providing more intensive and targeted instruction matched to student needs. To close achievement gaps, important components of intervention typically consist of more explicit instruction, scaffolding, opportunities for the student to practice and respond, and additional motivational strategies. Within UDL and technology, more targeted use of technologies may be implemented. That is, if specific instructional technologies are used in tier 1 for all students, those same technologies can be used with more explicit instruction or with additional technologies. For example, if all students are provided calculators for solving routine arithmetic calculations, tier 2 interventions may include explicit instruction in how to use calculators more efficiently through tutoring or coaching sessions on strategy use and/or additional technologies such as calculators with more functions, or calculators with multiple-line screens to keep better track of inputs may be substituted. Tier 2 interventions should be considered supplemental to (in addition to core instruction), not in place of, core instruction. Typically, tier 2 interventions and supports are provided to small groups of students (versus individually) in order to be efficient and cost-effective. In best practices, interventions are provided fluidly and flexibly, based on student needs, and are delivered through collaboration between teacher teams.

At tier 2, progress monitoring also intensifies, with student progress monitored at least weekly to ensure that interventions are sufficiently strong to be accelerating progress. Both frequent progress monitoring and the use of pre-determined decision-making rules are critical to avoid the problem of continuing to use intervention practices that are not responsive to student needs. Recommended practice is to use collaborative teaming (e.g., grade-level teams at elementary, teaching teams at middle school) for teachers to review student progress data at least monthly to (a) modify and strengthen interventions and strategies and (b) allow for flexible grouping and teacher collaboration to meet student needs.

Tier 3: Intensive, Individualized Intervention

The primary feature of interventions provided at tier 3 is individualization of interventions, based on problem solving and student progress data. The most intensive and individualized intervention is provided only to students who need this level of support, typically defined as no more than 5% of students. Tier 3 is not a place (special education, gifted program, ELL classroom) or a person (special educator). Instead, it is defined by intensity and individualized supports needed to accelerate student progress. Typically, intensity has been defined by the specialized nature of interventions, technologies, or strategies, the specialized nature of training to provide the intervention, or the amount of time needed to show progress, and so on. In an ecological approach, all school staff members collaborate to support all students, and resources are directed based on demonstrated student need.

When data indicate that students need the most intensive level of support to accelerate progress, a referral may be initiated to determine eligibility to receive specific services such as special education or gifted education. Ideally, this evaluation is not focused on demonstrating that a student is "non-responsive" and subsequently a qualifying "non-responder," eligible for special education. Consistent with the focus of the law,

the emphasis of evaluation and decision making should be on (a) identifying the specialized instruction, support, technology, and so on, that has been shown to accelerate progress and (b) translating this support into a functional IEP. At tier 3, frequent progress monitoring and parent involvement in decision making are key to best practices as well as to meet federal and state requirements (Barnett et al., 2007).

Special Education Within a Tiered Model

We believe the notions of RtI should be evaluated and revised to be more rapidly responsive to all students, both high and low performers, those with disabilities, and those with other diverse learning needs. Within this reevaluation, it is necessary to clarify the relationship between tier 3 supports and special education. Specifically, we must acknowledge that special education is not, and should not, be viewed as a place or a person (a possible misconception within the field of practice).

Special education is a service that provides specially designed instruction. Specifically, IDEA states that special education is "specially designed instruction, at no cost to the parents, to meet the unique needs of a child with a disability" (§300.26). Moreover, IDEA clearly defines specially designed instruction as

> means of adapting, as appropriate to the needs of an eligible child under this part, the content, methodology, or delivery of instruction, (i) to address the unique needs of the child that result from the child's disability, (ii) to ensure access of the child to the general curriculum, so that the child can meet the educational standards within the jurisdiction of the public agency that applies to all students. [§300.26(b) (3)]

Within IDEA, it is clear that special education is provided for students with disabilities. The qualifying term "disabilities" is also defined within the law. Thus, within our ecological view of RtI, a student with a disability may receive tier 3 supports; however, there may be other students with diverse learning needs who also require tier 3 supports but do not qualify for special education because they do not have a disability. For instance, students may require tier 3 supports because they are ELLs and have difficulty with the primary language of the school. Additionally, students may receive tier 3 supports because they are gifted and their performance is well above that of their peers in science or math.

Again, the premise of the framework is to provide success for all students. This principle does not segregate learners based on diversity of need. A comprehensive system provides the instruction and supports for those who need it, regardless of need. Such a system must be flexible enough to provide a proactive learning environment that uses scientifically based instruction and purposeful instructional design, which includes technology supports, and, when necessary, responds rapidly to individual student needs. This type of framework allows for a student with a disability to receive specialized instruction for a particular need (intensive reading instruction delivered by a special education teacher) while only receiving technology supports for other areas (e.g., mathematics instruction). Similarly, a student identified as gifted may receive acceleration or enrichment in mathematics but require little support in language arts.

QUESTIONS AND IMPLICATIONS FOR THE FIELD

Integration of UDL principles and technology into an ecological RtI framework raises several implications and questions related to practice, personnel preparation, research, and policy. We have begun to identify some of these implications and questions and present them in the following.

Implications for Practice

From the experience of many large-scale state-level implementation efforts of RtI, several practice implications have been noted as critical to sustain a high level of implementation (Jimerson, Burns, & VanDerHeyden, 2007). Commonly cited recommendations for implementation include using teams as structures at district, school, and teaching levels; using implementation tools to support consensus building, planning, and sustaining practices; sustaining leadership for implementation; and using high-quality, imbedded professional development and coaching to sustain practices at the classroom level.

These same recommendations can be applied to implementation of UDL practices in a systematic way. Too often in education, new practices or strategies have become "fads" that are not fully implemented and supported. Implementation research (e.g., Fixsen et al., 2005) has made it clear that key practices, consistent with those noted previously, are essential to sustain implementation. An ecological framework for RtI and UDL requires a systematic, large-scale look at schoolwide practices and structures to support students. Implementation cannot occur in a piecemeal fashion, one classroom at a time, or one student at a time.

Building flexibility into RtI decision making. In order to have an ecological, multi-tiered system of support that meets the needs of all students, school systems must consider mechanisms that address the variability of student supports based on their changing needs. Although RtI proponents often fall within either a

"standard protocol" or a "problem-solving" instructional decision-making camp (Fuchs et al., 2010), this distinction may not be necessary. School districts should consider a hybrid solution that includes a team-based problem-solving approach along with the use of scientifically validated instructional practices in order to reduce the rigidity of decisions related to instruction, placement, and general student supports. Simply stated, although many RtI models attempt to simplify RtI decision making through the use of standardized decision protocols, we believe that RtI decision-making protocols need to allow for team-based problem solving that includes contextual variables. School teams must have access to tools and supports that provide for data-based decision making. For instance, as previously mentioned, K-12 entities (possibly through university partnerships) should provide teachers with access to research databases. Such access enables school teams to have the most up-to-date research across multiple journals to search and locate scientifically based solutions.

Another means of supporting this work is the development of instructional toolkits that use UDL-based instructional design. Such toolkits should be designed to help scaffold decision making related to instructional, behavioral, and environmental supports so that scientifically based instructional practices, learning strategies, technology supports, and other environmental considerations are addressed to support group as well as individual student needs across tiered instruction and intervention.

For example, instructional toolkits around mathematics could include suggestions about how to differentiate based on UDL and use various scientifically based instructional strategies and available technology supports for core curriculum at tier 1 instruction for all students. This same toolkit could include information on progress monitoring specific to that core curriculum in order to identify students who could benefit from tier 2 supports. For tier 2, the toolkit could guide teachers towards specific strategies related to the mathematic concepts and problem solving, as well as more specific technologies and other instructional supports. Finally, information can be presented about how to intensify the intervention and technology supports for students who may need tier 3 supports within that mathematics content.

Collaboration among educators and related service personnel. Tiered instruction and interventions, by providing increasingly more individualized and explicit supports, require a range of professional expertise. Many current RtI frameworks rely on an integrated, flexible system that includes all educators in general education, special education, gifted education, and education of ELLs. If we consider tiered supports in a more flexible and fluid system in which instructional planning includes access considerations throughout the tiers, there is much greater need for collaboration in providing more interdisciplinary instruction. An integrated, ecological approach to RtI and UDL requires classroom teachers, special educators, instructional technology specialists, AT specialists, and related services providers to collaborate to provide more interdisciplinary, fluid, and flexible supports based on data. The resulting work will logistically require administrative support and flexible scheduling for planning time and collaborative teaching.

Ongoing, focused teacher supports. The need for interdisciplinary collaboration can only occur with district- and schoolwide teacher support in building professional capacity. Just-in-time or on-demand professional development (PD) and ongoing support must accompany this ecological RtI/UDL framework. Such PD must include not only conceptual understanding of UDL and its integration into RtI, but also practical supports (e.g., suggestions for how to use the toolkit) to assist in day-to-day problem solving, instructional design, and decision making through scaffolded teacher supports, such as instructional coaching.

Systemic investment in supporting comprehensive UDL-based RtI frameworks. For a districtwide ecological RtI framework to work effectively, there must be systematic investment in capacity building. At the district and school level, administrative supports would include investment in instructional technologies that allow for enhanced learning at all tiers. Along with these technologies, it would be necessary to invest in curricular design and other materials that allow for UDL. Further, such an investment in technologies and curricula must be accompanied by supports (including previously noted professional development) so that the resulting instruction is implemented with fidelity. Without such a solid curricular and technology foundation, it would be difficult for teachers to create universally designed instruction and, thus, it would be difficult to accurately assess the supports needed for students with various instructional needs.

Universal screening. A major cornerstone of RtI is decision making based on data gathered through universal screening, repeatable assessments that are given to all students in order to gain information about their performance in age-appropriate skills, such as oral reading fluency and math computation. When considering its use in a system that integrates UDL into the RtI framework, questions emerge about how to utilize universal screening in a manner that is consistent with UDL. For example, assessments would need to include options for students who are ELLs or students who can-

not access traditionally administered assessments. Simply stated, questions remain about how universal screening can make considerations for multiple means for representation, expression, and engagement.

Implications for Personnel Preparation

For RtI and UDL practices to be fully and effectively implemented in schools, it is essential that the content be embedded in educator preparation programs, including PK-12 educators, special educators, administrators, and related services personnel such as speech-language specialists, school psychologists, and counselors. Without this more proactive focus on educator preparation, there will be an increased need for continued professional development to "catch up" existing school personnel in these practices. Thus, recent reports have not been positive regarding the extent to which this content is included in teacher preparation programs (Sailor, 2008).

All preparation programs should incorporate important core content within RtI and UDL practices, including understanding of tiers of instruction and intervention; knowledge of scientifically based approaches and methods for determining research support; knowledge of assessment practices, including universal screening, data-based progress monitoring, assessing instruction, and functional assessment; collaborative teaming; use of problem-solving practices; and implementing UDL-based instructional design that uses purposeful differentiated instruction.

In addition, different preparation programs would need a more intensive focus on certain practices. For example, school leadership preparation would include a stronger focus on instructional leadership, flexible scheduling, and supporting technology capacity. All teacher preparation programs would include more of a focus on instructional strategies, technology supports, and UDL. While having a focus similar to that of their general education counterparts, special education programs should also offer more specific knowledge about scientifically based individualized strategies, technology supports, and assistive technology as well as how to conduct base-level usability testing. Finally, school psychology and other related services personnel preparation programs would include more of a focus on data-based decision-making practices.

Research Implications

A great deal of research has shown the positive effects of implementing a comprehensive approach to RtI (e.g., Burns et al., 2005; Jimerson et al., 2007). However, as we have suggested an ecological framework for RtI that integrates UDL-based instructional planning and content delivery, research should address how these two frameworks integrate. Broad research questions include development of integrated models and tools incorporating RtI and UDL practices and investigation of factors that sustain or inhibit comprehensive implementation, including the following:

- What supports are needed to implement an ecological RtI framework?
- How can various types of research (e.g., design-based research) be used in developing effective environments?
- How do we measure the degree to which instructional design and delivery integrate UDL principles?
- How can we measure a system's capacity and readiness to implement an ecological RtI framework?

Policy Implications

Fully integrating the principles of UDL with RtI at all levels, including national, state, district, school, classroom, and individual, has several policy implications. First, there is a need to more fully integrate principles across practices within policy documents and recommendations. Ideally, reauthorization of the Elementary and Secondary Education Act will incorporate and integrate key principles fundamental to both RtI and UDL, as both are founded in effective core instructional practices to ensure success of more students. At all policy levels, there is a need to continue to bring together groups that represent different constituencies and different perspectives, to incorporate shared thinking and shared principles, and to avoid the continued isolation and "silos" that exist across groups.

State-level policy must proactively address implications of a flexible, needs-based system. Issues needing discussion at a state level include assessment systems, support for implementation, support for technology, and licensure. At district and school levels, educators, in collaboration with community partners, will need to develop methods for communication and consensus building to incorporate key principles in practice. Important decisions such as scheduling, personnel decisions, and assignment of personnel will need to be examined to ensure that practices support a comprehensive model that is flexible and student-needs based. Too often, practices continue to be based on what has been done historically, not on what is effective or needed for students.

These policy initiatives are heavily tied to financial supports for students receiving instruction, intervention, and supports through the tiers. In order for this flexible, ecological structure of support to work effectively, policy must address means for more flexibility in state and district spending for students both with and without disabilities. The current spending flexibility within IDEA (2004) allows 15% of funding to address

needs of students at risk for academic failure. Policy must ensure that students with disabilities receive free and appropriate public education (FAPE) within the LRE from well-prepared, specialized professionals, while at the same time not allowing students to fall through the cracks because of inadequate frameworks of service delivery due to funding. Other industrialized countries have shown how a greater emphasis on education requires a modernized funding system (Darling-Hammond, 2010). Thus, federal, state, and local policy must reflect the need for a more ecologically based educational system.

FINAL THOUGHTS

At this time, many of the implementation descriptions and tools for RtI do not explicitly include UDL instructional design principles and practices with purposeful use of technology in the written descriptions. We believe RtI approaches would be enhanced through more explicit inclusion of UDL instructional design and practices.

Based on this belief, we have embarked on a field-based project with Cincinnati Public Schools (CPS) to develop an ecological framework for RtI and UDL implementation. CPS has had a district-wide model for a comprehensive approach to tiers of instruction and intervention for academics and behavior, called Pyramid of Interventions. Like many districts, CPS has been implementing several components of RtI, UDL, and PBIS practices (PBIS is known in the district as Positive School Culture), but they had not yet been integrated into a comprehensive and supported set of practices.

Our collaboration includes key partners in CPS from general education, special education (including related services personnel), and gifted education, and partners in University of Cincinnati represent the same groups. Training modules and strategies to support implementation are being developed during the 2010-2011 school year. As this collaborative effort continues, we aim to study this framework and share results with others interested in integrating RtI and UDL.

We encourage others to embark on designing, implementing, and investigating ecological frameworks that consider how various elements, including UDL and focused technology use, can support students across the tiers of instruction and intervention. An RtI framework that only considers instructional strategies is missing the complexity of student success. An ecological RtI framework that provides a more systemic view is important to supporting the diverse nature of student needs. Moreover, a purposeful framework that aligns the various components and practices already existing within today's schools (e.g., RtI, UDL, instructional technology, differentiation, assistive technology, PBIS) provides for a more streamlined environment for practitioners and a more seamless experience for students.

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