

Response to Intervention: An Introduction

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A Brief Review of the Research Literature

What is RTI?

The National Center on Response to Intervention (NCRTI), funded by the U.S. Office of Special Education Programs offers the following definition of RTI:

Response to intervention integrates assessment and intervention within a multi-level prevention system to maximize student achievement and to reduce behavioral problems. With RTI, schools use data to identify students at risk for poor learning outcomes, monitor student progress, provide evidence-based interventions and adjust the intensity and nature of those interventions depending on a student's responsiveness, and identify students with learning disabilities or other disabilities. (NCRTI, 2010, p. 2)

Key to this definition is the premise that by intervening early, struggling students will obtain the skills they need and avoid special education placement later (Newman-Gonchar, Clarke, & Gersten, 2009). NCRTI (2010) describes four essential components to RTI:

- A school-wide, multi-level instructional and behavioral system for preventing school failure
- Screening
- Progress monitoring
- Data-based decision making for instruction, movement within the multi-level system, and disability identification (in accordance with state law) (p. 1).

Abstract



This review provides an introduction to response to intervention (RTI), including how it is defined, reasons for its growing popularity, an introduction to an emerging body of research, a brief discussion of what it all means, and suggestions about directions for future research.





As for the multitier (or multilevel) system, most observers describe three levels of intensity:

1. High quality core instruction that meets the needs of most students in the general education classroom
2. Evidence-based interventions of moderate intensity that address the learning or behavioral challenges of most at-risk students
3. Individualized intervention(s) of increased intensity for students who show minimal response to secondary prevention (NCRTI, 2010, p. 4).

Another way to look at RTI is as a way to coordinate and gain coherence among the general classroom, special education, and Title I services for struggling students (Newman-Gonchar, Clarke, & Gersten, 2009).

According to Douglas Fuchs and Lynn Fuchs (2006), two researchers from Vanderbilt University who have done extensive research and development in RTI dating back to the early 2000s, this approach is seen by most educators as a way to deliver early intervention, especially for early *reading* problems.

This is not accidental. Many of the same policymakers behind RTI were also responsible for Reading First, a major component of No Child Left Behind (2002), which requires schools to use scientific knowledge to guide selection of core curricula and to use valid screening measures and progress monitoring to identify students in need of more intensive instruction. In a sense, RTI may be understood as an important aspect of Reading First and current educational policy. (Fuchs & Fuchs, 2006, p. 94)

Why is there so much interest in RTI?

Fuchs and Fuchs (2006) point to two major reasons for the growing interest and adoption of the RTI model: (a) the skyrocketing costs of special education and (b) the shortcomings of the IQ-achievement discrepancy model for identifying children with learning disabilities. During the 1976-1977 school year, a year after passage of the Education of All Handicapped Children Act of 1975, less than 2% of children had been identified as learning disabled. With the passage of the Act, which legitimized learning disability as a special-education category, the proportion jumped to more than 6% in the 1999-2000 school year—which became a very expensive proposition for districts and states (Fuchs & Fuchs, 2006).

One of the main culprits for this dramatic rise was the difficulty, using the IQ-achievement discrepancy method of LD identification, in properly distinguishing between children with true disabilities and those whose learning deficits are correctable with appropriate instruction (Fuchs & Fuchs, 2006). There is little agreement in how to compute the discrepancy, how great it should be, or which IQ tests should be used, which has led to inconsistency in the prevalence of learning disabilities within and among states, and a general impression that “the [learning disability] designation is whatever teachers and parents want it to be” (Fuchs & Fuchs, 2006, p. 96).



RTI, on the other hand is seen as urging the appropriate use of research-based approaches to assessment and instruction, leading many to the expectation that, logically, it should decrease the number of children incorrectly labeled as disabled and provide more targeted help within the context of general education for students who, for various reasons, have fallen behind. This leads us to the main question addressed in this paper.

What do we know about the impacts of RTI?

Status of research to date. Until recently, developers and proponents of RTI have relied on studies of individual components (e.g., peer tutoring) to put together research-based approaches to intervention, but little research had been done on the RTI process itself (VanDerHeyden, Witt, & Gilbertson, 2007). However, an emerging body of research—much of which is limited in its generalizability due to methodological limitations—provides some evidence of the effectiveness of the RTI approach to identification and placement of students with learning disabilities. One meta-analysis and two research reviews provide systematic overviews of this emerging research base.

Meta-analysis by Burns, Appleton, and Stehouwer (2005). This research team set out to answer the following questions:

1. How effective are the large-scale RTI models currently in practice as compared to those developed for research?
2. Does RTI lead to improved systemic and student outcomes?
3. On average, what percentage of the student population was determined to have a disability under RTI? (Burns, Appleton, and Stehouwer, 2005, p. 384)

They conducted a comprehensive search of the major research indexes and databases, and located 21 studies that met their criteria for inclusion in a meta-analysis.¹ Eleven of the studies examined the effects of at least one of four widely adopted RTI models: (1) the Heartland Agency (Iowa) Model, (2) Ohio's Intervention Based Assessment, (3) Pennsylvania's Instructional Support Teams, or (4) the Minneapolis Public School's Problem-Solving Model. All four models use group-level problem solving; that is, a team of educators selects research-based learning experiences for individual students based on their assessments of the students' needs. The remaining 10 studies described results of intervention models that were developed and implemented by researchers. The studies were further categorized by unit of analysis (school or student) and by the type of outcome being studied—student outcomes (i.e., measures of academic skill, growth in a particular skill, and/or time on task completion) or systemic outcomes (i.e., referrals to or placement in special education, duration of student time in special

¹ Briefly stated, these criteria included (1) the implementation of an intervention, (2) measures of either student learning or systemic outcomes, (3) a unit of analysis at either the student or school level (not district or statewide), (4) at least one between-group and/or within-group comparison, (5) quantitative data that could be used to compute effect sizes, and (6) a study report written in English (Burns, Appleton, and Stehouwer, 2005).



education, and number of children retained in grade). The researchers computed effect sizes using Cohen's d (Cohen, 1988) and unbiased estimates of effect (UEE), which is a method for weighting the estimation of the effect by using d and the sample size for each study (Hedges, 1982).

In answer to their first research question, they found strong UEEs for both categories of models, that is, the four field-based RTI models and the 10 models implemented by university faculty for research; however the UEEs for the field-based models were stronger. "Field-based RTI models resulted in a UEE of .94 for student outcomes and 1.80 for systemic outcomes. RTI models implemented for research led to a UEE of 1.14 for student outcomes and 0.47 for systemic outcomes" (Burns, Appleton, and Stehouwer, 2005, p. 387). Effect sizes (and UEEs) of .80 and above are considered to be strong. The researchers suggested the differences between the field-based and researcher-implemented models may be a result of the field-based models having been in operation longer and having undergone refinement over a period of years.

In response to their second question about the ability of RTI to improve systemic and student outcomes, Burns and colleagues found that the UEE for student achievement and systemic outcomes both exceeded 1.0 (UEE = 1.54 and 1.02, respectively). Burns and colleagues observed, "Finding that both systemic and student outcomes improved with an RTI model in use is a promising sign" (Burns, Appleton, and Stehouwer, 2005, p. 389).

Finally, in answer to their third research question, this meta-analysis looked at the mean percentage of the student population that was determined to have a disability under RTI, finding on average that less than 2% of the student population was identified as LD among the field-based RTI models, which is much lower than estimates of the population as a whole (5.7% in 2002).

The researchers pointed out that all of the field-based studies were quasi-experimental, which may have posed threats to the internal validity. They suggested the need for randomized controlled trials focused both on systemic and student outcomes to confirm these findings, and recommended that researchers look carefully at fidelity of implementation issues.

*Research review by Hughes and Dexter (n.d.).*² This research team was also interested in research that investigated the effects of RTI as a holistic approach and not as an aggregation of individual research-based interventions. They, too, conducted an extensive search of the major indexes (i.e., PsychINFO, ERIC, Google Scholar, and ProQuest), reviewed reference lists of studies, and, additionally hand searched several relevant journals (1996 to January 2008). They found only 11 studies that met their

² The authors' description of their literature search strategy indicates that this review was likely produced in 2008 or later.



criteria for inclusion in the review.³ Next they conducted a descriptive analysis of each of the studies, noting for each study several attributes (summarized in Table 1).

Table 1. Summary of Characteristics of RTI Models in 11 Studies

Attribute	Findings
The RTI model used (i.e., field-based or a researcher-designed model)	10 field based, 1 research based
Use of a problem-solving (i.e., school personnel made team-based decisions about needed interventions on an individual student basis) or a fixed protocol for determining interventions	7 problem solving, 4 fixed protocol
Grade levels	11 elementary level, 4 extending into secondary level
Number of schools and students involved	Number of schools from 1 to 227; number of students from 10 to 3,101
Implementers (teachers, researchers, or a combination)	1 researcher-implemented, 7 teacher-implemented, 3 researcher- and teacher-implemented
Study design	3 historical contrast, 3 single-case, 3 quasi-experimental, 1 correlational analysis, 5 descriptive methods (no randomized controlled trials)
Measured outcomes	4 reading progress, 1 math performance, 1 behavior, and others focus on special education referrals or fidelity of implementation.

Source: Synthesis of information in Hughes and Dexter (n.d.)

Despite the complexities presented by this variation in study methodologies and purposes, Hughes and Dexter (n.d.) presented four major findings:

1. All of the studies that examined the impact of RTI on student academic achievement found some improvement.
2. All but one of the studies that measured changes in academic achievement studied reading achievement at the elementary level; only one study with a small sample (N = 14) looked at math achievement.
3. The studies that focused on the impact of RTI on referral and placement rates showed the rates remaining steady or decreasing slightly.
4. Factors considered important for scalability and sustainability of RTI programs—described in most of the studies—included the following:

³ Briefly stated their criteria included (1) publication in a peer-reviewed journal, (2) use of at least two tiers of an RTI model, (3) the reporting of quantitative measures of student academic/behavioral outcomes and/or systemic outcomes (Hughes & Dexter, n.d.).



- extensive, ongoing professional development,
- administrative support at the system and building level,
- teacher buy-in and willingness to adjust their traditional instructional roles,
- involvement of all school personnel, and
- adequate meeting time for coordination. (Hughes & Dexter, n.d., p. 9).

Overall, Hughes and Dexter characterized the research supporting RTI as “emerging.” They reported that there had been no randomized controlled trials, and urged more longitudinal research.

Summary of nine key studies by Newman-Gonchar, Clarke, and Gersten (2009). This research team focused on RTI approaches to helping struggling students learn mathematics. In this case the authors focused more on the characteristics of the described programs than the rigor of research, but offered appropriate caveats about the limitations of the studies in their summaries. Writing for an audience of practitioners, their goal was to share what had been learned about nine programs that included the following features: (1) a defined screening process to identify students in need of intervention; (2) the delivery of a tier 2 intervention; and (3) a procedure to monitor student response to the intervention. Their findings are summarized in Table 2.

As described by these authors, the studies by Fuchs, Fuchs, and their colleagues have the most rigor, and provide the best evidence to date about the ability of Tier 2 mathematics interventions to reduce referrals to special education, and perhaps reduce later math disabilities. They seem to work best when they are aligned with whole class Tier 1 interventions (see especially Fuchs, Fuchs, & Hollenbeck, 2007; and Fuchs, Fuchs, & Craddock, in press). Other studies provide evidence, although nothing like certainty, that there is a baseline to the intensity and duration of additional treatment needed; 15 minutes of Tier 2 tutoring for 2nd grade students, 3 or 4 times a week led to significant improvements (Bryant, et al., 2008), while 5 minutes did not (VanDerHayden & Burns, 2005). The studies summarized by Newman-Gonchar, Clarke, and Gersten (2009) in this report also provide evidence that even a narrowly focused intervention (math computation only) in teacher approaches to Tier 1 and 2 interventions may be able to produce more appropriate and accurate referrals of students for evaluation and placement in special education services.



Table 2. Summary of Findings for Mathematics RTI Models in Nine Studies

Authors	Study design	No. of students	Tier	Grade	Description of intervention	Outcome(s)
Fuchs, Compton, et al. (2005)	Randomized controlled trial	70 in treatment /69 in control	2	1	Regular mathematics instruction plus 30 minutes of intensive small group instruction followed by 10 minutes of computer-based instruction; mastery of topics assessed each day with reteaching if necessary for at-risk students	There were significant improvement in three major performance measures; one measure (fact fluency) continued to show weakness.
Bryant, et al. (2008)	Regression discontinuity	51	2	1, 2	15-minute tutoring sessions 3 or 4 days a week in addition to regular instruction for at-risk students	First graders showed gains, but not statistically significant; second graders showed statistically significant gains.
Fuchs, Fuchs, & Prentice (2004)	Randomized controlled trial	201 in four groups (see description)	1	3	Hot Math—a program that emphasizes transfer of problem-solving strategies to different contexts—was administered to three groups of students: Group A (60 control, 69 experimental) students not at-risk for reading or math difficulties; Group B (5 control, 8 experimental) students at-risk for math disabilities only; Group C (20 control, 12 experimental) students at-risk for both math and reading disabilities; Group D (12 control, 15 experimental) students at risk for reading disabilities only. All groups spent similar amounts of time on math each week (about 275 minutes); control groups used regular curriculum, experimental groups spent part of their time with Hot Math.	Significant effects were found for experimental groups using Hot Math as a whole class, Tier 1 intervention. Students at risk for math disability (MD) improved less on computation and labeling; students with both math and reading problems improved least on these two measures. Students with only MD improved in understanding as much as their nondisabled peers.
Fuchs, Seethaler, et al. (2008)	Randomized controlled trial	42*	2	3	In addition to their regular classroom mathematics instruction experimental group students received one-on-one tutoring for 20-30 minutes three times a week for 12 weeks.	In four word-problem measures the treatment group effects were significant for two and not significant for two; all effect sizes were positive but the power of this study was weak due to small sample size.

Table 2 continued on next page



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Fuchs, Fuchs, and Hollenbeck (2007)	Randomized controlled trial	N not provided	1 & 2	3	Hot Math (word problem focus) was used for experimental groups in both regular classroom instruction and in supplemental tutoring for at-risk students. Four groups of at-risk students were compared, those who received (1) Hot Math in classroom and tutoring; (2) Hot Math in classroom with no tutoring; (3) regular classroom instruction and Hot Math tutoring; and (4) regular classroom instruction and no tutoring.	Fewer students were at-risk for MD after they received Hot Math classroom instruction; even fewer were at risk after they received both classroom and tutoring instruction. "This appears to reduce the prevalence of mathematics disabilities" (p. 22).
Fuchs, Fuchs, and Craddock (in press)	Randomized controlled trial	1,141 (119 classrooms)	1 & 2	3	This study was structured similarly to Fuchs, Fuchs, and Hollenbeck (2007) using a different word problem approach, <i>schema broadening instruction</i> (SBI), in place of Hot Math. The experimental tutoring groups included a self-regulation component in addition to SBI, but the SBI content was closely aligned for the classroom and tutoring treatment groups.	At-risk students who received the SBI tutoring (Tier 2 instruction) were able to narrow the achievement gap with non-at-risk peers. Nearly half as many at-risk tutoring students were designated as having MD as the at-risk control students. There was no difference between the SBI classroom and the typical classroom instruction groups.
VanDerHayden, Witt, & Gilbertson (2007)	Integrated time series (with multiple baseline components)	2,708 (5 schools)	1 & 2	Elementary grades	The researchers examined the impact of Screening to Enhance Equitable Educational Placement (STEEP) on teacher requests for pre-referral evaluations of students for possible special education placement. The authors phased the intervention into each school in a staggered fashion, collecting baseline data for 1 to 3 years before the intervention. In Tier 1 all students were screened for computational fluency; if a class mean was below a benchmark the whole class received an intervention that lasted for 10 minutes for 10 days. Students who were unsuccessful received an extra 10 minutes of	Teachers requested fewer referrals, and those students they did refer were more likely to be found eligible for special education. The proportion of minority students did not change as a result of the STEEP intervention. These results must be considered exploratory because of the narrow focus (computation only) and the brief duration of the intervention.



Table 2. Summary of Findings for Mathematics RTI Models in Nine Studies

Authors	Study design	No. of students	Tier	Grade	Description of intervention	Outcome(s)
					individual tutoring during regular classroom time (this was considered Tier 2). Tier 2 students also received rewards for scoring higher than their last score. Only students who did not respond to the Tier 2 intervention were recommended for evaluation.	
Adroin, Witt, Connell, and Koenig (2001)	One shot case study with staggered implementation	14 students (2 class-rooms)	1 & 2	4	This is a smaller exploration of the STEEP process (see above) using a very brief intervention. Fourteen at-risk students were given a “Can’t Do Won’t Do” assessment, where they were rewarded for surpassing their previous score on subtraction problems. A peer tutoring component provided practice time, with tutor and tutee switching roles (14 minutes). At the end of this session only five students were deemed to need additional time (they received 20 minutes of instruction). In the end, one student was referred for evaluation, having not responded to the intervention.	No inferences can be drawn from this study due to the lack of a control group. However, all but one of the students improved their achievement scores on subtraction.
VanDerHayden & Burns (2005)	One shot case study	No N provided (1 school)	1 & 2	3, 4, 5	In another STEEP study, the goal was to examine the effectiveness of using screening and progress monitoring data to plan and deliver mathematics instruction. All of the classes in the school scored below a determined benchmark on computational fluency. The Tier 1 intervention lasted for 30 minutes a day (with peer tutoring as the core of this instruction). Students were tested each day; low scorers received an additional 5-minute scripted lesson each day (Tier 2). Students who achieved mastery moved up to the next level.	Results from the SAT 9 showed little change for students scoring below average before the intervention, but students who scored above average improved. This suggests (although without an experimental design cannot substantiate) that 30 minutes of classwide peer tutoring with an additional 5 minutes of instruction for struggling students was not helpful in raising the achievement of struggling students.

* The authors did not mention how the students were divided between control and experimental groups.

SOURCE: Synthesis of information from Newman-Gonchar, Clarke, and Gersten (2009)



What does this all add up to?

The emerging research indicates the following outcomes of RTI:

- *Reductions in percentages of students identified as LD.* Characterized as a systemic improvement by Burns, Appleton, and Stehouwer (2005) in their meta-analysis of 11 studies, they found that, on average, less than 2% of the student population was identified as LD among the field-based RTI models compared with estimates of the population as a whole (5.7% in 2002). Hughes and Dexter (n.d.) in their descriptive review of the literature did not indicate such a large effect, reporting that placement rates remained steady or decreased slightly.
- *Gains in student achievement.* Burns and colleagues (2005) also found strong positive effects on student achievement, with a UEE of 1.54. Work by Fuchs, Fuchs and colleagues focused on mathematics interventions has shown promise for certain interventions both in the regular classroom (Tier 1) and in supplemental instruction (Tier 2); the interventions are even more powerful when the same approach is used in both tiers for students at risk of mathematics difficulties (Fuchs, Fuchs, & Hollenbeck, 2007; and Fuchs, Fuchs, & Craddock, in press).

Where do we go from here?

The research base is still new for studying the outcomes of RTI, but there have been some good studies done, with more on the way. In addition to the ongoing work by the team at Vanderbilt, the U.S. Department of Education's Institute of Education Sciences is conducting evaluation studies of key programs and services supported under the Individuals with Disabilities Education Improvement Act of 2004. Efforts to develop RTI approaches to the identification of and early intervention for children at risk of specific learning disabilities were stimulated by this law's provisions. The 60-month evaluation (2008-2013) will address the following questions:

- What are the impacts of a range of Response to Intervention models on academic outcomes—such as reading achievement, grade promotion, and identification for special education—for students in elementary schools?
- Do the impacts of these RTI models vary for different groups of students within study schools?
- What is the range of RTI practices and policies currently being used by a representative sample of districts and schools, and how do the RTI models in the impact study fit into this broader context? (National Center for Education Evaluation and Regional Assistance, n.d.)

These are all good questions, which the West Virginia Department of Education may want to investigate here in the state. In addition, Hughes and Dexter (n.d.) suggest examining the factors considered important to the success and sustainability of RTI programs. In any case, RTI seems to be an innovation worth additional research and development. It could help reduce unneeded placements of students in special education programs, reducing costs and freeing up resources for children who truly need services.



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