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Reading Intervention Outcomes for Adults With Disabilities in a Vocational Rehabilitation Setting: Results of a 3-Year Research and Demonstration Grant

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Abstract

This study reports on an examination of the effectiveness of a reading intervention for adults with disabilities in a vocational rehabilitation setting. Participants were 57 adults with disabilities and low reading skills enrolled at the Reading Clinic at the Michigan Career and Technical Institute. As part of a 3-year research and demonstration grant evaluation project, participants received an individualized reading intervention that targeted phonological processing, orthographic pattern recognition, and comprehension for adults with disabilities and low reading levels. The particular program incorporated fluency exercises at every level of the structured, explicit, and systematic intervention curriculum. Results showed that participants made moderate to large gains in passage reading accuracy and comprehension during the course of the intervention. Gains in passage reading rate were not statistically significant. Results are discussed in relation to theories of reading disability and intervention for adults with reading disabilities in vocational rehabilitation settings.

Keywords

adult literacy, vocational rehabilitation, disabilities, reading difficulties

National literacy surveys have reported that nearly one in five U.S. adults, or approximately 60 million individuals, had difficulties reading at a functional level in 2009 (Kutner et al., 2007; National Center for Education Statistics, 1993; National Center for Education Statistics, 2005). For this population, difficulties with reading correlate with negative outcomes across multiple domains, including education, psychological health, interpersonal development, physical health, employment, and civic engagement. Occupationally, limited reading skills reduce employment opportunities and curb potential income (Sum, 1999). Not surprisingly, of adult struggling readers in the United States, almost half live below the poverty level (National Center for Education Statistics, 1993). Reading difficulties also correlate strongly with incarceration (reviewed in Kozol, 1985). The U.S. prison population has a higher percentage of struggling readers than the nonincarcerated population (Haigler, Harlow, O'Connor, & Campbell, 1994). One third of prisoners performed at the lowest of the National Adult Literacy Survey (NALS) levels, as compared to only one fifth of the general population (Haigler et al., 1994). Outside the criminal justice system, higher literacy levels correlate with voter turnout in public elections (National Center for Education Statistics, 1993). These relationships among reading ability, incarceration, and voting highlight the association between literacy and positive civic engagement.

Low reading levels pose expensive challenges for the U.S. economy. Leaders in business and industry have reported spending millions each year for basic reading, writing, and math skills training for employees (National Institute for Literacy [NIFL], 2000). Despite these efforts, less than 10% of the 1993 NALS adult struggling readers received intervention services (NIFL, 2000). More troubling, federal funding for literacy programs decreased in the past decade, as illustrated by the funding history for the Even Start family literacy intervention program, which dropped from

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$225 million in fiscal year 2005 to $66 million in 2009 and 2010 (U.S. Department of Education, 2010). Overall, these statistics highlight the profound costs of reading difficulties, and they demonstrate the pending need for effective reading programs for struggling readers in vocational rehabilitation programs.

The field of vocational rehabilitation faces an alarming paradox: Funding for reading programs is increasingly restricted to programs grounded in evidence-based practice and scientific research (reviewed in Mikulecky, 2005), yet a minimal body of evidence and research exists from which to draw theory and practice (Kruidenier, 2002a). This paradox illustrates the pressing need for research on the efficacy of reading interventions for adult struggling readers. The current study contributes to this effort by offering an analysis of the efficacy of a specific reading intervention with a specific population of adult learners; the discussion considers implications for rehabilitation counseling. This study is grounded in several bodies of research: studies of reading interventions conducted with children, examinations of effective instructional techniques for individuals with learning disabilities (LD), research on the specific characteristics of adults with reading difficulties, and adult literacy intervention studies, each of which is reviewed below.

Findings From Reading Interventions Studies With Children

Adult literacy scholars have cited the importance of reading intervention research with children because the PreK–12 literature provides a starting place, accepted theories, and established methodologies available for use with adult populations (Comings & Soricone, 2007). Some adult literacy researchers have also proposed that the stronger the evidence is at the PreK–12 level, the more likely that the same will eventually be shown at the adult level (Kruidenier, 2002b). At this time, NIFL, the National Institute for Child Health and Human Development (NICHD), and the Office of Vocational and Adult Education monetarily support research using K–12 reading models and methodologies for adults reading at low levels (NICHD, 2006). Thus, research findings from children's intervention studies can inform adult reading instruction (for an alternative view, see Sticht, 1988).

The National Reading Panel performed a comprehensive review of children's intervention studies (National Research Council, 1998) and identified essential components for reading instruction, including decoding, fluency, and comprehension. The panel made instructional recommendations for each of these components. For decoding, the report advised teaching systematic phonics, which is the explicit instruction of letter–sound relationships for use in reading and spelling. For reading fluency, the meta-analysis found support for guided, repeated oral reading. For reading comprehension, the report named both vocabulary instruction and explicit text comprehension strategy instruction as effective instructional practices. The panel endorsed teaching vocabulary directly and indirectly, through multiple exposures and repetition, and counseled against using a single method. Text comprehension instructional components include comprehension monitoring, cooperative learning, graphics and semantic organizers, question answering, question generation, text structure analysis, and summarization.

In summary, comprehensive reading instruction for children should include instruction at multiple levels, including decoding, fluency, and comprehension. Moreover, specific methods (e.g., systematic phonics instruction, repeated readings, vocabulary instruction, comprehension strategy instruction) are particularly effective in improving the reading skills of students whose literacy skills lag behind those of their peers. These principles of effective instruction likely apply to interventions for adults struggling to acquire literacy; thus, they were a critical part of our literacy intervention.

Effective Instructional Techniques for Individuals With LD

The field of special education has generated applicable research as well: an examination of effective instructional techniques for individuals with LD. In a meta-analysis of treatment outcomes for younger students with LD, Swanson (1999) found that the combination of direct instruction with strategy instruction showed the greatest student learning gains. Direct instruction, or bottom-up skill building, teaches a fundamental series of skills, whereas strategy instruction, or top-down analytical approaches, teaches rules and procedures to utilize across settings (reviewed in Corley & Taymans, 2002). Taught together, these two approaches arm students with basic skills plus the independence to be planful, proficient, and flexible with strategies (Corley & Taymans, 2002). Lovett and colleagues' intervention research also emphasized the importance of combining skills instruction with metacognitive strategies for younger struggling readers (Lovett, Steinbach, & Frijters, 2000).

For adult students with LD, the following techniques proved most effective: individualized instruction, learning through guided discovery, collaborative transition planning combined with vocational planning, and teaching trade skills and literacy (Scanlon et al., 1998). Because LDs impede skill development, researchers indicate that students with LDs may require many more instructional hours than typically developing students to make equivalent gains (Comings & Soricone, 2007). Based on these findings, adult literacy interventions should include an intensive combination of direct instruction in basic skills and strategy instruction,

Table 1. Definitions of Technical Terms From the Reading Intervention Field

Term	Definition	Source
Automaticity	Accurate, fast, and effortless performance of reading subprocess, such as word identification	National Research Council (1998)
Comprehension	Understanding the literal meaning of text and also being able to draw inferences	National Research Council (1998)
Decoding	Applying letter–sound (grapheme–phoneme) correspondence to break the alphabetic code	National Research Council (1998)
Fluency	Ability to read text quickly and accurately, and with appropriate prosody, while having cognitive energy to attend to comprehension	National Research Council (1998)
Grapheme	Letter(s) or symbol(s) used to represent a sound in a language	Woodcock (1997)
Nonword reading	Also known as pseudoword reading; assesses an individual's capacity to apply grapheme or phoneme	Woodcock (1997)
Orthography	Visual representation of letters and letter patterns	Wolf (2007)
Phoneme	Unit of sound in a language	National Research Council (1998)
Phonological processing	Ability to reflect on, segment, and manipulate the sounds in words	Wolf (2007)
Semantic	Meaning of words	Wolf (2007)

with an emphasis on functional literacy skills relevant to vocational aspirations.

Characteristics of Adult Struggling Readers

The present study also relied on research regarding the characteristics of adult struggling readers. Specifically, research in this area has demonstrated that adult struggling readers have multiple and varied deficits. As a cohort, they display some common skills profiles, which can help to characterize their literacy needs and may differentiate them from children matched on reading level. Compared to children, adults who struggle with reading have had more exposure to print and thus have a better understanding of the purpose of print (Curtis, 1997). Measured alongside typically developing children matched for reading level, these adults tend to have a larger oral vocabulary (Greenberg, Ehri, & Perin, 1997). An oral vocabulary advantage has limitations, however, as the adults' vocabulary understanding often remains bound to the aural context where they originally heard the word (Curtis, 1987, cited in Curtis, 1997). Their vocabulary may lack the semantic depth typically acquired through multiple, varied exposures in text (for working definitions of technical terms from the reading intervention field, please see Table 1).

Research has also shown that adult struggling readers may demonstrate unique profiles of vulnerability in reading component skills, fluency, and comprehension (Kruidenier, 2002b). Reading component skills include *phonological processing*, defined as the ability to reflect on, segment, and manipulate the sounds in words, which directly facilitates the process of matching a specific letter with a specific sound (grapheme–phoneme correspondence), thereby allowing a reader to break the alphabetic code to read words (also known as decoding). Component skills also include word reading, nonword reading, and the output capacity of spelling (Greenberg et al., 1997). In a study by Greenberg and colleagues (1997), an adult sample displayed lower phonological processing and spelling scores alongside higher word identification scores than a group of children matched for reading level. In the realm of reading fluency, adult struggling readers often display slow reading because of a lack of automatic word recognition; moreover, they often demonstrate slower reading rates compared to reading-level-matched children and poorer performance on timed, as compared to untimed, measures (Curtis, 1997; Smith, 1990).

Because of their relative strength in oral language, adult struggling readers may be able to make faster progress than children at the same starting point (Sticht, 1988). However, this oral language advantage may dissipate once children attain late elementary reading levels. For instance, one study comparing children and adult readers matched for third, fourth, and fifth grade levels found that the adults had higher receptive vocabulary scores at the third and fourth grade levels but not at the fifth grade level (Greenberg et al., 1997). Adults' relative strength in oral vocabulary may boost reading instruction initially, but this advantage may disappear as adults' reading catches up to the limited background knowledge and literary vocabulary. Thus, the duration of reading interventions for adult populations should be individualized to ensure sufficient gains by all participants.

Themes From Research on Adult Literacy Interventions

Although adult literacy intervention research is in its infancy, a recent meta-analysis (Kruidenier, 2002b) has offered converging support for comprehensive reading invention programs that include instruction in component skills, fluency, and comprehension, as necessary. Kruidenier (2002b) found evidence that fluency may be taught through repeated reading of passages of words and text. In the area of reading comprehension, the meta-analysis provided support for teaching explicit reading comprehension strategies and combining comprehension instruction with basic skills instruction. The findings of this meta-analysis were limited because of the small number of experimental studies of adult literacy interventions, again highlighting the need for further research.

The Current Study

Situated within the sparse historical research context of adult struggling readers, the present study represents an initial effort to understand the effects of a specific reading intervention with a specific population of adult learners. The reading intervention examined in this article was designed to incorporate the most promising components of effective literacy instruction, based on studies of children's reading interventions, individuals with LD, characteristics of adult struggling readers, and the few existing studies of adult literacy interventions. Accordingly, this individualized reading intervention targeted phonological processing, orthographic pattern recognition, and comprehension for adults with disabilities and low reading levels. The program incorporated fluency exercises at every level of the structured, explicit, and systematic intervention curriculum. The study analyzed extant data from the Michigan Career and Technical Institute (MCTI) Reading Clinic located in Plainwell, Michigan. Research questions were as follows:

1. Did adult participants in the Reading Clinic show statistically significant gains in reading rate, accuracy, or comprehension after completing an individualized reading program?
2. Did gains in reading rate, accuracy, or comprehension relate to participant characteristics, such as gender, intelligence, number of disabilities, beginning reading scores, or number of treatment hours?

Because the reading program was designed to include the recommended instructional components summarized above, the hypothesis was that students would display gains on all three dimensions of text reading: accuracy, rate, and comprehension. The results are discussed in terms of both theoretical and practical implications for the fields of adult literacy and vocational rehabilitation.

Method

Setting

From 2001 to 2003, federal and state of Michigan sources funded Project Advance Research and Demonstration Grant, an investigation of a specific reading intervention and its efficacy with various at-risk populations with low reading levels attending literacy programs in various settings. The MCTI received the initial grant and piloted the methodology with 10 groups of students at MCTI. The present study investigated this sample of students. MCTI functions as a comprehensive rehabilitation and vocational center and is the second largest of its type in the United States. The campus offers housing for individual students and students with families, a cafeteria serving three meals daily, leisure services, and extracurricular facilities. Support services include a health department staffed with registered nurses, personal and employment counselors, and visiting psychologists. The majority of students enrolled at MCTI live on campus. Educational and vocational training programs include the Reading Clinic and basic education, work skills, wood finishing, cabinetmaking, culinary arts, automotive technology, electronics, custodial, drafting, grounds maintenance or landscaping, retail marketing, office automation, and printing classes.

To enroll at MCTI, individuals have to receive assistance from Michigan Rehabilitation Services or the Michigan Commission for the Blind. All students in this study had at least one documented disability that was considered a barrier to employment. On entering MCTI, the students spent their first 10-week term in Career Assessment Services, where they completed inventories and consulted with staff to gauge skills, interests, and readiness for vocational programs. Students whose reading abilities registered below the level required for their target trade entered the Reading Clinic for intervention before continuing on to their vocational program. Occasionally, trade instructors would guide students who were struggling with reading, but already in a vocational program, to the Reading Clinic. In this arrangement, some students participated in both the intensive reading intervention program and vocational training.

Program Implementation

Project Advance implemented a reading methodology that had been shown to be effective with various ages and ethnicities in various settings (Eden et al., 2004; Kennedy & Backman, 1993; Sadoski & Wilson, 2006). The intervention

has three components (described below) that were used separately or in tandem, depending on each student's profile. All components used a systematic, multisensory approach, guided Socratic questioning, and multiple exposures and repetition to enable students to "discover," reinforce, and independently apply and monitor reading skills and strategies. The first component addressed phonological processing, starting with auditory and tactile processing before moving to phoneme–grapheme correspondence and then to single syllable and multisyllabic words. The second component addressed orthographic processing by identifying and building visual memory of common letter and word patterns. The third component addressed reading comprehension by teaching visualizing and using gestalt processing to understand text. Thus, this program overall was designed to address the major components of reading as outlined by the National Research Council (1998) using direct, systematic instruction combined with metacognitive strategy instruction (Swanson, 1999).

For the phonology and orthography components, each lesson followed the same basic structure, moving systematically from exercises at the sublexical level through the text level. At each step, clinicians guided student acquisition of basic skills and top-down approaches. Clinicians modeled and encouraged flexible, metacognitive strategy use. When students demonstrated approximately 80% mastery, they would be introduced to the next skill or level in the curriculum sequence. Fluency exercises at the text level included guided oral reading at students' instructional level. In the case that students had identified and met the prerequisites for a particular trade, clinicians included authentic materials, reading, and vocabulary from the target trade (Scanlon et al., 1998). For students who read dysfluently (i.e., at a laborious or halting pace), clinicians incorporated additional exercises, such as repeated reading, oral reading, echo reading, paired reading, and teacher modeling (Kruidenier, 2002b; McShane, 2005). Following reading, clinicians asked students questions that required higher order thinking skills, such as questions requiring recall, summarization, comparison and contrast, integration, synthesis, and opinion formation (Kruidenier, 2002b).

For the comprehension component, students progressed from visualizing oral language to pictures to written text. With written text, students moved from the word level to simple sentence to multiple sentences to paragraph to multiple paragraphs to whole page. Clinicians guided students to build and describe mental images from the most general to the most detailed characteristics. At each step in the comprehension component, clinicians guided student acquisition of bottom-up processing and top-down approaches (Swanson et al., 1999). Clinicians asked students higher order thinking questions at the completion of each reading (Kruidenier, 2002b). Students also worked on vocabulary comprehension through multiple modalities: learning the meaning of a word, reading it in text, discussing the meaning and usage, creating a sentence with the word, and drawing a picture of the word (National Research Council, 1999).

With all components, students progressed as far and as quickly as possible through the curriculum over the 10-week term. The clinic coordinator and director made hourly lesson plans from detailed clinician notes of student responses. Pacing reflected individual student needs, so students began at different places in the curriculum, moved at different speeds, and finished at different places (Sticht, 1988).

Participants received intervention in small groups ranging in size from 1 to 5 students ($M = 2.46$) per teacher. Each group received 3 consecutive hours of intervention, rotating to a new teacher each hour. Teacher rotation reduced the potential effect of individual differences in teaching ability and program delivery consistency. For the other half of the day, groups received supplemental instruction in writing, mathematics, and leisure activities. Students referred from vocational programs returned to their trade training for the other half of the day. A critical component of our intervention was the individualized nature of program duration. Based on the research, struggling adult readers may need extended opportunities for instruction. The majority of participants in this study attended one 10-week term in the Reading Clinic, with a minority (10.5%) attending two terms. Participants returned for a second 10-week term if the student, clinic director and coordinator, and MCTI counselor agreed that a second term could potentially improve reading levels further, enabling more advanced trade opportunities within MCTI.

Treatment Integrity

Clinicians who delivered the intervention received 40 hours of training for program delivery, completing specific training units for each aspect of the program—phonological processing, orthographic pattern recognition, and comprehension. Throughout the 10 pilot groups of Project Advance, a total of 11 clinicians (10 women, 1 man) delivered the reading program. Of these 11 clinicians, all had some postsecondary education and the majority had some previous teaching experience (83%). Only 1 of the clinicians worked full-time with students; the other clinicians rotated on a part-time basis. Two external consultants, contracted from a reading methodology company, worked on site at MCTI during one 10-week term (more than 400 hours) to observe implementation and make appropriate revisions to program delivery. The program consultants and Reading Clinic coordinator observed clinicians to ensure consistency. Following the observations, clinicians received feedback and guidance regarding program delivery, pacing, and rapport with students.

Grouping and Assessment Procedures

Because reading intervention research has documented positive effects of homogeneous grouping—that is, better intervention response (Vaughn, Hughes, Moody, & Elbaum, 2001) and more instructional time spent on intensive reading intervention (Besser et al., 2004)—students with similar strengths, deficits, and needs were grouped together. The Reading Clinic director and coordinator administered all assessments and grouped students homogenously based on like performance on the following screening measures: the *Woodcock Diagnostic Reading Battery* (WDRB) Word Identification, Word Attack, Passage Comprehension, and Listening Comprehension subtests. The WDRB has been widely normed and deemed appropriate for individuals ages 4 years to 90 years or older, with moderate to high reliability and validity (Woodcock, 1997). Based on screening profiles, groups received the appropriate combination of phonological processing, orthographic pattern recognition, and comprehension aspects of the reading methodology.

Each student received a comprehensive pre- and posttest battery that measured language and literacy abilities. The current study analyzed scores on the *Gray Oral Reading Tests–Fourth Edition* (GORT-4; Wiederholt & Bryant, 2001) from pre- to posttest. With norms for individuals up to 18 years 11 months in age, this test yields standard scores, percentiles, and age and grade equivalents, derived from a large sample with moderate to high reliability and validity (Wiederholt & Bryant, 2001). Because the current sample's age range (18–59 years) exceeded the GORT's normative sample age range, raw scores were used for statistical analyses. Standard scores ($M = 10$, $SD = 3$) compared to a sample of 18 years to 18 years 11 months and grade equivalents were used only for descriptive purposes.

Participants

Participants in the Reading Clinic during the research and demonstration period were considered *completers* if they completed a minimum of 80 hours of treatment or improved at least two grade equivalents on the WDRB Word Identification, Word Attack, and Passage Comprehension subtests. These requirements for a completer represented the combined interests of the MCTI and those of the researchers who designed and marketed the specific reading intervention and empirical findings that link achievement to hours of treatment (i.e., Comings, 2007).

The data analyzed in this study are drawn from only those completers with both pre– and posttests for the GORT-4. Of 89 students who received the GORT-4 during Project Advance, 32 were excluded because of two factors: (a) missing data (less than 10% of the students exited early and therefore did not have complete posttesting) or (b) incorrect test administration (the Reading Clinic director and coordinator experienced a steep learning curve for administering the GORT-4, which has precise requirements for establishing basals and ceilings). A total of 57 participants remained for the current analyses. Of the participants, 47 were male (82.5%) and 10 were female (17.5%). Participants represented three ethnicities: Caucasian (82.5%), African American (15.8%), and Asian American (1.8%). The sample ranged in age from 18 to 59 years ($\mu = 21.11$). Participant treatment hours ranged from 21 to 263 ($\mu = 95.36$). Prior educational attainment information was available for 90.5% of the participants, with the majority of the sample (78.4%) having completed high school before entering MCTI. Two students (3.5%) had enrolled in postsecondary institutions before entering MCTI.

Disabilities and conditions were culled from MCTI student files, which included previous neuropsychological and psychological reports, educational history, and physical examinations as well as documentation filed during MCTI attendance. Complete disability and condition profiles were available for 91.23% of the participants. *Disability* was defined according to the Americans with Disabilities Act (1990) as a person having an impairment or condition that substantially limits a major life activity or having record of this impairment, and it was operationalized at MCTI as an impediment to gainful employment and conditions diagnosed by professionals with documentation submitted for student admissions and records. These participants had, on average, approximately 4 ($\mu = 3.75$, range = 1–10) diagnosed disabilities and/or conditions within the following major categories: cognitive (including LD, attention disorder, cognitive impairment or intelligence quotient less than 80, and neurological conditions), psychological or psychiatric, physical (including medical conditions and physical impairments), and substance abuse. The vast majority (91.2%) of students had an LD most often comorbidly with another diagnosed disability (84.2%). Intelligence quotient (IQ) scores were available for 87.72% of the participants, showing a mean IQ of 85.72, with a range of 73 to 107. Using criteria based on the Survey of Income and Program Participation (U.S. Census Bureau, 2006), this sample of adults would be classified as having moderate to severe disabilities. The general population at MCTI demonstrated similar demographics and prevalence in disabilities as this specific sample: 82% male, average age between 20 and 21 years, and LD as the most prevalent disability (Mulka & Miller, 2010). The sample used in this study can be considered representative of the larger population at the rehabilitation and vocational setting.

Statistical Methods

Descriptive statistics and data analyses were completed using SPSS 13.0. Visual inspection of the data showed two sets of outliers: four students who received more than 140 hours of treatment and four students 30 years of age and older. These outliers could possibly come from different

Table 2. Descriptive Statistics: IQ Scores, Pre- and Posttest GORT-4 Standard Scores and Grade Equivalents for Adults With Moderate to Severe Disabilities

Variable	*n*	Rating[a]	*M*	*SD*	Range	GE
Full IQ	44	Average	85.66	7.87	73.00–107.00	—
Verbal	44	Average	85.84	7.65	70.00–102.00	—
Performance	44	Average	88.55	11.91	68.00–119.00	—
Discrepancy	44	—	10.70	7.81	1.00–36.00	—
Verbal dominant	19	—	9.26	6.72	1.00–25.00	—
Performance dominant	25	—	11.80	8.52	1.00–36.00	—
GORT pretest standard score						
Rate	50	Very poor–poor	3.73	1.70	1.00–8.00	4.78
Accuracy	50	Poor	4.96	2.50	1.00–13.00	5.78
Comprehension	50	Poor–below average	5.24	1.93	1.00–9.00	6.66
GORT posttest standard score						
Rate	50	Very poor–poor	3.96	1.82	1.00–7.00	4.91
Accuracy	50	Below average	6.68	2.66	1.00–13.00	7.42
Comprehension	50	Below average	6.14	2.10	2.00–10.00	7.85

Note: GE = grade equivalent; GORT-4 = *Gray Oral Reading Test–Fourth Edition* (Wiederholt & Bryant, 2001). Intelligence quotient scores represent standard scores with a mean of 100 and a standard deviation of 15. Rate, accuracy, and comprehension scores represent standard scores with a mean of 10 and a standard deviation of 3 (compared to a normative sample of 18 years to 18 years, 11 months).
a. Descriptive rating from the GORT manual.

subpopulations with potentially different responses to intervention than the primary population under study (Cohen, Cohen, West, & Aiken, 2003). Although their data were theoretically valuable, their numbers were so small as to preclude our evaluation of their responses to intervention. Future research will need to address these subpopulations. To avoid the problematic influence of outliers in our statistical analyses, a total of 7 participants were removed from the data set. The primary study sample ($n = 50$) had a mean age of 19.46 and 84.85 mean treatment hours.

Paired-samples *t* tests were conducted to evaluate the impact of the reading intervention on the text reading performance of the participants, as measured by three subscales from the GORT-4 (rate, accuracy, comprehension). These analyses evaluated the null hypothesis that there was no difference between pre- and posttest scores.

To evaluate the effect of participant characteristics on improvement in reading, gain scores were calculated for each participant by subtracting the pretest raw score for each GORT-4 dimension from the posttest raw score. Pearson product–moment correlation analyses were conducted to evaluate the direction, strength, and significance of the relationships between a variety of participant characteristics and gain scores. Dichotomous participant characteristics (e.g., gender) were evaluated using one-way between-groups analysis of variance.

Results

Descriptive statistics for the primary study sample's IQs and pre- and posttest GORT-4 scores are presented in Table 2. Note that the smaller sample size for IQ scores indicates missing data from MCTI student files. The subsample's mean full-scale IQ score (85.66) represents the bottom cusp of the average range. A closer investigation of the sample's verbal and performance IQ scores reveals discrepancy profiles. A total of 19 students had verbal-dominant profiles, with the mean discrepancy being 9.26 points. Also, 25 students had a performance-dominant profile, with the mean discrepancy being 11.8 points.

Table 2 also presents the sample's mean standard scores (and the associated performance categories) on the GORT subscales at pretest and posttest. The sample's mean rate score of 3.73 at pretest and 3.96 at posttest both fall at the cusp of the very poor to poor range. The sample's pretest accuracy score of 4.96 was characterized as poor, whereas their posttest accuracy score of 6.68 was characterized as below average. Similarly, the sample's mean comprehension scores moved from the poor to below average range (5.24 at pretest) into the below average range (6.14 at posttest). For comparison purposes, the sample's mean raw score was converted to a grade equivalent, also presented in Table 2. Rate grade equivalents remained at late fourth grade from pre- to posttest, whereas accuracy moved from 5.78 to 7.42 and comprehension moved from 6.66 to 7.85.

The study investigated the null hypotheses that there were no differences between pre- and posttest raw scores for rate, accuracy, and comprehension. Results of the *t* tests are summarized in Table 3. There was no significant change in reading rate, $t(49) = -1.41$, $p = .17$ (two-tailed). In contrast, results showed a statistically significant gain in reading accuracy from pretest to posttest, $t(49) = -8.92$, $p = .00$

Table 3. Paired Samples *t* Tests Between Pre- and Posttest GORT-4 Raw Scores

Pair	*M*	*SD*	*SEM*	99% Confidence Interval		*t*	*df*	*p*[a]
				Lower	Upper			
1. Pre- and posttest rate	−0.82	4.11	0.58	−2.38	0.74	−1.41	49	.17
2. Pre- and posttest accuracy	−6.40	5.08	0.72	−8.32	−4.48	−8.92	49	.00
3. Pre- and posttest comprehension	−4.56	11.91	1.69	−9.08	−0.05	−2.71	49	.01

Note: GORT-4 = *Gray Oral Reading Test–Fourth Edition* (Wiederholt & Bryant, 2001). Participant *n* = 50; excluded outliers (participants older than 30 years of age with more than 140 treatment hours).
a. Significance computed for two-tailed test.

Table 4. Descriptive Statistics and ANOVA Results for Reading Gains by Gender

Task	Men[a]		Women[b]					
	M	*SD*	*M*	*SD*	*F*	*p*	Welch	*p*
Gain in GORT accuracy	0.78	3.56	1.00	5.03	0.02	.89	—	—
Gain in GORT rate	6.51	4.51	5.89	7.46	0.11	.74	0.06	.82
Gain in GORT comprehension	3.08	9.09	9.00	18.55	2.03	.16	0.87	.38

Note: GORT = *Gray Oral Reading Test–Fourth Edition* (Wiederholt & Bryant, 2001). Welch's robust test of equality of means was conducted because the assumption of homogeneity of variance was violated for gains in GORT rate and GORT comprehension. In both cases, the null hypothesis (that men and women displayed equal means) could not be rejected.
a. *n* = 41.
b. *n* = 9.

(two-tailed). The eta-squared statistic (.62) showed a large effect size. Similarly, results showed a statistically significant gain in reading comprehension, $t(49) = -2.71$, $p = .01$ (two-tailed). The eta-squared statistic (.13) showed a moderate effect size.

This study also evaluated the relationship between participant characteristics and gains in reading skill. The relationship between gender and improvement in text reading was investigated using one-way between-groups analyses of variance and Welch's robust test of equality of means as necessary to address violations of the assumption of homogeneity of variance. Results from these analyses, presented in Table 4, demonstrate that male and female participants did not differ significantly on accuracy gain scores, $F(1, 48) = 0.02$, $p = .89$, on rate gain scores, Welch $F(1, 48) = 0.06$, $p = .82$, or on comprehension gain scores, Welch $F(1, 48) = 0.87$, $p = .38$. Thus, the null hypothesis that there were no differences between gains scores displayed by males and females on text accuracy, rate, and comprehension could not be rejected.

To evaluate the relationship among age and pretest literacy scores and gain scores, Pearson product–moment correlation analyses were conducted. The correlations among the variables are presented in Table 5. The results indicated that gains in rate and accuracy from pretest to posttest were not significantly related to any of the participant characteristics. In contrast, the results confirmed a moderate negative relationship between pretest comprehension and comprehension gain, $r(48) = -.50$, $p < .01$, such that participants with lower initial levels of reading comprehension made greater gains, on average, than participants with higher initial levels of reading comprehension. Table 5 also shows a positive relationship between gains in comprehension and verbal intelligence, $r(48) = .30$, $p < .05$, indicating that individuals with higher verbal intelligence scores made greater gains in reading comprehension, on average, than individuals with lower verbal intelligence scores. Other dimensions of the intelligence score—performance and full-scale IQ—were not significantly correlated to reading scores. In addition, the number of disabilities did not show a significant correlation with reading scores.

The relationship between treatment hours and gains in literacy was also evaluated, and as Table 5 shows, the correlations between treatment hours and pretest rate, accuracy, and comprehension were weak and nonsignificant. This suggests that the duration of this individualized intervention (as determined by observed response to intervention) was not related to beginning literacy skill. The correlations between treatment hours and gains in passage reading rate, accuracy, and comprehension were also weak and nonsignificant.

Discussion

The current study analyzed the effects of an intensive reading intervention with a particular population: adults with moderate to severe disabilities in a vocational rehabilitation setting. The intervention included key components culled from a review of relevant literature in the areas of children's reading interventions, LD in childhood and adulthood, and adult reading interventions. Attrition rates for adult literacy programs typically range from 30% to 90% (Comings & Soricone, 2007; Wagner & Venezky, 1999). Project Advance had an attrition rate of only 10%. Factors

Table 5. Correlations Between Gray Oral Reading Tests Gain Scores and Various Participant Characteristics

	1	2	3	4	5	6	7	8	9	10	11	12
1. Pretest rate	—	.79**	.18	–.12	.02	–.09	.09	–.09	.03	–.21	.08	.06
2. Pretest accuracy		—	.30*	–.14	–.05	–.03	–.00	.02	–.01	–.15	–.18	.03
3. Pretest comprehension			—	.18	.03	.19	–.16	–.10	.17	–.18	–.09	–.50**
4. Full-scale IQ				—	.57**	.87**	–.46**	.03	–.17	–.06	.18	.17
5. Verbal IQ					—	.16	.44**	–.23	–.05	–.01	.19	.30*
6. Performance IQ						—	–.82**	.07	–.20	–.14	.08	.07
7. Verbal–performance discrepancy							—	–.20	.15	.12	.04	.11
8. Treatment hours								—	.05	.18	–.09	–.08
9. Number of disabilities									—	.08	.01	.01
10. Rate gain										—	.15	.21
11. Accuracy gain											—	.18
12. Comprehension gain												—
M	26.32	31.48	33.60	85.66	85.84	88.55	–2.70	84.85	3.61	0.16	1.59	0.94
SD	9.26	9.79	12.04	7.87	7.65	11.91	13.07	27.29	1.88	0.99	1.38	2.94

*$p < .05$. **$p < .01$.

that might have contributed to such a remarkably low attrition include (a) program efficacy (a combination of factors including intervention efficacy and staff aptitude), (b) rehabilitation setting (a "captive" audience who lives on site and has access to the numerous benefits listed in the methods section), and (c) learner characteristics (having an awareness of the need for literacy, internal motivation, and increased metacognitive capacities).

A description of this sample can inform the counseling field as to potential profiles of adult populations in vocational rehabilitation settings. This vocational rehabilitation sample was, on average, 20 to 21 years old and had a mean IQ of 86. Their low–average intelligence scores were accompanied by, on average, nearly four disabilities. Most of the students had an LD as their primary disability. More than half of the sample had an LD accompanied by other cognitive (i.e., attention disorder, cognitive impairment, or neurological condition) or mental (i.e., psychological or psychiatric) disabilities. The majority of these students had completed high school before attending the Reading Clinic.

The subgroup chosen for this particular study excluded outliers (students who received more than 140 hours of intervention or who were 30 years of age and older). The primary sample thus had a slightly younger average age, between 19 and 20 years. The low–average full-scale IQs resulted from nearly 10-point discrepancies between the verbal and performance subscales. The discrepancy scores suggest that these students have distinct strengths and distinct weaknesses; the low–average intelligence scores do not result from generally depressed cognitive capacities. Prior to intervention, the sample's reading profiles showed a relative strength in comprehension, slightly weaker abilities in accuracy, and even weaker abilities in reading rate. Their scores approximated grade equivalents of mid-sixth for comprehension, high fifth for accuracy, and high fourth for rate.

The subgroup received an average of 85 hours of individualized, systematic reading intervention that included phonology, orthography, and comprehension components, as appropriate. Students received intervention in homogeneous groups consisting on average of two to three students. After intervention, these students displayed statistically significant gains in accuracy and comprehension but not in reading rate. Comprehension and accuracy moved to the below average range, whereas rate stayed in the very poor to poor range. In terms of grade equivalents, comprehension moved to high seventh, accuracy to mid-seventh, and rate stayed at high fourth.

Perhaps the most promising finding for the rehabilitation counseling field emerges in consideration of the inherent potential of this particular sample. Despite atypical development and numerous risk factors, such as low–average IQ, multiple disabilities, unemployment, and history of reading difficulty, this emerging adult sample showed a substantial response to intervention. In fact, some of the lowest readers made the largest gains. Comprehension pretest scores were significantly negatively correlated with the change in comprehension scores. Possibly, these readers had an oral language advantage and simply needed access to the printed word. Once equipped with skills to decode and recognize words, those with the lowest comprehension scores were better prepared for understanding written text. Alternatively, maybe those with the lowest comprehension scores had the skills to read the words on the page but needed better comprehension strategies provided by the visual imagery component.

Despite these important gains in accuracy and comprehension, this population remained constrained by slow reading rates. Rate remained relatively constant, resistant to an average of 85 hours of treatment. The group's mean posttest rate remained in the very poor to poor range and was more than 2 standard deviations below average. Slow reading

rates, such as these, linger as markers for adult struggling readers with disabilities. Individuals with slower reading rates have a lower likelihood of reading if given the opportunity to engage in an alternative activity (Rasinski, 2000; Winn, Skinner, Oliver, Hale, & Ziegler, 2006). Consequently, even though these adults had increased accuracy and comprehension abilities, their slow reading rates might still deter them from engaging in leisure reading and thus not gain the myriad of benefits acquired by reading (Stanovich, 1986).

In the current study, rate remained extremely slow, despite improvements in word- and text-level abilities. Although models of reading disability suggest that improving accuracy should improve rate (Torgesen, Rashotte, & Alexander, 2001), this was not observed in the present case. Possibly, the intervention did not have sufficient duration to enable improvements in rate, and students' decoding and word recognition skills still lack automaticity that could be improved by more phonology and orthography training. However, analyses that examined the relationship between hours of treatment and gains in literacy did not show a significant result. This finding is complex and warrants further consideration. Because the research on adult literacy interventions suggested that adults may require more instruction to make adequate gains, we designed our intervention to allow for individualization in program duration. In consultation with their counselor and the clinic director, students could enroll in a second term to receive more hours of the intervention if it was felt that more progress could be made. In this case, a nonsignificant relationship between treatment hours and gains in literacy suggests that these consultative decisions were made appropriately. Students with more treatment hours made similar gains in literacy as compared to students with fewer treatment hours. However, it might be the case that the criterion for success for these consultative decisions was set too low and that all students would have benefitted from additional intervention hours. Future research would need to inform this point.

In this particular adult sample, rate did not correlate with comprehension. Thus, for emerging adults with primarily LD, this might indicate more of an independence of rate and comprehension abilities, which may reflect a unique developmental trajectory. To be more precise, this group appears to have higher comprehension abilities despite very poor reading rate. This may be evidence of the oral language advantage previously reviewed for adult struggling readers. In other words, these emerging adults may be using top-down comprehension strategies to compensate for their slow reading speed. This provides additional understanding of reading development across the life span, particularly for atypically developing readers who do not receive appropriate early intervention. Hence, for a population of emerging adults with primarily LD, once they have acquired basic decoding, word recognition, and comprehension abilities, rate could still persist as an area of need.

If slow rate presents as an additional cause of reading difficulties, the next application of theory to practice regards effective intervention strategies for improving rate. The study intervention incorporated components recommended from a vast amount of children's intervention research and much sparser adult intervention research. These components included phonology, orthography, and comprehension with integrated exercises targeting fluency at the lexical and text levels. Thus, this study contributes to a serious gap in the research on effective literacy interventions for struggling adult readers. Findings suggest that an individualized, multicomponential reading program resulted in large gains in reading accuracy and moderate gains in reading comprehension among adults in a vocational rehabilitation setting. The participants did not show gains in reading rate, which raises concerns about the applicability of children's intervention strategies and minimal adult research with this particular population. The study results underscore the need for further study of intervention strategies for improving reading rate and fluency in adult populations with disabilities.

Implications for Training

Results from this current study should be considered descriptive rather than prescriptive; however, both the characteristics of the current sample and the response to intervention suggest potential implications for the training of rehabilitation counselors. The findings provide potentially useful information for implementing three professional standards of the Council on Rehabilitation Education (CORE):

1. The use of assessment
2. Employment and career development
3. Research and program evaluation

The use of assessment (CORE Standard C.7) in the current study highlights the value of considering IQ profiles alongside assessments in reading and language for clients. Looking beyond the low–average general IQ score revealed that these adults with disabilities had distinct strengths and weakness rather than a generally flat IQ. Rehabilitation counselors should investigate low–average IQ to find if a discrepancy exists, which may be an indicator of potentially promising responses to intervention. Empirical studies have demonstrated that verbal IQ can predict comprehension in statistical models (e.g., Thomson & Raskind, 2003), and this study affirms this relationship with the finding that verbal IQ correlates significantly to the reading comprehension gains achieved through treatment. IQ should always be considered in conjunction with other language- and reading-based assessments, which often have stronger predictive capacities concerning response to intervention (Stage, Abbott, Jenkins, & Berninger, 2003; Vellutino, Scanlon, &

Lyon, 2000). In this particular study, incoming reading comprehension scores were indirectly related to gains made in reading comprehension. Thus, a client with lower reading comprehension may have significant gains to be made in comprehension through systematic, individualized reading intervention.

The emerging adult sample in this study, primarily with LD, made significant gains in reading accuracy and comprehension, even with low–average IQ and below-average incoming reading scores. Thus, clients with LD and low cognitive indicators should not necessarily be excluded from intervention opportunities. Counselors engaging in vocational planning (CORE Standard C.4.3) with clients should consider rehabilitation services such as the studied reading intervention, as this could result in meaningful reading gains. Reading level directly relates to income and employment (Strucker, Yamamoto, & Kirsch, 2007). An analysis by Vanderberg and Disney (2003) of job eligibility using career planning software *Open Options* (Danielski, 2002) revealed that the number of jobs available nearly doubled when the applicant's general education degree (GED) level increased from the first to the second level. GED Levels 1 and 2 correspond roughly to grade equivalents of 4 and 5 (Eguez, Taylor, & Bergman, 1996). This analysis illustrates the potential impact of even limited growth in literacy abilities.

Analyses and interpretation of data from the Reading Clinic exemplify systematic research and program evaluation of the effectiveness of rehabilitation counseling services (CORE Standard C.8.3) at the MCTI. The current study can be considered a model for research and development and program evaluation using a quasi-experimental design. The findings indicate robust outcomes for the current intervention in this setting and call for future research.

Limitations and Directions for Future Research

The MCTI study has limitations in that it looked at a very specific sample of students with specific demographic characteristics. Having low–average IQ and moderate to severe disabilities could affect the intervention response. Without an experimental design, results cannot be attributed to any particular variable or methodology. This group's response to intervention still suggests directions for future research concerning rate and fluency in adult struggling readers.

One area of future research would be additional descriptive or experimental studies with the MCTI population or similar populations that assess the efficacy of interventions that include additional components targeting reading rate. For example, a subsequent intervention could include systematic exercises targeting speed and automaticity at the sublexical and lexical levels as well as timed, repeated reading (Torgesen et al., 2001). The intervention could also include exercises at the text level, such as accelerated reading, designed to improve reading speed (Breznitz, 2006). In addition, consideration could be given to structured free reading time, such as the design utilized in *Extensive Reading* (Greenberg, Rodrigo, Berry, Brinck, & Joseph, 2006), which would expose students to many of the positive experiences that accompany reading. Based on the research and evidence available for adult populations at this time, these components would be the next appropriate strategies for attempting to remediate reading rate.

Although researchers have suggested that preventing fluency problems is easier than remediating them (Torgesen et al., 2001), this study provides evidence that certain adult populations desperately need interventions that target rate and fluency, in addition to other deficits such as phonological processing and comprehension. Based on the present descriptive study and the review of literature related to adult reading interventions, a major question remains: "Is the reading rate of adults with disabilities amenable to change?" Future research in this direction will help to answer this question as well as suggest preliminary developmental trajectories for children with certain types of reading disabilities, specifically those who do not receive appropriate reading intervention and become adults who struggle with reading. With such studies, the field will come closer to constructing a unified theory of cognitive development across the life span, including both typically and atypically developing readers. With a cohesive and inclusive theory of cognitive development, service providers will have the essential base for making appropriate referral to reading interventions for a heterogeneous population.

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References

Americans with Disabilities Act of 1990, 42 U.S.C.A. § 12101 *et seq*. (West 1993).

Besser, S., Brooks, G., Burton, M., Parisella, M., Pare, Y., Stratford, S., & Wainwright, J. (2004). *Adult literacy learners' difficulties in reading: An exploratory study*. London, UK: National Research and Development Centre for Adult Numeracy and Literacy.

Breznitz, Z. (2006). *Fluency in reading: Synchronization of processes*. Mahwah, NJ: Lawrence Erlbaum.

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences* (3rd ed.). Hillsdale, NJ: Lawrence Erlbaum.

Comings, J. P. (2007). Persistence: Helping adult education students reach their goals. In J. Comings, B. Garner, & C. Smith (Eds.), *Review of adult learning and literacy: Connecting research, policy, and practice* (pp. 23–46). Mahwah, NJ: Lawrence Erlbaum.

Comings, J., & Soricone, L. (2007). *Adult literacy research: Opportunities and challenges* (NCSALL occasional paper). Cambridge, MA: National Center for the Study of Adult Learning and Literacy.

Corley, M. A., & Taymans, J. M. (2002). *Adults with learning disabilities: A review of the literature*. In J. Comings, B. Garner, & C. Smith (Eds.), *Annual review of adult learning and literacy* (Vol. 3, pp. 44–83). San Francisco, CA: Jossey-Bass.

Curtis, M. E. (1987). Vocabulary testing and vocabulary instruction. In M. G. McKeown & M. E. Curtis (Eds.), *The nature of vocabulary acquisition* (pp. 37–51). Hillsdale, NJ: Lawrence Erlbaum.

Curtis, M. E. (1997). Teaching reading to children, adolescents, and adults: Similarities and differences. In L. R. Putnam (Ed.), *Readings on language and literacy: Essays in honor of Jeanne S*. Chall (pp. 75–88). Cambridge, MA: Brookline Books.

Danielski, J. (2002). Open options (Version 28) [Computer software]. Plymouth, MI: Career Planning Specialists Software.

Eden, G. F., Jones, K. M., Cappell, K., Gareau, L., Wood, F. B., Zeffiro, T. A., . . . Flowers, D. L. (2004). Neural changes following remediation in adult developmental dyslexia. *Neuron*, *44*, 411–422. doi:10.1016/j.neuron.2004.10.019

Eguez, J., Taylor, L., & Bergman, T. (1996). *A workforce basic skills norming study of Iowa's JTPA and PROMISE JOBS target populations*. Retrieved from http://casas.org

Greenberg, D., Ehri, L. C., & Perin, D. (1997). Are word-reading processes the same or different in adult literacy students and third-fifth graders matched for reading level? *Journal of Educational Psychology, 89*, 262–275.

Greenberg, D., Rodrigo, V., Berry, A., Brinck, T., & Joseph, H. (2006). Implementation of an Extensive Reading program with adult learners. *Adult Basic Education*, *16*, 81–97.

Haigler, K. O., Harlow, C. W., O'Connor, P. E., & Campbell, A. (1994). *Literacy behind prison walls: Profiles of the prison population from the National Adult Literacy Survey*. Washington, DC: National Center for Education Statistics.

Kennedy, K., & Backman, J. (1993). Effectiveness of the Lindamood Auditory Discrimination in Depth Program with students with learning disabilities. *Learning Disabilities Research and Practice*, *8*, 253–259.

Kozol, J. (1985). *Illiterate America*. New York, NY: Anchor Doubleday.

Kruidenier, J. (2002a). *Literacy education in adult basic education*. Retrieved from http://www.ncsall.net/?id=574

Kruidenier, J. (2002b). *Research-based principles for adult basic education reading instruction*. Washington, DC: National Institute for Literacy.

Kutner, M., Greenberg, E., Jin, Y., Boyle, B., Hsu, Y., & Dunleavy, E. (2007). *Literacy in everyday life: Results from the 2003 National Assessment of Adult Literacy* (NCES 2007-480). Washington, DC: U.S. Department of Education, National Center for Education Statistics.

Lovett, M. W., Steinbach, K. A., & Frijters, J. C. (2000). Remediating the core deficits of developmental reading disability: A double-deficit perspective. *Journal of Learning Disabilities*, *33*, 334–358. doi:10.1177/002221940003300406

McShane, S. (2005). *Applying research in reading instruction for adults: First steps for teachers*. Washington, DC: National Center for Family Literacy.

Mikulecky, L. (2005). *Adult literacy policy, scientifically based research, and evidence-based practice*. Retrieved from http://www.ncsall.net/?id=777

Mulka, P., & Miller, P. (2010). *Michigan Career and Technical Institute NCA final report: 2000–2005*. Plainwell, MI: Michigan Career and Technical Institute.

National Center for Education Statistics. (1993). *National Adult Literacy Survey*. Washington, DC: Author.

National Center for Education Statistics. (2005). *A first look at the literacy of America's adults in the 21st century*. Retrieved from http://nces.ed.gov/NAAL/PDF/2006470.pdf

National Institute for Child Health and Human Development. (2006). *Adult literacy research network*. Retrieved from http://www.nichd.nih.gov/research/supported/alrn.cfm

National Institute for Literacy. (2000). *Literacy skills for 21st century America: A foundation for creating a more literate nation*. Washington, DC: National Institute for Literacy. Retrieved from ERIC database. (ED448284)

National Research Council. (1998). *Preventing reading difficulties in young children*. Washington, DC: National Academy Press.

Rasinski, T. V. (2000). Speed does matter in reading. *Reading Teacher*, *54*, 146–150.

Sadoski, M., & Wilson, V. (2006). Effects of a theoretically based large-scale reading intervention in a multicultural urban school district. *American Educational Research Journal*, *43*, 137–154. doi:10.3102/00028312043001137

Scanlon, D., Mellard, D. P., Garrison, S., Lancaster, S., Mellard, J., & Rausch, T. (1998). *What we know about literacy practices for adults with learning disabilities: A review of published research*. Boston, MA: Boston College. Retrieved from ERIC database. (ED421633)

Smith, M. (1990). *Project read: A study of twenty reading disabled adults*. Lee, MA: Appalachian Press.

Stage, S. A., Abbott, R. D., Jenkins, J. R., & Berninger, V. W. (2003). Predicting responses to early reading intervention from verbal IQ, reading-related language abilities, attention rating, and verbal IQ-word reading discrepancy: Failure to validate discrepancy method. *Journal of Learning Disabilities*, *36*, 24–33. doi:10.1177/00222194030360010401

Stanovich, K. E. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly*, *21*, 360–406.

Sticht, T. G. (1988). Adult literacy education. In E. Z. Rothkopf (Ed.), *Review of research in education* (Vol. 15, pp. 59–96). Washington, DC: American Educational Research Association.

Strucker, J., Yamamoto, K., & Kirsch, I. (2007). *The relationship of the component skills of reading to IALS performance: Tipping points and five classes of adult literacy learners*. Cambridge, MA: National Center for the Study of Adult Learning and Literacy. Retrieved from www.ncsall.net

Sum, A. (1999). *Literacy in the labor force: Results from the national adult literacy survey*. Washington, DC: ED Pubs.

Swanson, H. L. (Ed.). (1999). *Interventions for students with learning disabilities: A meta-analysis of treatment outcomes*. New York, NY: Guilford.

Thomson, J. B., & Raskind, J. H. (2003). Genetic influences on reading and writing disabilities. In H. L. Swanson, K. R. Harris, & S. Graham (Eds.), *Handbook of learning disabilities* (pp. 256–270). New York, NY: Guilford.

Torgesen, J. K., Rashotte, C. A., & Alexander, A. W. (2001). Principles of fluency instruction in reading: Relationships with established empirical outcomes. In M. Wolf (Ed.), *Dyslexia, fluency, and the brain* (pp. 333–355). Parkton, MD: York Press.

U.S. Census Bureau. (2006). *Survey of income and program participation*. Retrieved from http://www.census.gov/sipp

U.S. Department of Education. (2010, January). Even Start funding status. Retrieved from http://www2.ed.gov/programs/evenstartformula/funding.html

Vanderberg, L., & Disney, L. (2003). [Job availability based on reading and writing functional levels in *Open Options*]. Unpublished analysis.

Vaughn, S., Hughes, M. T., Moody, S. W., & Elbaum, B. (2001). Instructional grouping for reading for students with LD: Implications for practice. *Intervention in School and Clinic*, *36*, 131–137.

Vellutino, F. R., Scanlon, D. M., & Lyon, G. R. (2000). Differentiating between difficult-to-remediate and readily remediated poor readers: More evidence against the IQ-achievement discrepancy definition of reading disability. *Journal of Learning Disabilities*, *33*, 223–238.

Wagner, D. A., & Venezky, R. L. (1999). Adult literacy: The next generation. *Educational Researcher*, *28*, 21–29.

Wiederholt, J. L., & Bryant, B. R. (2001). *GORT-4: Examiner's manual*. Austin, TX: PRO-ED.

Winn, B. D., Skinner, C. H., Oliver, R., Hale, A. D., & Ziegler, M. (2006). The effects of listening while reading and repeated reading on the reading fluency of adult learners. *Journal of Adolescent & Adult Literacy*, *50*, 196–205. doi:10.1598/JAAL.50.8.4

Woodcock, R. W. (1997). *WDRB: Examiner's manual*. Itasca, IL: Riverside.

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