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Reading Disorders

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Abstract
The present entry summarizes current research on reading disorders. Historical trends along with the most recent perspectives on the definitions, subgroup classifications, and causes of the problems related to reading are reviewed. This entry also provides an analysis of treatments to improve reading skills and types of interventions resulting in successful outcomes. We conclude by examining the main issues in the field of reading disabilities.

INTRODUCTION

The goal of the present entry was to review literature on reading disorders and problems associated with poor reading skills. First, the variety of terminology and definitions are examined and the current definitions of the disorder and the classifications are provided.

Next, a more detailed description of the processes involved in good reading and possible causes of problems in reading are explored. Among these potential causes are impairments associated with basic processes related to reading recognition, language processes, naming speed, and memory. Neurological basis of reading problems and some possible genetic factors to account for reading deficits are also discussed. Then we proceed to examining various scientifically based treatments and factors that are related to successful intervention outcomes. Finally, the entry concludes by reviewing controversial and problematic issues in the field of reading disabilities.

The term reading disorders has been used interchangeably in literature with the term dyslexia, learning-disabled readers, specific reading disabilities, learning disabilities in reading or reading disabilities. For simplicity, we will use the term reading disabilities. Children or adults with reading disabilities have an unexpected failure in reading, but otherwise possess average intelligence and motivation in schooling considered necessary for accurate fluent reading. Reading disabilities are among the most common neurological-based disorders affecting children with prevalence rates of 5–10% in clinics and about 17% in unselected population-based samples.[1] These incidence figures and the review of research reflected in this entry are primarily based on children who are having difficulty learning to read alphabetic language. There has been little consensus on the incidence of reading disabilities in nonalphabetic languages. Reading disabilities is a persistent chronic condition that does not represent a transient developmental lag. Depending on the definition, the incidence of children with reading disabilities in special education classes is conservatively estimated to reflect 2–5% of the public school population. It is also the largest category of children served within the context of the label learning disabilities, and children with learning disabilities are the largest diagnostic group of children served in special education.

By definition, children and adults classified as having reading disabilities are those individuals with normal intelligence, but who suffer mental information processing difficulties. Children or adults with reading disabilities are a subgroup of a larger diagnostic category known as learning disabilities. The terms are used interchangeably because approximately 80% of the intervention research on learning disabilities focuses on reading.[2] Several definitions refer to reading disabilities as reflecting a heterogeneous group of individuals with "intrinsic" disorders that are manifested by specific difficulties in the acquisition and use of listening, speaking, reading, and writing. Most definitions of reading disabilities assume that reading difficulties of such individuals are

1. Not due to inadequate opportunity to learn, general intelligence, or to significant physical or emotional disorders, but to basic disorders in specific psychological processes (such as remembering the association between sounds and letters).
2. Not due to poor instruction, but to specific psychological processing problems. These problems have a neurological, constitutional, and/or biological base.
3. Not manifested in all aspects of learning. Such individuals' psychological processing deficits depress only a limited aspect of academic behavior. For example, such individuals suffer problems in reading, but not necessarily arithmetic.

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Before discussing the causes and issues related to reading disabilities, a brief historical review is necessary.

HISTORICAL TRENDS

In 1877, Kussmaul called attention to a disorder he referred to as word blindness, which was characterized as an inability to read, although vision, intellect, and speech were normal. Following Kussmaul's contribution, several cases of reading difficulties acquired by adults due to cerebral lesions, mostly involving the angular gyri of the left hemisphere, were reported (Hinshelwood[3] for a review). In one important case study, published by Morgan,[4] a 14 year old boy of normal intelligence had difficulty recalling letters of the alphabet. He also had difficulty recalling written words, which seemed to convey "no impression to this mind." That case study was important because word blindness did not appear to occur as a result of a cerebral lesion. After Morgan's description of this condition, designated as a specific reading disability, research was expanded to include children of normal intelligence who exhibited difficulties in reading. Hinshelwood's[3] classic monograph presents a number of case studies describing reading disabilities in children of normal intelligence. On the basis of those observations, Hinshelwood inferred that reading problems of those children were related to a "pathological condition of the visual memory center" (p. 21).

Researchers from the 1900s to the 1940s generally viewed reading difficulties as being associated with structural damage to portions of the brain that supported visual memory (Geschwind[5] for a review; also Monroe[6]). A contrasting position was provided by Orton,[7,8] who suggested that reading disabilities were reflective of a neurological maturational lag resulting from a delayed lateral cerebral dominance for language. Orton described the phenomenon of a selective loss or diminished capacity to remember words as strephosymbolia (twisted symbols). Orton[8] noted that "although these children show many more errors of a wide variety of kinds it is clear that their difficulty is not in hearing and not in speech mechanism, but in recalling words previously heard again or used in speech, and that one of the outstanding obstacles to such recall is remembering all of the sounds in their proper order" (p. 147).

Orton stated that such children with reading disabilities had major difficulties in "recalling the printed word in terms of its spatial sequence of proper order in space" (p. 148). Thus, for Orton, reading difficulties in children with reading disabilities were seen as reflecting spatial sequences in visual memory or temporal sequences in auditory memory. However, it is important to note the conceptual foundation for much of Orton's research was challenged in the 1970.[9] Today reading difficulties are viewed primarily as language problems and memory difficulties (Stanovich[10]). Memory difficulties are popularly conceptualized in terms of difficulties in language processes.

ASPECTS OF READING DISORDERS

Subgroups of Reading Disabilities

The heterogeneity of performance of individuals with reading problems has led to some confusion in the field and has prompted researchers to theorize the existence of distinct subtypes of reading disabilities.[11–13] In their recent examination of the current state and perspectives on learning disabilities, Fletcher et al.[11] proposed the existence of three types of reading disability. The first type is associated with problems in word recognition and spelling. The second form refers to difficulties in reading comprehension. Finally, the third type includes individuals who experience difficulty in reading fluency and poor automaticity of word reading.

The largest number of students with reading disabilities demonstrate problems on word level recognition. It is the most common and best understood form of reading disability and is associated with deficits in phonological awareness (the ability to hear and manipulate sounds in words and understand the sound structure of language), automatized rapid naming, and verbal working memory. However, a subset of students with reading disabilities (RD) who have intact word recognition skills show deficits in reading comprehension. This type of disability is related to problems in oral language and working memory. (Working memory is the capacity to integrate new information with old information when high demands are made on attention.) Finally, a group of students with average word decoding skills differ in reading fluency: these individuals have either slow reading rate or average rate but low reading accuracy.

A prominent study by Morris and colleagues[12] explored the variability of reading disability subtypes in a large group of 7–9 years old children with reading problems. Based on the results of their study several reading subtypes emerged: two subtypes without reading disability, five subtypes with specific reading disability, and two were categorized as "globally deficient," in the sense that performance across all measures was very low. Five specific reading disability subgroups varied with regard to phonological (working) memory and rapid naming. Six of the reading disability groups exhibited deficits in phonological awareness skills. The authors concluded that children with reading disabilities could be differentiated from the "garden variety" poor readers on the basis of their vocabulary level, which was in the average range for children with specific reading disabilities.

Overall, Morris and colleagues work on subtyping reading disabilities is consistent with the phonological

processing hypothesis, which postulates that problems in the phonological domain account for reading difficulties. These phonological problems either occur in isolation or co-occur with problems in other cognitive domains.

Other subtype studies tested whether good and poor readers could be differentiated on their performance on memory-related measures. For instance, Swanson[13] examined individual differences in several forms of memory of students with and without reading disabilities. Although several subgroups with different profiles emerged, the results indicated that children with reading disabilities had low performance on memory tasks not because of reading, but rather due to inefficient working memory. Swanson concluded, that "connection between reading and WM operate on a continuum of independence to dependence as reading becomes more skilled" (p. 327).

Adults with Reading Disabilities

Reading disability persists through the lifespan, and children with reading disabilities grow up and become adults with reading disabilities. As these young adults transition to a new stage of their lives, they encounter new problems and challenges at home, at work, and in the community. In adulthood, the implications of having a reading problem are different and not that obvious. Unfortunately, the large number of general population today is still unaware of the specifics of reading disability and because it is "invisible," the behavior of these individuals is often misinterpreted and not understood by people with whom they interact in the beyond-school world. Less research has been conducted with adults with reading disabilities than with school-age children and adolescents. The majority of research on adults with reading disabilities has focused largely on examining their social and emotional development, vocational training, transition to postsecondary education, and issues related to employment.

The Individuals with Disabilities Education Act 2004 (IDEA 2004), the Americans with Disabilities Act (ADA), and Section 504 of the Rehabilitation Act, define the rights of people with learning problems, including reading disability. Individuals with learning disabilities in reading are legally entitled to receive special services and appropriate instruction to help them cope with and overcome their learning problems and to adapt to the new environment. Such services may include workplace accommodations, extended time on tests and exams, or use and provision of assistive technology.

Reading Disabilities as a Subcategory of Learning Disabilities

As mentioned earlier, a great deal of research on reading disabilities has been linked to a larger diagnostic category known as learning disabilities. The term learning disabilities was first coined in a speech by Samuel Kirk delivered in 1963 at the Chicago Conference on Children with Perceptual Handicaps. Clinical studies prior to 1963 showed that a group of children who suffered perceptual, memory, and attention difficulties related to their poor academic (i.e., reading) performance, but who were not intellectually retarded, were not being adequately served in the educational context. Wiederholt,[14] in reviewing the history of the learning disabilities (LD) field, said that its unique focus was on identifying and remediating specific psychological processing difficulties. Popular intervention approaches during the 1960s and 1970s focused on visual-motor, auditory sequencing, or visual perception training exercises. Several criticisms were directed at these particular interventions on methodological and theoretical grounds.

By the late 1970s, dissatisfaction with a processing orientation to remediation of learning disabilities, as well as the influence of federal regulations in the United States (Public Law 94-142), remediation programs focused primarily on teaching the basic skills of reading, such as phonics and sight word identification. The focus on basic skills rather than psychological processes was referred to as direct instruction. The mid-1980s witnessed a shift from the more remedial-academic approach of teaching to instruction that included both basic skills in reading and cognitive strategies (ways to better learn new information and efficiently access information from long-term memory). Children with learning disabilities, primarily in the area of reading, were viewed as experiencing difficulty in "regulating" their learning performance, especially on reading comprehension tasks. An instructional emphasis was placed on teaching students to check, plan, monitor, test, revise, and evaluate their learning during their attempts to learn or solve problems.

The early 1990s witnessed a resurgence of direct instruction intervention studies, primarily influenced by reading research, which suggested that a primary focus of intervention should be directed to phonological skills. The rationale was that because a large majority of children with learning disabilities suffer problems in reading, some of these children's reading problems are exacerbated due to a lack of systematic instruction in processes related to phonological awareness. This view gave rise to several interventions, which focused heavily on phonics instruction and intense individual one-to-one tutoring to improve children's phonological awareness of word structures and sequences.

From the turn of the twenty-first century to the present, assessments of reading disabilities have been linked to intervention. A method of identifying school-aged students with reading disabilities known as response to intervention (RTI) first establishes low academic performance and then determines if a disability is present. The RTI model is partially based on intervention programs

that have distinguished children experiencing academic difficulty due to instructional deficits from those with disability-related deficits.[15] Federal regulations in the United States regarding the Individuals with Disabilities Education Improvement Act of 2004 have influenced the use of RTI by supporting a child's response to scientific, research-based intervention as a process for learning disabilities identification. In general, the RTI model identifies whether a student's current skill level is substantially lower than the instructional level (based on predetermined criteria: e.g., below the 25th percentile). Low academic performance is established using standardized, norm-referenced and/or curriculum-based measurements. After establishing low performance, empirically based interventions are implemented to determine if a disability is present. Student progress is monitored during the intervention. When a student does not respond to high-quality intervention, the student may have a reading disability.

Causes of Reading Disabilities

Before discussing the possible causes of reading disabilities, it is necessary to highlight what good reading entails and some of the processes (when not operating properly) that may underlie or contribute to reading disabilities. Written words are symbolized representations of the spoken word. The ability to read depends on the acquisition of a variety of different types of knowledge and skills. Good reading ability assumes adequate language comprehension and fluent word identification. Most models of reading suggest that knowledge of certain things are stored in our mind (referred to as coding) and can be transformed into units of spoken/written language. This stored information allows us to acquire information related to the spoken and written language. The storing and retrieving of language information is referred to as linguistic coding. Some aspects of linguistic coding involve speech codes or our ability to represent information in the form of words and word parts. This is referred to as phonological coding. There are other types of coding processes that are related to reading. Some of these codes relate to semantic coding which relates to our ability to store information about the meaning of concepts represented by words and word parts (e.g., -ing, -ed) and syntactical coding, which is the ability to store word rules that set constraints on how words are organized in sentences. There is also pragmatic coding, which is the ability to store information about conventions governing the use of language and how we communicate (in terms of changes in volume, pitch, intensity of spoken language). Linguistic and visual processes together also facilitate the establishment of associations of printed words. Visual coding refers to sensory or high-level visualization processes that facilitate storage or representations of written words or graphic symbols.

Proficiency in reading would require the child to actively engage in all of the aforementioned coding processes. There is an "awareness" feature to the coding process. For example, "phonological awareness," which refers to a child's ability to conceptually understand and have an explicit awareness of spoken words and that they consist of individual speech sounds (phonemes) and that there are combinations of speech sounds (syllables, sound units). Such knowledge is viewed as very important in learning letters and carrying out sound values and converting the alphabet symbols to sounds. There is also "orthographic awareness" which refers to the child's sensitivity to how letters or words are organized.

Given all these particular coding process, several models of reading disabilities have emerged. Vellutino et al.[16] provide an overview of research on specific reading disabilities across four decades. They conclude that adequate facility in word identification, due to basic deficits in phonological coding (converting written letters and words into sounds, skills of segmenting and blending sounds associated with letters—what is generally referred to as phonics knowledge) underlie reading disabilities. These deficits in phonological coding are defined as an inability to use speech codes to represent information in the form of words and parts of words. In short, these individuals have an inability to represent sound units in one's mind. Based on the review by Vellutino et al.[16] most cases of reading disabilities are due to phonological coding deficiencies rather than more basic deficits such as visual, semantic, and syntactical processing of information. There are some studies that have suggested that there may be some general language deficits in this population. Some of these general problems have been related to difficulties in attention, making association between sounds and visual shapes, processing verbal to auditory information or transfer, and working memory. We will briefly review some of the research programs that seek to determine the causes of reading disabilities.

Basic processes related to word recognition

Linda Siegel and her colleagues at the University of British Columbia have conducted several studies on basic processes related to reading disabilities.[17,18] Her studies define reading disabilities in terms of word recognition skills that "all" children with reading problems have. A significant contribution of Siegel's program is her definition of reading disabilities. She suggests that the focus of definition should be at the reading recognition level and suggests that a cutoff below the 25th percentile or 20th percentile should contribute to the operationalization of reading disabilities. This work is based on the assumption that there is no reliable evidence to indicate that IQ plays a cognitive role in development of reading skills. Reading disabled children at all IQ levels have equal difficulty in

phonological processing tasks, such as to the word meaning, recognizing the visual forms of pseudo words, and pseudo word spelling. Work by Siegel indicates there are five possible processes that underlie the development of reading skills in the English language. These processes involve phonology, syntax, working memory, semantics, and orthography. Most of this research shows that difficulties in phonological processing are fundamental problems for children with reading disabilities, and these problems continue to adulthood. Three processes are critical in the analysis of reading disabilities: those related to phonological processing, syntax, and working memory.

Language processes

Virginia Mann at the University of California at Irvine has focused on language processes and their relationship to reading disability (Mann[19]). Her studies on language processing skills and reading problems indicate that poor readers have problems with phoneme awareness, morpheme awareness, and with three aspects of language skill: 1) speech perception under difficult listening conditions; 2) vocabulary, especially in terms of naming ability; and 3) use of the phonetic representation in linguistic short-term memory. Several of these process share a common core related to phonological coding, which concerns the sound pattern of language. Based on comparative studies (e.g., American and German instruction) her research suggests that awareness of phonemes is enhanced by methods of instruction that direct a child's attention to phonetic structures of words. Instructional experiences alone are not the only factors that account for failure to achieve phoneme awareness. Some other factors are related to speech perception (i.e., the awareness of rhyme), working memory, and problems with morphology.

Naming speed

Several studies by Marianne Wolf[20,21] have found a connection between rapid naming of letters, numbers, and objects and reading disabilities. Slow naming speed marks a core deficit associated with reading disabilities. Her work has found strong relationships between rapid naming of letters and sound deletion (phonological awareness task). Rapid naming is associated not only with initial reading fluency but also whether there are any fluency gains after practice. Some research has investigated the role of rapid naming and reading achievement in languages other than English. The research suggests that slow naming speed is somewhat distinct from phonemic awareness. Some of Wolf's work has focused on subtyping by strengths and weaknesses in rapid naming as well as phonological awareness. That research suggests a double deficit hypothesis, in which children can vary in terms of difficulty on phonological skills, rapid naming skills, or both of those skills.

Memory

Lee Swanson and his colleagues have researched reading disabilities by primarily focusing on short-term memory, working memory and their distinction. Deficits in reading comprehension and problem solving experienced by children with reading disabilities are related to memory problems in a speech-based storage system and/or memory problems related to specific aspects of a general executive system of working memory. The executive system focuses on the monitoring of information, focusing and switching attention, and activating representations from long-term memory. Problems in the executive system of children with reading disabilities are related to the inefficient mental allocation of attention and the poor inhibition of irrelevant information. Problems in executive processing are described in terms of limitations in attentional capacity rather than processing strategies. Because short-term memory has minimal application to complex academic tasks, the majority of his research on reading disabilities focuses on the relationship between working memory and complex cognition (reading comprehension, word problems).

Neurological basis

Studies by George Hynd and colleagues at the University of Georgia have focused on the neurological correlates of reading disabilities.[22,23] Neurobiological evidence for reading disabilities is primarily done through postmortem, electrophysiological, family, and functional imaging studies. Evidence from this neurological data suggests the disruption of the neurological system for language in individuals with reading disabilities. Brain-based research in reading disabilities has focused on the planum temporale, gyral morphology of the perisylvian region, corpus calossum, as well as cortical abnormalities of the tempo-parietal region. Although at this point in time it is difficult to summarize this research, the neural biological codes believed to underlie cognitive deficits in reading disabled seemed to be centered on the left tempo-parietal region. Differences in the asymmetry of the planum temporale have consistently been found in association with reading disabilities. Specifically, asymmetry of the planum temporale is due to a larger right plana. A reversal of normal pattern of left greater than right asymmetry has been found in individuals with developmental dyslexia.

Recent studies by Sally Shaywitz and Bennett Shaywitz[1] at Yale University have found differences in the tempo-parieto-occipital brain regions between reading disabled and non-impaired readers. The converging evidence using functional brain imaging in adult reading disabled readers shows a failure in the left hemisphere posterior brain system to function properly during reading. Some brain imaging studies show differences in brain activation

in frontal regions in reading disabled compared to non-impaired readers. The majority of this research has focused on the brain regions where previous research has implicated reading and language. The research shows clear activation patterns related to phonological analysis. For example, on nonword rhyming tasks reading disabled readers experience a disruption of the posterior system that involves activation of the posterior superior temporal gyrus (also known as Wernicke's area, the angular gyrus, and the striate cortex). The research demonstrates a persistent nature of a functional disruption in the left hemispheric neural systems and indicates that this disorder is lifelong.

Genetic factors

Several studies have addressed genetic influences on reading disabilities. This research suggests that phonological coding abilities have a genetic etiology. The Colorado twin studies support the existence of major gene effects on reading disabilities, although the precise information about the mode of inheritance is less clear. Some of the literature[24] has found the localization of dyslexic gene sites (some of the gene sites have been attributed to chromosome 1, 2, 6, 15, and 18). Some research suggests that genes which contributed to nonword repetition also account for the genetic basis of memory span score. Recent developments have focused on genotype/phenotype correlations, biological consequences of specific genetic changes, and intentional intervention strategy guided by genetic profiles.

Scientifically Based Treatments

In the field of reading disabilities, the term treatment or intervention is defined as the direct manipulation (usually assigned at will by the experimenter) of variables (e.g., instruction) for the purposes of assessing learning,[1] efficiency,[2] accuracy,[3] and understanding. Swanson et al.[2] have provided the most comprehensive analysis of the experimental intervention literature on learning disabilities, and specifically reading disabilities to date. Interventions were analyzed at three levels: general models of instruction, tactics used to convey information, and components that were most important to the instructional success.

In terms of general models, their synthesis of methodologically sound studies (those studies with well-defined control groups and clearly identified samples) found that positive outcomes in remediation reading were directly related to a combination of direct and strategy instructional models. These models included a graduated sequence of steps with multiple opportunities for overlearning the content and skills, cumulative review routines, mass practice, and teaching of all component skills to a level that showed mastery. The interventions involved: 1) teaching a few concepts and strategies in depth rather than superficially; 2) teaching students to monitor their performance; 3) teaching students when and where to use the strategy in order to enhance generalization; 4) teaching strategies as an integrated part of an existing curriculum; and 5) providing teaching that included a great deal of supervised student feedback and practice.

In terms of tactics, Swanson[25] divided studies into eight models based on key instruction tactics: direct instruction (a focus on sequencing and segmentation of skills), explicit strategy training, monitoring (teaching children strategies), individualized and remedial tutoring, small interactive group instruction, teacher-indirect instruction (teacher makes use of homework and peers' help for instruction), verbal questioning/attribution instruction (asking children key questions during the learning phase and whether they thought what they were learning would transfer), and technology (using computers to present concepts). The results indicated that explicit strategy instruction (explicit practice, elaboration, strategy cuing) and small group interactive settings best improved the magnitude of treatment outcomes. Explicit strategy instruction included two key components. One component included strategy cues. These studies included instructional components related to reminders to use strategies or multisteps, the teacher verbalizing steps or procedures to solve problems, and use of "think aloud" models. The other component of strategy instruction was elaboration. These studies included instructional components related to providing additional information or explanations about concepts, and/or providing redundant text or repetition within text.

What makes an intervention effective regardless of its theoretical orientation or approach? Swanson[25] analyzed interventions at the component level to address this question. He and his colleagues[26] found that effective instructional models follow a sequence of events:

1. State the learning objectives and orient the students to what they will be learning and what performance will be expected of them.
2. Review the skills necessary to understand the concept.
3. Present the information, give examples, and demonstrate the concepts/materials.
4. Pose questions (probes) to students and assess their level of understanding and correct misconceptions.
5. Provide group instruction and independent practice. Give students an opportunity to demonstrate new skills and learn the new information on their own.
6. Assess performance and provide feedback. Review the independent work and give a quiz. Give feedback for correct answers and reteach skills if answers are incorrect.
7. Provide distributed practice and review.

They also found that some instructional components were far more important than others. For reading comprehension, those key instructional components that contributed in significantly improving the magnitude of outcomes were

1. Directed response/questioning. Treatments related to dialectic or Socratic teaching, the teacher directing students to ask questions, the teacher and a student or students engaging in reciprocal dialogue.
2. Control difficulty or processing demands of task. Treatments that included short activities, level of difficulty controlled, teacher providing necessary assistance, teacher providing simplified demonstration, tasks sequenced from easy to difficult, and/or task analysis.
3. Elaboration. Treatments that included additional information or explanation provided about concepts, procedures or steps, and/or redundant text or repetition within text.
4. Modeling by the teacher of steps. Treatments that included modeling by the teacher in terms of demonstration of processes and/or steps the students are to follow to solve the problem.
5. Small group instruction. Treatments that included descriptions about instruction in a small group, and/or verbal interaction occurring in a small group with students and/or teacher.
6. Strategy cues. Treatments that included reminders to use strategies or multisteps, use of "think aloud models," and/or teacher presenting the benefits of strategy use or procedures.

In contrast, the important instructional components that increased the effect sizes for word recognition were

1. Sequencing. Treatments included a focus on breaking down the task, fading of prompts or cues, sequencing short activities, and/or using step-by-step prompts.
2. Segmentation. Treatments included a focus on breaking down the targeted skill into smaller units, breaking into component parts, segmenting and/or synthesizing components parts.
3. Advanced organizers. Treatments included a focus on directing children to look over material prior to instruction, directing children to focus on particular information, providing prior information about task, and/or the teacher stating objectives of instruction prior to commencing.

The importance of these findings is that only a few components from a broad array of activities were found to enhance treatment outcomes.

Two very important instructional components emerged in Swanson's analysis of treatments for children with reading disabilities. One component was explicit practice which included activities related to distributed review and practice, repeated practice, sequenced reviews, daily feedback, and/or weekly reviews. The other component was advanced organizers which included: 1) directing children to focus on specific material or information prior to instruction; 2) directing children about task concepts or events before beginning; and 3) the teacher stating objectives of the instruction.

ISSUES IN THE FIELD OF READING DISABILITIES

Fundamental problems of definition have severely affected the field of reading disabilities within the public school context. This is because considerable latitude exists among psychologists in defining reading disabilities. This latitude is influenced by social/political trends as well as nonoperational definitions of reading problems. The field of study is further exacerbated because the number of individuals classified with reading disabilities has increased dramatically over the last 20 years. Unfortunately, without reliable and valid definitions of reading disabilities, very little progress in terms of theory development will emerge.

A related impediment to advances in the field is whether students with reading disabilities perform any different than low achievers. Traditionally, studies that have studied children with reading disabilities have relied primarily on uncovering a significant discrepancy between achievement in a particular academic domain and general intellectual ability. The implicit assumption for using discrepancy scores is that individuals who experience reading problems, unaccompanied by a low IQ, are distinct in cognitive processing from slow or low achievers. This assumption is equivocal. A plethora of studies have compared children with discrepancies between IQ and reading with children who are non-discrepantly defined poor achievers (i.e., children whose IQ scores are in the same low range as their reading scores). These studies found that the two groups were more similar in processing difficulties than different.[27,28] As a result, some researchers state that current procedures to identify children with reading disabilities are invalid. They have suggested dropping the requirement of average intelligence, in favor of a view where children with reading problems are best conceptualized as existing at the extreme end of a continuum from poor to good readers. In addition, some researchers have argued that IQ is irrelevant to the definition of reading disabilities and that poor readers share similar cognitive deficits, irrespective of general cognitive abilities.

In contrast to the argument that children with reading disabilities look no different than other poor readers in cognitive functioning or treatment outcome, Hoskyn and Swanson[27] found in a synthesis of the literature that although children with reading disabilities and poor readers share some deficits in phonological processing and automaticity (naming speed), performance by children

with reading disabilities was superior to poor readers on measures of syntactical knowledge, lexical knowledge, and spatial ability. Another important finding was that cognitive differences between the two ability groups were more obvious in the earlier grades. Perhaps more important, Swanson and Hoskyn[29] found that students with reading disabilities and low achievers differed in the magnitude of their responsiveness to treatment. After reviewing several intervention studies, the results showed that students who had low reading scores (25^{th} percentile) but average IQ scores were less responsive to interventions than children whose reading and IQ scores were in the same low range (25^{th} percentile) (see also pp. 300–301).[29]

One of the practical difficulties within the field is that students who are identified by a political notion of reading disabilities have very little resemblance to the description offered within the scientific discipline. Thus, in contrast to the above arguments related to the validity of reading disabilities as a field, most researchers who study the processing difficulties of children with reading disabilities do not use the discrepancy criteria. The majority of researchers rely on cutoff scores on standardized measures that are above a certain criterion of general intelligence measures (e.g., standard score >85) and cutoff scores below a certain criterion (standard score <85) on primary academic domains (e.g., reading or mathematics). Researchers distinguish individuals with reading disabilities from other general handicapping conditions, such as mental retardation, visual, and hearing impairments. Further specification is made that socioeconomic status, being bilingual, and conventional instructional opportunity do not account for depressed achievement scores. Such specification allows the scientists to infer that the learning problems are intrinsic to the individual.

CONCLUSION

Children and adults with reading disabilities have normal intelligence but have difficulties in phonological processing, syntax, and working memory. These problems manifest themselves by poor performance on word recognition and reading comprehension tasks. Poor performance is defined as reading scores below at least the 25^{th} percentile on a norm-referenced reading test. There is a biological basis to reading disabilities that causes lifelong difficulties in reading. Effective intervention programs focus on the explicit teaching of word and comprehension skills.

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