

# A Hypothesis of Reading Instruction as a Cause of Dyslexia

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## Abstract

Dyslexia is a reading disability affecting a large number of people worldwide. People with dyslexia have at least normal levels of intelligence, yet they nevertheless have significant difficulties with reading. Dyslexia is known to have genetic causes; however, some researchers believe that there are also environmental factors at play. Specifically, the way in which a child is taught to read can possibly influence whether or not that child ultimately ends up with dyslexia or other reading difficulties. This paper presents the hypothesis that the way a child is taught to read can be a major factor in the development of dyslexia. There has been speculation about this idea in previous literature, but that speculation has been based only on anecdotes and case studies; empirical research is added in this paper. This hypothesis is based on research showing that certain approaches to teaching reading can induce difficulties with phonetic skills (in other words, difficulty associating written letters with spoken sounds in a language that uses an alphabetic writing system) and fMRI-measurable brain patterns matching those of people with dyslexia. Additionally relevant is that those approaches are widespread in the English-speaking world—most specifically in the United States. Reading difficulties not related to phonetic skills would not be implicated in this hypothesis. The literature justifying this hypothesis is discussed, as well as the challenges to the hypothesis and a way that it can be tested. The importance of proposing this hypothesis is that if flawed reading instruction is indeed one primary cause of dyslexia, then reform in elementary schools is vital.

**Keywords:** dyslexia, reading disability, genetics, environment, phonics

## 1. Introduction

Dyslexia is a disorder affecting approximately 20% of children in the United States (Hurford, Hurford, Head, Keiper, Nitcher, & Renner, 2016). Dyslexia is “characterized by difficulties with accurate and/or fluent word recognition. These difficulties typically result from a deficit in the phonological component of language” (Hurford et al., 2016, p. 1). In other words, individuals with dyslexia often appear to struggle with phonological skills—the ability to associate sounds with written letters (Moats, 2000). While the origins of dyslexia are complex, some scholars (e.g., Engelmann, 2007; Fletcher & Lyon, 1998; Vellutino, Fletcher, Snowling, & Scanlon, 2004) have argued that dyslexia is at least partially an environmental disorder—specifically, that it is partly caused by how a child is taught to read. Given that reading disabilities can have devastating consequences for a child (Engelmann, 2007; Francis, Caruana, Hudson, & McArthur, 2019; Hernandez, 2012; Maughan, Rowe, Loeber, & Stouthamer-Loeber, 2003), it is vital to address and reject teaching methods if they are shown to be causing dyslexia. This work proposes the hypothesis that although there are cases in which dyslexia is caused solely by genetic factors, inappropriate reading instruction is a leading cause of dyslexia, to the point that effective reading instruction could actually prevent dyslexia from arising in some students with genetic predispositions. It is important to emphasize that this is a hypothesis, and it is quite challengeable; however, it is worth presenting in order to address the possibility that by reform in the teaching of reading, the prevalence of reading disability could decline enormously.

## 2. How Reading “Happens”

Before delving into dyslexia and its causes, it is important to clarify what reading is. In a language with an alphabetic writing system (a writing system in which written letters represent sounds of the language), reading depends on two factors: decoding and language comprehension (Parker, 2019). “Decoding” refers to the ability to “sound out” a word; this means identifying the sounds associated with each letter and being able to combine them. For example, if a speaker of English sees the word “tree,” reading it would require identifying the sounds associated with each letter (t/r/e/e) and blending them (mentally or orally) in order to produce a full word (“tree”).

At this point, language comprehension comes into play. “Language comprehension” refers, essentially, to vocabulary knowledge. If a person hears the word “tree,” is he aware that that word refers to a tall plant with leaves? If so, then upon sounding out t/r/e/e, he will understand the word that he is reading. If he does not know that word, then sounding out the text that he sees will simply produce a sound that is nonsense to him. As an example, one can take this “word”: [garpaga]. A literate English-speaker can sound out that string of letters, but he would not comprehend anything, because the word is not real. In sum, in order to read in a language with an alphabetic writing system, one must be able to sound out the letters that he sees, and one must know the meaning of the word that he is sounding out. A “formula” of reading to describe this concept has been used by many scholars, such as Parker (2019):

$$RC = D \times LC \quad (1)$$

This formula means “reading comprehension equals decoding times language comprehension.” Put simply, if one understands a word that he hears and can sound out the letters that make up that word when it is written (thus allowing him to hear it either auditorily or in his mind), he will understand it when he reads it. Dyslexia involves a significant deficit in this formula.

### 3. Defining Dyslexia

Seidenberg (2018, p. 153) states that with regards to defining dyslexia, “[g]etting an answer requires deciding whom to ask.” While the number of different definitions of dyslexia is staggering, all definitions agree that dyslexia consists of difficulty with reading (Seidenberg, 2018). Since reading in a language with an alphabetic writing system is based most fundamentally on phonics (Fletcher & Lyon, 1998), this paper will consider that dyslexia is a reading disorder in which a person of at least average intelligence has difficulty with phonics; this means that a person has difficulty associating spoken sounds with written symbols (Hurford et al., 2016). For example, a person with dyslexia may not be able to associate the written symbol “m” with the sound produced when placing together one’s lips and expelling air through the nose. This can also be described as “inaccurate and/or dysfluent word recognition” (Anderson, 2021) due to its consisting of one’s inability to associate accurately a sound with a written symbol. Despite the large number of definitions of dyslexia, the above definition and description are currently described as consensus (Anderson, 2021). In alphabetic writing systems (such as that of English), having this type of difficulty is an extreme hindrance to reading ability, given that reading in such a language depends heavily on being able to “sound out” words. Simply put, if one can not fully understand the link between sounds and letters, one can not read easily, thus resulting in dyslexia. As explained by Parker (2019), “[d]yslexics can’t read because they can’t decode [sound out letters].” Other reading difficulties are caused by non-phonological problems; such types of reading difficulties would not be applicable to this hypothesis, as the phonetic component of the disorder is key to what will be discussed.

### 4. The Prevalence of and Consequences of Dyslexia and Other Reading Difficulties

Approximately 20% of children in the United States suffer from dyslexia (Hurford et al., 2016). The consequences of having dyslexia or any other reading difficulty can be devastating. G. Reid Lyon, former chief of the National Institute of Child Health and Human Development, testified before the United States congress in 2001 with the following statement:

Of children who will eventually drop out of school, over 75 percent will report difficulties learning to read... Surveys of adolescents with criminal records indicate that at least half have reading difficulties, and in some states, the size of prisons a decade in the future is predicted by fourth grade reading failure rates. Approximately half of children... with a history of substance abuse have reading problems (cited in Engelmann, 2007, p. 109).

Due to the high number of students with reading difficulties who end up dropping out of school, it must be noted that students who drop out of school face immense challenges for the rest of their lives, such as a higher likelihood of being chronically unemployed and ending up incarcerated (Sum, Khatiwada, & McLaughlin, 2009), and ultimately a higher likelihood of developing health problems and having a shorter life expectancy (SSAT, 2011). Additionally, reading difficulties in early years are predictive of mental health problems (such as depression and anxiety) as children grow up (Francis et al., 2019; Maughan et al., 2003). Quite simply, reading is the foundation of success in education. If a child does not learn to read early (during the first years of primary school), he will be hindered for the remainder of his education—as he advances through each grade level, more and more of his education will depend on reading (such as having to read articles or chapters of books as homework), and with poor reading skills, he will inevitably fall behind. As explained in the book *The Academic Achievement Challenge* by Jeanne Chall, “[r]eading... has been widely correlated with achievement in the other school subjects. It is often used as an index of overall achievement” (Chall, 2000, p. 57). Put succinctly in an article from the journal *Reading*

*and Writing*, deficits in reading skills prevent students from “accessing the academic school curriculum” (Graham, White, Tancredi, Snow, & Cologon, 2020, p. 1896). This is precisely what leads to an elevated drop-out rate for students with dyslexia or other reading issues—without reading skills, they simply can not engage in the tasks required of them in most classes beyond the level of primary school. The consequences of dropping out of school are enormous, both to the individual and to society; therefore, addressing reading problems is crucial. The debate about reading issues and effective reading instruction is in fact currently being discussed as a human rights issue in the United States (Fairfax County NAACP, 2021). As argued by education researcher E.D. Hirsch, “[e]very child reading at grade level by the end of 1st or 2nd grade would do more than any other single reform to improve the quality and equity of American schooling” (Hirsch, 1996, p. 148).

## 5. The Causes of Dyslexia

Although scholars such as Seidenberg (2018) and Lyytinen et al. (2015) show evidence confirming that genetic factors can cause or contribute to the development of dyslexia—these factors often being hereditary—it is possible that many cases of dyslexia are largely caused by environmental factors. For example, Kershner (2021) argues that prenatal and childhood stress can be major factors in the development of dyslexia. Additionally, ineffective reading instruction has been suggested to play a role. A recent article from *American Public Media* explains in detail how the way reading is taught in many schools across the United States and other countries quite literally teaches students to approach reading the way that a dyslexic person does (Hanford, 2019). The article explains research from the University of Maryland showing that, as determined by fMRI scans, teaching English speakers to read English words in a foreign alphabet (in this case, Korean script) via what is called the “whole-word method” or “sight-word method” results in their brains showing the same patterns as those of a person with dyslexia when attempting to read; on the other hand, participants taught with a “components/phonics” method quickly developed normal reading skills in the new script (Bolger, 2007). This brings about the following questions: what methods of teaching reading exist, and what are their influences on the development of dyslexia? Additionally, as noted in the introduction: could ineffective methods of teaching reading be a leading cause of dyslexia, and could there be cases in which a genetic predisposition to dyslexia could in fact be overcome with better reading instruction?

## 6. The Role of Reading Instruction

Given the devastating consequences that can be caused by dyslexia (and by poor reading skills in general), it is important to determine what schools and society can do in order to prevent dyslexia. If flawed reading instruction is a leading cause of dyslexia, then fixing reading instruction is the key to improving education. Historically, in English-speaking countries, there have been two broad approaches to teaching reading: the “sight-word/whole-word method” and the “phonics” method (Parker, 2019). A variety of techniques for teaching reading exist (with a wide variety of names), but all of them fall under the umbrella of one of the two general approaches. Some methods claim to “mix” the two approaches, but even in those methods, one approach becomes so dominant as to negate the other (Moats, 2000). The argument about which of these approaches should be used has gone on in American schools for decades and has been referred to as “the reading wars” (Chall, 2000; Daniels, Hyde, & Zemelman, 2005; Hanford, 2018). Despite the years of debate, the research consistently finds that phonics-based approaches to teaching reading are much more effective than sight-word methods (Chall, 2000; Coyne, Kame’enui, & Carnine, 2011; Engelmann, 2007; Fletcher & Lyon, 1998; Hanford, 2019; Moats, 2000; NITL, 2005; Seidenberg, 2018). Additionally—as noted above—there is some research indicating that teaching reading via the sight-word method can induce reading patterns that match those of people with dyslexia (Bolger, 2007; Hanford, 2019). Below, the phonics method and the sight-word method of teaching reading are described, followed by an explanation of how the sight-word method could cause reading problems.

### 6.1 The Sight-Word Method

The “sight-word” approach to teaching reading has existed since at least the 1800’s. As explained by Parker (2019):

Most children who learn to read during the 19th century are taught from either Noah Webster’s Blue-Backed Speller or from the famous McGuffey Readers. Both sold over 100 million copies, placing them in the same league as the Bible. McGuffey was explicit in his directions to teachers: they could use his primer with what he called the “word” method (top-down), the “phonic” method (bottom-up), or a combination of the two methods. Here’s how McGuffey described these methods: “*The Word Method* [sight-word approach] teaches a child to recognize words as wholes. This method pays no attention to elementary sounds and diacritical marks. After a number of words are taught as wholes, the children are told the names of the letters, and learn to spell.” [Emphasis added]

Put simply, with the sight-word method, children are not taught the connections between sounds and written letters.

Instead, students are required to memorize full words as if they are pictures. Sounding out words is not emphasized. If any phonics (sound-letter correspondence) is taught, it is only an “incidental” and minor inclusion. The sight-word method has also been called whole language, reading with the three-cueing system, balanced literacy, MSV, and the whole-word method (Hanford, 2019). In schools in the United States, the sight-word method is the most commonly used approach for teaching reading (Hanford, 2019).

Additionally, it is important to mention that this method is not related to the process of sight-word reading caused by orthographic mapping. After sounding out a word multiple times, that word becomes “orthographically mapped” in one’s long-term memory—in other words, repeatedly associating particular sounds with particular sequences of written letters results in one’s being able to recognize a word as a whole when it is seen (Hanford, 2019; National Reading Panel, 2000). Recognizing a word as a whole via orthographic mapping when reading is often called “sight-word reading.” However, that process is very different from memorizing a word as a picture (as is done in the sight-word *method* of teaching reading)—such memorization ignores associating sounds with letters; rather, it consists of associating an entire word as an “image” connected with a certain meaning. Without making the associations between spoken sounds and written symbols, sight-words are not easily retained in long-term memory (National Reading Panel, 2000).

### 6.2 The Phonics Method

Phonics methods to teaching reading consist of first teaching phonemes—the basic sounds of a language; with this, the correspondence between these sounds and written letters is taught directly and explicitly (Parker, 2019). As opposed to the “top-down” (Parker, 2019) perspective of the “sight-word” method (learn words before letters), phonics takes a “bottom-up” approach that teaches written letters and their sounds before having students attempt to read full words. The emphasis is on sounding out words rather than seeing words as whole units to be memorized. Just like the sight-word method, the phonics method has existed for hundreds of years (some scholars, such as Flesch [1955], claim that the phonics method was the primary method of teaching reading in languages with alphabetic writing systems from the invention of the alphabet thousands of years ago up until the 1900s). The previously mentioned “McGuffey Readers” of the 1800’s describe the phonics method as such:

“By the Phonic Method, the child is first taught the elementary sounds of letters; he is then taught to combine these elementary sounds into words. The sound is first taught, and then the character which represents it; the spoken word is learned, and then its written and printed form. This method pays no attention to words as wholes until the elementary sounds composing them are learned.” (cited in Parker, 2019)

## 7. Potential Problems with the Sight-Word Method

### 7.1 Reading vs. Memorizing Words

As previously mentioned, for teaching reading in a language like English that depends on an alphabet, phonics-based approaches are much more effective than sight-word approaches. This is because knowing the connection between sounds and written letters allows a reader to sound out words of which he knows the *meaning* but has not seen *written* before. For example, a native speaker of English will likely know the word “tree” even before he learns to read. When reading, if he sees the letters t/r/e/e, and he knows the sounds associated with those letters, he can sound out the word, thus hearing and understanding the word “tree.” If, however, this reader has been taught with the sight-word method, he may not be able to read the word “tree” if it is not one of the whole words that he has memorized. The key is that when *speaking* English, the individual knows the word “tree.” If he knows the sounds of written letters, he can also sound out the word and understand it when he encounters it in writing. However, if he has only been memorizing words as if they were pictures and has not yet memorized the word “tree,” then he can not read it even though, as an English speaker, he knows what the word means when he hears it. Education professor Dr. Martin Kozloff has expressed this concept in a blog post:

[I]f a child memorizes ten words, the child can read only ten words, but if the child learns the sounds of ten letters, the child will be able to read 350 three-sound words, 4,320 four-sound words, and 21,650 five-sound words (Kozloff, 2002).

In this blog post, Kozloff does not provide a source for the exact numbers that he stated, but even so, the principle he expresses stands—memorizing words enables one to read only those words. Learning letters and their sounds allows one to read all words that are made up of those letters. Put simply, reading via the sight-word approach is not truly reading in an alphabetic system; reading consists of phonetic knowledge resulting in one sounding out words quickly and accurately.

### 7.2 Interference with Reading

Some evidence—although largely anecdotal—from researchers indicates that memorizing words if they were

images can actually prevent a child from later learning how to read well. This concept of sight-word reading interfering with proper phonetic reading was proposed as early as 1929 in *The Journal of Educational Psychology* in an article bluntly entitled “The ‘Sight Reading’ Method of Teaching Reading, as a Source of Reading Disability” (Orton, 1929).

Similar observations were reported by Siegfried Engelmann, the author and co-author of several extremely successful programs for teaching reading in English (Stockard, Wood, Coughlin, & Khoury, 2018). Engelmann writes that using a beginner reading program to teach a child who does not yet have any reading knowledge is very effective; however, using the same type of program with a student who has some reading knowledge but reads poorly is ineffective:

Our... strategy was to put them [older students with reading issues] in our beginning reading program and teach them from scratch. For those students who had virtually no reading skills, this remedy was effective. The students were able to move through the program at a relatively fast rate and experience success in learning to read. For some of the other students, this solution was not highly efficient because these students had some reading behavior, and they also had strong habits and routines that led them to make decoding mistakes. They needed a program that targeted their abortive strategies and that discredited and replaced them with effective strategies (Engelmann, 2007, pp. 208–209).

Anecdotes of the same issue are mentioned in many works, such as the 1955 book *Why Johnny Can't Read* by Rudolf Flesch:

[R]emedial reading cases are harder to teach than first-graders for the simple reason that they already have four or five or six years of [sight-word instruction] behind them. It usually takes at least a year to cure them of the habit. There wouldn't be any remedial reading cases if we started teaching reading [with phonics] instead of [the sight-word method] in first grade (Flesch, 1955, p. 18).

This concept has also been expressed by the nonprofit organization Literacy How:

We have had many conversations with teachers about the fact that the system (sight-word teaching) is not only void of research and evidence, but—equally important—*it is also teaching children habits that are difficult to change* [Emphasis added]. Worse yet, this approach sets children up for frustration and failure (Literacy How, 2018).

In other words, students who have been taught to read poorly have habits that are very difficult to overcome, yet those habits must be overcome in order for the student to learn to read well. In sum, if a child has been taught to read poorly, the situation can not easily be fixed by “starting over”; instead, the child must go through the long and difficult process of “undoing” the poor reading strategies that he has learned so that he can then learn to read correctly. These acquired reading difficulties could end up being diagnosed as dyslexia. Again, it is important to consider this possibility with great caution, as it is, at the time of writing, based almost entirely upon anecdotal evidence.

## 8. Summary of Phonics Methods, Sight-Word Methods, and Learning to Read

Teaching reading via phonics means teaching the connections between sounds and written letters. The idea is to have students sound out words in order to read (Parker, 2019). Teaching reading via the sight-word method consists of having students memorize full words as if they were pictures or symbols. Sounding out words is rarely, if ever, involved (Hanford, 2019; Parker, 2019). Extensive research has shown that teaching reading with phonics is by far the most effective method in a language with an alphabetic script, whereas students taught with the sight-word method often fail to learn to read well (Bolger, 2007; Chall, 2000; Coyne, Kame'enui, & Carnine, 2011; Engelmann, 2007; Fletcher & Lyon, 1998; Hanford, 2019; Moats, 2000; NITL, 2005; Seidenberg, 2018). In fact, there is evidence that teaching students to read an alphabet via the sight-word method results in those students' ending up displaying brain imaging patterns consistent with those of people diagnosed with dyslexia (Bolger, 2007). Additionally—although based mainly on anecdotes—some scholars (e.g., Engelmann, 2007; Flesch, 1955) have argued that teaching a child to read via the sight-word method makes the child develop an ineffective reading “reflex” or “habit” that interferes with effective reading processes. Due to this, a child who has learned to read via the sight-word method can not simply “start over,” being taught with phonics; instead, his sight-word conditioning must be undone in order for effective reading to be taught.

The issues of brain activity and reflexes/habits are key to the hypothesis of this paper. The data on brain activity specifically differentiates reading instruction's potentially causing *dyslexia* with causing *other* types of reading difficulties. Considering that brain activity patterns seen in people with dyslexia can be induced by teaching reading via the sight-word method, and considering that teaching a student with the sight-word method can instill

habits that prevent the student from easily adapting to proper reading, it is possible that many individuals diagnosed with dyslexia only have dyslexia because of the way they were taught to read; biological or genetic factors could be entirely absent. Even if biological factors are present, it is possible that reading instruction can override any biological issues in certain cases. It is important to note that in many studies of reading instruction, a certain number of students who are taught to read with the sight-word method ultimately manage to figure out the sound-letter correspondences on their own (effectively teaching themselves phonics) and learn to read properly (Hanford, 2019), so it could be argued that those students who could not do so must have had a biological predisposition to dyslexia. However, in Bolger's (2007) study, while the divide described above appeared amongst students taught with the sight-word method, *all* of the students who were taught Korean script via the phonics method learned to read it. This indicates that if any of the students in the phonics group had a biological predisposition to dyslexia, it was *overcome* by the effectiveness of phonics instruction. In other words, the research suggests that some students taught to read with the sight-word method still manage to learn to read well, but they manage to do so *in spite of* ineffective instruction. The other students taught with sight-words acquire dyslexia or other reading disabilities. Students taught with phonics tend to show overwhelming success, suggesting that if there is a biological basis to dyslexia in their cases, it can sometimes be beaten by teaching reading well.

In sum, there are undoubtedly cases in which dyslexia is caused primarily or entirely by genetic factors. In those cases, reading instruction does not play a role in causing dyslexia. However, there is preliminary evidence that in some cases, students can overcome genetic factors if they are taught reading via an effective method. In those cases, the student only develops dyslexia if faulty reading instruction is used. It can therefore be said that despite genetic factors being present in those situations, flawed reading instruction is at fault for the child's dyslexia. Additionally, there is evidence that certain methods of reading instruction induce patterns and behaviors that are characteristic of dyslexia. This could cause dyslexia even in students who have no genetic predisposition whatsoever. Because these apparently flawed methods of reading instruction are the most widely-used approach to teaching reading in the United States, I hypothesize that flawed reading instruction is a major cause of dyslexia.

## 9. Discussion

The purpose of proposing this hypothesis is to encourage teachers, principals, superintendents, and other school officials to examine the way their schools teach reading; it is possible that significant improvements could be made to their curricula and teaching methods that could drastically reduce the number of cases of dyslexia. This is especially relevant in the United States, where the sight-word method is the most prevalent approach for teaching reading in elementary schools (Hanford, 2019). Additionally, if school officials choose to address reading instruction, it is vital for them to know that "sight-word method" is an umbrella term; this approach to teaching reading has also been called the whole-word method, whole language, balanced literacy, reading with the three-cueing system, and MSV (Hanford, 2019). However, it is important to point out the potential challenges to the hypothesis.

The most important challenge is the following: the evidence regarding fMRI brain scans of students taught to read via the sight-word method comes only from the study by Bolger (2007). While it is significant that the scans of those students' brain activity match scans of students diagnosed with dyslexia, it is important to note that this study was done with university students and had a small number of participants ( $n = 30$ ). Although the process that these students went through very closely mimics ways that children are taught to read, there is always the possibility that simply through maturation, the university students would be undergoing very different processes in their brains when compared to the brains of young children who are learning to read. Additionally, these university students were essentially being taught to read for the second time in their lives; they were being taught to read English words in Korean script, but they had obviously already learned to read English with its own alphabet. It is possible that learning to read a second alphabet leads to different brain activity from what is present when one is learning to read for the first time.

Another consideration is that, as noted earlier in the quote from Seidenberg (2018), defining dyslexia is complex. This paper looks at dyslexia as a phonological issue, but reading disability can also be caused by other factors. If genetic factors related to reading, but unrelated to phonics, are leading to dyslexia, then instruction via phonics would not solve the problem in those cases.

Furthermore, although the information from Engelmann (2007) and Flesch (1955) is noteworthy, it is also primarily anecdotal. Accordingly, it is information that can contribute to the formation of a hypothesis, but not to support of a comprehensive theory. More research into this issue is needed. A potential study to look into this hypothesis could consist of monitoring children who theoretically have a genetic predisposition to dyslexia (based on family history). The way that they are taught to read (phonics vs. sight-word) would be recorded, and students'

later reading performance would be assessed, along with taking fMRI scans to see how a student's brain responds to reading. The same data can be collected from a control group of students who do not have any known genetic predisposition to dyslexia. According to the hypothesis, all children of normal intelligence who are taught with a phonics method should learn to read and should show normal brain patterns when reading, regardless of their genetic predisposition to dyslexia. If they develop reading difficulties anyway, but the difficulties are because of something other than phonological issues, the hypothesis still stands. Results showing otherwise would contradict the hypothesis presented in this paper. Some research very similar to this has been conducted, such as that done by Torppa et al. (2006) in Finland; however, in such studies comparing a control group to a group of students with a genetic predisposition for dyslexia, the method of teaching reading is not controlled. Controlling for that particular variation would be needed in order to carry out the study described in this paper; it must be assured that some students are taught with a phonics approach, and others are taught with a sight-word approach. It would be best to use specific teaching programs of each method (such as the Fountas & Pinnell programs that rely on the sight-word method [Hanford, 2019; Moats, 2000] and Direct Instruction programs that rely on a strict phonics approach [Engelmann, 2007]) to ensure as much regularity in the experiment as possible.

There is an ethical consideration in such an experiment, however—if one is operating under the hypothesis that teaching students with a sight-word method can induce dyslexia, then it is unethical to willingly teach them with that method (unless perhaps there is a structure in place to quickly address and remedy reading problems as soon as such problems appear). This makes testing the hypothesis difficult. An option is to give reading tests and fMRI scans to children who are being taught to read in a school or district in which elementary teachers are already required by the administration to teach reading with the sight-word method. Even in such a case, it would be advisable to consult with the district beforehand about switching instruction to a phonics method and providing remedial instruction if there is any sign that reading problems are arising in students. All of that being said, the ethical problems with this kind of experiment still linger, and given the damaging effects of reading disability, any research into this topic should be carried out with great caution.

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