The State of Learning Disabilities

RESEARCH & REPORTS

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BOON-dah Learning

Integrating Storytelling with STEM

The State of Learning Disabilities

RESEARCH & REPORTS

1 Summary & Report

BOOM-dah Learning

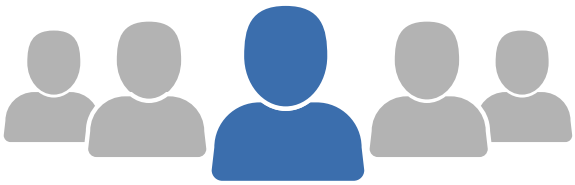
Integrating Storytelling with STEM

The State of Learning Disabilities: Understanding the 1 in 5

Snapshot of Learning and Attention Issues in the U.S.

1 in 5

children in the U.S. have learning and attention issues.



Only a ***small subset*** receive specialized instruction or accommodations...

1 in 16

public school students have Individualized Education Programs (IEPs) for specific learning disabilities (SLD) such as dyslexia and for other health impairments (OHI) such as ADHD and dyspraxia

1 in 50

public school students receive accommodations for disabilities through a civil rights statute called Section 504

...while millions of children with learning and attention issues are ***not formally identified***.

What are Learning and Attention Issues?

Learning and attention issues are brain-based difficulties in reading, writing, math, organization, focus, listening comprehension, social skills, motor skills or a combination of these. Learning and attention issues are not the result of low intelligence, poor vision or hearing, or lack of access to quality instruction.

Common Examples

Learning disabilities, such as:

- Dyslexia
- Dyscalculia
- Dysgraphia

Other difficulties that affect learning and behavior, such as:

- ADHD
- Executive function deficits
- Dyspraxia
- Nonverbal learning disabilities

Risk Factors

GENETICS

Learning and attention issues tend to run in families. Genes that can affect brain structure and chemistry get passed down from parent to child.

TOXIN EXPOSURE

Exposure to lead and other environmental factors have been linked to ADHD and other issues that impact learning, attention and behavior.

ADVERSE CHILDHOOD EXPERIENCES

Trauma, such as abuse, neglect, and other adverse childhood experiences, can increase the likelihood of being identified with learning or behavior issues.

National Center for Learning Disabilities

For more information about the challenges and opportunities for the 1 in 5 students with learning and attention issues, visit **ncld.org/StateofLD**

Barriers to Success

REPEATING A GRADE

Children with learning and attention issues often don't receive early or effective interventions. A third of students with SLD or OHI have been held back a year, which increases the risk of dropping out.

SCHOOL DISCIPLINE

Students with disabilities are more than twice as likely to be suspended as those without disabilities, and the loss of instructional time increases the risk of course failure and school aversion.

DROPPING OUT

Students with SLD drop out of high school at nearly three times the rate of all students. The top reason students with SLD drop out? 57% cited disliking school or having poor relationships with teachers or peers.

JUSTICE INVOLVEMENT

Unaddressed learning and attention issues lead to conditions that push students into the school-to-prison pipeline. A large study found that half of young adults with SLD or OHI had been involved at some point with the justice system.

NOT FINISHING COLLEGE

Young adults with learning disabilities enroll in four-year colleges at half the rate of the general population. Their completion rate for any type of college is 41%, compared to 52% of all young adults.

UNEMPLOYMENT

Only 46% of working-age adults with learning disabilities are employed. Compared with adults who do not have learning disabilities, adults with these issues are twice as likely to be jobless.

Ways to Help

RAISE AWARENESS

Learning and attention issues can look like laziness or lack of intelligence, but with the right support, children can achieve at high levels. Less stigma and high expectations are key.

EMPOWER PARENTS

With major changes ahead in education policy, it has never been more important to empower parents with information and help them be effective advocates for their children.

EQUIP TEACHERS

Most students with SLD or OHI spend 80% or more of the school day in general education classrooms, and all educators need more resources and strategies to meet the needs of diverse learners.

INTERVENE EARLY

If a child is struggling with academics or behavior, it's imperative to find out why and to provide targeted, evidence-based instruction and intervention as early as possible.

PERSONALIZE LEARNING

Aligning learning with each student's interests, strengths and needs—as well as rigorous standards—helps all children, especially those with learning and attention issues.

INCORPORATE SOCIAL AND EMOTIONAL LEARNING (SEL)

Embedding SEL instruction into the curriculum and tailoring it for students with learning and attention issues can help develop important skills such as managing emotions and persevering.

BUILD SELF-ADVOCACY SKILLS

Helping students understand how they learn and practicing how to ask for accommodations are essential for success and can be fostered through mentoring.

FOCUS EARLIER ON POSTSECONDARY TRANSITIONS

Helping high-schoolers adjust to changing expectations can promote resilience as they transition to college or the workplace.

ADVOCATE FOR INCREASED FUNDING

Education laws offer protections and can be powerful tools for change, but implementing them requires adequate, steady funding to provide supports and services.

National Center for Learning Disabilities

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Contact: info@ncld.org
www.ncld.org

Dyslexia:
The School Report

Why education "must try harder"
to support every dyslexic learner

NAME: **World's Education System**

SUBJECT: **Dyslexia** DATE: **October 2022**

The Big Picture - overview

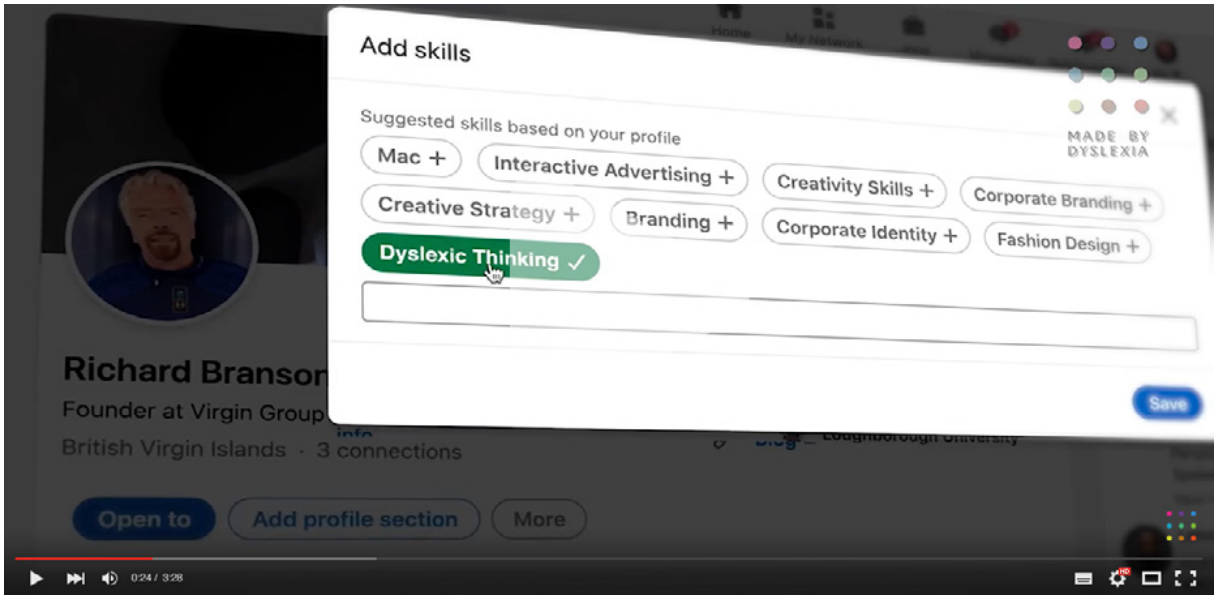
Dyslexic Thinking *is a direct match* for the skills for the future

2022 has been a BIG year. It's the year that the world finally recognised Dyslexic Thinking as a skill. It's the year that Dyslexic Thinking officially entered the dictionary as a noun.

And it's the year the world's **BIGGEST** careers platform LinkedIn, added Dyslexic Thinking as a skill.

This is a result of our campaigning, and our research with EY and Manpower which recognised that Dyslexic Thinking is a direct match for the skills for the future – as defined by the World Economic Forum.

Watch the campaign film here https://www.youtube.com/watch?v=D5Phdr6wUMs



BIG progress

Some educational systems are making rapid progress, with New York being best in class. This year, the world's **BIGGEST** city, with the **BIGGEST** number of teachers, and the **BIGGEST** number of schools – trained **EVERY** single teacher to spot and support every dyslexic child. They recognised that the city's schools should be nurturing the creative, innovative Dyslexic Thinkers who are fundamental to building its future…

"New York City has trained EVERY teacher to spot and support every dyslexic child"

… they also recognised that, unsupported dyslexia is the cause of some of the biggest societal problems and inequalities. Mayor of New York, Eric Adams (himself dyslexic), is passionate about addressing the school-to-prison pipeline – in New York, **30-40%** of prisoners are dyslexic[1]. So, supporting dyslexia is a simple way to reduce racial and socio-economic disparities in educational outcomes.

Watch the Mayor of NYC addresses World Dyslexia Assembly here https://www.youtube.com/watch?v=6iNPxcohLc4

BIG problem

But progress in the rest of the world is slow. Despite:

- Knowing for decades how to spot and support dyslexia…
- Countless recommendations from reports and experts all around the world…
- Research now showing that Dyslexic Thinking is vital for our future…there is still a BIG gap in knowledge about dyslexia in our schools.

And this report shows that the majority of educational leaders must apply themselves with more focus in order to help dyslexic children to fulfil their potential. **It's time to Learn Dyslexia**.

Made By Dyslexia has conducted the biggest ever research survey with the global dyslexia community, which finds that:

Only 1 in 10
teachers has a good understanding of dyslexic strengths[2]

Over half
say their school fails to understand dyslexic challenges[3]

Only 4%
of schools screen ALL learners for dyslexia[4]

This results in 80% of dyslexics leaving school unidentified.[5]

BIG (but simple) solution

The solution to this BIG problem is simple and irrefutable: we need to train all teachers to spot, support and empower the **1 in 5 dyslexic students** who are in every classroom, around the world. And we need to do it at speed… just like New York City.

We need to train all teachers to spot, support and empower the 1 in 5 dyslexic students who are in every classroom

> ***"It's time we stopped pulling people out of the river and go upstream and stop them from falling inthe first place."***
>
> **Archbishop Tutu**

What is dyslexia

21st century definition of dyslexia

Dyslexia influences as many as **1 in 5 people** and is a genetic difference in an individual's ability to learn and process information. As a result, dyslexic individuals have differing abilities, with strengths in creative, problem-solving and communication skills and challenges with spelling, reading and memorising facts.

Generally, a dyslexic cognitive profile will be uneven when compared to a neurotypical cognitive profile. This means that dyslexic individuals really do think differently.

Traditional benchmarking disadvantages dyslexics, measuring them against the very things they find challenging.

What is Dyslexic Thinking?

Dyslexic Thinking is now recognised as a noun in the dictionary as a creative and innovative way to think. LinkedIn also recognise it as a valuable and sought-after workplace skill and have added it to their platform. Here is the entry in dictionary.com

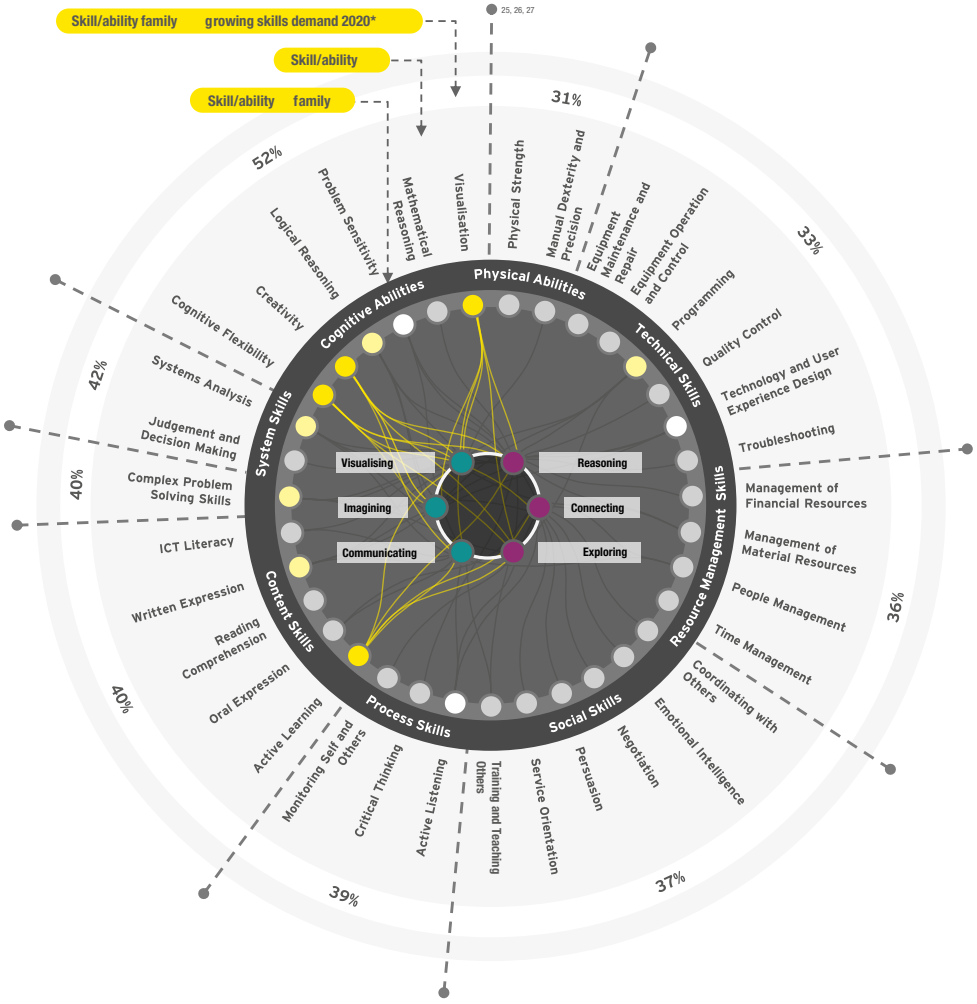
Dyslexic Thinking is now recognised as a noun in the dictionary

The exact skills the world needs

Dyslexic Thinking skills are valuable and vital. They are the 'soft skills' every workplace is looking for like creativity, adaptability, leadership, innovation, problem solving and critical thinking. As our 2018/19 reports with global consultancy EY, Value of Dyslexia[6], found: these skills are a direct match for those identified by the World Economic Forum as the skills of the future.[7]

Watch the EY Film

Dyslexic strengths align to core work-related skills and abilities of the future



Source: Value of Dyslexia, Made By Dyslexia & EY, p.29[8]

The BIG opportunity

Dyslexic minds are poised to fill this skills gap

Right now, the world is experiencing an unprecedented skills gap. Our 2020 report, The Dyslexic Dynamic[9], pointed out that talent shortages are at a 15 year high.

Dyslexic minds are poised to fill this skills gap. As technology takes over the tasks dyslexics find more challenging, the soft skills that are most valued in today's workplaces are the exact skills that people with dyslexia excel at.

By 2025 machines and humans will share roles 50-50. The **50%** of 'human' skills needed map directly with Dyslexic Thinking. As 1 in 5 people are dyslexic, this represents a global workplace talent pool of over **700 million** people.

This fact was recognised by LinkedIn, who in April 2022, added Dyslexic Thinking as a skill to its platform.

Watch the Dyslexic Thinking campaign film https://youtu.be/D5Phdr6wUMs

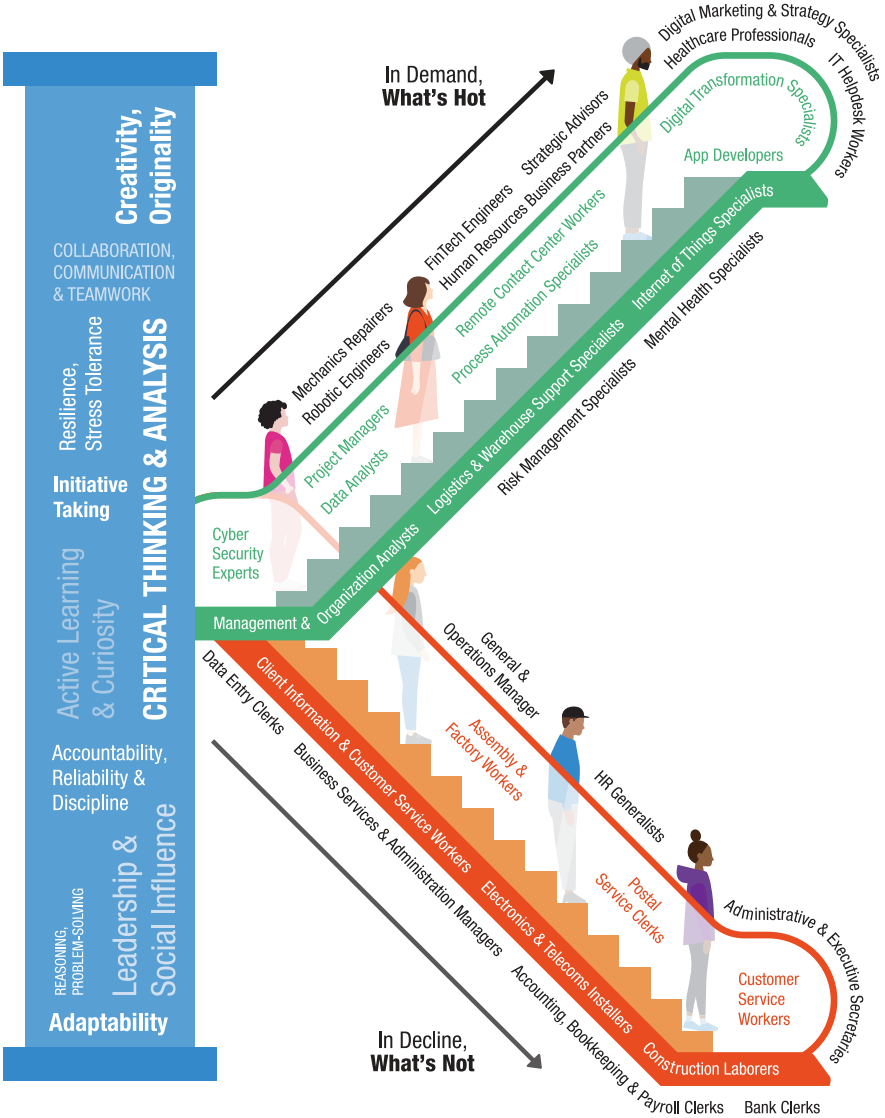
"Dyslexia is a talent, first and foremost. And it's a talent that needs to be recognised as something that can make a fundamental shift in how organisations recruit and solve the skills shortage across the world."

Matthew Higgs - VP Randstad Sourceright

1 in 5 people are dyslexic
this represents a global workplace talent pool of over 700 million people

Now companies like HSBC, Facebook (Meta) and EY are actively looking for dyslexics, recognising that Dyslexic Thinking is a valuable asset to every team. In fact, entrants on British Intelligence agency, GCHQ's, apprentice scheme are 4 times more likely to have dyslexia than other organisations' programmes.[10]

50% of 'human' skills needed map directly with Dyslexic Thinking



Source: Dyslexic Dynamic, Made By Dyslexia & ManpowerGroup Talent Solutions, p.9[11]

The BIG Problem

But, despite dyslexics being ready for the workplace of tomorrow, research shows that there are big gaps in educators' knowledge of dyslexia today. And our global education system must learn how to fill them.

Made By Dyslexia has conducted the biggest ever research survey with the global dyslexia community and found that:

- Only **1 in 10** say that **teachers have a good understanding of dyslexic strengths**[12]
- **Over half** say their school **fails to understand dyslexic challenges**[13]
- **Only half** of schools, districts or authorities **use the term dyslexia**[14]

There is global consensus on how to spot, support and empower dyslexic children. There is also global consensus that almost all can thrive in a mainstream setting if the right support is put in place. But despite this, support in schools remains patchy at best, and non-existent in places due to the lack of teacher training and the reluctance to identify dyslexic children.

Only 1 in 10
teachers has a good understanding of dyslexic strengths

Over half
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Only half
of schools, districts or authorities use the term dyslexia

Early identification is crucial for dyslexic learners. The earlier it's discovered and supported the sooner dyslexic kids catch up and keep up. But our 2022 research finds that:

- **85%** say the process of identifying dyslexia was difficult or not possible[15]
- **Only 4%** say their schools screen all learners for dyslexia[16]

This means **80%** of dyslexic children **leave school unidentified**.[17]

85%

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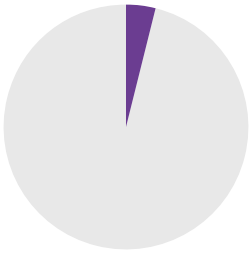

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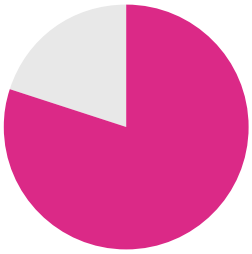


80%

of dyslexic children leave school unidentified

When it comes to accommodations to level the playing field in exams, dyslexic students are also missing out. Our research found:

- **Nearly two thirds** say it was **difficult or impossible** to get accommodations and adjustments in tests and exams[18]
- **Only 5%** saw exams as an effective way for dyslexic students to demonstrate their knowledge of a subject[19]

Exams fit neatly into the biggest dyslexic challenges, with their emphasis on rote learning and timed tests. Skills which are fast becoming less relevant to workplaces in the age of technology.

In the mainstream classroom, dyslexic learners should be supported by teachers who have an understanding of the strengths and challenges which come with dyslexia. But many are not:

- **Only 20%** would describe the support they receive in the classroom as **good**[20]
- **80%** are left to muddle through with support that is average, poor or non-existent.[21]

The BIGGEST Special Educational Need (SEN)

Dyslexia is very common, accounting for 80% of Special Educational Needs and neurodiversity according to Yale[22]. And we know the teaching strategies that help dyslexic learners help ALL learners. So, by training all teachers to use evidence-based methods that work for dyslexics, we can transform educational outcomes for all.

> ***"Whatever is good for a dyslexic learner is good for all learners and if we just taught what was best for dyslexics, everyone would get better – so it really is a magic bullet."***
>
> **Gavin Horgan** - Head of Millfield School, UK

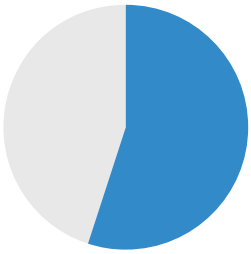
The BIG Failure

Failure to spot and support dyslexia is resulting in some of society's biggest problems. And we've known this for decades.

Studies funded by the UK government in 2009, showed that:

- **55%** of children **failing SATs** at Key Stage 1 & 2 were **dyslexic**[23]
- **55%** of children leaving school **unable to read and write** were unsupported dyslexics[24]
- This figure rose to **100%** in dyslexic children from **disadvantaged backgrounds**[25]

In the US, only **1 in 50 dyslexic** students receive the accommodations they need by law[26].



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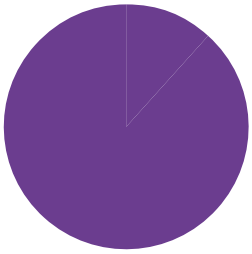


100%
of dyslexic children from disadvantaged backgrounds leave school unable to read and write

Dyslexia and exclusion

Teachers are unaware of the emotional impact that dyslexia has on students, which can have devastating consequences. Our research found that:

- **Only 12%** said their school **had a good understanding of the emotional impact** associated with struggling with dyslexia[27]

Left unidentified or unsupported, children can develop behavioural problems which can result in school exclusion and long-term loss of learning opportunities.

- **65%** of children screened at a London **Pupil Referral Unit were dyslexic**[28]
- In the UK, children with Special Educational Needs (SEN) like dyslexia are **7 times more likely to be excluded from school**[29]
- While in the US, students with Special Educational Needs (SEN) are **more than twice as likely to be suspended**[30]

Dyslexia and prison pipeline

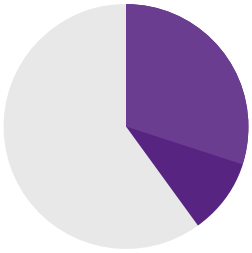
All of these factors, push a disproportionate number of dyslexic students into the school-to-prison pipeline.

- In the US, over **50%** of young adults with SEN **end up in the justice system**[31]
- **30-40%** of the prison population in New York is dyslexic[32]
- **More than half** of inmates in the UK prison system are dyslexic[33]

This failure is preventable with the right identification and support.

A 2012 programme in the UK: Dyslexia Behind Bars found that when prisoners were taught to read, the reoffending rate dropped to 5.9% within 4 years (instead of 55% in 2 years or 68% in 5 years).

In the US, **50%** of young adults with SEN end up in the justice system



30-40% of the prison population in New York is dyslexic

More than half of inmates in the UK prison system are dyslexic

The BIG history lesson

We've known how to spot and support dyslexia for decades. We've also known what the consequences are for society when we **DON'T**.

Throughout history, the media have reported on our education system's failure to properly identify and support dyslexics. But for too long, governments have swept dyslexia under the carpet – creating inequitable education systems where support has only been available if you can afford to pay for it or know how to fight for it.

Enough is enough

We cannot allow future generations of valuable citizens, who have 10/10 the skills we need, to be failed by the education system. We need to create an equal society where every dyslexic child is enabled to reach their potential because their thinking is valuable and vital.

Otherwise, we are doomed to watch history repeat itself. What journalists in 1944 couldn't have foreseen is the role technology can play in the 1st century to scale support (through free training) and reach every classroom, throughout the world.

We have the tools. We have the training. The time for action is NOW.

"Those that fail to learn from history are doomed to repeat it."

Winston Churchill - (dyslexic himself)

"Our city has failed too many kids whose Dyslexic Thinking skills were not spotted or supported."

Eric Adams - New York City Mayor (dyslexic himself)

"Enough is enough. Support shouldn't be dependent on your ability to pay or fight for it but be freely available in every single school."

Kate Griggs - Founder & CEO of Made By Dyslexia (dyslexic herself)

1944

Life magazine reports that "Dyslexia is responsible for 70% of school failures in 6 to 12 year olds."

1974

The Houston Chronicle points to the link between unsupported dyslexia and "juvenile delinquency".

The mystery of dyslexia

BY WARREN H. YOUNG

Clues that may indicate dyslexia

A Word of Caution:

Another word of caution:

2008

BBC News reports 55% of children failing SATs are dyslexic

LIVE **BBC NEWS CHANNEL**

Last Updated: Friday, 14 March 2008, 03:26 GMT

E-mail this to a friend Printable version

Dyslexia link to school failures

Many schoolchildren could be failing reading and writing tests because they are unaware they are dyslexic, new government-funded research suggests.

Campaigners say dyslexia could affect one child in five

A study by Hull University academics of 1,300 children said dyslexia was a major cause of failure.

Over half of those who did not achieve expected levels in SATS tests displayed all the signs of being dyslexic.

The research has led to calls for more specially-trained teachers in schools as well as better diagnosis.

'Often ignored'

The study, commissioned by dyslexia charity Xtraordinary People, claims to be the first to firmly identify dyslexia as a major cause of underachievement in primary schools.

It looked at seven and 11-year-olds who failed to reach expected levels of reading and writing in national tests.

The majority - 55% - displayed all the signs of being dyslexic.

Campaigners say the research shows many such children are being let down by schools as they could overcome the reading disorder if they received a diagnosis and specialist teaching.

A brief history of dyslexia

1896

Dyslexia was first reported in the British Medical Journal, originally referred to as "Word Blindness."

1920s

The International Dyslexia Association was founded – the oldest organisation dedicated to the study of dyslexia.

1926

The Gow School opens in New York to teach dyslexic boys with small classes and a different approach to reading.

1935

Drs Orton & Gillingham published the first successful dyslexia intervention programme, still used today.

1936

Millfield becomes the first UK school to support dyslexia using the Orton Gillingham method and to recognise dyslexic strengths.

1944

Life magazine in the US reports that "Dyslexia is responsible for 70% of school failures in 6 to 12 year olds."

1959

The Schenck School in Atlanta was founded by David Schenck as the first elementary school to develop the potential of dyslexic kids.

1971

Helen Arkell Centre opens in the UK to support dyslexics and train teachers, helping everyone to understand that dyslexics learn differently.

1972

The British Dyslexia Association was formed to advocate for the rights of dyslexics in the UK and offer training and support to its members.

1974

Houston Chronicle reports on dyslexic strengths and recognises the link between unsupported dyslexia and behavioural problems.

2004

Campaigning charity, Xtraordinary People, was founded by Kate Griggs, to showcase dyslexic strengths and push for education reform.

2006

BBC documentary "Real Story", shows how intervention can transform the lives of dyslexic children in one of London's lowest performing schools.

2009

'No to Failure' report demonstrates the link between unsupported dyslexia and school failure and the effectiveness of dyslexia support.

2009

Rose Dyslexia Review, commissioned by the UK government, recommends the screening of every child and the training of every teacher.

2017

Made By Dyslexia launches to help the world to redefine dyslexia and train every teacher and workplace to spot, support and empower every dyslexic.

2018 /19

The EY Value of Dyslexia report finds Dyslexic Thinking skills match directly with WEF "future skills" and the skills dyslexics find challenging are in decline.

2020

The Manpower Dyslexic Dynamic report finds that dyslexics have the exact skills needed to fill the global talent gap today.

2022

New York becomes the first city in the world to train every teacher to spot & support dyslexic learners with free training from Made By Dyslexia.

2022

Dyslexic Thinking is officially added to the dictionary as a noun, and LinkedIn – the world's BIGGEST careers platform adds Dyslexic Thinking as a skill.

The BIG Solution (conclusion & recommendations)

The indisputable fact is: Dyslexic Thinking is vital to our future.

Research proves it.

The world's **BIGGEST** careers platform (LinkedIn) recognises it.

And some of the **BIGGEST** global employers (HSBC, EY, Meta) are actively recruiting for it.

But our **BIGGEST** problem is that these valuable skills are not being spotted or supported in our schools.

When they are not spotted, they can be responsible for some of society's **BIGGEST** failures, whether that's educational failure, school exclusion or even prison. This results in wasted potential that's entirely preventable. Our global education system must learn to support the needs of dyslexic children.

The solution is clear – we need to skill up teachers – at speed – to make sure every school around the world can **spot, support and empower every** dyslexic mind.

Made By Dyslexia has already come up with a solution by creating free training so every teacher can 'Learn Dyslexia' and empower the 1 in 5 dyslexic children in their classroom.

This online video-based training is created in partnership with Microsoft and features expert teachers from schools that are world renowned for supporting dyslexia.

Find them at https://www.madebydyslexia.org/learndyslexia

The world's **BIGGEST** city has already taken it. New York has trained all 100,000 teachers with the skills to identify the signs of dyslexia and evidence-based methods to support it.

Now the rest of the world needs to follow.

Learn Dyslexia (conclusion & recommendations)

One single day can make a world of difference to the outcomes of the 1 in 5 dyslexic learners in every classroom.

That's why Made By Dyslexia is launching the 'Learn Dyslexia' campaign and asking every school across the world to allow every teacher to **#TakeADayForDyslexia** and skill up using our **FREE** online training.

- The training is free – no budget needed
- It's online and available to all, on demand
- It can be completed on specific training days, or individually on-demand with no cover costs

Access training at madebydyslexia.org/learndyslexia

"This training enables every teacher to create an inclusive classroom where dyslexics can thrive. It is essential for EVERY teacher, because whether you've recognised them or not, dyslexics are 20% of EVERY classroom and have exactly the thinking our workplaces need."

Josh Clark - IDA Chair & Head of Landmark School

"The training opened my eyes to a whole new way of inclusive teaching."

Primary Teacher - UK

"Ticks all the boxes – short, keeps your attention, factually-strong and incredibly effective."

Primary Teacher - UK

About Made By Dyslexia

Made By Dyslexia is a global charity led by successful dyslexics. Our purpose is to redefine dyslexia and help the world to properly understand, value and support it.

Our mission is to train every teacher and help every workplace to spot, support and empower every dyslexic mind. This mission is aligned with the following 3 UN Sustainable Development Goals (SDGs) and we aim to achieve this by 2030.

We are achieving our mission by creating highly effective, free training which equips teachers with the skills they need to spot, support and empower dyslexic learners. It also transforms how dyslexic learners see and value their own skills.

Since our launch in 2017, we have created the world's largest community of dyslexic people and allies, who like us are passionate about driving change. Our inspirational events, strategic partnerships, ground-breaking reports and global community is driving change.

Made By Dyslexia is a social movement, on a mission and at speed.

Contact: media@madebydyslexia.org

[1] New York City Government. Available at: https://www1.nyc.gov/office-of-the-mayor/news/288-22/transcript-mayor-eric-adams-appears-live-the-yes-network#/0 (Accessed: 5 September 2022)

[2] Dyslexia in education 2022: new global research, Made By Dyslexia, October 2022

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The efficacy of narrative therapy and storytelling in reducing reading errors of dyslexic children

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Abstract

Narrative and stories in education have been the focus of increasing attention in recent years. The idea of narrative is fertile ground for adult educators who know intuitively the value of stories in teaching and learning. Narrative is deeply appealing and richly satisfying to the human soul, with an allure that transcends cultures, centuries, ideologies, and academic disciplines. The present study examined the efficacy of narrative therapy and storytelling in reducing reading errors of dyslexic children. Sample of 30 dyslexic 1st to 3rd graders were identified as dyslexia using the Dyslexia Checklist (Michaeli, 2006). The sample was administered the Wechsler Intelligence Scale for Children (WISC-R,1974) and Diagnostic Reading Test (Bahari Gharahgoz, 2006) and randomly assigned to an experimental and a control group. During a five month period, the experimental group received twenty five, one hour sessions of individual training with the narrative therapy by counselor and storytelling by children. The control group received none. The two group pre-post tests of reading errors were compared using ANCOVA. The results revealed that, controlling for the intelligence variable, the application of narrative therapy accounted for a 60% reduction in reading errors.

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Keywords: narrative therapy, story telling, dyslexia, reading errors.

1. Introduction

Dyslexia is a language learning disorder that results in deficits in reading, spelling, and phonological (Balise, Black, Nussbaum, Oakland Stanford, 1998). Dyslexia is evident when accurate and fluent word reading and/or spelling develops very incompletely or with great difficulty. This focuses on literacy learning at the word level and implies that the problem is severe and persistent despite appropriate learning opportunities. It provides the basis for a staged process of assessment through teaching(British Psychological Society,1999).

Miles and Miles (1990) suggest the following as possible indicators of dyslexia in primary age children.1- confuses left and right, 2- difficulty in saying long words, 3- difficulty in subtracting, 4- difficulty in learning tables, 5- difficulty in saying months of the year, 6- confuses b and d for longer than most children, 7- difficulty in recalling

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digits, 8- family history of similar difficulties. Miles emphasises that a dyslexic child won't necessarily show all these difficulties and that a non-dyslexic child may well have problems with some of the items.

Given the difficulties in defining and identifying dyslexia, it is hard to come up with a precise estimate of the number of individuals with this impairment. The consensus among many researchers (Miles and Miles, 1990, Singleton and Thomas 1994) and organizations such as the British Dyslexia Association (Peer,1994) is that at a conservative estimate 4 per cent of the population are severely dyslexic and another 6 per cent have mild to moderate dyslexia. this indicates that there will be one severely dyslexic child in each class. Until recently most researchers also reported a ratio of about three boys to every one girl with dyslexia.

Organising or learning difficulties affecting fine co-ordination skills and working memory skills. It is independent of overall ability and conventional teaching. When untreated there are significant limitations in the development of specific aspects of speech, reading, spelling, writing and sometimes numeracy—which may lead to secondary behavioural problems—although other areas of ability are unaffected(Riddick,2003).

Children diagnosed with a learning disability are also often familiar with the individualising effects of having a disability, causing them to feel different or isolated from their peers (Witherell & Rodis, 2001). These experiences have been known to increase children's risk of constructing a negative self-concept (McGrady et. al., 2001), which can ultimately and significantly disturb their ability to socialise appropriately with others (Bowen & Glenn, 1998). Research suggests that students diagnosed with disabilities experience rejection from their peers, as they are often the victims of bullying (Heinrichs, 2003). The social problems experienced by these children, proved to be a common theme throughout the literature.

Singer (2007) believes that children diagnosed with dyslexia are at higher risk of intense emotional feelings of pain and sorrow. Consequently, the counsellor maintained a sensitive and respectful attitude while engaging with the child in this study.

Stacey (1997) suggests that the result of educational and developmental assessments has a very negative effect on the dominant narratives of students diagnosed with a learning disability. She notes that "these descriptions usually involve deficit-based terms that implicate their whole persons and encourage young people to develop a hopeless, defeatist lifestyle" (Stacey, 1997). The narrative therapist makes every effort to avoid such labelling or defining of clients by their problems; rather, clients are seen as resourceful, and their stories are appreciated and valued (Winslade & Monk, 1999).

Generally, Therapeutic play with children is an effective clinical intervention that has been successfully utilized by therapists for many years. Various techniques of play therapy have been used ranging from free play to structured projects with great therapeutic success. The narrative play therapy approach was privileged over child-centered play therapy and cognitive-behavioral play therapy for four distinct reasons. Firstly, children diagnosed with a learning disability rarely get invited into conversations that provide them with the space to express themselves freely (Rodis, Garrod, & Boscardin, 2001). Within the narrative approach, and similar to that of the child-centered play therapy approach, the child's perspectives are privileged, as children are understood to be the experts on their own lives (Morgan, 2000),. Rather than making assumptions about the child's reality the narrative therapist remains curious, acknowledging the child's voice.

Secondly, narrative play therapy especially the story telling with felts with a multi-sensory approach, are empowered, as they are encouraged to combine auditory, visual, and kinesthetic element into learning task. Children experience the words with three basically sensors and so the children understand and learn better.

Thirdly, narrative play therapy is different from deficit approaches which focus on individuals' failings: the narrative approach is an optimistic approach as it is more interested in the achievements and successes in the child's life. Similar to child-centered play therapy, narrative play therapy assumes that individuals are skillful and competent, and that they have a multitude of values and abilities sufficient to manage their problems in life (Morgan, 2000). Because children diagnosed with a learning disability are often very familiar with their shortcomings, this shift in focus allows for the re-shaping and creating of a new identity, a new understanding of themselves and others in the world. Lastly, children respond positively to narrative therapy because the narrative framework appreciates and encourages children's playful attitude towards serious problems (Freeman, Epston and Lobovits, 1997). Children diagnosed with a learning disorder are able to approach their serious and traumatic experiences and understandings within the context of a light and playful space.

Story telling with felts is a narrative play therapy that uses the multi-sensory approach. Through the Story telling with felts, children can narrate their stories by using all their senses.

Most authorities considered that the key features of effective learning and teaching for children and young people with dyslexia should be multi-sensory, well structured and interactive and that they should raise self-esteem and be relevant and meaningful. A specific combination of visual, auditory, and kinesthetic learning might allow some students who struggle to read to become successful and retain the required information(Riggs,2008).

Unfortunately, there is not a large amount of research focused on the effectiveness of play therapy or narrative therapy on dyslexia, but some research done in this regard are as follows: Topper(2010) found that the narrative play therapy is effective on self-esteem increasing of a boy who diagnosed as a learning disability, and also Crow(1994) indicated that low achiever children in reading who received play therapy scored significantly higher on the self-concept inventory than children in the control group.

Packman & Bratton (2003) examined the effectiveness of group play/activity therapy as a school-based intervention with fourth and fifth grade learning disabled preadolescents exhibiting behavior problems. Their study revealed that preadolescents who participated in group play/activity therapy demonstrated a reduction in problem behavior.

1.1. Purpose of the Study

This study was designed to examine the effectiveness of narrative therapy on dyslexic primary school children. In particular, one hypotheses was tested:

H1. Children in narrative therapy group would show more reading errors reduction compared to control group.

2. Method

2.1. Participants

Sample of 30 dyslexic 1st to 3rd graders in the city of Tabriz were identified as dyslexia using the Dyslexia Checklist (Michaeli, 2006). The sample was administered the Wechsler Intelligence Scale for Children (WISC-R,1974) and Diagnostic Reading Test (Bahari, 2006) and 15 children randomly assigned to narrative therapy group and 15 children to control group.

2.2. Measures

Wechsler Intelligence Scale for Children—Third Edition-Revised.

The WISC-R is a commonly used measure of general intelligence for children ages 6 to 16 years. The WISC-III-R is organized into two scales (Verbal and Performance IQ) and a total score (Full Scale IQ). IQ and factor Index scores yield standard scores with a mean of 100 and a standard deviation of 15. The WISC-III is well standardized on a sample of 2,200 children who match the 1988 U.S. Census data and are representative of the U.S. population on a number of important demographic variables including race/ethnicity, geographic region, gender, age, and parent education. The average split-half reliability coefficients for IQ and Index scales are: .95 for the Verbal IQ, .91 for the Performance IQ, .96 for the Full Scale IQ, .94 for the Verbal Comprehension Index, .90 for the Perceptual Organization Index, .87 for the Freedom from Distractibility Index, and .85 for the Processing Speed Index (Kaufman & Lichtenberger, 2000).

Dyslexia checklist (micheli,2006):

This checklist is designed by using the proposed signs of International Dyslexia Association and so according to the DSM-IV-TR. The reliability of test in Cronbach's alpha is 0.82, and test's validity was approved by 5 experts in special problems learning centers.

Diagnostic Reading Test (Bahari Gharahgoz, 2006)

This test is used to assessing reading's skill and number of reading's errors(omission, repetition, substitution),that includes 8subscales(words reading , text reading, words understanding , comprehension, visual memory, auditory memory, fractionated and compound).
Words reading , text reading, words understanding , comprehension belong to Reading skills field, and visual memory, auditory memory, fractionated, compound are in Developmental reading skills field.
The content validity of test was approved by teachers. The reliability of test in test-retest ranges from 0.68 to 0.96.

2.3. Procedure

Type of research method employed in this research was pre-test, post-test with control group. After choosing 30 children who had dyslexia according to the Dyslexia checklist, and also all students according to the scores of Wechsler Intelligence Scale for Children, were diagnosed as a normal children. They were assigned randomly to narrative therapy and control group. For narrative therapy group twenty five, 45-minute sessions of individual training was designed. The Diagnostic Reading Test was used for assessing the efficacy of narrative therapy on reading errors in pre-test and post-test.

The therapy started one week later after performing pre-test program. In experimental group, telling story with felts was used, but control group received no intervention.

In narrative therapy group, the story telling therapy with felts was used. Traditionally, one of the most popular physical mediums for storytelling adaptations has been flannel/felt board stories(Faurt,2009). Through the therapy therapist and children by using the story characters and letters which made of the paper or felt, narrated their story on the felt board. The sturdy board covered in soft, fuzzy flannel or felt onto which felt figures or pieces may be placed to illustrate a story or concept. The child narrated his or her stories with attaching the figures on the felt board, the counselor asked the child the names of story's figures or characters, and the child named the figures with loud sound and spelled, then the child attached the name of story's characters by using the felt made letters. This method with using the multi-sensory approach caused the dyslexic children could be overcome their reading problems and increased his/her self efficacy, in addition to the therapist be able to establish the friendly relationship with child through the narrative therapy session and helped them (Kaduson & Schaefer, 1998).

3. Results & Discussion

For analyzing and examining the hypotheses of research the ANCOCA was used for each subject separately, then mean, standard digression, adjusted mean, and η2 for research group was obtained (narrative therapy, and control group)and are given in table 1&2.

Table 1: means, SD, adjusted mean,

	Narrative therapy group				**Control group**			
	Pre Test		Post Test		Pre Test		Post Test	
	M	SD	M	SD	M	SD	M	SD
Verbal intelligence	3.20	2.10	3.21	2.10	3.20	2.35	3.19	2.35
Performance intelligence	2.10	0.88	2.15	0.84	1.90	0.92	1.92	0.90
Reading's errors	3.50	1.58	1.10	0.99	3.45	1.26	3.46	1.28

Table 1: covariance analysis

	Adjusted mean		ANCOVA F (1,17)	η2
	Narrative	**Control**		
Verbal intelligence	1.23	1.21	6.618	0.000
Performance intelligence	0.65	0.61	6.663	0.003
Reading's errors	0.49	2.71	33.076 *	0.60

*P<0.01
Notation: The multivariate F ratio was obtained by Wilks' lambda.

A one-way analysis of covariance (ANCOVA) was conducted. The independent variable was narrative therapy, and the dependent variables were verbal intelligence, performance intelligence, and Reading's errors. After analysis of covariance, comparisons of means should be done but since independent variable has two levels (narrative therapy and control group) there is no need to do post hoc. After controlling the effect of pre- test on post- test, adjusted means among two groups are reported in table 1. The results revealed that there is a significant relation between narrative therapy and Reading's errors ($p<0.01$, $F(1,17)=33.076$). The strength of the relationship between Narrative therapy and the Reading's errors was very strong, as assessed by partial $\eta 2$, with the Narrative therapy accounting for 66 percent of the variance in dependent measure holding constant the Reading's errors. Also it is shown Reading's errors means in post-test(after controlling pre-test) among narrative therapy group is less than control group, in other words narrative therapy reduced Reading's errors. But there is no relationship between narrative therapy and verbal intelligence ($p=0.17$, $F(1,17)=6.618$), and also between narrative therapy and performance intelligence ($p=0.09$, $F(1,17)=6.663$).

According to these results, the hypothesis of research was supported very strongly. It means the narrative therapy reduces the numbers of reading's errors. This paper revealed that the narrative therapy approach has many benefits when working with such children. Because this approach focuses on the achievements of the child rather than on deficit focused models, it offers a new conceptualization of learning disorders that better meets the needs of such students. Rather than viewing the student diagnosed with a learning disability as the source of the problem, the narrative approach believes the label (learning disability) and the student's relationship to it is the problem. On the other hand, this kind of Narrative therapy (storytelling with felt), by using the multi-sensory approach and with specific combination of visual, auditory, and kinesthetic learning might allow some students who struggle to read to become successful and retain the required information .

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Educational Interactive Storytelling for Narrative Comprehension and Recall in Dyslexic Children: Employing a Mythic Narrative Structure

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ABSTRACT
Dyslexia has a significant impact in the development of literacy skills, which represent a crucial factor in success at school. Analyzing oral traditions in their function to preserve cultural capital, we come upon interesting similarities with study patterns used for and by dyslexic children, in their effort to understand and use written material. In this paper we outline a framework for the design of interactive systems, related to educational interactive storytelling, which aim in the development of literacy skills through narrative comprehension and recall in dyslexic children. We will examine a cognitive model of narrative comprehension, review a set of study skills for dyslexic children and propose a narrative framework based on the structure of the monomyth together with a teaching and assessment method. Finally, we will present the basic structural components for the construction of a prototype interactive storytelling system.

Categories and Subject Descriptors
K.3.1. [Computers and Education]: Computer Uses in Education, D.2.10 [Design]: Methodologies, K.8.0 [Personal Computing]: General - Games

General Terms
Design, Human Factors

Keywords
Dyslexia, interactive storytelling, narrative comprehension, narrative recall, oral tradition, myth

INTRODUCTION

Dyslexia has a significant impact in the development of literacy skills, which represent a crucial factor in success at school [1]. The demand to develop literacy skills dominates the school curricula, which are usually either content-centered or instructor-centered.

In this paper we focus on a framework that employs a user-centered approach that potentially combines the importance of content, an interactive system and the involvement of instructors and students.

The deciphering aspect of reading presents a special difficulty in the dyslexic students and has been approached by a number of studies and educational software and games [2]. Moreover, even when the decoding process and the working memory are controlled properly by the students, deficits in reading comprehension still remain [3]. For this reason the following proposed design framework for educational interactive storytelling leverages higher-order cognitive processes concerning narrative comprehension and recall. This paper is concerned with narrative rather than expository text because it is the primary genre of oral discourse and also considered the easiest to recall [4].

A COGNITIVE MODEL FOR NARRATIVE COMPREHENSION

Narrative comprehension mechanisms which readers employ are quite stable among individuals within and between cultures [5]. These cognitive processes contain six levels of discourse structure: *the surface code* (the exact wording and syntax of the explicit text or the intonation patterns in the case of oral narrative), *the textbase* (the meaning of the explicit propositions in the narrative), *the situation model* (the mental micro-world describing the narrative), *the thematic point* (the moral or premise of the story), *the agent perspective* (the narrators point of view) and *the genre* (the specific category of narrative under consideration). These levels need to interact gracefully with each other and for none to dominate. In order to facilitate synchronous interaction among the constraints, placed by these six representational levels, the conversions of a genre can be used [5].

The cognitively represented actual wording, syntax and propositions used in storytelling do not remain long in memory. The surface code lasts in memory less than a

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minute and the textbase for approximately an hour [6], [7]. The situation model consists of a deeper level of representation than the surface code and the textbase; it directly influences the processes of inference and recall and it is close to our current computational models of narrative generation [8]. Although the process of acquiring the thematic point can have a significant influence in narrative comprehension and recall, it is generally very difficult for many children to construct a theme during and after reading. The agent perspective is not often salient in the mind of the reader; children potentially construct multiple agents in their cognitive representations. The conventions of a narrative genre can guide both the creation and the comprehension of narrative material. The notion of genre is thoroughly analyzed in a following section.

Although every level of the cognitive model should be accounted for when developing a narrative framework, for the reasons stated above focus on the situation model is given.

Situation model

The situation model is a mental representation of the state of the narrative world, containing background world knowledge, relevant to the explicit text. It is coherently organized by formulating themes and messages that transfer information to the readers [5].

The situation model consists of five dimensions [8]: *space* (the physical layout of the narrative world), *time* (the timeline of the story and the sequence of events), *causation* (the causes and effects of the events in the narrative), *intentionality* (the goals and motives of the characters) and *protagonists and objects* (the characters of the story and the objects they encounter). For a student the reading time may increase whenever a narrative faces a break in coherence or in the continuity of these dimensions [9] and each dimension influences directly the processes of comprehension and recall of the narrative [8].

STUDY SKILLS FOR NARRATIVE COMPREHENSION AND RECALL

Among the study skills proposed by Reid [1] for school based learning, it appears that the following set can aid the dyslexic child build effective strategies for better comprehension and recall in narrative material. They can also facilitate children to acquire and develop a situation model that corresponds to the narrative under consideration.

The following study skills are important:

- **Sequencing information:** children should be able to know the sequence of the events in the story. Through this particular skill the dyslexic children understand the temporal dimension of the situation model.
- **Use of context:** children should rely on semantic context, which serves as a comprehension and memory aid.
- **Developing schemata:** the developing of story schemata can be accomplished through a story framework (i.e. story scripts and story grammars). Story schemata can form the building blocks for the construction of situation models.
- **Developing imaginative and visual skills:** these skills through the formation of inferences help the dyslexic children imagine and visualize details that are omitted in the story.
- **Repetition and over-learning:** these skills can help the child overcome difficulties in short-term memory.
- **Developing mnemonics:** mnemonics provide visual (e.g. a familiar scene) and auditory (e.g. rhyme, alliteration) cues for the recall of a narrative material.

FORMULATING THE NARRATIVE FRAMEWORK

We propose a narrative framework based on the narratives of oral traditions. Oral traditions are systems that are characterized by multiple constraints. These constraints are related to: the organization of meaning, the imagery of the narrative events and the patterns of sound found in narration (i.e. rhyme alliteration, rhythm, music). Through these constraints organized and coherent stories can be created. We will compare some of the characteristics of oral traditions, as examined by Rubin [4], with the study skills presented in the previous section. Oral traditions are sequential; the narrative recall in these traditions is following a serial pattern and is guided by multiple constraints such as theme, rhyme and rhythm (**sequencing information**). They have a context-rich organization and thus semantic contexts and cues select particular aspects of the meaning of a word and reduce or eliminate ambiguity (**use of context**). Their use of theme is equivalent with the use of a schema. The stories of oral traditions can be parsed to scripts and story grammars (**developing schemata**). Oral traditions contain agents and actions that are easy to visualize (**developing imaginative and visual skills**). They use repeated material, such as formulaic phrases, trembling (the rule of 3's in fairy tales) and narrative patterns (**repetition and over-learning**). They use mostly spatial imagery; the heroes of epic are always on the move and thus invoking a highly developed spatial-memory system (**developing mnemonics**, acquiring the **spatial dimension** of the situation model). Oral traditions employ the repetition of sounds as a poetic device (through rhyme, alliteration and assonance) and as a memory aid (**developing mnemonics**).

The concept of the monomyth, as described by Joseph Campbell [10], is found in many oral traditions and in many myths around the world (i.e. the theme of the novice hero in epic poetry [4]). The monomyth describes the stages of the journey of the mythological hero form the world of everyday life to the special world of the adventure and back. This concept has been chosen as the basis of the proposed narrative framework. In order to make the framework more elaborate and specific, a subset of Propp's

[11] functions is mapped to the stages of the monomyth. In his morphological analysis of the Russian fairy tale Propp identifies the functions that are performed by the characters (dramatis personae) of Russian fairy tales. The proposed model comprises of 27 stages with each stage representing a narrative event. Each stage has a number of variants that can be employed, a prerequisite (for the selection of the appropriate variant) and an indication, showing whether a particular stage is mandatory (it cannot be omitted) or can be thrice repeated (use of trembling). This model is used to generate random stories for the proposed interactive storytelling application. The story stages of the narrative model are presented in Table 1.

Table 1 - The story stages of the narrative model

Story stage	Depends on Story Stage	Mandatory	Trembling
1. Initial situation		YES	NO
2. The villain causes harm or injury	1	YES	YES
3. Misfortune is made known; the hero is approached with a request or command	2	YES	NO
4. Refusal of the call		NO	NO
5. Supernatural aid	4	NO	NO
6. The seeker agrees to or decides upon counteraction	2	YES	NO
7. The hero leaves home		YES	NO
8. The hero is tested, interrogated, attacked, etc.		YES	YES
9. The hero reacts to the actions of the threshold guardian	8	YES	YES
10. The hero acquires the use of a magical agent	9	NO	NO
11. The road of trials		YES	YES
12. Approach to the inmost cave		NO	NO
13. The hero and the villain join in direct combat	2	YES	NO
14. The hero is branded		NO	NO
15. The villain is defeated		YES	NO
16. The initial misfortune is liquidated	2	YES	NO
17. Refusal of the return		NO	NO
18. The hero returns		YES	NO
19. The hero is pursued		YES	YES
20. Rescue of the hero from pursuit	19	YES	YES
21. The hero, unrecognized, arrives home or in another country	1	YES	NO
22. A false hero presents unfounded claims		NO	NO
23. The hero is recognized	21	YES	NO
24. The false hero or villain is exposed	2 and/or 22	NO	NO
25. The hero is given a new appearance		YES	NO
26. The villain is punished	2	NO	NO
27. Freedom to live		YES	NO

Apart from the hero character, the system will use a group of virtual characters that will be recycled through the generated stories. Each character will be able to perform certain sets of actions. The actions are grouped via the archetypes that are found in the monomyth, as proposed by Vogler [12]. These archetypes are the following: the mentor, the threshold guardian, the herald, the shape-shifter, the shadow, the ally and the trickster (the hero archetype corresponds to the user's avatar).

We will also use a set of formulaic phrases that will present specific actions in the narrative. The actions that are constant in our framework include the call to adventure, an act of villainy, the departure from a homeland, etc. For each recurring action a phrase containing rhyme or alliteration will be used at specific points of the story. Through these formulaic phrases and through the continuous experimentation with the application, we argue that the children will build a coherent sequence of the events that take place.

TEACHING AND ASSESSMENT METHOD

The teaching and assessment method that is proposed (based on [13], [14]) develops in the following steps. Firstly the child is introduced to the storytelling activity. The student then experiences the interactive story through the control of a character avatar. At the completion of a story episode (each one consists of a setting, a set of characters, a specific problem, the actions performed and the resolution of the problem) a set of schema-based questions will appear to the user in the form of an embedded narrative (how did the story start, where did it take place, who were the main characters, etc.). The user may respond through selecting from multiple-choice answers. At the completion of the story the user is asked to solve an interactive narrative puzzle. The goal of the puzzle will be to place the story events in the correct form and order.

THE INTERACTIVE STORYTELLING SYSTEM

The basic structural components for the construction of the proposed prototype interactive storytelling system are: *the narrative model*, *the story generator*, *the schema-question generator*, *the user interaction* and *the post-story assessment application*. For the representation of the narratives the video format (found in film and video games) has been chosen due to its facilitating role: in narrative comprehension, in the construction of complex inferences, and in the minimization of processing resources. In the next paragraphs follows a brief examination of the components of the proposed architecture.

The narrative model

The narrative model contains a pattern for generating random stories together with a set of pre-authored characters. Each stage will be represented as an animated sequence, or as an interactive scene of the narrative world. For every recurrent action in the model a set of audio phrases will be employed. These formulaic audio phrases will represent specific events. For example, when the hero of a story accepts the call to his adventure *the acceptance of the call* phrase can be fired, e.g. - "And so our hero sallied forth into the unknown and mysterious world". The authoring of the scenes, the characters and the audio material will be done by the application designer, though the instructor that will employ the software must be aware of the general structure of the narrative model.

Story generator

The story generator will pick randomly stages of the narrative model, cast a set from the repertoire of characters and build a story depending on certain prerequisites and variations. The final product of the story generator will be a series of interactive scenes, animation sequences and formulaic audio phrases; all combined form a narrative world.

Schema-question generator

At the conclusion of every episode in the story, a set of schema-based questions will be presented to the user in the form of an embedded narrative. The questions will be constructed automatically depending on the generated story.

User interaction

The user will explore the narrative world in an almost linear way. S/he will control an avatar's movement and will interact with certain objects and characters in the virtual world. The actions performed will not change the route of the story but will enable the player to engage in the virtual world and get information from the story's characters. The progression from one stage to the other will be performed either immediately or when the player's avatar reaches certain locations.

Post-story assessment application

After the completion of each story, the user is asked to complete an interactive narrative puzzle, in order to express and summarize his/her understanding of the generated story. In the puzzle the user is called to indicate the characters, the objects, the settings and some key actions of the most important parts of the story. The puzzle will provide interactive feedback in order to let the children experiment and understand the causal chains of the narrative events that arose during the course of the story.

CONCLUSION

We argue that interactive storytelling appears to be a promising tool for strengthening literacy skills in dyslexic children. Analyzing oral traditions in their function to preserve cultural capital, we come upon useful similarities with study patterns and methodology used for and by dyslexic individuals, in their effort to understand and use written material.

Every parameter of the narrative model that is used to build the stories offers a ground pillar to the dyslexic children. The coherent and constrained structure of the generated stories allows the dyslexic children to understand the sequence of narrative events, rely on semantic context and develop imaginative and visual skills. The generated schema-questions and the post-story assessment facilitate the development of story schemata, which are critical in acquiring a situation model that corresponds to the generated narrative. Also the use of rhyme and the spatial dimension of the stories can aid the developing of mnemonics. Finally we argue that the overall repetitive nature of the narrative patterns can aid over-learning in a non-tedious way. An example of an interaction scenario and its design will be presented in detail during the workshop.

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Adaptive Storytelling as a Teaching Strategy with Specific Learning Disability

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Abstract

This study presented the use of adaptive storytelling as a teaching strategy in a reading class to learners with Specific Learning Disability. The study was conducted at one of the elementary schools in Williston, North Dakota, USA, school year 2020-2021. The participants of this study were Grade 4 learners with Specific Learning Disability. The study collected data about the learners' oral reading profile, learners' performance on the pretest and the post-test, learners' feelings in the reading class, and learners' behavior during the reading class. During the implementation of the study, lesson plans were presented with a lesson plan that does not use adaptive storytelling as a teaching strategy to the control group while the lesson plan that was using adaptive storytelling as a teaching strategy was presented to the experimental group. Five lessons were presented to each reading class. With the gathered data, the study determined the significant relationship between the reading profile and behavior during reading class as well as it determined the significant difference between the pretest and the post-test scores in reading. The findings show the need for an action plan to use an adaptive storytelling as a teaching strategy with specific objectives that has to be implemented in a one on one setting for students to improve their reading behaviors and achieve a more interactive reading sessions.

Keywords: *adaptive storytelling, oral reading special education, specific learning disability, teaching strategy*

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Introduction

In an era where English is identified as the global language, proficiency in oral skill becomes an essential aspect of daily living – whether at home, in school, or the workplace. Considered the most widely researched and the "most enigmatic of the so-called language skills" (Alderson, 2005), reading is a complex process where there is an interaction between the reader and the text. In order to develop the learners' reading comprehension skills, there is a need to motivate them to read then slowly lead them to understand what they are reading. Comprehending a text is quickly absorbed once the learner is interested in what he/she is reading. This scenario is even more challenging when handling learners with special needs. Reading is the most common learning disability which affects approximately 80 to 90 percent of all learning disabilities in the United States of America (Lauren, 2009). In this age of technology, literacy skills, particularly language skills development, are challenged by media and information technology. There are five basic language skills: listening, speaking, reading, writing, and visualizing, all need to be taught explicitly in all curriculum. Reading proficiency can only be achieved if one's reading comprehension is fully developed. Hudson et al. (2005) asserted that being fluent in reading is a good reader's characteristic.

Learners with learning disabilities often encounter issues with their academic instruction due to the disability in reading and writing and encounter the following issues like auditory and visual memory problem, motor coordination, sustaining attention and focus, auditory and visual perception, and inhibiting impulse. Storytelling as an approach help learners with specific learning disabilities to help them to understand themselves and their problems. In the process, learners gain skills with modeling story’s characters in encountering similar issues, stories can make the learners to changes their attitudes towards themselves because of knowing of pleasant and unpleasant experiences through storytelling. Children learn effective strategies through assimilating a fictional character. Storytelling can be used as a tool to help learners with specific learning disability.

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Storytelling is the oldest and most popular way of teaching, especially among children. From the creation stories to legends, myths, folk tales, and fables, every culture has its own stories to tell, act as entertainment, education, cultural preservation, and instilling moral values. Through these stories, children learn to develop their listening and speaking skills. Storytelling is the oldest form of education based on the reasons.

The National Storytelling Network defines storytelling as an ancient art form and a valuable form of human expression. It is an effective educational tool that can quickly get the learner's attention. Because the story is essential to so many art forms, however, the word "storytelling" is often used in many ways. The most notable definition of storytelling is that *storytelling is the interactive style of using words and actions to depict the elements and images while encouraging the listener's imagination.* Learners with specific learning disabilities need interactive and exciting activities in class. They have a lesser attention span and have difficulty responding to certain tasks. Learners with a specific learning disability are capable of learning but may be slower than regular children. With this regard, stories allow individuals to think, feel, and interact. The study documents the achievement of adaptive storytelling as a learning tool to help learners with a specific learning disability develop and improve their reading comprehension skills.

Using storytelling in the classroom is a way to help literacy development by improving oral reading, reading comprehension, and writing. With the interrelated nature of reading and writing processes, storytelling is an effective pedagogical strategy that can improve instruction to increase learners' competencies in all areas (Miller & Pennycuff, 2008). Huss and Magnuson (2006) assert that stories should "fit" the child's reading level. With the stages of reading development, by six years old, adults are encouraged to scaffold a child's language because he/she can understand more words but can read a few. At 7 or 8 years old, the child learns the essential decoding elements, sight vocabulary, and meaning context in reading common topics. The learner's skills are extended through guided read-aloud, repeated, and monitored oral reading with the adult's assistance to model. Moreover, during reading, adults need to engage in conversations with children to learn new vocabulary (Westberg et al., 2006). At the end of this

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period, the learner transitions out of the learning-to-read phase and into the reading-to-learn phase (Snow, 2004).

This study determined the achievement in adaptive storytelling as a teaching strategy with specific learning disabilities amongst 4th-grade learners with specific learning disabilities in one of the elementary school in North Dakota, USA, the school year 2020 – 2021 as basis in making an action plan to address the need of accommodating students with special needs to improve their reading ability in class.

Literature Review

In Federal law, under the Individuals with Disabilities Education Act (IDEA), the term "specific learning disability" is one of 13 categories of disability. This law leads to provision of providing appropriate program and support to learners with Specific Learning Disability. In providing Free Appropriate Public Education, an Individualized Education Plan has to be in place. The IDEA maintains that parents and teachers who qualify for special education must develop an Individualized Education Program, or IEP, to establish specific education for a child's explicit needs. This requires the team to meet initially to determine a child's eligibility for an IEP and come together annually to assess the educational plan. The learner's educational strategy should focus on skill. Focusing on learners' academic performance that will lead to progress. This affirmation that storytelling as an interactive social activity in the classroom can help children learn better. Jean Piaget's progressively more sophisticated cognitive skills, from primitive thinking to advanced cognitive ability, proposes specific cognitive achievements fundamental to linguistic development. Linkages exist between children's motor ability, play behavior, and language development.

Researches focus on reading comprehension, and reading strategies vary in nature and context. The role of reading comprehension as a component of learning to address reading gaps has been explained in several studies (Fuenmayor et.al., 2008; Luckner & Handley, 2008; Dalton & Proctor, 2007). These studies confirm that reading comprehension is necessary for making learners learn. Reading is the most difficult to teach in a natural classroom setting because learners have a different reading background. Likewise, the role of the learner's mother

tongue affects how a learner reads. Thus, learning to read is a prerequisite to learning other content areas. As a result, learning to read leads to language learning, which is instrumental in understanding.

Children at risk of reading failure especially require direct and systematic instruction in these skills, and that instruction should be provided as early as possible. Children in kindergarten and the first grade respond well to instruction in phonemic awareness and phonics, provided the instruction is delivered in a vibrant, imaginative, and entertaining fashion. Children who experience early difficulty in reading respond well to phonics instruction through the late elementary school years. The Panel also concluded that guided oral reading had been clearly documented by research to be important for developing reading fluency — reading with efficiency and ease. In guided oral reading, learners read aloud to a parent, teacher, or other learners, who corrects their mistakes and provides them with other feedback. Specifically, guided oral reading helped learners across a wide range of grade levels learn to recognize new words, read accurately and easily, and comprehend what they read (Langenburg, 2000).

The study of Jaca et al. (2018) describes how *Pag-asoy* (storytelling in Cebuano language) served as a tool in developing the learners' oral fluency in their mother tongue. During the study period, the learners were introduced to local Cebuano stories to determine their oral language fluency during classroom interaction. The study found out positive effects of using Cebuano folktales in promoting the Cebuano language during the study of Pag-asoy. Using Cebuano stories provided an unequal impact on children because they can relate to the stories based on their experiences. The ability to use their first language confidently when they express themselves in a conversation. *Pag-asoy* (Storytelling) in the dialect was found to solicit more class participation and oral interaction than stories told in a different language. As a result, they develop reading fluency in their dialect (Cebuano) as they become expressive and participative. *Pag-asoy* children also enhanced the receptive skill of listening when they focused on the elements of the stories presented and actively asked and answered questions during the *Pag-asoy*.

In storytelling, the listener imagines the story. In most traditional theatre or a typical dramatic film; on the other hand, the listener enjoys the illusion that the listener is actually

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witnessing the character or events described in the story. The storytelling listener's role is to create the vivid, multi-sensory images actively, actions, characters, and events—the reality—of the story in his or her mind, based on the teller's performance and the listener's own past experiences, beliefs, and understandings. The completed story happens in the mind of the listener, a unique and personalized individual. The listener becomes, therefore, a co-creator of the story as experienced (Niemi, et.al., 2014).

From the cognitive perspective of learning to read, reading comprehension (or, simply, reading) can construct linguistic meaning from written representations of language. This ability is based upon two equally important competencies. One is language comprehension–the ability to construct meaning from spoken representations of language; the second is decoding–the ability to recognize written representations of words. These two main foundations of reading are represented by the two supporting legs in this cognitive framework's graphic depiction. Both of these are complex abilities themselves, each based on other abilities. In this simple view of reading, both language comprehension and decoding are necessary for reading comprehension success. Neither is sufficient in itself. On the one hand, being fully competent in a language but having no ability to recognize its written words will not allow successful reading comprehension. On the other hand, neither will have the ability to recognize a language's written words but not have the ability to understand their meaning. In this view, the only route to successful reading comprehension is success at both language comprehension and decoding. Weakness in either ability will result in weak reading comprehension. Thus, knowing where obstacles to reading and its acquisition exist requires assessing language comprehension and decoding abilities. Let's consider the abilities needed for success in these two broad domains (Hoover & Gough, 2019).

Reading is process and that it starts with word recognition. Dahan and Magnuson (2006) espoused that spoken word recognition is a distinct subsystem providing the interface among low-level perception and cognitive processes of retrieval, parsing, and interpretation. The narrowest conception of the process of recognizing a spoken word is that it starts from a string of phonemes, establishes how these phonemes should be grouped to form words, and passes these words onto the next level of processing. Thus, there is value in providing reading opportunities to students as affirmed by the study of Kahsay (2020) that based on his findings it is

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recommended that English teachers of high schools should teach their students to use explicit reading strategies and help them practice and employ these strategies in their class.

The goal of many recent intervention studies has been to examine the conditions that must be in place for all children to acquire adequate reading skills. Although the ultimate goal of reading instruction is to help children acquire the skills necessary to comprehend text, an important sub-goal for early reading instruction is to teach children to identify words accurately on the printed page (Torgesen, 2010).

In this present study, adaptive storytelling is used as a teaching strategy among students with specific learning disability in order to help and support them in the students' reading ability.

Methodology and Methods

This study was conducted in one of the elementary schools in Williston, North Dakota, USA. The school was built in the year 1981. This school caters to 450 learners in Kindergarten through 4th grade using K-12 Content Standards of North Dakota under the Department of Public Education. The school's vision is to welcome and celebrate the learners, staff, parents, and the community's individuality. The school aims to educate with passion in a safe and respectful environment. Moreover, strive to educate with the highest level of technology. Furthermore, pledge to prepare learners to graduate and achieve personal success. The school's mission is to prepare learners to be successful at the next level of education, work, and life. The subject of the study was a total of sixteen 4th grade learners with Specific Learning Disability. Eight (8) learners belonged to the experimental group while another eight (8) learners belong to the control group. Each subject's demographics included the subjects' reading profiles based on North West Evaluation Association (NWEA) and the subjects' reading fluency based on word count per minute. Based on NWEA, the experimental group has three (3) subjects that is in the Kindergarten level, one (1) first-grade level, three (3) second-grade level, and one (1) first-grade level. While the control group has one (1) Kindergarten level, one (1) first- grade level, three (3) second-grade level, and three (3) third-grade level. Based on reading fluency (words per minute), the experimental group has one (1) Kindergarten level, three (3) first-grade level, two (2) second-grade level, one (1) third-grade level, and one (1) fourth-grade level. While the control

group has one (1) Kindergarten level, three (3) first grade level, two (2) second-grade level, two (2) third-grade level.

This study employed the quasi-experimental research design, which looked into the effects of storytelling on learners' reading comprehension with a Specific Learning Disability. This study used the group design method, which utilized survey questionnaires, a behavior checklist, a pre-test, and a post-test for the data analysis in comparing both groups.

A descriptive research design was used in this study, employed both quantitative and qualitative techniques. A researcher-made questionnaire on learners' reading profile which is used to determine the learner's reading ability regarding reading books they read, frequency of reading, and oral reading ability, classroom observation which was used as a tool to determine learner participation, a pre-test and a posttest was used to compare data, and reading participation behavior checklist which was used to assess the learners' participation during instruction was utilized to gather needed data and information regarding the research subjects to triangulate all data gathered to ensure validity and reliability of the findings.

This study used the Input-Process-Output (IPO) approach in handling information. The input stage included the subject's reading profile, pre-test, posttest performance, feelings about reading, subject's behavior in reading, the significant relationship between the reading profile and behavior in reading, and significant differences in pre-test and posttest scores in reading performance. In the process stage, the researcher acquired the transmittal letter and the task commission from the head of the institution. The data gathered will be classified, tabulated, computed, and treated statistically following the research objectives. After this, the data will be interpreted and analyzed. In the output process, the study's findings was the basis for creating the proposed action plan to help teachers, parents, learners, administrators, and future researchers use adaptive storytelling as a teaching strategy.

Appropriate permission was secured before administering the instrument to the intended research subjects. The data gathering activities obtained the approval of concerned offices through official communication duly endorsed by the research adviser and college dean before administering the research instruments.

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During this phase, the researcher adhered to the confidentiality clause to protect the research subjects' privacy and the participating institutions. The researcher obtained a transmittal letter from the elementary school's principal. Once granted, the survey questionnaire was distributed.

All sixteen (16) grade 4 subjects with Specific Learning Disabilities were divided into two groups based on their reading class. One reading class was chosen to be the experimental group which consists of 8 subjects, while the control group consists of 8 subjects. The survey questionnaires, pre-test, post-test, and the use of adaptive storytelling implementation as a teaching strategy and classroom observation were done in each reading class.

In facilitating the analysis of gathered data, a T-test was used in determining if there was a significant discrepancy between the means of the two groups in this study. This includes the discrepancy between the mean values from each data set, the group's standard deviation, and the number of data values.

To facilitate the analysis of the gathered data, the researcher used a 5 point scale to score. The use of frequency, mean, rank, standard deviation, and t-test as statistical treatment was used in this study.

Results and Discussion

This research determined the achievement in adaptive storytelling as a teaching strategy amongst 4th-grade learners with specific learning disabilities in an elementary school in North Dakota, USA, the school year 2020 - 2021. The study had sixteen (16) subjects who are grade 4 learners with Specific Learning Disabilities. In gathering data, survey questionnaires, a behavior checklist, and a pretest and a posttest were used. This study employed the quasi-experimental research design that looked into the effects of adaptive storytelling on learners' reading comprehension with a Specific Learning Disability. This study used the group design method. All the data is presented, analyzed, and interpreted showed no significant relationship between the participant's oral reading ability and reading class behavior. The study also achieved and showed that there was no significant relationship between the correct word count with the pretest and the post-test. It also revealed no significant difference in comprehension questions between the pretest score and the post-test score. This study's participants are grade 4 learners with

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Specific Learning Disabilities. More rigorous and consistent use of teaching strategies that work for them has to be implemented before making some changes. More time is needed to implement adaptive storytelling as a teaching strategy to progress each participant.

The learner's profile from both groups revealed that most learners read books in the control group (six (6) or 75%) on storybooks (ten (2) or 33.33%). They read the books every day (two (2) or 33.33%) or once or twice a week (two (2) or 33.33%). The Grade 4 learners' reading ability is classified as first graders (three (3) or 37.50%) based on the gathered data. Furthermore, the data showed that 50% of the learners read books in the experimental group, and 50 % do not read books. However, it was textbooks (two (2) or 50.00%) that learners love to read every day (two (2) or 50.00%) to those who read books. The Grade 4 learners' reading ability is classified as first graders (three (3) or 37.50%) based on the gathered data. Based on the gathered data, the participants' oral reading profile/ability in both groups was classified as first-grade readers.

The performance of both groups in their pre-test and post-test showed that in the control group, specifically in participants' performance incorrect word count, most of them fell under the Very Good category (three (3) or 37.50%). The participants scored poor or fair in the comprehension question (three (3) or 37.50%). Also, the data showed the results of the pre-test performance of the experimental group in reading. It showed that participants' performance incorrect word count fell under categories of Poor, Fair, and Very Good (two (2) or 25.00%). The participants scored either Poor or Fair (three (3) or 37.50%). These data implied that even if learners can read based on the correct word count, writing skills also significantly impacted their performance. The learners writing skills were poor or fair based on their comprehension answers. The comprehension answers were not in complete sentences and had incorrect spellings. It also implied that developing reading skills in Grade 4 learners is one of every early education program's key goals. Through reading, learners expand their vocabulary and learn about the world, contributing to success in spelling and writing. Sometimes there may be a not diagnosed learning difficulty to blame for learners who struggle with dyslexia. In these situations, parents and teachers should discuss and provide children with appropriate coping strategies to make sure they continue to progress and achieve reading proficiency.

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The data showed the results of the post-test performance of the participants in reading. It showed that in the control group, specifically in the performance of participants incorrect word count, many fell under the Good, Very Good, and Excellent categories. While in the comprehension question, half of the participants scored Fair (four (4) or 50.00%). Also, the data showed the results of the post-test performance of the experimental group in reading. It shows that participants' performance incorrect word count fell under the Good and Excellent categories (three (3) or 37.50%). The participants scored Fair (four (4) or 50.00%). These data implied that it made very little to no difference with the post-test results in both groups compared to the learner's pre-test results. These elementary school learners substantially define themselves as readers, which significantly influences their development as learners. Those who succeed in becoming a fluent, strategic, and joyful reader is not guaranteed success in school or life. Thus, those who do not succeed in reading or become reluctant readers face long odds of achieving success in school and life. Every educator, parent, and policymaker knows the critical importance of reading in the elementary grades. Given the importance of success in reading for millions of children and our society as a unit, one would imagine that there would be a deal of research on how teachers can most effectively teach children to read.

The feelings of the participants of both groups in reading exhibit that most participants say that they pick up their books (eight (8) or 100.00%). Only two (2) of them (25.00%) say that they read challenging books. About 75.00% of them read books for fun. Fifty percent of the participants read books wherein they can. However, the participants said that it was not easy for them to read the books (five (5) or 62.50%) of the books they read. It was difficult for them to read the books (five (5) or 62.50%), and a few participants (three (3) or 37.50%) says that they need help with their reading difficulty. Moreover, the table shows that only a few of them (two (2) or 25.00%) acknowledge that they can read well. The data also showed that most participants say that they pick up their books (eight (8) or 100.00%). Only one participant (12.50%) says that they read challenging books. About 37.50% of them read books for fun. Fifty percent of the participants read books wherein they can. Nevertheless, the participants said that it was not easy for them to read the books (three (3) or 37.50%) of the books they read. It was difficult for them to read the books (five (5) or 62.50%), and a few participants (3, 37.50%) says that they need

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help with their reading difficulty. Moreover, the table shows that only a few of them (2, 25.00%) acknowledge that they can read well.

The data implied that the majority of these learners pick their books to read. Most of them read books for fun but would somehow or never try to read challenging books. Some of them needed help in reading, and most of the need have difficulty in reading. These learners get frustrated when they get to read a challenging book or even words to read. They get overwhelmed with lengthy words or sentences per page and struggle with reading most of their school life. These data implied that these learners liked to read for fun but struggled and had difficulty reading challenging words.

The level of the participants' behavior of both groups in reading as to each of the lessons as adaptive storytelling was used in five lesson plans namely: identifying the living and the non-living things, all about nouns, common and proper noun, verb tenses: past, present, future, and all about me indicate a positive feedback. The data showed the participants' behavior in identifying the living and non-living things of the control group. It showed that the indicator, participates actively during the question-and-answer portion of the storytelling, got the highest mean of 3.88 (Often), followed by the indicators, Talks with a classmate, and Eyes on the teacher, got a mean of 3.63 (Often) respectively. While the indicator, It persistent when having difficulty got the lowest mean of 1.75 (Never). The data also showed the participants' behavior in identifying the experimental group's living and non-living things. The study shows that the indicator, Comprehends the reading material, got the highest mean of 4.63 (Always), followed by the indicators, Pays attention during class, Listens well with other learners around, and Sitting correctly during the lesson, got the mean of 4.00 (Often). While the indicator, Does not listen to the story, got the lowest mean of 1.00 (Mean). The data implied that the experimental group participants were actively listening during the lesson compared to the control group. The use of adaptive storytelling was more interesting in presenting a story than the plain storytelling that the control group had. Grade 4 learners love to listen to stories. There is hardly anyone among us who has not heard a story during our childhood. In contrast, stories keep these Grade 4 learners engaged and let them feel that they are also participating in the process of storytelling. Language learning and learning, for that matter, happens when learners are engaged in meaning-making activities. Suppose storytelling is made into an exciting experience and fun-filled activity. The

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listeners also participate in the telling, guessing, manipulating. In that case, it could be a joyous learning experience.

The data showed the participant's behavior in the lesson All About Nouns that in the control group, the data show that the indicator, Participates actively during the question-and-answer portion of the storytelling, got the highest mean of 3.88 (Often), followed by the indicator, Talks with a classmate (3.75, Often), and Eyes of the teacher (3.63, Often). While the indicator, Annoys, or distracts other learners, got the lowest mean of 1.75 (Never). Also, the data showed the results of All About Nouns in the experimental group. It shows that the indicator, Comprehends the reading material, got the highest mean of 4.63 (Always), followed by the indicators, Listen well with other learners around, and Sitting correctly during the lesson with a mean of 4.00 (Often) respectively. While the indicator, Does not listen to the story with the lowest mean of 1.00 (Never). The data implied that the experimental group paid more attention than the control group when presented with the lesson. The participants in the experimental group were actively listening during the lesson compared to the control group. The use of adaptive storytelling was more interesting in presenting a story than the plain storytelling that the control group had. The Grade 4 learners have an inborn love of stories. The stories create magic and a sense of wonder. It teaches them about life and the people around them. The storytelling is a unique way for students to understand, respect, and appreciate other cultures and reflect a positive attitude to people from different lands, races, and religions.

The data showed the participant's behavior in the lesson Common and Proper Noun that in the control group, the data show that the indicator, Participates actively during the question-and-answer portion of the storytelling, got the highest mean of 3.88 (Often), followed by the indicator, Talks with a classmate, and Eyes of the teacher (3.63, Often) respectively. While the indicator, Persistent when having difficulty, got the lowest mean of 1.75 (Never). Also, the data showed the results on Common and Proper Noun Scavenger Hunt in the experimental group. It shows that the indicator, Comprehends the reading materials, got the highest mean of 4.63 (Always), followed by the indicators, Listens well with other learners around, and Sitting correctly during the lesson, with a mean of 4.00 (Often) respectively. While the indicator, Does not listen to the story, got the lowest mean of 1.00 (Never). The data implied that the experimental group paid more attention than the control group when presented with the lesson. It

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made no difference with the participant's behavior in the lesson Identifying Living and Non-Living Nouns and All About Nouns in both groups. The participants in the experimental group were actively listening during the lesson compared to the control group. For this implication, schools need to improve the literacy learning of Grade 4 learners; different strategies need to be employed. Using storytelling in the classroom is a way to address literacy development by improving the oral language, reading comprehension, and writing. These are interrelated nature of the processes part in reading and writing. Storytelling is an effective strategy that can be woven into instruction to increase students' competencies in all areas that address how storytelling can be used as a strategy in the classroom to improve literacy learning in reading and writing.

The data showed the participant's behavior in the lesson Verb Tenses that in the control group, the data show that the indicator, Participates actively during the question-and-answer portion of the storytelling, got the highest mean of 3.88 (Often), followed by the indicators, Talks with a classmate, Eyes of the teacher, and Fidgety during reading (3.63, Often) respectively. While the indicator, Persistent when having difficulty, got the lowest mean of 2.00 (Rarely). Also, the data showed the results of Verb tenses in the experimental group. It shows that the indicator, Comprehends the reading materials, got the highest mean of 4.63 (Always), followed by the indicators, Listens well with other learners around, and Sitting correctly during the lesson, with a mean of 4.00 (Often) respectively. While the indicator, Does not listen to the story, got the lowest mean of 1.00 (Never). The data implied that the experimental group paid more attention than the control group when presented with the lesson. It made no difference with the participant's behavior in the lesson Identifying Living and Non-Living Nouns, All About Nouns, and Common and Proper Noun in both groups. The participants in the experimental group were actively listening during the lesson compared to the control group. The data implied that comprehension, or extracting meaning from what you read, is the ultimate reading goal. Experienced readers like the Grade 4 learners take this for granted and may not appreciate the required reading comprehension skills. The process of comprehension is interactive and strategic. Rather than passively reading text, readers must analyze it, internalize it, and make it their own. To read with comprehension, developing readers must read with some proficiency and then receive explicit instruction in reading comprehension strategies.

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The data showed the participant's behavior in the lesson All About Me that in the control group, the data show that the indicators, Participates actively during the question-and-answer portion of the storytelling. The eyes of the teacher got the highest mean of 3.88 (Often) respectively. The indicators follow this, Talks with a classmate, Expresses ideas on the topic, and Comprehends the reading material (3.63, Often). While the indicator, Persistent when having difficulty, got the lowest mean of 1.75 (Never). Also, the data showed the results of Verb tenses in the experimental group. It shows that the indicator, Comprehends the reading materials, got the highest mean of 4.63 (Always), followed by the indicator, Sitting correctly during the lesson with a mean of 4.00 (Often). While the indicator, Does not listen to the story, got the lowest mean of 1.00 (Never). The data implied that the experimental group paid more attention than the control group when presented with the lesson. It made no difference with the participant's behavior in the lesson Identifying Living and Non-Living Nouns, All About Nouns, Common and Proper Noun, Verb Tenses, and All About Me in both groups. The participants in the experimental group were actively listening during the lesson compared to the control group. These data implied that stories could be appealing educational tools because they engage Grade 4 learners, believable and entertaining, and easily recall facts from the story. Most learners should agree on the stories' contents as exciting and informative to engage learners in storytelling. Listening to the stories helped them learn.

In summary, the data implied that the participants in the experimental group were actively listening during the lesson compared to the control group. The use of adaptive storytelling was more interesting in presenting a story than the plain storytelling that the control group had. The results from the behavioral observations during the implementation of the five lessons that were in both groups had the same results.

Based on this study's research findings, an action plan on was proposed. The proposed action plan is intended to improve Grade 4 learners with Specific Learning Disability's reading comprehension. It aims to address the reading difficulty patterns using adaptive storytelling as a teaching strategy that will also increase student participation in the reading class. In this action plan, the adaptive storytelling will be used as a teaching strategy in a one-on-one setting. In this regard, this plan specifies objectives with corresponding specific learning goals that target a

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reading disability pattern. Educators will utilize adaptive storytelling as a teaching strategy and use interventions and differentiation reflected in their IEP.

Objectives:

1. Determine the learner's reading ability:
2. Improve the learners with Specific Learning Disability reading comprehension by increasing learner's reading difficulty patterns, namely: reading fluency, vocabulary acquisition, and written expression skills; and
3. Use adaptive storytelling as a teaching strategy in a one-on-one setting in the resource room.

The action plan has three learning goals and professional practice:

Learning goal number 1: When given a first-grade level reading probe, the learner will increase his/her reading with 50% accuracy based on counting the correct words in 4 out five consecutive sessions data collected and observed by the special education teacher resource room. This goal's characteristic will be carried through the special education services in a one-on-one setting and will be reported every end of the quarter this school year 2020-2021.

Professional Practice: To achieve this goal, a special education teacher will provide the learner with teaching decoding skills and word recognition skills using adaptive storytelling to increase the learner's reading fluency in one-on-one instruction. Special education teacher will monitor instruction by the correct word read and progress monitoring using a first-grade reading probe.

Learning goal number 2: When given synonym/antonym probe, the learner will increase his/her vocabulary acquisition with 80% accuracy based on his/her answer and using the words given in a sentence in 4 out of five consecutive sessions data collected and observed by the special education teacher in the resource room. This goal's characteristic will be carried through the special education services in a one-on-one setting and will be reported every end of the quarter this school year 2020-2021.

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Professional Practice: To achieve this goal, a special education teacher will provide the learner with first-grade vocabulary words using adaptive storytelling to increase the learner's vocabulary acquisition in a one-on-one instruction. Special education teachers will monitor instruction based on learner progress.

Learning goal number 3: When given comprehension questions based on the adaptive storytelling presentation, the learner will increase his/her writing skills by 50% based on his/her written answers with correct sentence construction, spelling, correct capitalization, and punctuation in 4 out five consecutive sessions data collected and observed by the special education teacher in the resource room. This goal's characteristic will be carried through the special education services in a one-on-one setting and will be reported every end of the quarter this school year 2020-2021.

Professional Practice: To achieve this goal, a special education teacher will teach the learner the parts of speech and write correct sentence patterns using adaptive storytelling to increase the learners' written comprehension skills in a one-on-one instruction. The special education teacher will monitor instruction by checking correct sentence construction, spelling, punctuation, and progress monitoring using a first-grade reading comprehension questions probe.

Findings

The findings of this study include that the grade 4 learners had a wide range of reading needs. A pattern of reading difficulty was evident in the study as reading fluency, vocabulary acquisition, and written expression skills. In order to improve the participant's reading comprehension, the reading difficulties have to be addressed first on a one-on-one basis. The reading group that the participants participated in was not enough support based on the data presented in chapter 2 of this study. The need for one-on-one reading service minutes support will help for each of the participants considering that the study results did not make any significant change with their reading skills. With each lesson, though, the participants could comprehend the story presented but answering comprehension questions in writing was the most challenging part. Thus, giving appropriate individual interventions and differentiation that targets each specific reading difficulty pattern would be beneficial. With the participant's behavior in the reading class,

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engaging learners in the choice of story and content that are interesting and informative would make the participants involved. Collected data indicated that half of the experimental group had reading problems that would significantly impact their learning performance in the classroom context that involves reading. Furthermore, given that the control group learners demonstrated their willingness to read, children in the experimental group demonstrated their inability to read, depicting a scenario that affects individuals' thought processes in their immediate environment. The research findings portrayed a unique realization that will enable teachers to make informed decisions that benefit the children's learning process with Specific Learning Disabilities and their ability to overcome issues, which hinder their comprehension.

Conclusion

This study responded to six research questions to establish adaptive storytelling as a teaching strategy, which will help modify learning challenges among learners with Specific Learning Disabilities. Adaptive storytelling proved to be an exciting teaching strategy that made the experimental group familiar with the words in the story, which made them more attentive at the first attempt during the lesson Identifying Living and Non-Living Thing. Although it made the reading material exciting and they comprehend the story when asked comprehension questions orally during the lesson, they never made any difference in their behavior towards reading. Each learner's self-concept to succeed in tests issued in the learning environment plays an essential role in shaping their perspectives even in later life stages. Notably, many students described themselves as readers, which enabled them to overcome different scenarios that influenced their ability to overcome reading problems. However, individuals who fail in the tests may be discouraged from attempting different approaches to improve their grades and change their perspectives towards life; even though most students love to read textbooks, individuals' ability to overcome different reading problems inspired by their willingness to select their reading materials.

Adaptive storytelling is an exciting approach that enables learners to comprehend different aspects, which would not have accomplished because of the different challenges that emerge during the learning process and our data. However, teachers contribute mainly towards the learner's ability to overcome the challenges that interfere with their learning process.

Recommendations

Based on the findings of the study, the following are the recommendations:

1. Use adaptive storytelling as a teaching strategy in developing learner's reading difficulty patterns in a one-on-one setting.
2. Target each learner's reading difficulty pattern to improve reading comprehension by teaching the skills. The reading difficulty pattern identified was reading fluency, vocabulary acquisition, and written expression skills. The out of the study will work on those skills.
3. It is recommended that learners with Specific Learning Disabilities will be taught the skills in a one-on-one setting in the resource room with the special education teacher.
4. Specific learning goals will be needed to address specific learning deficits.
5. Engage learners in the selection of stories to improve the interest and create a sense of belongingness.
6. Provide interventions and differentiation that will accommodate each Grade 4 learner with Specific Learning Disability. Update each IEP to reflect the needed accommodations and modifications.

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LEARNING & TECH

What's Going On In Your Child's Brain When You Read Them A Story?

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ANYA KAMENETZ

LA Johnson/NPR

"I want The Three Bears!"

These days parents, caregivers and teachers have lots of options when it comes to fulfilling that request. You can read a picture book, put on a cartoon, play an

audiobook, or even ask Alexa.

A newly published study gives some insight into what may be happening inside young children's brains in each of those situations. And, says lead author Dr. John Hutton, there is an apparent "Goldilocks effect" — some kinds of storytelling may be "too cold" for children, while others are "too hot." And, of course, some are "just right."

Hutton is a researcher and pediatrician at Cincinnati Children's Hospital with a special interest in "emergent literacy" — the process of learning to read.

For the study, 27 children around age 4 went into an FMRI machine. They were presented with stories in three conditions: audio only; the illustrated pages of a storybook with an audio voiceover; and an animated cartoon. All three versions came from the Web site of Canadian author Robert Munsch.

While the children paid attention to the stories, the MRI, the machine scanned for activation within certain brain networks, and connectivity between the networks.

"We went into it with an idea in mind of what brain networks were likely to be influenced by the story," Hutton explains. One was language. One was visual perception. The third is called visual imagery. The fourth was the default mode network, which Hutton calls, "the seat of the soul, internal reflection — how something matters to you."

The default mode network includes regions of the brain that appear more active when someone is *not* actively concentrating on a designated mental task involving the outside world.

In terms of Hutton's "Goldilocks effect," here's what the researchers found:

In the audio-only condition (too cold): language networks were activated, but there was less connectivity overall. "There was more evidence the children were straining to understand."

In the animation condition (too hot): there was a lot of activity in the audio and visual perception networks, but not a lot of connectivity among the various brain networks. "The language network was working to keep up with the story," says Hutton. "Our interpretation was that the animation was doing all the work for the child. They were expending the most energy just figuring out what it means." The children's comprehension of the story was the worst in this condition.

The illustration condition was what Hutton called "just right".

When children could see illustrations, language-network activity dropped a bit compared to the audio condition. Instead of only paying attention to the words, Hutton says, the children's understanding of the story was "scaffolded" by having the images as clues.

"Give them a picture and they have a cookie to work with," he explains. "With animation it's all dumped on them all at once and they don't have to do any of the work."

Most importantly, in the illustrated book condition, researchers saw increased connectivity between — and among — all the networks they were looking at: visual perception, imagery, default mode and language.

"For 3- to 5-year-olds, the imagery and default mode networks mature late, and take practice to integrate with the rest of the brain," Hutton explains. "With animation you may be missing an opportunity to develop them."

When we read to our children, they are doing more work than meets the eye. "It's that muscle they're developing bringing the images to life in their minds."

Hutton's concern is that in the longer term, "kids who are exposed to too much animation are going to be at risk for developing not enough integration."

Overwhelmed by the demands of processing language, without enough practice, they may also be less skilled at forming mental pictures based on what they read, much less reflecting on the content of a story. This is the stereotype of a "reluctant reader" whose brain is not well-versed in getting the most out of a book.

One interesting note is that, because of the constraints of an MRI machine, which encloses and immobilizes your body, the story-with-illustrations condition wasn't actually as good as reading on Mom or Dad's lap.

The emotional bonding and physical closeness, Hutton says, were missing. So were the exchanges known as "dialogic reading," where caregivers point out specific words or prompt children to "show me the cat?" in a picture. "That's a whole other layer," of building reading Hutton says.

In an ideal world, you would always be there to read to your child. The results of this small, preliminary study also suggest that, when parents do turn to electronic devices for young children, they should gravitate toward the most stripped-down version of a narrated, illustrated ebook, as opposed to either audio-only or animation.

The State of Learning Disabilities

RESEARCH & REPORTS

3 Reading Intervention Research

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INTERNATIONAL LITERACY ASSOCIATION READING RESEARCH QUARTERLY

Forty Years of Reading Intervention Research for Elementary Students with or at Risk for Dyslexia: A Systematic Review and Meta-Analysis

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ABSTRACT

This meta-analysis included experimental or quasi-experimental intervention studies conducted between 1980 and 2020 that aimed to improve reading outcomes for Grade K-5 students with or at risk for dyslexia (i.e., students with or at risk for word reading difficulties, defined as scoring at or below norm-referenced screening or mean baseline performance thresholds articulated in our inclusion criteria). In all, 53 studies reported in 52 publications met inclusion criteria (m = 351; total student N = 6,053). We employed robust variance estimation to address dependent effect sizes arising from multiple outcomes and comparisons within studies. Results indicated a statistically significant main effect of instruction on norm-referenced reading outcomes (g = 0.33; $p < .001$). Because there was significant heterogeneity in effect sizes across studies ($p < .01$), we used meta-regression to identify the degree to which student characteristics (i.e., grade level), intervention characteristics (i.e., dosage, instructional components, multisensory nature, instructional group size), reading outcome domain (i.e., phonological awareness, word reading/spelling, passage reading, or reading comprehension), or research methods (i.e., sample size, study design) influenced intervention effects. Dosage and reading outcome domain were the only variables that significantly moderated intervention effects (p = .040 and p = .024, respectively), with higher dosage studies associated with larger effects (b = 0.002) and reading comprehension outcomes associated with smaller effects than word reading/spelling outcomes (b = −0.080).

Dyslexia is a specific learning disability characterized by difficulties with accurate or fluent word recognition and spelling (Fletcher et al., 2019). When operationalized as word reading accuracy more than 1.5 standard deviations below the mean, estimates of dyslexia's prevalence in the population are roughly 7% (Peterson & Pennington, 2012). Research in cognitive neuroscience, genetics, developmental psychology, and education has demonstrated that dyslexia is neurobiological in origin and heavily determined by genes, while also influenced by environmental factors (Fletcher et al., 2019; Grigorenko et al., 2020). Individuals with dyslexia are at greater risk for negative academic and occupational outcomes (Boscardin et al., 2008; Daniel et al., 2006; Hernandez, 2011). That said, early identification and remediation has been found to increase both the academic and emotional well-being of individuals with or at risk for developmental dyslexia, even demonstrating efficacy in preventing the incidence of reading difficulties (RDs) altogether (e.g., Al Otaiba et al., 2009; Mathes et al., 2005).

Although individual intervention studies and descriptive syntheses have furnished information about what works to improve outcomes for young students with dyslexia, there is a need for meta-analytic research

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examining the effects of reading instruction on reading outcomes for this population specifically. Previous meta-analyses (e.g., Gersten et al., 2020; Neitzel et al., 2022; Slavin et al., 2011; Suggate, 2010; Swanson et al., 1999; Wanzek et al., 2016, 2018) report robust findings about effective early reading instruction for elementary-grade students with or at risk for RDs broadly defined (i.e., defined as including a wide range of reading and language difficulties). Specifically, these systematic reviews reveal that multicomponent reading interventions that provide explicit, systematic instruction in foundational skills (going forward, we use the term *foundational skills* to refer to phonological awareness [PA], phonics knowledge, word reading, spelling, and connected-text reading) and simultaneously focus on meaning (i.e., both word meanings and comprehension of connected text) are associated with significant positive effects. Three of the most recent among these meta-analyses, all of which employed stringent standards for inclusion and sophisticated meta-analytic methods, reported mean intervention effects of 0.23 (Neitzel et al., 2022) and 0.39 (Gersten et al., 2020; Wanzek et al., 2018).

It is possible and even likely that reading interventions that include an explicit, systematic approach to foundational skills instruction are effective, with effects estimated in the same range, for students with or at risk for dyslexia specifically. Individual intervention studies demonstrate that word RDs can be effectively remediated when instruction systematically and explicitly develops students' PA, teaches grapheme–phoneme correspondences, and provides practice reading words and connected text (e.g., Lovett et al., 2000; Morris et al., 2012; Vellutino et al., 2004). However, because no large-scale, rigorous meta-analysis focuses on the effects of reading instruction or intervention for this population of students, this hypothesis is difficult to confirm.

A synthesis of intervention research findings for students with or at risk for dyslexia depends on a clear operational definition of dyslexia. Miciak and Fletcher (2020) demonstrate a lack of validity for approaches to dyslexia identification that seek "to subdivide children into dyslexia and nondyslexic groups based on IQ, cognitive discrepancies, or other hypothesized markers of unexpectedness or etiology" (p. 7). Persuaded by their review of research, we defined dyslexia as the lower part of a continuous distribution of word reading and spelling skill (Miciak & Fletcher, 2020). We operationalized this definition by including studies that used a participant screening threshold of performance at or below the 25th percentile or reported mean baseline performance at or below the 16th percentile on a standardized measure of word reading, spelling, or skills foundational to word reading (e.g., PA, phonics knowledge). By focusing specifically on intervention effects on reading outcomes for this population of students, this review has the potential to demonstrate whether findings about effective instruction for students with RDs broadly hold for students with or at risk for dyslexia specifically.

Recent Meta-Analyses of Reading Intervention Research

Participant Samples

During the last two decades, seven meta-analyses (Donegan & Wanzek, 2021; Gersten et al., 2020; Neitzel et al., 2022; Slavin et al., 2011; Suggate, 2010; Wanzek et al., 2016, 2018; see Table 1) have investigated the immediate effects of reading instruction on word reading outcomes for elementary-grade students with or at risk for RDs. One additional research meta-analysis (Galuschka et al., 2020) investigated the immediate effects of spelling instruction on spelling outcomes for students with reading or spelling difficulties. Other rigorous reviews have been conducted as well, but they (a) focused only on comprehension outcomes (Denton et al., 2022; Hwang et al., 2021); (b) focused only on follow-up effects measured after the conclusion of the intervention (Suggate, 2016); (c) only included particular types of reading interventions (e.g., branded or unbranded Orton-Gillingham interventions; Ritchey & Goeke, 2006; Stevens et al., 2021); (d) included students in middle or high school (Flynn et al., 2012; Scammacca et al., 2015, 2016; Wanzek et al., 2013); (e) focused on a different or narrower subset of students, such as English learners (Cheung & Slavin, 2012; Ludwig et al., 2019; Richards-Tutor et al., 2016; Roberts, Hall, et al., 2021); or (f) primarily explored associations between student characteristics and intervention effects (Al Otaiba & Fuchs, 2002; Stuebing et al., 2015; Tran et al., 2011).

The seven meta-analyses that are most relevant to the current review (see Table 1) included studies with elementary-grade participants with or at risk for RDs who did *not* exhibit word reading or spelling difficulties (i.e., students with specific reading comprehension difficulties and language impairments), as well as including participants who did. The Wanzek et al. (2016) review included studies with participants in kindergarten (K) through Grade 3 who had "low achievement, low phonemic awareness, low income, language disorders" (p. 556). Grade K-5 students included in studies meta-analyzed by Slavin et al. (2011) were "children in the lowest 33% (or lower) of their classes, or any children receiving tutoring or other intensive services to prevent or remediate serious reading problems" (p. 5). Neitzel et al. (2022), who sought to replicate and extend the Slavin et al. meta-analysis, included Grade-6 "students reading below grade level or reading in the lowest half … of their grade" (p. 153). Donegan and Wanzek (2021) included Grade 4–5 students "described by study authors as below grade level in reading, at risk for

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TABLE 1
Comparing Characteristics of Previous Meta-Analyses of Reading Intervention Research

	Suggate (2010)	Slavin et al. (2011)	Wanzek et al. (2016)	Wanzek et al. (2018)	Gersten et al. (2020)	Donegan and Wanzek (2021)	Neitzel et al. (2022)	Current meta-analysis
Search dates	1982–2007	1970–2009	1995–2013	1995–2015	2002–2017	1988–2019	1990–2020	1980–2020
Grey literature	N	Y	N	N	N	N	Y	Y
Total studies	85	96	72	25	33	33	65	53
Participant grades	PK-7	K-5	K-3	K-3	1–3	4–5	K-6	K-5
Included interventions	"A reading intervention" (p. 1560)	"Specific, potentially replicable programs for children who are having difficulties learning to read" (p. 5)	"Interventions targeted early literacy" (p. 556)	"Interventions targeted early literacy" (p. 614)	"A reading intervention: that is, preventative instructional practices and activities designed to help students who are considered at risk for reading difficulties" (p. 405)	"A reading intervention targeting literacy in English for students struggling with reading was provided" (p. 1947)	"A reading program, defined as a specific, replicable school day/school year approach … designed to improve the reading achievement of struggling readers" (p. 152)	"Instructio … focused on PA, phonics, word reading, spelling, or a combination of these domains. Studies that had other intervention components in addition … were included" (p. 13)
PA-only interventions included	Y	Y	Y	Y	N	Y	Y	Y
OL/Vocab-only interventions included	N	Y	Y	Y	Y	Y	Y	N
Fluency-only interventions included	N	Y	Y	Y	Y	Y	Y	N
Technology-supported interventions included	N	Y	Y	Y	Y	Y	Y	Y
Whole-class interventions included	N	Y	N	N	N	N	Y	Y
Dosage/Duration	Any	Minimum duration of 12 weeks	15–99 sessions	100 or more sessions	Minimum dosage of 8 hours	Minimum of 15 sessions	Minimum duration of 12 weeks	Minimum of 2 sessions
Outcome measure type	Standardized and unstandardized	Standardized and unstandardized[a]	Standardized and unstandardized	Standardized and unstandardized	Standardized and unstandardized[b]	Standardized and unstandardized	Standardized and unstandardized[a]	Standardized only

(continued)

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TABLE 1
Comparing Characteristics of Previous Meta-Analyses of Reading Intervention Research (*continued*)

	Suggate (2010)	Slavin et al. (2011)	Wanzek et al. (2016)	Wanzek et al. (2018)	Gersten et al. (2020)	Donegan and Wanzek (2021)	Neitzel et al. (2022)	Current meta-analysis
Outcome domains	Prereading (concepts of print, letter naming, PA, pseudoword reading); reading (word reading, reading of connected text, general reading measures); reading comprehension	Combined reading outcomes	Foundational reading skills (PA, phonics, word recognition, fluency); language or reading comprehension[c]	Combined reading outcomes	Word or pseudoword reading; passage reading fluency; reading comprehension	Foundational reading skills (PA, phonics, word reading, spelling, fluency); Comprehension (vocabulary, reading comprehension)[c]	Alphabetics; fluency; reading comprehension; general reading	PA; word or pseudoword reading; spelling; passage reading; reading comprehension
PA measures	Y	N	Y	Y	N	Y	N	Y
OL/Vocab measures	N	Y	Y	Y	N	Y	N	N
Spelling measures	N	N	N	Y	N	Y	Y	Y
Moderator variables	Participant characteristics (grade, severity of RDs); intervention characteristics (duration, instructional components, group size, language); outcome measure characteristics (reading domain); research methods (research design, publication year)	None	Participant characteristics (grade); Intervention (dosage, instructional components, group size, implementer)	Participant characteristics (severity of RDs); intervention characteristics (dosage, group size); research methods (study year)	Participant characteristics (grade, severity of RDs); intervention characteristics (instructional components, implementer, scripting, feedback, dosage, group size); outcome measure characteristics (standardized vs. unstandardized, reading domain); research methods (research design, nature of comparison group)	Intervention characteristics (dosage, instructional components, group size, individualization); outcome measure characteristics (standardized vs. unstandardized; research methods (publication year)	Participant characteristics (race/ethnicity, poverty); intervention characteristics (supplemental nature, group size, implementer); outcome measure characteristics (reading domain); research methods (research design, level of assignment)	Participant characteristics (grade); intervention characteristics (dosage, instructional components, multisensory nature, group size); outcome measure characteristics (reading domain); research methods (sample size, study design)
Robust variance estimation	N	N	N	Y	Y	N	Y	Y

Note. RD = reading difficulties; PA = phonological awareness; OL = oral language; Y = Yes; N = No. Outcome domains = domains for which effects were reported in disaggregated fashion.
[a]Slavin et al. (2011) and Neitzel et al. (2022) excluded effects on "measures of reading objectives inherent to the experimental program (but unlikely to be emphasized in control groups)" (Slavin et al., p. 5).
[b]In the meta-analysis conducted by Wanzek et al. (2018), only 24 of the 328 effect sizes used were derived from researcher-developed measures.
[c]Studies reported effects in disaggregated fashion on standardized foundational skills measures and unstandardized foundational skills measures, standardized language/reading comprehension measures and unstandardized language/reading comprehension measures.

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reading disabilities or difficulties, or identified with reading disabilities" (p. 1946).

The Suggate (2010) meta-analysis included studies with "samples of disadvantaged students" (p. 1560) in Grades PreK-7, but went further by distinguishing between samples "(a) *at-risk*, as characterized by coming from communities with low socioeconomic status and/or being lower performing readers, or (b) *struggling*, that is, reading at or below the 15th percentile, diagnosed with a reading or learning disability (including dyslexia), or having a discrepancy of at least one standard deviation between intelligence quotient and achievement" (p. 1560) and investigating the degree to which severity of reading risk moderated intervention effects. Similarly, Wanzek et al. (2018) included studies with participant samples of Grade K-3 "students with learning disabilities or students identified as at risk for RDs (e.g., students with low ability, low phonemic awareness, language disorders)" (p. 615), but attempted to investigate the degree to which sample mean pretest performance on standardized measures predicted intervention effects.

Gersten et al. (2020) had the most stringent participant risk criterion for inclusion, one that was at least partially norm-referenced: They required included studies to have Grade 1–3 students with "a score on a valid screener or screening battery indicating that the student was likely to be at risk for reading failure at the end of the school year" or "a score on a norm-referenced standardized test … indicating that the student performed below the 40th percentile at the beginning of the school year or at the end of the previous school year" (p. 406). Gersten et al. (2020) further coded studies according to participants' reading "risk level," defined as a two-level variable such that performance at the 25th percentile on a norm-referenced screener distinguished between "at-risk" and "minimal risk" samples (p. 409).

Moderator analyses that investigated the effects of severity of RDs on intervention effects tended to exclude a large number of studies that did not provide enough information to estimate participants' initial RDs. For example, Gersten et al. reported that only 16 included studies provided the information necessary for coding participants' risk level according to their criteria: 12 included studies had samples that were at more risk for RDs and four had samples that were at less severe risk; the remaining 17 studies did not provide enough information to assess the level of participating students' risk. In the Wanzek et al.'s (2018) meta-analysis, only 12 of the 25 included studies reported sample pretest scores on standardized measures such that they could be used to analyze the association between pretest performance and intervention effects. Perhaps most importantly, neither Suggate (2010), Wanzek et al. (2018), nor Gersten et al. (2020) differentiated between initial performance on screeners that measured language or reading comprehension and those that measured word reading, spelling, or skills foundational to word reading or spelling.

Interventions

As Table 1 illustrates, the seven meta-analyses also differed in terms of acceptable intervention content domains, dosage, settings, and group size. For example, some teams excluded studies of interventions that only addressed PA (Gersten et al., 2020) or only addressed oral reading fluency (Suggate, 2010). Only Slavin et al. (2011) and Neitzel et al. (2022) examined the effects of whole-class interventions.

Outcomes

Finally, the seven reviews differed in terms of reading outcome domains included in analyses and outcome domains for which disaggregated effects were reported. Only four reviews (Donegan & Wanzek, 2021; Suggate, 2010; Wanzek et al., 2016, 2018) included effects on measures of PA and oral language/vocabulary in their analyses. Only Donegan and Wanzek (2021), Wanzek et al. (2018), and Neitzel et al. (2022) included effects on spelling outcomes in their estimates. When it came to reporting mean effect sizes, most authors (except for Slavin et al., 2011 and Wanzek et al., 2018) reported effects for separate reading domains. At the same time, each author team defined these reading domains differently. For example, Donegan and Wanzek (2021) and Wanzek et al. (2016) reported effects on "foundational skills" and "language/comprehension" (pp. 559–560) outcomes; Gersten et al. (2020) reported effects on "word or pseudoword reading," "passage reading fluency," and "reading comprehension" (p. 415) outcomes. All seven meta-analyses included effects on both researcher-developed/non-standardized measures and standardized, norm-referenced measures in their analyses; Wanzek et al. (2016) were the only team that reported disaggregated effects for each measure type.

Study Purpose and Research Questions

The most important way in which the present meta-analysis differed from the seven previous meta-analyses described above is our narrowed inclusion criteria regarding the participant sample: We required that students have or be at risk for word RDs as measured by a norm-referenced measure of word reading, spelling, or skills foundational to word reading or spelling. In this way, we hoped to estimate intervention effects for students with or at risk for dyslexia specifically, rather than students with RDs broadly. In addition, unlike previous meta-analyses described above and in Table 1, we only reported the effects on standardized, norm-referenced measures (i.e., we excluded studies that only employed researcher-developed

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measures). We made the decision to report effects on norm-referenced measures because such measures are less likely than researcher-developed measures to be highly aligned to treatment. Although researcher-developed measures that are closely aligned to content taught during an intervention can provide important insight when evaluating intervention effectiveness (Clemens & Fuchs, 2022), such measures can also vary widely across studies. Using norm-referenced measures enabled us to more confidently compare (and calculate mean intervention effects across) studies and participants. We included effects on spelling outcomes in our estimates, as spelling difficulties are endemic to students with or at risk for dyslexia and are frequently targeted in interventions.

We required studies to have a foundational skills component alone or in addition to other intervention components, because we were interested in measuring the effects of interventions that directly addressed the word reading or spelling difficulties experienced by students with dyslexia. Thus, like Suggate (2010), we excluded interventions that only addressed passage reading fluency or only addressed vocabulary/oral language. Unlike Suggate, we also excluded studies that only addressed reading comprehension (i.e., without also addressing word reading, spelling, or skills foundational to word reading or spelling).

Like previous meta-analyses, we explored the potential moderating effects of participant characteristics (i.e., grade level), intervention characteristics (i.e., instructional components, dosage, group size), outcome measure characteristics (i.e., reading domain), and research methods (i.e., sample size, research design). We also explored the effects of moderators that have not been examined previously. In addition to asking whether intervention effects differed when spelling was included as an instructional component, we asked about the effects of instruction on outcomes for students with or at risk for dyslexia when morphological awareness or vocabulary instruction were instructional components. Both cross-sectional (e.g., Tunmer & Chapman, 2012) and longitudinal (e.g., Kendeou et al., 2009) research suggests that oral vocabulary knowledge contributes to word reading. Morphological knowledge has also been found to contribute to word reading, even when controlling for the influence of phonological processing and orthographic knowledge (Deacon, 2012). When students read an unfamiliar word, partial decoding will often be close enough to the correct phonological form that they will be able to arrive at a correct identification if the word is in their listening vocabulary. Similarly, morphological knowledge can help students segment an unfamiliar word into decodable chunks. As Perfetti (2007) articulates in his Lexical Quality Hypothesis, the accuracy and fluency of a student's word recognition depends on the quality of the word's semantic, orthographic, and phonological representation in a student's mental lexicon.

Finally, we were interested in determining whether the effects of interventions that describe themselves as "multisensory" differ from the effects of interventions that do not. Recent legislative mandates and policy briefs that call for teacher training and provision of evidence-based instruction for students with dyslexia explicitly support the use of multisensory instruction. Stevens et al. (2020) reported that at least 20 states have passed legislation explicitly calling for training in and provision of instruction for students with dyslexia that is multisensory in nature. In addition, parents of students with dyslexia often request multisensory reading interventions and litigation resulting from parents' unmet requests for multisensory instruction has increased in recent decades (Rose & Zirkel, 2007).

The purpose of our study, then, was to conduct a meta-analysis that would help to estimate the mean effect of interventions and identify evidence-based intervention components for elementary-grade students with or at risk for dyslexia. We asked:

1. What is the mean effect of reading interventions that include instruction in foundational skills on reading outcomes?

2. Are intervention effects moderated by participant characteristics (i.e., grade level), intervention characteristics (i.e., dosage, content foci, multisensory elements, group size), outcome measure characteristics (i.e., reading domain), or research methods (i.e., sample size, research design)?

Method

Search

To identify studies for inclusion, we searched peer-reviewed research articles and grey literature published in English on or after January 1, 1980 and before January 1, 2021, following PRIMSA guidelines (Liberatti et al., 2009). We had two primary reasons for including studies published since 1980. First, we wanted to err on the side of including older research. We examined previous reading intervention research reviews and found that the earliest start date for searches was typically 1980 (e.g., Ritchey & Goeke, 2006; Scammacca et al., 2015). Second, the Education for All Handicapped Children Act was signed into law in 1975, which helped to kickstart research for children with disabilities in the 1980s.

The search included a three-step process. First, we searched the electronic databases of ERIC and PsycINFO with a combination of the following Boolean search terms, specifying that abstracts must include one of the following population identifiers (*dyslex**, *reading difficult**, *reading disabilit**, *risk for reading difficult**, *risk for reading disabilit**, *reading delay**, *reading disorder**, *learning disab**) and a term that described reading interventions (*reading*

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interven, reading instruction, phon*, correspondence*, reading fluency*). See Appendix A for a description of databases and search terms used in the previous meta-analyses (see Table 1) to which we draw comparisons. This search yielded 13,752 unique articles. After a 1-hour training, nine screeners used the Covidence systematic review software (Covidence, 2021) to screen abstracts. If information needed to ascertain eligibility for inclusion was not provided in the article abstract, studies were recommended for full-text review. All abstracts were independently screened by at least two screeners; the first author reviewed and resolved screening disagreements.

After the conclusion of abstract screening, 541 full texts were retrieved for review. Before beginning full-text review, seven reviewers participated in a 3-hour training and achieved >90% reliability with the first author when reviewing a practice set of three articles. Reviewers were expected to apply inclusion criteria in a pre-specified order and identify the same reason for exclusion when exclusion was appropriate. All texts were independently reviewed by two reviewers and disagreements were resolved by the first author.

Studies were included if they met the following criteria:

1. Publication date was on or after January 1, 1980 and before January 1, 2021.
2. Source articles used screening criteria requiring that participants perform at or below the 25th percentile on a norm-referenced test of word reading, spelling, or foundational skills (i.e., PA, knowledge of grapheme–phoneme correspondences, real word reading, pseudoword reading, spelling, or passage reading accuracy or fluency). Source articles were also included when the meta-analysis team determined that the study sample had a mean baseline score at or below the 16th percentile on at least one of the norm-referenced test types listed above. Studies including students without foundational skill difficulties were included when disaggregated data were provided for the subset of students with these difficulties. For these studies, only disaggregated data were used to calculate effect sizes. Studies were excluded if participants had intellectual disabilities, autism spectrum disorders, or sensory disabilities (e.g., deafness, blindness).
3. Participants were in Grades K-5 (ages 5–11), or the sample mean age was within this range.
4. Studies employed experimental or quasi-experimental, treatment-comparison or multiple treatment-comparison research designs with at least 15 participants per group. For quasi-experimental design studies to be included, we required that groups be equivalent at pretest (i.e., there could be no statistically significant difference between groups at baseline on a reading measure). Acceptable comparison conditions included (a) "business as usual" classroom reading instruction, (b) "business as usual" exposure to non-reading instruction or study hall, (c) a researcher-manipulated non-reading treatment (e.g., math, attention-training), or (d) a researcher-manipulated reading treatment that did not involve instruction in PA, word reading, or spelling. Comparison conditions that consisted of different dosages of the "treatment" intervention and historical comparison conditions were excluded.
5. Instruction took place across more than one session and focused on PA, phonics, word reading, spelling, or a combination of these domains. Studies that had other, additional intervention components were included.
6. The primary language of instruction was English (i.e., greater than 50% of instruction was delivered in English). Studies with interventions that incorporated first language supports within English-language instruction were included.
7. The intervention setting was school based (i.e., this included school-based after-school tutoring and school-based summer instruction). Parent-delivered reading interventions were not included, nor were interventions delivered in clinical settings.
8. The study had at least one calculable effect size on a norm-referenced measure of PA, knowledge of grapheme–phoneme correspondences, pseudoword reading, real word reading, spelling, or passage reading.

Of the 541 studies reviewed, 38 met all inclusion criteria. Studies were excluded because they did not meet at least one eligibility criterion, applied in the following order: enrolled students with mean age outside of the eligible age range (k = 35); implemented fewer than two intervention sessions (k = 2); did not address PA, phonics, word reading, or word spelling (k = 29); were conducted in a language other than English (k = 35); were not conducted in a school setting (k = 26); did not employ an eligible, norm-referenced outcome measure (k = 24); employed an ineligible study design (k = 158); did not provide enough information to calculate effect size (k = 32); did not enroll at least 15 participants per group (k = 12); enrolled students who did not have word RDs (k = 105); reported the results of analyses already reported in another publication (k = 43); and reported follow-up outcomes only (i.e., for studies that had immediate intervention effects reported in a separate publication; k = 2). The order in which full-text review criteria were applied impacted these numbers (e.g., any of the 32 studies excluded because they did not provide enough information to calculate effect size may have also failed to meet the subsequent requirements). We

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did not attempt to contact authors of studies to retrieve information that was not reported in articles (e.g., statistics needed to calculate effect sizes or determine whether student participants met the RDs criterion).

After the initial search, we completed a hand search of the five journals that published the greatest number of included studies (*Exceptional Children*, *Journal of Educational Psychology*, *Journal of Learning Disabilities*, *Journal of Research on Educational Effectiveness*, and *Learning Disabilities Research & Practice*). This hand search included articles published on or after January 1, 2016 and before January 1, 2021. Based on the hand search, two additional articles were identified for review; both were ultimately excluded.

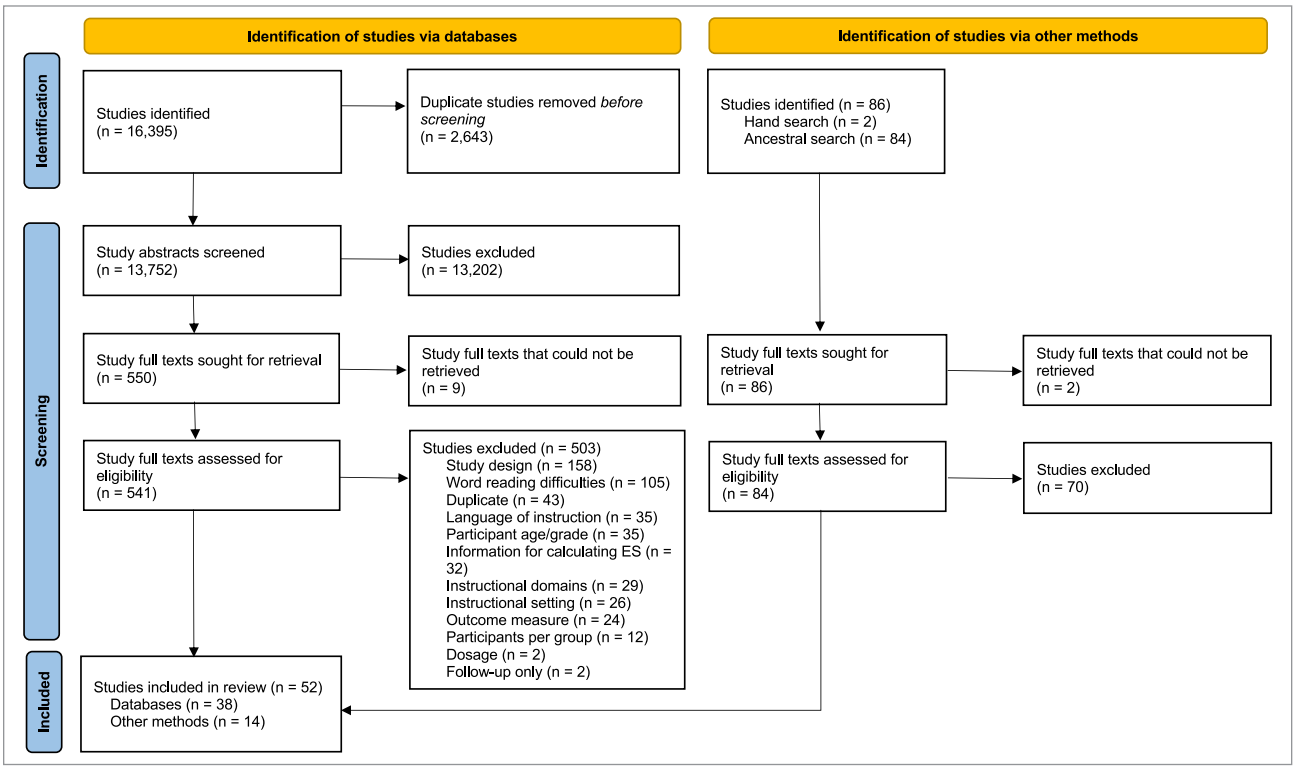
Finally, we completed an ancestral search of articles included in relevant literature reviews conducted in the last 5 years (Gersten et al., 2020; Suggate, 2016; Wanzek et al., 2016, 2018). After an initial review of abstracts, the team reviewed the full text of 82 articles; 14 additional peer-reviewed articles met inclusion criteria and were coded. Thus, a total of 53 studies within 52 publications (38 identified through the database search and 14 identified through the ancestral search) were identified for inclusion. Figure 1 represents our search procedure and results at each stage of the search process.

Coding Procedures

We coded for characteristics of participants, interventions, outcome measures, and research methods within included studies. Information about definitions used to code for these variables is provided in Appendix B (see supplemental online materials). Eight coders participated in a 3-hour training and independently coded articles until they obtained a minimum of 90% reliability with the first author in each code sheet section. Once coding began, all articles were independently double coded by two members of the author team. When coding discrepancies arose, the first author resolved disagreements.

Coding procedures for the multisensory instruction variable may merit further explanation. To be coded as a "multisensory" intervention, interventions needed to be explicitly described by the author team as using a "multisensory" approach. We coded for the variable in this way because there is a lack of consensus as to what constitutes multisensory instruction (Fletcher, 2018), and districts acting on previously described legislative mandates requiring that students with dyslexia be provided with multisensory instruction are likely to select a program that explicitly describes itself as multisensory.

FIGURE 1
PRISMA Search Flow Diagram



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Effect Size Calculation and Meta-Analytic Procedures

To quantify the effects of interventions on reading outcomes for students with or at risk for dyslexia in Grades K-5, we used standardized mean differences between intervention and control groups estimated with Hedges' *g* (Hedges, 1981), using study-reported posttest mean (M) and standard deviation (SD) estimates for each condition. We used adjusted posttest means (i.e., posttest means adjusted for pretest scores) when they were available. When only test statistics (*F* statistics) were provided, *F* values were transformed to Hedges' *g* effect sizes. When calculating study-level effect sizes, if there was more than one measure within a given outcome domain (i.e., more than one measure of PA, decoding/encoding, connected-text reading, or reading comprehension), we calculated a mean effect size using a random effects model that employed a restricted maximum likelihood approach to estimate variance. All analyses were conducted with the *metafor* package (Viechtbauer, 2010) and the *clubSandwich* package (Pustejovsky, 2019) for the *R* statistical computing environment (R Core Team, 2019).

Outlier Analysis

Prior to estimating average effect sizes across studies, we examined the distribution of raw effect size estimates to identify outliers. We defined an outlier as a value below the first quartile minus three times the interquartile range (−1.24) or above the third quartile plus three times the interquartile range (2.07; Tukey, 1977). We identified one outlier at the upper end of the distribution (2.54; Storey et al., 2020) and winsorized the value to the upper fence value.

Estimation of Mean Effects

There are several sources of dependencies in our effect size estimates. Many included studies reported intervention effects on multiple measures. Several studies included multiple contrasts because they examined the effects of more than one intervention or control condition. Effect size estimates from a single study are likely to be correlated because they are from the same or a shared sample. Therefore, we used three-level, multivariate random effects analyses, assuming a correlation of .80. In addition, we used robust variance estimation (RVE) to account for dependencies in our data (Hedges et al., 2010; Pustejovsky & Tipton, 2022), applying small-sample corrections to standard errors, hypothesis tests, and confidence intervals (Tipton, 2015; Tipton & Pustejovsky, 2015). In these analyses, we used study as a clustering unit. This analytic approach estimates the average effect size using all information available and then adjusts the standard errors to account for the inherent clustering of these related effect sizes. The model decomposes the variance of the effect size into three parts. The Level 1 variance is the sampling variance estimated via the traditional variance calculation. The Level 2 variance is the within-study variance. The Level 3 variance is the variance between the studies. We examined the possibility of publication bias with a modified version of Egger's regression that accounted for dependent effect size estimates (Egger et al., 1997; Rodgers & Pustejovsky, 2021).

To describe the heterogeneity between studies and within each study, we report the restricted maximum likelihood estimate of the between-study variance (τ^2) and within-study variance (ω^2). We also report the *Q* statistics and I^2 statistic partitioned to each level to reveal the extent to which heterogeneity among true effect sizes contributes to the observed variation in the effect size estimates. We adopt the guideline articulated by Higgins et al. (2003), which holds that I^2 of 50%–75% indicates a moderate amount of heterogeneity, enough to conduct moderator analyses.

Moderator Analysis

We first examined each moderator separately using meta-regression, as this single moderator approach has predominated in previous meta-analyses (e.g., Gersten et al., 2020; Wanzek et al., 2016) and single moderator analyses can provide meaningful point estimates for each level of the categorical moderators. The effects of moderators were tested using small-sample-adjusted *t*-tests for the moderators with two categories. For the moderators with more than two categories, we used the Wald test function from the *clubSandwich* package (Pustejovsky, 2019) that applies small-sample-adjusted *F* tests for the moderators with more than two categories. Next, we conducted a multiple meta-regression analysis to model the effects of the moderators simultaneously. This approach allowed us to look at the impact of each moderator while controlling for other potential moderators; it provided us with information as to how moderator effects should be interpreted in the context of other moderators.

Results

Table 2 presents participant and study characteristics for the 53 studies included in this meta-analysis, which encompassed 351 individual effect sizes and a combined sample of 6,053 students (M = 114.21, SD = 79.45, range = 32–422). We provide intervention characteristics alongside of study-level effect sizes in Table 3.

At least partly as a result of our search years, decision to include grey literature, and differences in inclusion criteria compared with those articulated in previous meta-analyses (see Table 1), only 14 of the 53 studies we identified for

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TABLE 2
Participant and Study Characteristics

Study	*N*	Grade	Design	Fidelity
Al Otaiba et al. (2005)	73	K	RCT	Y
Baker et al. (2000)	84	1–2	RCT	N
Blachman et al. (2004)	69	2–3	RCT	Y
Burns (2011)	78	1	RCT	Y
Christodoulou et al. (2017)	47	1–4	RCT	N
Coyne et al. (2013)	162	K	CRT	Y
Denton et al. (2010)	422	1	RCT	Y
Denton et al. (2014)	206	1	RCT	Y
Donegan et al. (2020) Study 1	153	4	RCT	Y
Duff et al. (2014)	145	1	QED	Y
Fawcett et al. (2001)	87	2	QED	N
Fives et al. (2013)	227	2	RCT	Y
Frantz (2000)	78	2–6	QED	N
Georgiou et al. (2020)	48	3	RCT	Y
Graham et al. (2002)	54	2	RCT	Y
Gunn et al. (2005)	245	K-3	RCT	Y
Hagans and Good (2013)	50	1	RCT	N
Hatcher et al. (2006)	77	K	RCT	N
Jenkins et al. (2004)	99	1	RCT	Y
Little et al. (2012)	90	K	RCT	Y
Lovett et al. (2017)	219	1–3	QED	Y
Mathes et al. (2003)	89	1	QED	Y
Mayfield (2000)	60	1	RCT	N
Miciak et al. (2018)	270	4	RCT	Y
Morris et al. (2012)	279	2–3	RCT	N
Nicolson et al. (1999)	102	1	QED	N
O'Callaghan et al. (2016)	98	PK-K	RCT	N
O'Connor et al. (2002)	46	3–5	RCT	Y
O'Shaughnessy and Lee Swanson (2000)	45	2	RCT	Y
Scanlon et al. (2005)	84	K-1	RCT	N
Simmons et al. (2011)	206	K	CRT	Y
Storey et al. (2020)	32	1–4	RCT	N
Torgesen et al. (2010)	108	1	RCT	N
Toste et al. (2019)	108	4–5	RCT	Y
Vadasy, Jenkins, Antil, and Wayne (1997)	35	1	RCT	N
Vadasy, Jenkins, Antil, Wayne, and O'Connor (1997)	40	1	RCT	Y
Vadasy et al. (2000)	46	1	RCT	Y
Vadasy et al. (2005)	57	1	QED	Y
Vadasy et al. (2006)	67	K	RCT	Y
Vadasy et al. (2007)	43	2–3	RCT	Y
Vadasy and Sanders (2008a)	86	K	QED	Y
Vadasy and Sanders (2008b)	162	2–3	RCT	Y
Vadasy and Sanders (2009)	202	2–3	RCT	Y
Vadasy and Sanders (2010)	84	K	RCT	Y
Vadasy and Sanders (2011)	98	1	RCT	Y
Vaughn, Mathes, et al. (2006)	40	1	RCT	Y
Vaughn, Cirino, et al. (2006)	91	1	RCT	Y
Vellutino et al. (2008)	113	K	RCT	N
Wang and Algozzine (2008)	139	1	CRT	Y
Wanzek and Vaughn (2008) Study 1	50	1	RCT	Y
Wanzek and Vaughn (2008) Study 2	36	1	RCT	Y
Wanzek et al. (2020)	260	4	RCT	Y
Wise et al. (1999)	153	2–5	QED	N

Note. RCT = randomized controlled trial; CRT = cluster randomized trial; QED = quasi-experimental design; Y = Yes; N = No.

inclusion were included by Suggate (2010), 13 of the 53 were included by Slavin et al. (2011), 22 of the 53 were included by Wanzek et al. (2016), 10 of the 53 were included by Wanzek et al. (2018), 12 of the 53 were included by Gersten et al. (2020), and 15 of the 53 were included by Neitzel et al. (2022). A representation of the overlap (or lack thereof) between articles included in the seven meta-analyses is represented in Appendix C (see supplemental online materials). Despite the fact that January 1, 1980 was the start date for our search, all articles that met inclusion

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TABLE 3
Intervention Characteristics

Study	Treatment name	Instructional components	Implementer	Group size	Dosage	PA ES	D/E ES	TR ES	RC ES
Al Otaiba et al. (2005)	Tutor Assisted Intensive Learning Strategies	PA, D, RR, TR, RC, V	O	1:1	64	0.46	0.53		0.71
Al Otaiba et al. (2005)	Tutor Assisted Intensive Learning Strategies	PA, D, RR, TR, RC, V	O	1:1	32	0.57	0.22		0.37
Baker et al. (2000)	Start Making a Reader Today	D, TR, RC	O	1:1	24		0.40		0.28
Blachman et al. (2004)	Intensive Reading Remediation	D, E, TR, RC, V	R	1:1	133		0.86	0.73	0.51
Burns (2011)	Systematic and Explicit Teaching Routines	PA, D, RR, E, TR, RC, V	SP	SG	38		−0.12	−0.10	0.02
Christodoulou et al. (2017)	Seeing Stars	PA, D, RR, E, TR, RC	O	SG	120		0.63	0.17	
Coyne et al. (2013)	Early Reading Intervention	PA, D, E, TR	SP	SG	63	−0.03	−0.13		
Denton et al. (2010)	Responsive Reading Instruction	PA, D, RR, E, TR, RC	SP	SG	83	0.18	0.43		0.48
Denton et al. (2014)	Guided Reading	D, RR, TR, RC	R	SG	72		0.23		0.06
Denton et al. (2014)	Explicit Instruction	D, RR, M, E, TR, RC, V	R	SG	72		0.37		0.24
Donegan et al. (2020) Study 1	Voyager Passport	D, M, E, TR, RC, V	R	SG	46		−0.10	−0.14	0.11
Duff et al. (2014)	Reading and Language Intervention	PA, D, RR, E, TR, RC, V	SP	SG		−0.11	0.13	−0.11	0.10
Fawcett et al. (2001)	Interactive Assessment and Teaching	PA, D, E, TR, RC, V	R	SG			0.58		
Fives et al. (2013)	Wizard of Words	PA, D, TR, RC, V	O	1:1	29		0.09		
Frantz (2000)	Auditory Discrimination in Depth	PA, D, E	R	SG	20		−0.07		0.53
Frantz (2000)	Reciprocal Teaching	PA, D, RC	R	SG	20		0.42		−0.01
Georgiou et al. (2020)	Structured Word Inquiry	D, M, E, V	R	1:1	15		0.42		
Georgiou et al. (2020)	Simplicity	PA, D, M, E, TR, V	R	1:1	15		0.13		
Graham et al. (2002)	Spelling Instruction	D, M, E	R	SG	16		0.66		
Gunn et al. (2005)	Reading Mastery or Corrective Reading	PA, D, E, TR	R	SG	145		0.65		0.57
Gunn et al. (2005)	Reading Mastery or Corrective Reading	PA, D, E, TR, V	R	SG	145		0.20		−0.07
Hagans and Good (2013)	Early Literacy Intervention	PA, D	R	SG	15	1.11	−0.14	0.25	
Hatcher et al. (2006)	Sound Linkage Reading Intervention	PA, D, RR, TR	SP	SG	17	0.23	0.15		

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TABLE 3
Intervention Characteristics (*continued*)

Study	Treatment name	Instructional components	Implementer	Group size	Dosage	PA ES	D/E ES	TR ES	RC ES
Jenkins et al. (2004)	Sound Partners	D, RR, E, TR	SP	1:1	50		0.58		0.85
Jenkins et al. (2004)	Sound Partners	D, RR, E, TR	SP	1:1	50		0.55		0.75
Little et al. (2012)	Early Reading Intervention	PA, D, E, TR	SP	SG	80	0.36	0.22		
Lovett et al. (2017)	Triple-Focus	PA, D, M, E, TR, RC, V	R	SG	160		0.96	0.79	0.88
Mathes et al. (2003)	Peer-Assisted Learning Strategies	PA, D, RR, TR, RC	SP	SG	28	1.57	0.59		0.42
Mathes et al. (2003)	Peer-Assisted Learning Strategies	PA, D, RR, TR, RC	SP	SG[a]	24	1.61	0.73		0.70
Mayfield (2000)	Edmark Reading Program	RR, M, TR, RC, V	O	1:1	20		0.07		0.56
Miciak et al. (2018)	Intensive Reading Intervention	D, RR, E, TR, RC, V	R	SG	47		−0.11		−0.21
Morris et al. (2012)	Phonological and Strategy Training	PA, D, M	R	SG	70		0.59	0.19	0.51
Morris et al. (2012)	Phonological Analysis and Blending/Direct Instruction + Retrieval, Automaticity, Vocabulary, Engagement with Language, and Orthography	PA, D, M, E, TR, RC, V	R	SG	70		0.65	0.59	0.46
Morris et al. (2012)	Phonological Analysis and Blending/Direct Instruction + Classroom Survival Skills	PA, D	R	SG	70		0.22	0.20	0.25
Nicolson et al. (1999)	Interactive Assessment and Teaching	PA, D, RR, E, TR, RC, V	CD	SG	10		0.57		
O'Callaghan et al. (2016)	Lexia Core5	PA, D, RR, E, TR, RC, V	CD	1:1	17	0.37	0.33		
O'Connor et al. (2002)	Reading-Level Matched	PA, D, E, TR, RC	SP	1:1	36		1.18		1.45
O'Connor et al. (2002)	Grade-Level Matched	PA, D, E, TR, RC, V	SP	1:1	36		1.06		1.21
O'Shaughnessy and Lee Swanson (2000)	Phonological Awareness Training	PA, D, E	SP	SG	9	1.86	0.47		0.65
O'Shaughnessy and Lee Swanson (2000)	Word Analogy Training	PA, D, E, TR	SP	SG	9	1.19	0.38		0.74
Scanlon et al. (2005)	Text Emphasis	PA, D, RR, E, TR	SP	1:1	160		0.60		0.50
Scanlon et al. (2005)	Phonological Skills Emphasis	PA, D, RR, E, TR	SP	1:1	160		0.68		0.17
Simmons et al. (2011)	Early Reading Intervention	PA, D, E, TR	SP	SG	63	0.30	0.19		−0.12
Storey et al. (2020)	Headsprout Early Reading	PA, D, TR, RC, V	CD	1:1	70		2.54	0.91	

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TABLE 3
Intervention Characteristics (*continued*)

Study	Treatment name	Instructional components	Implementer	Group size	Dosage	PA ES	D/E ES	TR ES	RC ES
Torgesen et al. (2010)	Lindamood Phoneme Sequencing Program for Reading, Spelling, and Speech	PA, D, E, TR	CD	SG	107	0.67	0.80		0.53
Torgesen et al. (2010)	Read, Write, and Type	PA, D, E, TR	CD	SG	107	0.56	0.42		0.38
Toste et al. (2019)	Multisyllabic Word Reading	D, RR, M, E, TR, V	R	SG	27		0.28		0.06
Toste et al. (2019)	Multisyllabic Word Reading Intervention with Motivational Belief Training	D, RR, M, E, TR, V	R	SG	27		0.58		0.15
Vadasy, Jenkins, Antil, and Wayne (1997)	Sound Partners	PA, D, E, TR	O	1:1	54		0.56		
Vadasy, Jenkins, Antil, Wayne, and O'Connor (1997)	Sound Partners	PA, D, RR, M, E, TR	O	1:1	46		0.25		
Vadasy et al. (2000)	Sound Partners	PA, D, E, TR, RC	O	1:1	54		0.94		
Vadasy et al. (2005)	Sound Partners	PA, D, RR, M, E, TR	SP	1:1	64		0.80		0.82
Vadasy et al. (2005)	Sound Partners	PA, D, RR, M, E	SP	1:1	64		0.83		0.58
Vadasy et al. (2006)	Code-Oriented Instruction	PA, D, RR, E, TR	SP	1:1	36	0.26	0.65		0.27
Vadasy et al. (2007)	QuickReads	D, RR, E, TR, RC	SP	1:1	30		0.34	0.51	
Vadasy and Sanders (2008a)	Code-Oriented Instruction	PA, D, RR, E, TR	SP	1:1	36	0.37	0.33		0.39
Vadasy and Sanders (2008a)	Code-Oriented Instruction	PA, D, RR, E, TR	SP	SG	36	0.63	0.55		0.46
Vadasy and Sanders (2008b)	QuickReads	D, RR, TR, RC	SP	SG	30		−0.03	0.18	−0.01
Vadasy and Sanders (2009)	QuickReads	D, RR, TR, RC, V	SP	SG	30		0.14	0.28	0.19
Vadasy and Sanders (2009)	QuickReads	D, RR, TR, RC, V	SP	SG	30		−0.11	0.17	0.18
Vadasy and Sanders (2010)	Phonics-Based Instruction	PA, D, RR, E, TR, V	SP	1:1	36	0.03	0.48		0.47
Vadasy and Sanders (2011)	Sound Partners	PA, D, RR, E, TR, V	SP	1:1	40	0.18	0.20		0.10

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TABLE 3
Intervention Characteristics (*continued*)

Study	Treatment name	Instructional components	Implementer	Group size	Dosage	PA ES	D/E ES	TR ES	RC ES
Vaughn, Mathes, et al. (2006)	Proactive Reading	PA, D, RR, E, TR, RC, V	SP	SG	133	0.82	0.90	0.17	1.06
Vaughn, Cirino, et al. (2006)	Proactive Reading	PA, D, RR, TR, RC, V	SP	SG	133	0.19	0.31	0.29	0.06
Vellutino et al. (2008)	Project-Based Intervention	PA, D, RR, E, TR	SP	SG	28	0.95	0.50		
Wang and Algozzine (2008)	Targeted Intervention	PA, D, RR, TR	SP	SG	33	0.46	0.26		0.35
Wanzek and Vaughn (2008) Study 1	Reading Intervention	D, E, TR, RC, V	R	SG	33		0.06	−0.21	−0.07
Wanzek and Vaughn (2008) Study 2	Reading Intervention	D, E, TR, RC, V	R	SG	65		0.13	−0.05	−0.63
Wanzek et al. (2020)	Voyager Passport	D, RR, E, TR, RC, V	R	SG	75		0.22	0.18	0.08
Wise et al. (1999)	Phonological Awareness Training	PA, D, E, TR	CD	SG	60		0.43		

Note. PA = phonological awareness; D = decoding; RR = rote reading of whole words; M = morphology; E = encoding; TR = connected-text reading fluency; RC = reading comprehension; V = vocabulary; O = other implementer (e.g., community volunteer); R = researcher-delivered; SP = school personnel; CD = computer-delivered; 1:1 = one-on-one; SG = small-group; ES = effect size (all effect sizes were calculated using the formula for Hedges' *g*).
[a]This study was the only study for which the teacher-to-student ratio during the intervention session differed from the group size.

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criteria were published after 1996. As others have noted (Gersten et al., 2005), research quality standards were still emerging during the 1980s and 1990s. Because our search required that studies employ norm-referenced measures and experimental or quasi-experimental designs with at least 15 participants per group, studies from these decades were more likely to be excluded.

In all, 12 studies (23%) included students in kindergarten, 27 (51%) included first graders, 16 (30%) included second graders, 13 (25%) included third graders, nine (17%) included fourth graders, and four (8%) included fifth graders. In total, 16 of the studies (30%) included participants in two or more grades. In 12 of the studies (23%), 50% or more of the participants experienced economic disadvantage (measured as percentage of participating students eligible to receive free or reduced-price school lunch) and in five of the studies (9%), fewer than 50% of participants experienced economic disadvantage; in 36 studies (68%), no information about the socioeconomic status of the participant sample was provided. Five studies (9%) included at least 50% of students who were emergent multilingual students learning English (ELs); for the remaining studies, fewer than 50% of students were ELs (27 studies; 50%) or not enough information was reported to determine the number of ELs in the sample (19 studies; 36%).

All qualifying studies had designs that compared treatment groups to comparison or control groups; 41 (77%) were randomized control trials (RCTs), three (6%) were cluster-randomized trials, and nine (17%) were quasi-experimental research designs (QEDs). In 37 of the studies (70%), researchers described the collection of data on fidelity of intervention implementation and reported the results in the paper.

The 53 included studies provided effect sizes associated with 70 intervention treatment conditions. Table 3 describes intervention features for the 70 contrasts. The interventions examined most frequently included Sound Partners (eight treatment conditions) and QuickReads (four treatment conditions). Most (63%) interventions examined were delivered to small groups of students, with a mean small group size of 3.55 (SD = 1.11). The remaining contrasts (37%) examined the effects of one-on-one interventions. Interventions were implemented by school personnel in 46% of included contrasts; 33% were delivered by researchers or researcher-hired interventionists; 9% were computer-delivered or technology-supported; and 13% were delivered by someone who did not fall into these categories (e.g., a community volunteer). Across studies, intervention was provided for an average of 55.19 hours (SD = 40.75, range = 9–160 hours).

Although our inclusion criteria did not require this to be the case, all 70 interventions included word reading instruction. One study (Mayfield, 2000) only taught students to read words by rote. All other studies provided word reading instruction that addressed knowledge of grapheme–phoneme correspondences and decoding. Some interventions also included a PA instruction component (71%); 20% included instruction in morphology, 73% in spelling, 87% in connected-text reading, 50% in reading comprehension, and 41% in vocabulary. Five of the 70 interventions (7%) were described as using a "multisensory" approach.

Meta-Analytic Findings

Main Effects Analyses

The weighted average effect on combined outcomes was estimated as $g = 0.33$ (95% CI [0.25, 0.41], $p < .01$). As expected, there was substantial heterogeneity across effect sizes ($Q = 1747.03$, $df = 350$, $p < .01$) with between-study variance of $\tau^2 = 0.03$ and within-study variance of $\omega^2 = .05$, and a total I^2 of 63% (between-study = 23% and within-study = 40%).

Single Moderator Analyses

We report estimates of average effect size disaggregated by the levels of each moderator in Table 4.

Student Characteristics

The mean effect of intervention did not statistically significantly differ based on student grade level ($t = 1.82$, $df = 7.55$, $p = .11$). Descriptively speaking, studies with students in Grades 3–5 tended to have smaller effects ($g = 0.16$) than studies with students in Grades K-2 ($g = 0.36$); however, this difference was not statistically significant.

Intervention Characteristics

Of the instructional characteristics explored, only dosage and inclusion of a spelling instructional component were statistically significant moderators of effect sizes. The effects of dosage ($t = 2.21$, $df = 12.40$, $p < .05$) indicated that, with each additional hour of intervention, effect size tended to increase by 0.002. Interventions that provided spelling instruction in addition to word reading instruction had larger effects ($g = 0.37$) than those without a spelling instruction component ($g = 0.23$; $t = 2.93$, $df = 5.03$; $p = .03$).

Inclusion of a PA component in addition to a word reading component was not statistically significantly more effective than providing word reading instruction alone; however, descriptively speaking, interventions with a PA component outperformed ($g = 0.38$) those without a PA component ($g = 0.22$; $t = 2.03$, $df = 25.15$, $p = .05$). Interventions that provided morphology or vocabulary instruction as well as providing word reading instruction ($g = 0.34$) yielded very similar effects to word reading interventions without either component ($g = 0.33$; $t = 0.08$; $df = 8.18$, $p = .93$). The effects of interventions that were explicitly described as multisensory ($g = 0.20$) did not differ from

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TABLE 4
Results of the Separate, Single Moderator Analyses

Moderator	*m*	*k*	Effect size (beta)	SE	*df*	*p*	95% CI	*t/F*	*df*	*p*
Participant characteristics										
Grade level								1.82	7.55	.11
K-2	304	45	0.36	0.04	38.15	<.01	[0.28, 0.44]			
3–5	47	8	0.16	0.10	5.36	.16	[−0.09, 0.42]			
Intervention characteristics										
Dosage										
Intercept			0.34	0.04	39.05	<.01	[0.26, 0.41]			
Dosage (hour)			0.002	0.001	12.40	.047	[0.00, 0.004]			
Group size								1.02	13.32	.33
One-on-One	246	34	0.30	0.05	28.77	<.01	[0.20, 0.41]			
Small group	105	20	0.40	0.07	14.57	<.01	[0.25, 0.56]			
Multisensory								−1.41	3.19	.25
No	332	49	0.34	0.04	41.86	<.01	[0.26, 0.42]			
Yes	19	4	0.20	0.09	2.74	.14	[−0.12, 0.51]			
Morphology/ Vocabulary								0.08	8.18	.93
No	180	29	0.33	0.07	25.51	<.01	[0.17, 0.48]			
Yes	171	28	0.34	0.08	24.70	<.01	[0.17, 0.50]			
Spelling								2.93	5.03	.03
No	91	15	0.23	0.04	9.32	<.01	[0.14, 0.32]			
Yes	260	41	0.37	0.05	36.59	<.01	[0.28, 0.46]			
PA								2.03	25.15	.05
No	108	16	0.22	0.07	12.82	.01	[0.14, 0.32]			
Yes	243	38	0.38	0.04	31.63	<.01	[0.28, 0.46]			
Outcome measure domains								4.60	3, 21.8	.01
PA	42	20	0.44	0.07	25.59	<.01	[0.29, 0.60]			
Word reading/ Spelling	213	53	0.34	0.04	45.76	<.01	[0.26, 0.42]			
Text reading	31	17	0.25	0.05	18.39	<.01	[0.15, 0.34]			
Reading comprehension	65	35	0.26	0.05	38.53	<.01	[0.16, 0.35]			
Research methods										
Sample size			−0.001	0.001	6.49	.219	[−0.002, 0.001]			
Study design								1.16	2, 6.48	.37
RCT	273	42	0.31	0.04	34.47	<.01	[0.23, 0.39]			
Quasi	21	3	0.13	0.11	1.94	.34	[−0.34, 0.61]			
Other	57	8	0.53	0.13	6.27	.01	[0.21, 0.84]			

Note. PA = phonological awareness; RCT = randomized controlled trial.

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interventions not characterized as multisensory (g = .0.34; t = −1.41, df = 3.19, p = .25). Group size did not moderate intervention effects (t = 1.02, df = 13.32, p = .33).

Outcome Domain Characteristics

Intervention outcome domain was a significant moderator (F = 4.60, df = 3, 21.8, p = .01) of intervention effects, with effects on measures of reading comprehension (g = 0.26) and text reading (g = 0.25) appearing smaller than those on measures of word reading/spelling (g = 0.34) or PA (g = 0.44).

Research Methods

Neither sample size (t = −1.36, df = 6.49, p = .22) nor study design (F = 1.16, df = 2, 6.48, p = .37) significantly moderated intervention effects.

Multiple Moderator Analysis

The covariates included in the multiple moderator analysis explained 35% of the variance in effect sizes. As is illustrated in Table 5, results indicated that only dosage (t = 2.3, df = 12.24, p = .04) and outcome domain (F = 3.83, df = 3, 21.9, p = .02) were statistically significant moderators when controlling for other moderators. With each additional intervention hour, effect sizes tended to increase by 0.002. Intervention effects on reading comprehension outcomes tended to be smaller than effects on word reading/spelling outcomes.

Publication Bias

The modified Egger's regression test result indicated no evidence of funnel plot asymmetry (b = 0.02, df = 16.8, p = .89).

Discussion

The present meta-analysis differed from previous meta-analyses of reading intervention research in that it examined the effects of interventions on reading outcomes for samples of students with or at risk for word RDs, defined as scores below a given threshold on a norm-referenced measure of word reading, spelling, or skills foundational to word reading and spelling. Previous reading research meta-analyses have used norm-referenced inclusion criteria or examined the degree to which severity of RD operationalized relative to norm-referenced thresholds moderated intervention effects (e.g., Gersten et al., 2020; Suggate, 2010;

TABLE 5
Results of the Multiple Meta-Regression Moderator Analysis

Moderator	Beta	SE	*df*	*p*	*F*	*df*	*p*
Model					1.62	13, 10.3	.22
Intercept	0.149	0.153	11.175	.350			
Grade (K-2)	0.123	0.120	12.769	.324			
Dosage	0.002	0.001	12.248	.040			
Small group	0.042	0.098	11.289	.679			
Multisensory	−0.218	0.169	4.268	.263			
Morphology/Vocabulary component	−0.04	0.127	10.376	.760			
Spelling component	0.105	0.056	7.426	.101			
PA component	0.053	0.082	22.647	.530			
Outcome					3.83	3, 21.9	.024
PA	0.101	0.072	15.521	.180			
Text reading	−0.087	0.046	12.485	.084			
Reading comprehension	−0.080	0.031	26.487	.017			
Sample size	−0.001	0.000	4.906	.180			
Study design					1.16	2, 6.48	.371
Quasi	−0.265	0.157	3.494	.177			
Other	0.205	0.123	10.596	.213			

Note. Intercepts represent the mean effect of interventions provided to students in Grades 3–5, with the mean dosage, provided one-on-one, not described as multisensory, with morphology or vocabulary instruction, spelling instruction, and PA instruction components on word reading/spelling outcomes in studies with the mean sample size and RCT designs.

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Wanzek et al., 2018). However, these meta-analyses included studies with participants who scored below a threshold on any type of reading measure (i.e., measures of language and comprehension, as well as of word reading). We were unable to identify any other systematic review that examined effects on reading outcomes for students who scored below a norm-referenced threshold on measures of word reading, spelling, or skills foundational to word reading or spelling.

Results from this meta-analysis of 53 reading intervention studies reveal significant, positive effects on norm-referenced reading outcomes ($g = 0.33$, 95% CI [0.25, 0.41], $p < .01$) for students with or at risk for dyslexia. Findings indicate that students in Grades K-5 who score below a screening threshold of performance at or below the 25th percentile on a standardized measure of word reading, spelling, or skills foundational to word reading and spelling are likely to benefit from reading interventions that include a word reading instructional component. Like other reviews of reading intervention research that include the full span of elementary grades (e.g., Neitzel et al., 2022), this meta-analysis included many more studies (i.e., 45 of 53) conducted with students in Grades K-2 than with students in Grades 3–5. Research suggests that reading intervention effects may be larger for younger students (e.g., Connor et al., 2013; Lovett et al., 2017). In line with these findings, the mean effect estimate for this review might have been lower had all grades levels been represented to a similar degree within included studies.

The mean intervention effect size estimated in the current review resembles mean effect sizes reported in recent meta-analyses of reading intervention research that included students with a range of reading and language difficulties (i.e., with RDs that may or may not have included word RDs) in the elementary grades. It is comparable in magnitude to mean effect sizes reported in the meta-analyses that included effects on standardized and unstandardized measures (e.g., Gersten et al., 2020; Neitzel et al., 2022; Wanzek et al., 2018) and in the meta-analysis that reported disaggregated effects on standardized measures (i.e., Wanzek et al., 2016). For example, Wanzek et al. (2016) reported that less extensive reading interventions (i.e., those with fewer than 100 sessions) for students with RDs in Grades K-3 yielded a mean effect of 0.49 on standardized foundational skills measures and 0.38 on standardized language or comprehension measures. In estimating the effects of reading interventions for students in Grades 1–3, Gersten et al. (2020) reported a mean effect of $g = 0.39$. Neitzel et al. (2022) reported a mean effect of 0.26 on standardized and unstandardized combined reading outcomes for students in Grades K-6. Wanzek et al. (2018) estimated a mean effect of extensive interventions (i.e., with 100 or more sessions) on Grade K-3 reading outcomes of 0.39.

It may seem surprising that the present review's mean effect estimate and the mean effect estimated by Wanzek et al. (2016), both of which were based on standardized measures, were not significantly smaller than those estimated in the reviews that combined effects on standardized and unstandardized measures. One expects meta-analyses that include effects on both standardized and unstandardized measures to yield somewhat larger mean effects, because use of researcher-developed measures in intervention research is often associated with larger effect sizes (Scammacca et al., 2015; Swanson et al., 1999). However, Gersten et al. (2020), Neitzel et al. (2022), and Wanzek et al. (2018) each articulated strict research design and measurement requirements within their inclusion criteria; as a result, many effect sizes included in their meta-analyses were based on standardized, norm-referenced measures (e.g., in the meta-analysis conducted by Wanzek et al., 2018, only 24 of the 328 effect sizes used were derived from researcher-developed measures).

The fact that mean effects reported in other meta-analyses were close to our mean effect estimate and frequently within the confidence interval we identified for that mean effect (i.e., between 0.25 and 0.41) reflects a few realities. First, while students with dyslexia represent the lower end of a distribution of code-based reading skills, the distribution is a continuous one. Students above our norm-referenced threshold (i.e., students among those identified as students with RDs broadly defined in previous systematic reviews) may also struggle with word reading, spelling, and skills foundational to word reading and spelling, if to a slightly lesser degree. It makes sense that they also benefit from interventions that address those areas of weakness. The similarity of our finding to those reported previously is also a reminder that students with dyslexia frequently experience difficulties with language comprehension (Adlof & Hogan, 2018; Pennington et al., 2012; Snowling & Hulme, 2021), whether because language comprehension difficulties emerge as a secondary consequence of word RDs (Stanovich, 2009), are a different manifestation of the same underlying cognitive difficulty that causes dyslexia (Tallal et al., 1997), or are distinct but commonly comorbid difficulties (Catts et al., 2005). The truth is, most students with RDs experience both code- and language-based difficulties. In separate studies conducted with third graders (Jones et al., 2016) and eighth graders (Cirino et al., 2013), more than 85% of students with reading comprehension difficulties also had difficulties with accurate or fluent word reading. Similarly, most students who have word RDs also have difficulties with vocabulary knowledge (Clemens et al., 2017) and broader listening comprehension (Capin et al., 2021). Capin et al. (2021) found that only five percent of fourth-grade students with RDs presented specific word RDs (i.e., reading profiles characterized by more significant weaknesses in word reading than listening comprehension). Thus, it may not be surprising that the effects of interventions for students with or at risk for dyslexia are similar to effects estimated in previous meta-analyses that

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included studies with participants at risk for RDs more broadly.

Moderators of Intervention Effects

Though we explored the effects of eight moderator variables representing participant, intervention, outcome measure, and study characteristics, only dosage and outcome domain emerged as significant moderators of intervention effects in the multiple moderator model. When controlling for the effects of other moderators, higher dosage interventions, on average, yielded slightly larger effect sizes than lower dosage interventions: with each additional intervention hour, effect size tended to increase by 0.002 ($p = .040$). This is an important finding, because while practitioners are frequently advised to increase the intensity of reading interventions for students who demonstrate weak response to less-intensive interventions (Denton, 2012; Gersten et al., 2008), empirical examinations of the impact of dosage (i.e., one important dimension of intensity) on reading outcomes for primary-grade students with RDs have yielded mixed results. Some studies that directly examined the effects of intervention dosage have reported positive impacts of increased dosage (e.g., Al Otaiba et al., 2005), at least for students with the most severe RDs (Vaughn et al., 2003); other studies have found no benefit (e.g., Denton et al., 2011; Hatcher et al., 2006). A number of meta-analyses (e.g., Suggate, 2010; Wanzek et al., 2016) have reported nonsignificant relations between dosage of instruction and reading outcomes for primary-grade students with RDs, and Roberts, Hall, et al. (2021) reported a nonlinear relation between these two variables. Our finding that increased dosage is associated with accelerated reading development provides more evidence supporting recommendations to intensify interventions by increasing dosage to accelerate gains for students who are at risk for or have dyslexia. Intervention intensity may be particularly important in the context of students who have significant word RDs.

Outcome domain also moderated intervention effects. Specifically, effects on reading comprehension outcomes tended to be smaller than effects on word reading or spelling outcomes. This finding corroborates results reported by Gersten et al. (2020) and Neitzel et al. (2022), who found that outcome domain statistically significantly moderated intervention effects. Gersten et al. determined that effects on word/pseudoword measures were greater than effects on passage reading or reading comprehension measures; Neitzel et al. found that effects on alphabetics (i.e., PA, print awareness, letter naming, phonics knowledge, decoding, and encoding) and passage reading fluency measures were larger than those on general reading performance measures. Our finding, then, is similar to findings reported in previous research and further underscores the relative pliancy of word reading and spelling relative to reading comprehension. However, this finding should also be interpreted in light of our inclusion criteria, which required that interventions focus on at least one foundational skills domain but did not require that they focus on language or reading comprehension. As a result of this inclusion criterion, most included interventions primarily targeted foundational skills and knowledge, making word reading and spelling outcomes more aligned to interventions. Although improvements in foundational skills would be expected to translate to improved reading comprehension (Hoover & Gough, 1990), reading comprehension was nevertheless a less proximal outcome for this corpus of studies.

Student grade level was not a significant moderator of intervention effects. This finding is somewhat unexpected, as individual intervention studies that have manipulated the grade level at which students receive intervention suggest that earlier intervention is more effective than later intervention (e.g., Connor et al., 2013; Lovett et al., 2017). Wanzek and Vaughn (2007), in their meta-analysis of research examining the effects of extensive reading interventions on reading outcomes for K-3 students, determined that grade level significantly moderated intervention effects, with interventions delivered to younger students associated with larger effects. Additionally, mean effects reported in the one meta-analysis that focused solely on upper elementary-grade students (Donegan & Wanzek, 2021; mean $g = 0.09$ on standardized foundational skills outcomes and 0.13 on standardized measures of oral language or reading comprehension) were, descriptively speaking, smaller than those reported in recent meta-analyses of research with students in Grades 1–3 or K-3. It is worth noting that, in the single moderator analysis, studies with students in Grades 3–5 were associated with smaller effects ($g = 0.16$) than studies with students in Grades K-2 ($g = 0.36$), although this difference was not statistically significant. One explanation for the nonsignificant finding of the grade level moderator analysis is that we only identified eight studies for inclusion that examined the effects of instruction on outcomes for students in Grades 3–5, which reduced the statistical power of our analysis to detect a true effect. The lack of statistically significant grade-level effects reported in other previous meta-analyses (e.g., Gersten et al., 2020; Wanzek et al., 2016) may reflect similar constraints. Thus, there is a need for more research examining the effects of reading intervention on reading outcomes for upper elementary students with significant word RDs. When such research exists, the interaction of student grade level and intervention effects may be a variable worthy of exploration in future, better-powered meta-analyses.

Provision of (a) morphology or vocabulary instruction, (b) encoding instruction, or (c) PA instruction in addition to word reading instruction did not moderate intervention impact. Previous meta-analyses have also explored moderating effects of intervention components

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on reading outcomes, with mixed results that suggest nuance in the moderating effects of intervention components and potential interactions with participant characteristics. For example, Suggate (2010) reported that while neither grade level nor intervention component (i.e., PA, phonics, meaning-based, or mixed) variables on their own explained additional variance in the overall effect size, adding an intervention component by grade interaction term significantly improved the proportion of variance explained in the overall effect size. There appeared to be an advantage for phonics interventions from kindergarten to Grade 1, after which interventions with a comprehension component began to predominate and the advantage for phonics interventions dissipated.

Our intervention components single moderator analyses findings both corroborated and contradicted findings reported by Gersten et al. (2020). In the Gersten et al.'s study, providing instruction in encoding or writing yielded significantly higher effect sizes on reading outcomes for students in Grades 1–3. In contrast, interventions that included a PA instruction component tended to result in *smaller* effects on reading fluency outcomes. The results of our single moderator analysis provided support for the Gersten et al.'s finding about the benefit of incorporating spelling instruction into reading interventions for students with dyslexia. However, we did not find that interventions that included a PA instructional component were associated with smaller effects. The difference between this latter finding and the one reported by Gersten et al. may reflect the fact that studies included in the present meta-analysis included students with more significant word-level RDs. For this population of students, it may be beneficial (or at least may not be *less* beneficial) to provide PA instruction in addition to instruction in word reading.

The effects of interventions that were explicitly described as multisensory (g = 0.20) did not differ from interventions not characterized as multisensory (g = 0.34; p = .25). Our analysis was underpowered, and this is certainly a variable that deserves further study. Still, it seems evident, based on this and other research (e.g., Al Otaiba et al., 2018; Stevens et al., 2020) that there is not sufficient evidence for the benefit of reading instructional programs that describe themselves as multisensory to require that school districts use them in place of other evidence-based instructional approaches (i.e., other explicit, systematic approaches to foundational skills instruction) that do not describe themselves as multisensory.

Student group size was also not a statistically significant moderator of intervention effects. Our finding corroborates findings reported in a review by Elbaum et al. (2000), which suggested that small-group and one-on-one interventions have similar effects on reading outcomes. In agreement with Elbaum et al., neither Suggate (2010) nor Wanzek et al. (2016) reported significant associations between group size and intervention effect. However, our finding differs from one reported by Ehri et al. (2007), who directly manipulated the group size variable and found that one-on-one tutoring was more effective than small-group tutoring using the same program. Donegan and Wanzek (2021), Wanzek et al. (2018), and Neitzel et al. (2022) also reported that effect sizes associated with one-on-one interventions were larger than ones associated with small-group interventions. Descriptively speaking, studies in the present review that provided instruction to small groups of students appeared to have slightly smaller effects (g = 0.20) than studies that provided instruction one-on-one (g = 0.30). However, this difference was not statistically significant. The group-size variable may be worthy of study in future, better-powered research meta-analyses.

Neither study sample size nor research design were significant moderators of intervention effects. This is as it should be, given that study methods should not influence the impact of the intervention the study is evaluating. Nonetheless, the finding about the non-significant effect of research design is in contrast to findings reported in previous meta-analyses that demonstrate larger effect sizes for quasi-experimental studies than for RCT designs (e.g., Suggate, 2010). Scammacca et al. (2015) attributed their finding that the effects of reading interventions declined over time in part to the use of more rigorous research designs in recent years. Similarly, research has demonstrated that sample size is often inversely associated with effect size (e.g., Cheung & Slavin, 2012; Slavin & Smith, 2009). Slavin and Smith proposed that inverse relations between sample size and effect size may be due to publication bias, either because (a) small-sample studies need to achieve much larger differences between groups to achieve statistically significant findings or (b) small-sample studies reporting null effects are less likely to be published because they are underpowered, whereas journal editors are more likely to publish large-sample studies with null effects. Alternatively, this inverse relation may be due to super-realization bias: small studies are often conducted in more controlled settings that lack ecological validity but are more likely to yield large effects (Slavin & Smith, 2009). The fact that our meta-analysis did not replicate these findings may reflect the stringent standards we imposed regarding research design and methods (e.g., we required all studies to use norm-referenced measures at screening or pre-test). The vast majority of our studies (77%) were RCTs, and study mean sample size was above 100 (M = 114.21, SD = 79.45, range = 32–422).

Strengths and Limitations of The Present Review

There were several methodological strengths of this review. To identify the largest number of studies relevant to research questions, the research team searched for studies published during the last four decades (a longer span of time than has been searched by the author team of any relevant previous meta-analysis). The search included grey

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literature for the same reason, as well as to avoid bias in estimating intervention effects. Analyses used RVE to account for dependencies in the data and employed a multiple meta-regression model to explore the effects of each moderator variable while controlling for the potentially confounding effects of other moderators.

Relative to other meta-analyses on the topic of reading interventions, the present meta-analysis had a large sample of studies (k = 53) that employed experimental or QEDs and standardized, norm-referenced reading measures. The large number of studies identified for inclusion was a welcome surprise, given our stringent criteria for inclusion (note that more than 100 studies were excluded solely because participants did not have documented word RDs according to our inclusion criterion). That said, our moderator analyses would have been better powered had our corpus of included studies been even larger. The ERIC database indexes grey literature content (e.g., research reports, curriculum and teaching guides, conference papers, dissertations, and theses) published by 1,057 selected centers, agencies, programs, associations, and non-profit organizations. Still, there are other databases (e.g., Google Scholar; ProQuest; Theses Global) that might have yielded a larger pool of grey literature reports for screening and potential inclusion. Searching more databases could have resulted in identification of additional studies reported in peer-reviewed publications as well. Finally, conducting forward and backward searches for all articles identified for inclusion in the present review could have resulted in the identification of additional studies.

The fact that our ancestral search of articles included in previous reading intervention research meta-analyses yielded 82 articles that did not appear in our database search (14 of which met our inclusion criteria) was another cause for concern. At the same time, it is useful to observe the lack of overlap in the body of studies identified for inclusion in previous reviews of reading research (see Appendix C). Our search identified several studies that were not included in previous meta-analyses (i.e., 12 of our 53 included studies [23%] did not appear in a previous meta-analysis). Of the 41 studies included in our meta-analysis that were also included in at least one of the previous meta-analyses, 13 appeared in only *one* of the other meta-analyses (i.e., the other six previous meta-analyses did not include the study); 15 appeared in only *two* previous meta-analyses.

Researchers frequently observe lack of overlap in articles identified for inclusion in systematic reviews on the same topic. For example, in concurrent replications of a meta-analysis published by Makel and Plucker (2014), Lemons et al. (2016), and Makel et al. (2016) set out to replicate a set of search procedures outlined in the original meta-analysis. However, when searching for studies published between 1997 and 2013, Lemons et al. identified 70 studies eligible for inclusion; Makel et al. identified 109 studies eligible for inclusion during the same time frame. Of the studies that Lemons et al. included in their review, 46 did not appear in the Makel et al. literature search. Conversely, 11 of the studies included by Makel et al. in their review did not appear in the Lemons et al. literature search. Lemons et al. explained that the most likely explanation for each author team's failure to identify these studies during their search "is variation in how the different databases that were searched index the targeted journals. For example, different databases vary in whether specific journals are indexed as full text or abstract only" (p. 218).

It may also have been a limitation that we only explored intervention effects on norm-referenced reading assessments. While exclusively reporting effects on norm-referenced measures enabled us to more confidently compare intervention effects across studies and participants, it also meant that we were unable to examine effects on researcher-developed measures. This prevented us from better understanding intervention effects on assessments that were more proximal to the interventions being delivered, or on assessments that focused on particular subtypes of word reading or spelling items (e.g., ones that focused on a corpus of words of a particular type).

Finally, this meta-analysis was limited by the information provided in included studies. For example, researchers frequently failed to describe the comparison condition in any level of detail. It had originally been our intent to examine whether effects on comprehension were moderated by the nature of the comparison condition [e.g., distinguishing studies for which comparison students received (a) an alternate supplemental reading intervention provided by their schools, (b) core reading instruction while treatment-group peers were pulled for an intervention that supplanted core reading instruction, and (c) no reading instruction while treatment students received the reading intervention]. Due to insufficient description of these factors in the included studies, analysis of the impact of the counterfactual was not possible.

It was also sometimes difficult to reliably code for the content components of interventions, as authors provided very little detail about the reading interventions they were testing. When only a sentence or two in each publication was devoted to describing intervention components, it felt plausible that, say, PA instruction might have been a component of an intervention even when it was not mentioned explicitly. Conversely, there were times when authors briefly mentioned a particular component but in such a way that it was unclear whether it could be described as a full, stand-alone intervention component. For example, an author team might describe drawing students' attention to word meanings when warranted; we struggled to decide if this should "count" as providing vocabulary instruction.

As a final example, lack of information provided about students' initial word reading, spelling, or foundational reading skill performance prevented us from examining the degree to which the severity of students' dyslexia moderated intervention effects. It was difficult to rank or

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categorize study samples in a meaningful way due to the fact that many included studies *either* (a) reported pretest standard scores on a measure of word reading, spelling, or foundational skills (i.e., they did not report using a norm-referenced screening threshold) *or* (b) reported using a norm-referenced screening threshold (i.e., they did not report pretest standard scores on a measure of word reading, spelling, or foundational skills). If future research could, either in the body of the manuscript or within online supplemental materials, provide more information about sample pretest performance and the nature of instruction in treatment and comparison conditions, it would aid the work of future meta-analysts.

Implications for Policy, Practice, and Future Research

At the most basic level, findings from this meta-analysis support the provision of reading interventions that include instruction in foundational skills to students with or at risk for dyslexia in Grades K-5. Higher dosage interventions yield slightly higher effect sizes, supporting recommendations for educators to intensify interventions by increasing dosage to accelerate reading gains for students with or at risk for dyslexia.

It may be valuable for school personnel to know that effects of one-on-one interventions included in this meta-analysis did not meaningfully differ from effects achieved by small-group intervention, as small-group interventions are usually more feasible for educators and school systems to implement. That said, instructional group size may be a variable worthy of further explanation in future, better-powered meta-analyses of reading intervention research. Gersten et al. (2020) determined in their meta-analysis that group size was not a statistically significant moderator of intervention effects when considering all Grade 1–3 reading interventions; however, for Grade 1 specifically, effects were larger if the intervention was delivered to students individually rather than to small groups. The moderating influence of group size on reading outcomes may differ when considering narrower grade-level bands.

Similarly, the question as to whether intervention effectiveness differs in early elementary compared with later-elementary grades is one worthy of further research. In the present meta-analysis, mean effects of interventions delivered earlier (in Grades K-2) were not statistically significantly larger than effects of interventions delivered later (in Grades 3–5). Descriptively speaking, though, studies with students in Grades 3–5 were associated with smaller effects (g = 0.16) than studies with students in Grades K-2 (g = 0.36). Furthermore, regardless of differences in effects depending on grade level, interventions with an effect size of 0.33 are more likely to close the achievement gap for children in kindergarten than for children in Grade 5, as RDs tend to become more significant as children progress through the grades (e.g., Francis et al., 1996; Juel, 1988). In addition, in the absence of intervention, children with RDs are at risk for developing psychosocial and behavioral difficulties (Morgan et al., 2008). For all of these reasons, it is likely more prudent and cost-effective for school districts to intervene early than to intervene late if they are faced with a decision about how to direct limited intervention resources.

Our findings did not provide conclusive answers about the intervention components that distinguish more effective interventions from less effective ones when it comes to this population of students. That said, single moderator analysis results indicated that interventions with spelling instruction in addition to word reading instruction were more effective (g = 0.37) than those without a spelling instruction component (g = 0.23), a finding that was also reported by Gersten et al. (2020). Therefore, school administrators or educators selecting foundational reading interventions for elementary students with or at risk for dyslexia may want to opt for multicomponent interventions that include both word reading and spelling components. On the other hand, findings did not suggest that they should opt for interventions that describe themselves as multisensory over other evidence-based interventions that do not describe themselves in this way.

There is a final set of implications to point out, or at least a final set of questions to pose. In recent years, well-intentioned advocacy groups have pushed for the passage of laws mandating distinct approaches to instruction and assessment for students with dyslexia (Petscher et al., 2019). Gearin et al. (2021) reported that 47 U.S. states have now adopted legislation that requires creating and implementing dyslexia-specific processes for identifying and treating students. Although it may be too early to determine the effects of these policies, many new dyslexia laws promote practices shown to benefit diverse samples of students with RDs, such as universal screening, preventive intervention, explicit instruction, and use evidence-based reading programs. However, aspects of this legislative movement have been controversial (Elliott, 2020). Based on research that shows it is difficult to meaningfully distinguish between poor readers who are dyslexic and poor readers who are not dyslexic, Miciak and Fletcher (2020) have suggested that dyslexia identification and instruction need not be separated from other schoolwide, multitier systems of support that are implemented to prevent and treat RDs. There are some indications that these new laws may lead to uncertainty among educators about whether students with RDs should receive assessment and instruction through the Individuals with Disabilities Education Act (IDEA; 2006) or support through a dyslexia-specific processes outside of IDEA (Lindstrom, 2019; Tucker, 2015). This confusion has contributed to cases in which students with dyslexia who should have been referred for special education evaluation were not referred, or not referred in a timely fashion (Texas Education Agency, 2018).

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The debates about the value of the term dyslexia and issues related to classification validity (Elliott, 2020; Elliott & Grigorenko, 2014) are outside the scope of this paper. It is also worth noting that the way our inclusion criteria define dyslexia (i.e., significant word RDs, or word RDs below a given threshold) is commonly but not universally adopted. There are those who define dyslexia as *specific* word RDs (i.e., ones that are not accompanied by language comprehension difficulties), an encapsulated weakness in decoding found amid a "sea of strengths" in reasoning and creativity (Shaywitz & Shaywitz, 2020, p. 56) often described as "classic" dyslexia (Hogan et al., 2014, p. 201). The results of this meta-analysis are specific to the definition of dyslexia we articulate in our inclusion criteria. Finally, our methods do not allow us to draw conclusions about the degree to which the same interventions are associated with similar effects for these two populations of students: interventions that have been evaluated with populations of students with RDs broadly defined (i.e., interventions included in previous meta-analyses of reading intervention research) may tend to differ, perhaps in terms of content or method of delivery or intensity, from the subset of interventions evaluated in studies included in our meta-analysis (i.e., ones that were delivered to students with significant word RDs).

That said, interventions reviewed in this meta-analysis are more alike than unalike to interventions reviewed in the past. For instance, 35 of 53 included studies evaluated the effects of multicomponent interventions that focused on both code- and meaning-based elements of reading; previous systematic reviews have also observed the prevalence of multicomponent interventions among included studies (e.g., Gersten et al., 2020). Intervention dosage also appears similar to that reported in previous meta-analyses that reported this information (e.g., Denton et al., 2022; Gersten et al., 2020). The way in which the pattern of findings in the present review resembles patterns of findings reported in previous systematic reviews that evaluated the effects of interventions delivered to students with more broadly defined RDs (i.e., when considering both the magnitude of effects and the influence of moderators) suggests that similar reading interventions hold comparable levels of promise in remediating significant word RDs and in remediating RDs broadly defined. These findings should motivate future research that can answer the question: Is it necessary for students with dyslexia to receive instruction that is qualitatively different (e.g., such that it must be provided by different teachers, in different settings, using different materials) than that provided to students with broadly defined RDs?

NOTES

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Supporting Information

Additional supporting information may be found in the online version of this article on the publisher's website:10.1002/rrq.477/suppinfo

Appendix A. Comparing Searches in Previous Meta-Analyses of Reading Intervention Research

Appendix B. Definitions of Variables Used in Coding

Appendix C. Overlap Between Studies Included in the Present Review and Studies Included in Other Recent Reviews

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THE HECHINGER REPORT

JILL BARSHAY

PROOF POINTS: Leading dyslexia treatment isn't a magic bullet, studies find, while other options show promise

New research evidence is at odds with views of many dyslexia advocates and state policies

by **JILL BARSHAY**
October 10, 2022

In 2019, a grassroots campaign led by parents succeeded in passing a wave of dyslexia legislation. At least seven states, from Arkansas to Wisconsin, now require teachers to be trained in the Orton-Gillingham teaching approach and use it to help students with dyslexia read and write better. Many more states mandated hallmarks of the Orton-Gillingham method, specifically calling for "multisensory" instruction. In New York, where I live, the city spends upwards of **$300 million** a year in taxpayer funds on private school tuition for children with disabilities. Much of it goes to pay for **private schools that specialize in Orton-Gillingham** instruction and similar approaches, which families insist are necessary to teach their children with dyslexia to read.

But two recent academic papers, synthesizing dozens of reading studies, are raising questions about the effectiveness of these expensive education policies. A review of 24 **studies on the Orton-Gillingham method**, published in the July 2021 issue of the peer-reviewed journal Exceptional Children, found no statistically significant benefit for children with dyslexia. Instead, suggesting a way forward, a **review of 53 reading studies**, led by University of Virginia researcher Colby Hall and

published online September 2022 in Reading Research Quarterly, found that much cheaper reading interventions for children with a variety of reading difficulties were also quite effective for children with dyslexia.

There's no litmus test for dyslexia and education experts say the diagnosis covers a range of reading problems. Orton-Gillingham is one of the oldest approaches to help struggling readers, dating back to the 1930s, and it explicitly teaches letters and sounds, and breaks words down into letter patterns. It also emphasizes multisensory instruction. For example, students might learn the letter "p" by seeing it, saying its name, and sounding it out while tracing it in shaving cream.

"We have this approach that's so deeply rooted in legislation and in policy and practice, but we don't have the evidence base to support it," said Elizabeth Stevens, an assistant professor at Georgia State University, and the lead author of the 2021 Orton-Gillingham study. "The thinking is that OG [Orton-Gillingham] is the magic bullet, the thing that these students need. But Colby [Hall]'s paper says, 'No, these other reading interventions that explicitly teach these foundational skills significantly improve their reading outcomes.' These students can benefit from these other interventions."

The implication is that *maybe* children diagnosed with dyslexia don't need something that is substantially different from children with other reading struggles. This theory still needs to be tested. No well-designed research study has compared a dyslexia-specific remedy, such as Orton-Gillingham, head-to-head with more general interventions for children who struggle in reading.

More than 2 million children, nearly 3 out of 10 who receive special education services in the United States, have been diagnosed with dyslexia or a closely related reading disability. Getting the solution right is important, not only to help these children read and write, but to spend taxpayer funds on helping them efficiently.

Monica McHale-Small, director of education at the Learning Disabilities Association of America, and previously with the International Dyslexia

Association of America, and previously with the International Dyslexia Association, said there's a "growing consensus" that Orton-Gillingham approaches aren't necessarily what all children with dyslexia need. "The research is there," she said. "You can't deny the findings of multiple studies."

Many dyslexia advocates remain loyal to Orton-Gillingham, McHale-Small said, because so many parents have kids whom they believe were helped by Orton-Gillingham tutors. Meanwhile, it remains out of reach for many low-income families. Orton-Gillingham involves very expensive teacher training, she said, which many schools cannot afford. McHale-Small experienced the costs first hand when she was superintendent of the Saucon Valley school district in Pennsylvania and participated in a pilot study of Orton-Gillingham in 2016-17.* The American Institutes for Research, a nonprofit research group, found **no statistical benefits for these multisensory interventions** in a 2018 report.

"Science evolves. Science has to be taken seriously," said Maryanne Wolf, director of the Center for Dyslexia, Diverse Learners and Social Justice at UCLA and author of **Proust and the Squid**, a book about how the brain learns to read. "We don't need emphasis on 'multisensory'; we need emphasis on being explicit, systematic and after all of the components of language in our interventions."

The researchers in both the 2021 and 2022 studies all cautioned that the jury is still out on Orton-Gillingham. Better quality studies may still prove the method to be effective with children with dyslexia. Stevens had to throw out more than 100 of the studies she found; many were poorly designed, didn't compare children who didn't receive the treatment and didn't measure outcomes well. In the end, she reviewed only 24 of the better Orton-Gillingham studies and just 16 had enough numbers to include in her calculations. Several of these were rather small, as few as 10 or 12 participants. That's such a small number of children that it makes it hard to derive any meaningful conclusion from them.

"The corpus of studies included in our meta-analysis were not very high

"The corpus of studies included in our meta-analysis were not very high quality," said Stevens. "We need to do more high-quality research to fully understand the effects of that approach on the reading outcomes for students with dyslexia."

The larger 2022 analysis of 53 reading interventions had a higher bar for study quality and only one Orton-Gillingham study made the cut. Several of the reading interventions that marketed themselves as "multisensory" also made the cut, but the researchers didn't detect any extra benefits from them.

"They weren't more effective than the ones that didn't market themselves as multisensory," said Hall.

The good news is that most of the 53 reading interventions were effective and they had more similarities than differences. They were administered to children as either one-to-one tutoring sessions or in small groups. And they tended to provide direct, explicit step-by-step reading and writing instruction which includes not just traditional phonics but practice with clusters of letters, tricky vowel patterns and sounds. This is in sharp contrast with a teaching approach based on the belief that children can learn to read naturally if they are surrounded by books at their reading level and get lots of independent reading and writing time.

"Systematic instruction works for kids," said Emily Solari, a prominent reading expert and a professor at the University of Virginia, who was part of the 12-member research team on the 2022 study. "That is what we need to do for kids with dyslexia and for word reading difficulties."

Researchers noticed good outcomes for several commercial interventions, such as Lexia Core5, Sound Partners, and Rave-O. Many non-commercial interventions were effective too, including Sharon Vaughn's Proactive Reading intervention and Jessica Toste's Multisyllabic Word Reading Intervention + Motivational Belief Training. Toste's method isn't sold commercially, but the University of Texas associate professor gives it away free to teachers upon request.

In the meta-analysis, there were hints that spelling instruction may be especially beneficial to students with dyslexia. Frequency appeared to matter too.

"There's been decades of research to show that we actually need to do really intensive intervention with these kids, not just two days a week for 20 minutes," said Solari. "They need evidence-based core instruction, and then they need more. And often it's a lot more."

The researchers could not ascertain a minimum threshold or dosage for effectiveness. That still needs to be studied.

One of the trickiest things about studying dyslexia is defining it and determining who has it. Experts disagree. Some insist it is a genetic condition, but there is no genetic test. Others say a child's environment can cause it. Others believe it is neurobiological, but it is difficult to determine whether a reading difficulty is neurological in origin. The belief that children with dyslexia see letters backwards is a debunked myth of the past, but there is little agreement on what it is exactly.

When I interviewed the researchers behind the 2022 meta-analysis on reading interventions, they explained to me that dyslexia, or word reading difficulty, falls along a continuum. "People think of dyslexia like a broken leg, you either have it or you don't," said Hall. "But dyslexia and word reading difficulties are more like high blood pressure. It still needs to be addressed, but it's a different way of thinking about it."

In the 2021 and 2022 studies, researchers defined dyslexia as having "word-level reading difficulties." Some children were formally diagnosed with dyslexia and others hadn't been diagnosed, but they scored in the bottom 25 percent in basic word recognition, reading fluency and spelling. Dyslexia is generally distinguished from comprehension difficulties, but there is often overlap. Some children with word reading difficulties also have comprehension problems but some have excellent comprehension.

Both McHale-Small at the Learning Disabilities Association and Wolf at UCLA believe that there are various types of dyslexia and each may need different interventions. Not every child diagnosed with dyslexia struggles

to sound out words, for example. "The minute you see reading fluency problems, that is beyond phonics," said Wolf. "Over time, some of those kids just don't need that decoding emphasis."

"We need more research," said McHale-Small. "We know a lot about dyslexia but we need to know a lot more."

Millions of children and their parents are waiting for an answer.

**Clarification: Saucon Valley school district was not part of the pilot study, but McHale-Small served on the study's advisory committee and decided to implement an Orton-Gillingham intervention in her district.*

This story about ***children with dyslexia*** *was written by Jill Barshay and produced by* The Hechinger Report*, a nonprofit, independent news organization focused on inequality and innovation in education. Sign up for the* ***Hechinger newsletter****.*

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Howard A Dolgin

October 10, 2022 at 4:16 pm

Thank you for this column on Dyslexia and your other informative columns.

Tutoring instruction characterized as multi-sensory, systematic, structured, and sequential is often effective. Explicit phonics, decoding, fluency, spelling, and auditory discrimination should be included in the instruction. However, for some children, a sight-word program

might be more helpful. It depends on the student's response to the instruction. Use whatever works.

Debbie Meyer

October 10, 2022 at 6:24 pm

Nobody has a copyright or a trademark on Orton Gillingham. It is a general approach that informs many literacy programs that work well. We know though, that the more scripted an approach, the less training is needed. The less scripted programs take more professional development, but offer teachers a greater understanding of structured literacy.

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The State of Learning Disabilities

RESEARCH & REPORTS

4 Reading Disability in the Prison Population

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Integrating Storytelling with STEM

Dyslexia in Incarcerated Men and Women: A New Perspective on Reading Disability in the Prison Population.

- **Source:** Journal of Correctional Education . Sep2021, Vol. 72 Issue 2, p61-81. 21p.

- **Author(s):** Cassidy, Laura; Reggio, Kayla; Shaywitz, Bennett A.; Holahan, John M.; Shaywitz, Sally E.

- **Abstract:** The authors report findings on reading and IQ from a contemporary study of 145 individually tested incarcerated men and women in two maximum-security prisons in Louisiana. To their knowledge this study is the first to use the definition of dyslexia from the First Step Act (FSA) and the first to incorporate an IQ measure to differentiate those with dyslexia from individuals with cognitive impairment. The authors' findings indicate that almost half (47%) of the participants are classified as having dyslexia, 36% proficient, and 17% cognitive impairment. Both dyslexic prisoners and nondyslexic prisoners reported academic and behavioral problems in school that led to decreased years in school and decreased high school graduation rates, with 87% reporting dropping out of school with many inmates dropping out in middle school (mean age of completion of 9.6 years of school), 97% reporting having been in special education or received accommodations, and 59% having failed to receive a high school diploma or equivalency. The authors note that although the FSA calls for the Bureau of Prisons to screen prisoners for dyslexia using a screener that is evidencebased, with proven psychometrics for validity, efficiency and low cost, as well as readily available, a screener is not a diagnostic instrument and we discuss the next steps after inmates are screened as being dyslexic.

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