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The Impact of a Curriculum-Based Measurement Instrument on the Reading Comprehension Performance of Students with Dyslexia

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Dyslexia is a condition that is common among special education students. Dyslexia can cause many learning and psychological problems for students if not addressed early. The purpose of the study was to investigate the effect of a small group reading intervention on the reading comprehension proficiency of third grade students with dyslexia. In this study, the independent variable was inclusion in a small-group reading intervention. The dependent variable was reading comprehension, as measured by a series of Curriculum-Based Measurement (CBM) reading comprehension tests. The CBM is an assessment method which is used to monitor progress of students in basic academic areas. A special education teacher prepared all of the materials for these interventions and conducted them over the period of 25 school days. A multiple-baseline design was used to compare the timelines of the intervention's effectiveness among different participants. Analysis of descriptive statistics and nonoverlap of all pairs (NAP) tests were used to explore the results of the intervention. The results of the study showed that all three students experienced significant gains in their reading performance, with NAP effect sizes close to 1 across students. The students improved during the intervention period. Overall, the plots and the effect sizes showed promise for improving the reading performance of students with dyslexia.

Keywords: dyslexia, instructional activities, small group activity, curriculum-based measurement (CBM), reading

INTRODUCTION

Dyslexia is a learning disability that creates difficulties in recognizing words and speech sounds and impairs reading. Dyslexia mainly affects the areas of the brain that are responsible for language processing. Research has suggested that there is neither a connection between dyslexia and intelligence and dyslexia and vision (Frith, 2017). The most common symptoms include delayed speech, difficulties in learning new words, difficulties with word formation, impaired memory, and confusion between words that sound alike. The signs and symptoms of dyslexia are more apparent among school aged children than among people of different age groups (Ellis, 2016). People with dyslexia have been found to disproportionately face problems with their academic performance, relationship formation, mental health, and ultimately, integration into the workforce

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(Frith, 2017). Dyslexia is one of the most common learning disability diagnoses, with an estimated 43.5 million dyslexic children and adults in the U.S. alone (Ellis, 2016; Youman & Mather, 2013). Early diagnosis and intervention can help dyslexics develop the necessary skills to address their challenges, particularly in academic contexts; consequently, it is extremely important for researchers to identify impactful approaches to supporting dyslexic students (Van der Leij et al., 2013). In the present study, the researcher sought to evaluate the impact of the regular administration of a Curriculum-Based Measurement (CBM) test on the reading performance of a small group of third-grade students with dyslexia in a rural area of the United States. The study was undertaken with the intention of evaluating the utility of a new tool in service of the academic growth of elementary-age students with dyslexia and addressing the knowledge gap concerning best practices for such students.

The ultimate goal of developing reading skill is to develop the ability to decode texts of various genres and derive meaning from them. Students with dyslexia have been found to experience difficulties with reading comprehension and in deriving the meanings of texts due to their lack of decoding ability Thus, there is a persistent need to identify and apply effective strategies to help dyslexic students improve their literacy skills (Pearson, 2014). Previous studies have indicated that the adoption of effective instructional strategies in classrooms are one of the approaches that could help to significantly improve reading skills (Lundberg & Reichenberg, 2013). Research suggests that providing visual aids, using abstract puzzle-solving tasks, foregrounding group-oriented work, interviewing students concerning their perceptions of their own academic abilities, and incorporating varied formats of direct reading instruction may all contribute to the improvement of dyslexic students' reading performance; however, scholars have questioned the long-term impacts of these instructional interventions beyond the immediate space of the learning session (Berninger et al., 2013; Lundberg & Reichenberg, 2013; Wanzek et al., 2013). In response to this, the study's author seeks to explore the extent to which group-based instructional activities for students with dyslexia is associated with improvements in reading skills.

Research question

RQ: Does small group direct reading instruction have an impact on dyslexic third grade students' performance on CBM reading comprehension evaluations?

Relevant Testable Hypotheses

The independent variable in the present study was the provision of small group direct instruction, and the dependent variable was student performance on curriculum-based measurement (CBM) reading comprehension probes. Through the CBM instrument, students were evaluated for their reading comprehension acquisition. Therefore, the relevant testable hypotheses for this study were:

H0: Students with dyslexia who participate in small group direct instruction will not see any change in their scores on the CBM reading comprehension test.

H1: Students with dyslexia who participate in small group direct instruction will achieve higher scores on the CBM reading comprehension test.

Literature Review

The challenges that dyslexic youth experience can lead to long-term problems in academics, the workplace, and in their daily lives into adulthood (Nukari, 2022; Vender, 2022). Adequately addressing dyslexic students' challenges can be difficult owing to the executive functioning deficits they often develop in response to their challenges with comprehension, abilities to properly express themselves, frustrated self-concepts, and senses of belonging (Denton et al., 2021; Iyer et al., 2023; Ross, 2021; Snowling & Hulme, 2025; Walda et al., 2022). Challenges with reading can impair dyslexic students' abilities to access academic material that they may otherwise successfully understand and apply (Iyer et al., 2023; Kunwar & Sapkota, 2022; Lambert & Harriss, 2022). Dyslexia is common across cultural and linguistic contexts, is notoriously difficult for educators to identify, and has significant life-course impacts; for these reasons, the publication of research with high effect sizes is greatly incentivized, to the detriment of overall research quality (Daniel et al., 2024; Denton et al., 2021; Snowling & Hulme, 2025; Thompson & Caroll, 2025; Toffalini et al., 2021). In short, though dyslexia research has significant reach and is posed to have meaningful impact on many facets of the lives of dyslexics, a warped incentive structure in dyslexia research often undermines these efforts.

In recent studies, the impact of literacy-based interventions on students has been found to be variable. Al Otaiba et al. (2023) conducted a critical review of 14 meta-analyses on the impacts of reading and writing interventions among elementary school students, concluding that systematized reading-based interventions that incorporate collaboration between reading specialists, special educators, and classroom teachers support student growth in reading. Researchers are increasingly demonstrating interest in the use of technological assistance in individualized reading instruction for dyslexic students, raising questions about the ideal balances between the hyperindividualized skill-based instruction that generative AI technologies encourage and the pro-sociality of group work (Lim et al., 2023; Mazaheri et al., 2024; Middleton et al., 2025). Research that has focused on group work interventions foreground the importance of repeatability for concept formation, clear targeting of specific reading skills, and interpersonal engagement to address executive function challenges (Cho et al., 2023; Dunn et al., 2025; Mazaheri et al., 2024). The tension between impersonal machine learning work and the development of small-group, highly personalized intervention work demonstrates the present crossroads at which direct reading instruction research sits.

METHOD

Participants

The participants in this single-case study were a group of third grade students attending an elementary school in the Amherst, Massachusetts area. A small population was selected to ensure a high degree of alignment in individual student profiles and to ensure the continuity of instruction for individual students. At the time of the study, the school had about 350 enrolled students. Two 8-year-old white males -- who will be referred to as Mike and John -- and one 9-year-old white female -- who will be referred

to as Olivia -- participated in the intervention group. All participants had been formally diagnosed with dyslexia and had been referred to the study by their classroom teachers. The intervention group participated in a small group activity for improving reading comprehension. The researcher worked with one special education teacher employed at the site. The teacher, who was tasked with carrying out the intervention, had a bachelor's degree and had an active certification in special education. Prior to the study's completion, the teacher had four years of experience in teaching students with dyslexia.

Setting

The present study took place at an elementary school in Amherst, Massachusetts. Interventions were carried out in a dedicated special education room. Students were pulled out of class during direct reading instruction to participate in the study. All students had been previously acquainted with the special education room and with the teacher who performed the intervention work. When not in the special education room, the participants in this study would follow the standard routines of their respective third grade classrooms. Prior to undertaking the intervention, institutional review board (IRB) approval and parental consent was obtained by the researcher.

Outcome measurement

The dependent variable was the performance of students on the CBM reading test which, in the context of the present study, was used to measure the participants' levels of reading comprehension proficiency. Prior to the intervention period, participants were given a CBM test, which consisted of 12 comprehension questions concerning a short story at grade level. This pre-intervention measurement was meant to determine the participants' baseline levels of reading proficiency. During the intervention period, participants were given the CBM test every school day to indicate the changes in their reading proficiency. The test was administered by the building's special education instructor, who also ran the intervention group, in the interest of maintaining continuity for students and for the researcher. The scores on the CBM test were plotted on three trend charts to graph the progress of each student, allowing for temporal trends to be analyzed. The group work activities undertaken during the intervention period were tailored to the participants, based on the special education teacher's understanding of best practices and the curriculum. The researcher observed the participants' work during the intervention every morning.

Multiple baseline (MBL) design was used to evaluate the effects of group activities on participant CBM performance. In MBL studies, researchers collect data that follows individuals or groups through the course of similar interventions -- specifically, interventions in which the subject of the research is not anticipated to return to baseline -- to create a means of direct comparison throughout an intervention's course (Albert, 2013). Pre-intervention baselines are created once a pattern of performance is established to make direct comparisons to the independent variable during the intervention period; all data is plotted on a line graph over a duration of time to demonstrate the different progressions of change and the different degrees to which change occurs. This approach has particular relevance in educational research because it

accounts for the individual variation between students, it helps determine the optimal duration of time an intervention should last, and the temporal structure of MBL allows for follow-up work to confirm the long-term efficacy of an intervention. In the present study, MBL was used to better understand the ideal duration of an effective reading intervention for dyslexic students by creating a body of data that reflected the gradual reading progression of several students with similar diagnoses, school contexts, and familiarity with the interventionist. Durations of baseline measurements varied between different students to better demonstrate the period of adjustment between entering intervention and score improvements. Students entered the intervention period at staggered intervals (5 days, 7 days, and 12 days) to allow for the establishment of baselines. The Curriculum-Based Measurement test (CBM) was used to monitor student progress in the context of this study. CBM is an assessment method which is used to monitor progress of students in basic academic areas such as reading, spelling, writing, and math (McLane, n.d.). Students are given a brief test on a specific skill within a subject area to determine if they understand the topic at hand. When used in this manner, CBM provides current data about progress of students on a regular basis. These check-ins can be used to evaluate the performance of students with many different types of learning needs and learning profiles. In the context of the present study, each test took 3 to 5 minutes. All question sets contained 12 items and were focused on reading comprehension skills. The special education teacher recorded the number of incorrect responses of each student and compared the number of incorrect responses to the total number of responses. In this experiment, only one individual was tasked with evaluating performance, negating the need to measure inter-rater reliability.

The CBM test is a standard procedure with documented reliability and validity evidence (McLane, n.d.). The reliability of the CBM model for reading has been established in several studies, including test-retest and alternate form studies. In addition, the validity of the CBM has also been established in the technical documents officially released as a part of the test.

The dependent variable in the present study was exposure to the pull-out reading intervention described in the "procedures" section. The independent variable in the present study was the reading proficiency of students with dyslexia, as measured by the CBM academic achievement test. This variable is continuous. The CBM test was administered by a licensed special education teacher who had previously worked with the participating students and who had familiarity with the progression within the school's third grade curriculum. The special education teacher reviewed the students' files before undergoing the intervention in order to confirm that any type of accommodation or modification necessary for the participant to perform the test in accordance with their established classroom expectations was given. No such changes were needed aside from the direct instruction and setting shifts that were already embedded within the study's design. The measurements obtained from the CBM test were plotted on the chart to see if there existed trends in student progress.

Procedures

In the present study, the independent variable was exposure to small group reading instruction and the dependent variable was performance on the CBM evaluations. All participants had to be attending the third grade at the school site in question and have a dyslexia diagnosis on file to be asked to participate. Participants in the study were referred to the researcher by their classroom instructors. After receiving the referrals, the researcher reached out to prospective participants' guardians to explain the study, the risks of participation, the benefits of participation, and the privacy protections that would ensure the children for whom they were responsible would remain anonymous. The researcher also sent out a permission form for guardians to complete. All documentation had to be completed and returned before the study could begin.

All participants attended a pull-out intervention that targeted reading skills. Participants engaged in a set of small group activities planned and run by the special education teacher that were based on the same materials that the general education class used. The special education teacher would conference directly with classroom teachers to ensure that comprehension questions were in line with the in-class work being undertaken with other students. In the intervention group, students tried to predict the plots of stories by looking at the drawings and the title of the story prior to reading it together. As the group read the story, participants took turns and explained the story to each other after reading the story. Participants then asked the special education instructor and each other questions from the text about the story. Participants answered multiple-choice and open-ended reading comprehension questions concerning the stories to demonstrate their reading skills.

Research Design and Analysis Method

The purpose of the present study was to answer the research question, "Does small group direct reading instruction have an impact on dyslexic third grade students' performance on reading evaluations?" In the present study, the purpose was to measure the effect of a group work intervention in reading comprehension on reading performance, as measured by a CBM test on reading comprehension. The research design was multiple baseline across individuals (MBL), in which the researcher first measured a single behavior for one or more persons at multiple points in time (Kazdin, 2011). The baseline performance was measured for one participant and when it was stabilized -- or, when a trend had been established in the pre-intervention period -- the intervention was introduced to see if the pattern changed after that. The rest of the participants would gradually enter the intervention in the interest of determining whether the impacts of the intervention were only happening in the short term or continued. Once the performance in the post-intervention period stabilized in the first participant, then the intervention was given to the next participant, and so on. To aid in the analysis and interpretation of the data, the researcher assembled descriptive data for the three participants. Data representing the progression of each participant -- from baseline establishment to the end of the intervention period, as described in the procedures section above -- was plotted online graphs to demonstrate gradual changes in scores for each participant. In the following analysis, the researcher relied on

descriptive statistics to analyze differences in means and trends in student performance. Nonoverlap of all pairs (NAP) testing was then used to compare scores in baseline and intervention stages, indicating how profoundly scores changed between these two stages.

FINDINGS

Date Analysis and Results

The study spanned 25 days of instruction and intervention using continuous measurement of the reading comprehension of students in reading English class. During the baseline phase, the students had no intervention group work. In this phase of the study, students' reading comprehension was measured every day of the class using a 12-question CBM test. The intervention started when the first student's (Mike's) trend in the baseline phase was stabilized. During the intervention period, the first participant began the direct instruction intervention activity with a rotating group of classmates without formal dyslexia diagnoses while the other participants were measured on their baseline performance. CBM work was not done with nonparticipating students, and no data was collected from them. Students who were not part of the intervention group switched into the group work on a rotating basis until the three participants were all past the baseline measurement stage. After the intervention trend data had stabilized for the first participant (Mike), the intervention was then introduced to the second participant (Olivia). Olivia's performance was measured while the third participant (John) was being measured on his baseline. Mike, Olivia, and John all experienced the same progression. The experiment lasted 25 school days. The following three graphs show the performance trend for the three participants (Mike, Olivia, John) during the baseline and the intervention phases.

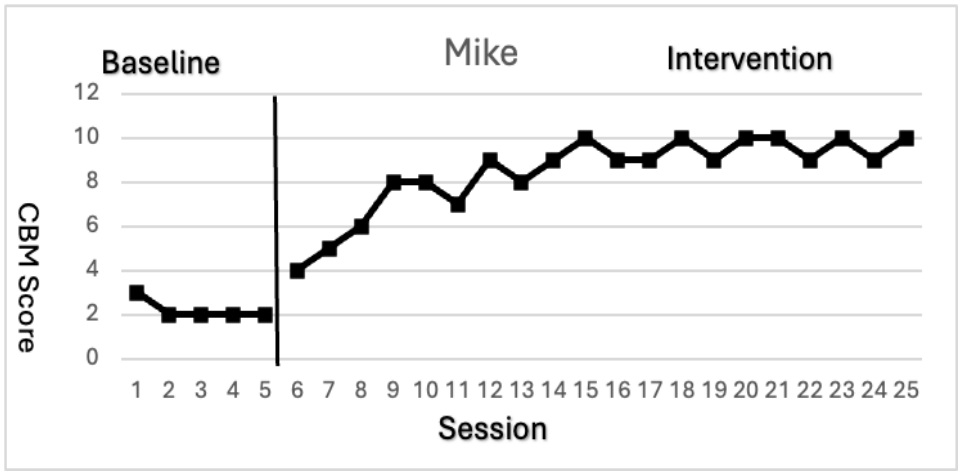

Figure 1
The performance trend for Mike during the baseline and the intervention phases

Figure 1 above shows Mike's (Participant 1's) performance throughout the course of the intervention. The first plot shows that Mike's performance on the CBM test was consistently improving during the intervention phase compared to his baseline performance (sessions 1-5, in which Mike correctly answered 2/12 questions four times in a row). During sessions 10-12, his performance shows some variation, and alternates between 6-8 questions correctly answered. Nevertheless, the overall trend is upward, with Mike consistently getting between 9-10 questions right after the 14th session. This represents a marked improvement over Mike's baseline performance. Small group activity was effective for Mike, with an Nonoverlap of All Pairs (NAP) value of 1.

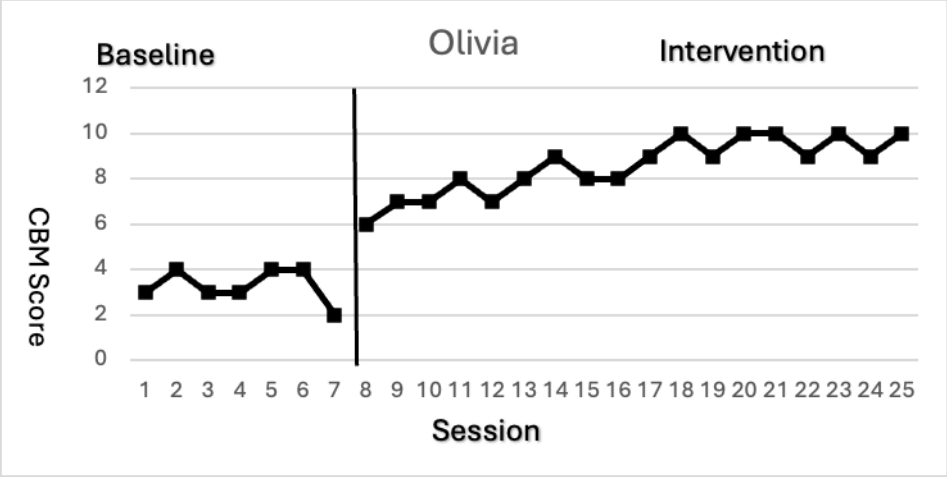

Figure 2
The performance trend for Olivia during the baseline and the intervention phases

The second plot shows that Olivia's performance on the CBM test is consistently increasing during the intervention phase compared to her baseline performance. During the seven baseline sessions, Olivia scored between 2-4/12. Olivia began her intervention two sessions after Mike. From the start of the intervention sessions, Olivia demonstrates marked improvement, showing her best performance on the CBM up to that point in the intervention (6/12). After a period of improvement between sessions 8-16, Olivia peaks between sessions 17-25, consistently scoring either a 9/12 or a 10/12 on the CBM. The overall trend is upward, and the intervention level is higher than the baseline session. A NAP test revealed a value of 1, suggesting significant changes in scores.

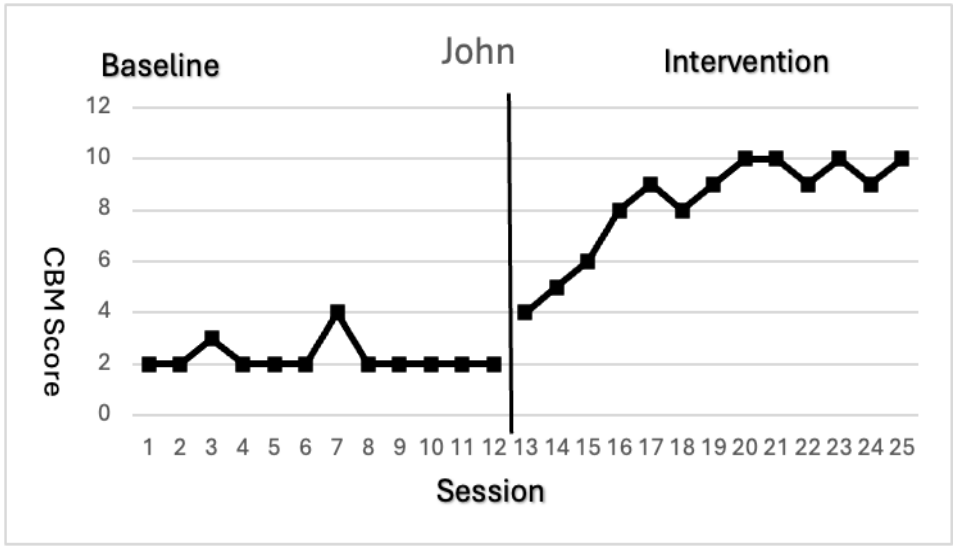

Figure 3
The performance trend for John during the baseline and the intervention phases

The third plot shows that John's performance on the CBM test is consistently increasing during the intervention phase and is consistently higher than his baseline performance. During John's twelve-session baseline instruction period, he consistently scored between 2-4/12 on the CBM, with ten of the sessions resulting in a 2/12 score. At the beginning of his intervention period, John experienced a period of steady growth, with sessions 13-17 leading to consistently higher scores during each subsequent test. During this initial onboarding, John starts scoring a 4/12 and increases to a 9/12. Between sessions 20 and 25, John consistently scores between 9-10/12, leaving him at the same level as the other two participants. The NAP value of John's scores was 0.99, demonstrating a high degree of change between the baseline and intervention periods.

In addition to the graphical information, the mean scores for Mike, John, and Olivia during the different phases of their experimental participation substantially changed. Table 1 below shows Mike, John, and Olivia's mean scores during the baseline and intervention phases. The means for each of the participants significantly increased. Curiously, all three participants demonstrated the same pattern of scores in the final five days of the intervention.

Table 1
Mean scores of participants on CBM tests administered in the baseline and the intervention phases

Student	Baseline	Intervention
Mike	2.2	8.45
Olivia	3.28	8.5
John	2.25	8.23

DISCUSSION

Dyslexia is a problem that is common among special education students worldwide, and that poses significant challenges for students' executive functioning skills, academic success, relationship success, and sense of belonging (Denton et al., 2021; Iyer et al., 2023; Ross, 2021; Walda et al., 2022). There have been several treatments proposed for treatment of dyslexia (Frith, 2017). In this study, the researcher sought to determine if a small group reading intervention could improve the reading comprehension proficiency of special education students, as measured by CBM tests. The study was designed in response to an increased push in contemporary scholarship towards the use of prosocial reading intervention designs that decenter rote machine learning (Cho et al., 2023; Dunn et al., 2025; Mazaheri et al., 2024). The participants in this experiment were three third-grade students (Mike, John, and Olivia). An MBL design was used for this experiment, in which the small pull-out instruction group was the intervention. Students were measured on their reading proficiency for 25 school days. The measure used was the CBM test.

The scores for the three students were recorded on three separate plots and stacked (Figures 1-3). As the plots and the mean scores (Table 1) show, all three participants saw significant gains over the course of the intervention -- in some cases, more than tripling their mean scores. The high degree of alignment between the special education teacher and the classroom teachers in this study echoed Al Otaiba et al.'s (2023) assertions about the importance of interdisciplinary collaboration and building-level collaboration. Though the present results suggest that strong alignment between teachers and the provision of high degrees of individualized attention to dyslexic students suggest that similar tactics may be used in other educational contexts in the future, the small sample size, specificity of context, and consistency of patterns in student performance suggest that additional critical work should be done to further explore what makes pull-out groups effective for dyslexic students.

LIMITATIONS

The present study had significant limitations. Only three students participated in the study, which was conducted in a rural area in the United States, which suggests significant gaps in data saturation and in cross-cultural applicability. Though collaboration between the special education teacher and the third grade classroom teacher heavily influenced the apparent success of the intervention, the particular nature of this collaboration could not be presented in great detail due to particular access-related limitations on the part of the researcher. The researcher chiefly relied upon analysis of descriptive statistics to evaluate the success of the study, suggesting that

more rigorous models may need to be used in the future. The study's design also created very limited opportunities for qualitative analysis of the intervention, which limited its overall effectiveness. Future studies would benefit from embracing mixed-methods approaches, larger sample sizes, and a greater degree of direct collaboration with instructional staff. The impact of new, "permanent" additions to pull-out intervention groups may also be worth exploring, given the rapidity of the growth of the second and third intervention participants.

IMPLICATIONS

The size of the study's sample, the level of data saturation reached, and the specificity of the study's setting all pose significant limitations on the study's contributions, and by extension, the reach of its implications. With this in mind, the results of this study can be applied for both practice and research. The present research suggests that highly collaborative elementary school special education departments can create opportunities for dyslexic students to find success with small group reading interventions, and provides a tangible example of how strong alignment practices can translate into significant student gains. The research also suggests that future researchers should give more active consideration to how prosocial reading interventions can help dyslexic students. Researchers may also explore how special education departments and elementary homeroom teachers collaborate to support dyslexic students. Given the study's context, this may be particularly important in rural schools, which may have a greater degree of resource limitation than schools in other areas.

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