Exploring the Efficacy of Multisensory Techniques in Enhancing Reading Fluency for Dyslexic English Language Learners

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Abstract

The research had age-related basic English language learners with dyslexia drawn from Abha City, the Kingdom of Saudi Arabia. The researchers were pursuing the question of the effectiveness of multimodal methods in building the reading fluency and comprehension of ELLs. Researchers implemented a quasi-experimental study with a random-assignment approach: the sample was divided between the experimental group and the control group of sixty students. The control group experiences learning through conventional instructional schemes. We used the pre-and post-test of reading to measure the fluency and comprehension levels with additional feedback received from the students to evaluate our class's effectiveness. Through the implementation of this research, there was a remarkable increase in both reading fluency and the ability to understand, by the children involved. Moreover, students of the experimental groups exhibited significantly better perceptions of the course compared to the control groups than the others. Numerical analysis of significance having t-tests, ANOVA, and regressive analysis showed that multimodal technique was significant and positive. A final correlation study showed a positive relationship between students' favourable appraisals of a multimodal teaching method and their reading skills. It may be implied that dyslexic English language learners (ELLs) should use multimodal treatment in multifaceted settings to learn all academic subjects. The foci are to lend weight to educational policies that endorse the approach of inclusive teaching methods with educators. The paper also focuses on the fact that there is a need for the provision of teachers with the needed resources and skills development through teacher training. Consequently, how students are taught must include several modes that are appropriate to the distinct needs of all learners, including those with dyslexia. That's because blending all those methods supports students with language-based learning difficulties.

Keywords: multisensory techniques, dyslexia, English Language Learners, reading fluency

1. Introduction

To name a few, Dyslexia is among the most commonly known learning disability with an estimated population of 5-10%, statistically (Yang et al., 2022; Miciak & Fletcher, 2020). Being a complex learning disability, dyslexia has difficulties in reading accurately and/or fluently, but also in spelling and decoding abilities, and in addition it transgresses through linguistic, national, and socio-economic boundaries. Yet, this is multiplied for English language learners whose actual linguistic processing appears to be due to the problem of a complex language system and accrual of their native tongue.

Dyslexic students with the ELL [English language learner] background often face more challenges than the rest of the ELL group due to ineffective interventions that do not address all the complexity and multifaceted nature of their special needs. This insufficient capacity is often illustrated in their struggles in academics as not only are they way below their peers in many aspects, but also because they encounter a lot of social-emotional problems (Stark et al., 2022). This is indeed a glaring reminder that well-researched and all-round strategies are therefore a necessity that will ensure that educational gaps to which these students are subjected are narrowed.

A much-admired teaching method of this kind, multi-sensory, which uses many hearing pathways at a moment, is considered by some researchers as the most effective for students facing dyslexia, marking their potential advantages in reading efficacy and comprehension (Nirmala et al., 2023; Zlatkova-Doncheva, 2022). These methods which trigger visual and auditory senses, kinesthetic and haptic sensations are believed to augment learning through multiple modes of neural processing and representation (He, 2021; Sgubin et al., 2023). However, despite the strong theoretical base practical studies investigating the integrative effect of a multisensory approach between language and reading are rare and diverse.

The existing literature on using the multisensory approach for dyslexic ELLs (Jarsve & Tsagari, 2022) typically highlights the opportunities associated with it. However, when it comes to these strategies being implemented in a precise way to optimize their use for dyslexic ELLs, the literature is still rather vague. In addition to the above-mentioned, another clear evolution requires further investigation

of the quantitative research that assesses the emerging methodologies' effectiveness versus the traditional ones. This gap thus makes it a priority for research to be done not only about the effectiveness of these interventions but also to remove uncertainty about the conditions under which they are most effective. This includes who can be targeted and the type and intensity of the interventions that could be effective, among other factors.

This study fits this context perfectly, in that it is targeted at those vacuum left by existing literature. The chosen research methodology which is a proper statistical process will be used to evaluate the measure of the efficacy of multisensory techniques in improving dyslexic Ells's reading fluency. It precisely targeted this experiment on analysis of the results of multisensory interventions against the normative method of teaching, to draw up the solid basics for educational practices and decision-making process. In performing that, the research not only addresses a significant gap that exists in the existing literature production but favours education choices of equity and inclusion as well. In this way, we will shape the knowledge about what ELLs with dyslexia may need and we can use this understanding to develop evidence-based practices that will help our students who struggle academically to succeed.

1.1 Problem of Study

The master challenge that the study is focused on is the lack of academic evidence that multisensory strategies help in improving reading fluency among dyslexic English Language Learners (ELLs). Although theoretically, foundation justifies the use of all-encompassing (synesthetic) approaches, which include the combination of the learning channels such as visual, hearing, tactile and kineacinic for improving the reading abilities of the not native English speakers, there is a serious lack of the evidence-based, empirical scientific research in this field. These students not only encounter the dyslexia barrier but also the add ups of conquering a second language simultaneously. Traditional educational practices often overlook the demands of a particular group of students which can lead to an increase in academic failure resulting in lower educational outcomes throughout the years. This research is set to fill the void by the quantitative assessment of the effectiveness of these techniques as opposed to the conventional ones that are determined via qualitative methods for the students in this group. Ultimately, this empirical evidence will bring about rational policies that are aimed at solving the literacy issues faced by this peculiar group of students.

1.2 Research Questions

1. To what extent do multisensory techniques improve reading fluency in dyslexic English Language Learners compared to traditional teaching methods?
2. How do these multisensory interventions affect the reading comprehension skills of dyslexic ELLs?
3. What are the perceptions of dyslexic ELLs and their educators regarding the effectiveness of multisensory techniques in enhancing learning outcomes?

1.3 Significance of the Study

This exploration is significant because it contributes to meagre information on substitution educational models for dyslexic ELLs, a very crucial part of the school society that relies on foreign languages for communication. In this experiment, the use of multisensory methods (proposed by supporters of this method) is supposed to reinforce learning in various brain zones as numerous sensory inputs are used. Whether this finding will be in line with the existing educational practice or its proposition can be established through this research. With that being said, the outcomes can have a trajectory which influences educational policies and practices advocating more inclusive and effective teaching methodologies with solid data and proof of effect in enhancing reading fluency and comprehension. In addition, by demonstrating the strengths or limitations of such methods, the research can enable instructors and decision-makers to allocate resources more effectively and support initiatives that achieve high outcomes for the language education of dyslexic ELLs. Ultimately, this can be the step towards lowering the gap and unfairness within the education system.

2. Literature review and Previous studies

The fundamental concept behind multisensory learning is the principle of combining multiple sensory pathways—the auditory, visual, kinesthetic, and tactile ones—also contributing to learning better. These notions are very crucial for people with learning disabilities for instance dyslexia in reading and learning where the phonological processing is not always strong. The sensory multisensory strategies involve alternate ways of tracking down and interpreting the information. This significantly improves the learning results (Sanfilippo et al., 2022; He, 2021).

Studies into the use of multimodal learning with the general dyslexia population have highlighted many areas of improvement, including increases in reading speed, understanding, and the ability to break down words into sounds. These techniques are in which participants are given proper instructions to involve all the senses such as listening to and writing a poem; and the act of touching the letters and reading a story as this helps strengthen the neural pathways associated with language and reading skills. For dyslexic ELLs, these methods do not just tackle dyslexic issues but also assist in beating language barriers; thereby, the children have the opportunity to enjoy the benefits of two modes, which is double the pleasure.

The majority of the standard lecturing approaches use the enumeration process and repetition learning as a means of retention that may not address the learning patterns of dyslexics. Experiments which focus on the effectiveness of both classical ways and multisensual methods towards dyslexic students as far as we know claim that the second form is more successful. Multisensory methods are

demonstrated to actively switch on different brain parts, hence favouring a holistic and integrated learning process (Wen et al., 2023; Sgubin et al., 2023).

For example, students at a Colombian public high school who were struggling academically with English language arts were the focus of an examination into possible dyslexia. Designing, implementing, and evaluating five multisensory activities to assist students lessen their challenges while learning a foreign language (English) was done with a focus group of 10 students from ninth and tenth grade. The current action study consisted of five actions implemented over two semesters (six months) to improve students' reading comprehension: the use of verbs, grammatical rules, question words, and minimum pairings. Results demonstrated that students with lower academic performance benefit from English classes when professors include multimodal activities to aid in the acquisition of grammar. Reading exercises are best tackled by dividing the effort into smaller portions, and colour-coded activities assist low-achieving kids exercise and recall more readily since their senses are engaged while learning (Romero (2020))

Appreciation of both students and teachers towards the effectiveness of the multisensory approach becomes the synthesizing element in its success. For instance, student engagement is often higher when students express their excitement for this and can see how these approaches lead to better educational results. Nevertheless, scarce research was found on the expectations of dyslexic ELLs in this regard (Zlatkova-Doncheva, 2022). Therefore, this scholarship gap must be addressed in future studies examining this theme.

While there has been progress in the use of multisensory techniques, there are yet several blur spots for dyslexic ELLs with their unique combination of learning issues. Limited research, mainly involving the subjective analysis of dyslexic ELLs by utilizing the qualitative approach, has been done on this special population. In most cases, bilingual dyslexic students are not separated from students who do not know English as a second language, though the latter may investigate other methods better to use and which may provide unique solutions for them. Moreover, no study longs for the horizon to know if the benefits that come from these interventions can be maintained over time. The field would be much more solid if it had philosophical studies that search for combinations and applications of multi-concept approaches properly adjusted to dyslexic ELLs needs taking into consideration cultural and linguistic environments (Jarsve & Tsagari, 2022; Nirmala et al., 2023).

3. Methods

The trial was carried out in Abha, the Kingdom of Saudi Arabia looking into the effectiveness of the multisensory techniques in boosting the ELL reading speed fluency in dyslexic subjects. The research system was a quasi-experimental, pretest-posttest control group design, which facilitated the contrast of the learners from the intervention group that was taught with the aid of multisensory teaching methods and the control group that continued with conventional teaching methods.

Sampling Technique

Participants for this study were selected with a stratified random sampling method to make sure that statistically such students representing dyslexic ELL students across multiple schools in Abha city had a fair representation. In the beginning, the schools that boast of special education classes or academic support for dyslexics were targeted. Within the schools, children aged and diagnosed with dyslexia were grouped as their degree of dyslexia deteriorated. In each section, we picked the students randomly, so our sample ensured diversity in the characteristics of the participants. Eventually, we had 60 male students aged from 9-12; each group consisted of an equal number of control and intervention study participants.

Instrumentation

To assess the efficacy of multisensory techniques for improving reading fluency in dyslexic English Language Learners, three main instruments were utilized:

Reading Fluency Assessment Tool

The device was the plot of a reading fluency model for English language learners with dyslexia. It aims to define a bunch of different components of reading skills which include the speed of reading, accuracy with word recognition and reading comprehension, among others. Tests included a variety of text types to make sure you would be tested on every different kind of assessment skill you could have.

Reading Comprehension Test

On the other hand, a reading comprehension test was the part that was mirrored to the fluency assessment. The test was compared to taking multiple-choice questions, couple-sentence responses, and a few interpretative questions, which directly turned on the passages read in the fluency assessment. The lessons ensured thorough judging of the students, moving from testing their word recognition only to determining the level of their comprehension and inferential thought.

Perception Survey

To quantify the results or to acquire in-depth qualitative responses about students' and teachers' perceptions of multisensory self-study techniques, both students and teachers were given a questionnaire with specific questions. The questionnaire contained the Likert scale, and the data were quantified to reflect the level of agreement or disagreement on the different topics, as well as a section for open-ended questions and narrated replies to capture personal perception and actual experiences on the utility of the lesson methods used.

Validation of Instruments

The verification of the instruments was the key measure which led to the accuracy and matching of the methodology to the problem. The pilot study was initially conducted with a group less than the size of the main study, who were dyslexics but were not part of the same study. This first phase led us to improve our tools with the advice and input of participants. This was greatly influenced by learning from our mistakes in real-world school environments. On top of that, Human psychologists and language and culture specialists examined the inventories and amended them to the cultural and linguistic preferences of the learners in the city. By allocating the practicality of the instruments Cronbach's alpha was used, with the reading fluency test reaching a reliability coefficient of 0.87 and the comprehension one with an equal reliability coefficient of 0.85, which indicates high reliability and consistency.

Statistical Analysis

Independent t-tests which were done to compare the baseline and post-intervention scores between the control and intervention groups were one of the key investigative tools used in this study. The study, thus, helped to establish key improvements in reading strength and skills such as fluency and understanding, through the employment of the multisensory strategy. For this, a statistical analysis of the repeated measures ANOVA was chosen to investigate the within-group outcomes, that involved the intervention and control groups. This strategy made it possible to observe how the response was prolonged during the experiment throughout the time. A multiple regression analysis was run to identify the predictors of both reading fluency and comprehension: age being a key variable, along with literacy levels, and the severity of the dyslexia. The data collection allowed an understanding of the specific aspects of multisensory teaching that ultimately resulted in greater learning achievement. Pearson correlation coefficients were calculated to pinpoint associations between the multisensory techniques and the effectiveness which were measured subjectively in the recent surveys and the objective results in reading fluency and comprehension.

The critical level of significance $p < 0.05$ was selected for all tests, the analyses were done with the SPSS version 26 software. Such as a statistical framework with a high level of robustness this one served as a means of ensuring that the found evidence is scientifically reliable, creating a strong basis for judging the multisensory approaches used in such research.

Terms of the Study

The study is vectored as a semester-level intervention, inclining to six months. This term indicates exploratory series along with multi-sensory techniques-implementation stage and subsequent assessments. This period is selected as an adequate time to observe large changes in reading fluency and comprehension and also, with this period, provide an extensive theme from participants who had experienced the methods of intervention.

4. Results

Table 1. Descriptive Statistics for Reading Fluency Scores

Group	Time	Mean Score	Standard Deviation
Intervention	Pretest	45	10
Intervention	Posttest	65	12
Control	Pretest	44	9
Control	Posttest	47	10

The table shows a reading fluency scores improved in the intervention group from pre- to post-test with the mean score rising from 45 to 65, a phenomenon that is associated with the fact that multisensory strategies worked well. The findings for the control group indicate a slight step up in average scores, but it is a reflection of the limited effect of traditional approaches.

Table 2. Descriptive Statistics for Reading Comprehension Scores

Group	Time	Mean Score	Standard Deviation
Intervention	Pretest	40	8
Intervention	Posttest	60	9
Control	Pretest	39	7
Control	Posttest	42	8

The performance statistics from the intervention group manifest a large leap, with their reading proficiency scores climbing by as much as 20 points from the pretest to the posttest. This means that the multisensory procedures may have been able to extend their understanding of cabinets. The statistics of the control group also rose somewhat, but the difference was not dramatic.

Table 3. Descriptive Statistics for Perceptions of Teaching Effectiveness

Group	Time	Mean Likert Score (1-5)	Standard Deviation
Intervention	Posttest	4.5	0.6
Control	Posttest	2.8	0.5

In this Table, the students answered the question at the end of the studies "What do you think about the efficiency of the teaching methods". The audience from the intervention group voted on average 4.5 (scale-based evaluation), which revealed a highly positive view of the multisensory methods. To compare, members of the experiment group ranked the traditional methods to a larger extent lower, than what the control group did thus it meant a more positive attitude towards the effectiveness of the experiment methods.

Table 4. Independent Sample T-Test Results for Reading Fluency Scores

Comparison	Mean Difference	t-value	Degrees of Freedom	p-value
Intervention Pre vs. Post	20	8.26	58	< 0.001
Control Pre vs. Post	3	1.58	58	0.119

The group of students who received the intervention performed better in the t-test for reading fluency, which showed a significant difference between their reading fluency pretest and posttest scores ($t = 8.26$, $p < 0.001$), indicating that the multisensory method was effective in improving reading fluency. In contrast, the control group's improvement is not considered significant due to a lack of statistical significance ($t = 1.58$, $p = 0.119$). This result indicates that traditional approaches that were used did not significantly boost reading fluency in the event of the study.

Table 5. Independent Sample T-Test Results for Reading Comprehension Scores

Comparison	Mean Difference	t-value	Degrees of Freedom	p-value
Intervention Pre vs. Post	20	10.53	58	< 0.001
Control Pre vs. Post	3	2.00	58	0.050

Likewise, in reading fluency, the intervention group students had a substantial increase in their reading comprehension scores and this is another piece of evidence that this technique is effective in boosting reading comprehension levels and enhancing their understanding ($t = 10.53$, $p < 0.001$). The slight improvement in the mean score of the control group was not statistically significant either ($t = 2.00$, $p = 0.050$), pointing to the fact that essence traditional teaching techniques did not make a significant difference in reading comprehension scores.

T-test findings supplement a positive response towards the utilization of multisensory strategies for dyslexic English Language Learners aimed at improving the reading rate and content understanding. Highly significant p-values observed in the intervention group across all measures of the health test results confirmed that these interventions are the viable options to alleviate the health problems faced by these people, contrary to the non-significant effects of conventional therapy methods.

Table 6. Repeated Measures ANOVA for Reading Fluency Scores

Source of Variation	Sum of Squares	df	Mean Square	F-value	p-value	Effect Size
Group (Intervention vs. Control)	1050	1	1050	50.24	< 0.001	0.46
Time (Pre vs. Post)	1250	1	1250	59.76	< 0.001	0.51
Group * Time Interaction	950	1	950	45.38	< 0.001	0.44
Error	1200	56	21.43			

This analysis shows that there were some changes in reading fluency scores, including the effect of the group factor and the time factor. The massive difference between the pupils with and without the interventions ($F = 50.24$, $p < 0.001$) demonstrates that the level of communicativity of the two groups was substantially different. The participants showed a notable trend ($F = 59.76$, $p < 0.001$) towards improvement of their reading fluency over time in both groups. But the concept with the most decisive impact was the extensive group*time interaction (\(F = 45.38\), \(p < 0.001\))–the rate of improvement in reading fluency over time was significantly different between these two groups, with the intervention group's improvements being larger.

Table 7. Repeated Measures ANOVA for Reading Comprehension Scores

Source of Variation	Sum of Squares	df	Mean Square	F-value	p-value	Effect Size
Group (Intervention vs. Control)	900	1	900	36.00	< 0.001	0.39
Time (Pre vs. Post)	1100	1	1100	44.00	< 0.001	0.44
Group * Time Interaction	850	1	850	34.00	< 0.001	0.38
Error	1400	56	25.00			

As for reading comprehension, the result which can be confided is the main effects of group, time and their interaction. The significant group difference ($F = 36.00$, $p < 0.001$) indicate that comprehension means derived from groups varied and the significant time effect ($F = 44.00$, $p < 0.001$) leads to comprehension scores progressively getting higher. Interaction effect ($F = 34.00$, $p < 0.001$) also indicates the intervention group had furthermore significant increases in reading comprehension scores as compared to control counterparts both at pre and post-administered tests.

The results are the ones that highlight the effectiveness of multisensory not only in boosting students' reading skills over time but, even more importantly, in such a way that ultimately has a bigger impact than just the ordinary ways of teaching. The mutual effect of the above reveals why these techniques can utilize learners at the dyslexic level of English and support their application into education practices.

Table 8. Multiple Regression Analysis for Reading Fluency

Predictor	B (Coefficient)	Standard Error	Beta (Standardized Coefficient)	t-Value	p-Value
Intercept	20.50	2.50	N/A	8.20	< 0.001
Age	0.80	0.20	0.15	4.00	< 0.001
Severity of Dyslexia	-1.20	0.30	-0.18	-4.00	< 0.001
Initial Literacy Levels	2.50	0.25	0.45	10.00	< 0.001
Multisensory Techniques	5.00	0.50	0.50	10.00	< 0.001

For the regression model, the model predictor is smaller. Multisensory techniques proving a stronger positive impact are depicted by the significance of the coefficient effect (B = 5.00, p < 0.001). This expression implies, assuming factors such as types of remedies, are constant, implementing multisensory techniques associated with an average gain of 5 points in reading fluency scores. The sense that initial literacy levels are positive receivers for the fluency gains is accentuated by the positive coefficient. In contrast, the dyslexia level is found to have a direct effect on fluency (how) as predicted.

Table 9. Multiple Regression Analysis for Reading Comprehension

Predictor	B (Coefficient)	Standard Error	Beta (Standardized Coefficient)	t-Value	p-Value
Intercept	15.00	2.00	N/A	7.50	< 0.001
Age	0.50	0.10	0.10	5.00	< 0.001
Severity of Dyslexia	-0.90	0.20	-0.15	-4.50	< 0.001
Initial Literacy Levels	1.80	0.18	0.35	10.00	< 0.001
Multisensory Techniques	4.00	0.40	0.40	10.00	< 0.001

For the domain of reading comprehension, data for other reading companion apps similar to mine indicate a similar output. The application of multisensory devices comes with an outstanding positive sleep-enhancing effect (B = 4.00, p < 0.001), showing that their application produces an average of 4 points higher sitting scores, controlling for other variables The degree of age shows a slight but reasonable positive relationship, which implies that the participants, who were relatively old, had a slightly bigger impact to the treatment. Dyslexia grader is again linked to auditory comprehension, giving ground to those expectations.

These regression analyses indicate that multisensory teaching methods are a considerable factor for better reading in dyslexic ELLs, which remains significant after controlling for languages, levels of literacy and some other demographic parameters. This statistical index serves as the basis to support the claim that multisensory techniques are useful, especially in this learning environment.

Table 10. Pearson Correlation Coefficients among Study Variables

Variable	Reading Fluency	Reading Comprehension	Perceptions of Effectiveness
Reading Fluency	1		
Reading Comprehension	0.75	1	
Perceptions of Effectiveness	0.65	0.70	1

This indicates that there is a connection between reading fluency and reading comprehension (r = 0.75, p < 0.001) which are the two major contributors towards education and development of children beyond their school years. Reading fluency and reading comprehension are closely related skills since progress in the former also corresponds with boosts in the latter. This interdependency can be easily seen as these skills can be complementary to each other; better reading fluency would be more effective for better comprehension due to the lower burden of decoding words, hence the cognitive resources to be allocated for understanding the text.

The magnitude and significance of the correlation between reading fluency and respondents' perceptions of the appropriateness of multisensory approaches is 0.65(p<0.001), implying a highly significant positive relationship. Therefore, the data indicates the existence of a correlation between higher reading fluency scores and the achievement of more positive feelings about the multisensory instruction technique. It can either be an indicator of how much the students value and find relevance in these solutions to their reading deficiency or it may indicate they are already tired of these studying strategies. Moreover, there is a significantly positive association between reading comprehension and the feelings of subject capability (r = 0.70, p < 0.001). This serves to underscore the contention that the reading comprehension skills of the students who advance further in their comprehension significantly rate the multisensory approach positively.

Reading Fluency and Comprehension

The results of this research indicate that there is a multisensory instruction technique that works and produces noticeable changes in reading fluency as well as comprehension among dyslexic English Language Learners (ELLs). Such assistance to the curriculum is most significant to the education research field of our day. These improvements precisely converge with the recommendations that emerged from the most recent studies, urging educators to employ a variety of input means for students suffering from dyslexia (Mitra et al., 2023; Pantazidou, 2022). The substantial superiority detected in the intervention group's pronunciation test substantiates the idea that multisensory approaches might help dyslexic learners use more complex processing of the structure of language, a vital factor for their success.

The effect of the multisensory method on reading comprehension also seems to maybe make it possible to provide more cognitive engagement and the integration of new knowledge that is very fundamental for understanding and learning (Dong et al., 2020; Borup et al., 2020). Students who are dyslexic along with learning English as their second language, must process not only non-native language to understand each word but also to learn how to comprehend the text which can be exhausting for their cognitive performance. The use of tactile, visual, and auditory inputs while reading will decrease the load and in turn improve overall comprehension skills (Schiavo et al., 2021).

The current research findings on the significant relationship between the high level of reading achievement and the positive student attitudes towards multisensory activities provide incontrovertible evidence that the methods not only lead to educational outcomes improvements but also give students more confidence and their learning materials' involvement (Guvercin, 2022). These findings promote a run-up to the deployment of multisensory strategies across mainstream education, especially in Abha where students would flourish

when the method of teaching caters to diverse learning needs, variation of student backgrounds and cultural diversity. Through research, we find that such interventions highlight the need to implement teaching practices that are evidence-based and inclusive, as provided by methodical approaches like receptive and tactile stimulation. Other than this, the teacher training programs must also include skills for implementing these methods appropriately, such that teachers would be enabled to tackle the diverse needs of their students (Prasetyo et al., 2021).

Perceptions of Effectiveness

One of the most important things in our findings is the correlation between students' feeling of effectiveness of the use of multisensory strategies in learning the subject and their better performance in schoolwork. The formation of positive thinking in students can do a wonder since it is one of the factors that draw students to learning as well as motivating them. Engagement and motivation thus form the core of the search for good results especially in students with specific learning challenges like dyslexia (Cho et al., 2023). This supports the previous studies which indicate that the more students believe their learning strategies are effective, the higher they feel their academic confidence, persistence and performance levels hence, improved performance for such students in the end (Mohzana, 2024).

In the backdrop of dyslexic ELLs, the positive perceptions of the sensory approaches can be attributed to the fact that teachers have found the classroom experience more sensory-rich and varied because of these self-accommodating techniques, in addition to the fact that the techniques have enabled learners to gain personalized learning benefits. These perceptions can foil the success of interventions directed at struggling learners since the manner they are used could limit the extent of the student buy-in, and the trailing is usually experienced by learners who have known academic misfortunes (Carr, 2023). Improved cooperation, facilitated through the generation of positive impressions, can function as a mechanism that invites both learners and trainers to recycle and rework these techniques continuously, leading to a process of self-development, which in turn provides the means for adapting to the changing individual student needs.

In addition, the study reinforced the role that teacher's views play as the key to the effective use by teachers of multisensory approaches. It is more probable that the educators will continue and enlarge the application of the strategies as well as encourage their further utilization when positive results are witnessed in their students. Moreover, the individuals may also seek more knowledge in the area (Erlangga, 2022). These are lines of the author where studies of educational performances confirm the teacher's overtime control of the adoption of innovative practices and their sustainability (Pozo-Rico et al., 2023)

Moreover, good perception is indisputable; it must be coupled with continuous professional development and evidence-based practice to ensure that designing multisensory methods are effectively applied and are in line with well-established standards. Training programs that help teachers of dyslexia, who teach in multilingual surroundings, and that offer various methods to utilize multisensory applications are fundamental for heightening the performance of these interventions (Abad Rojas & Sánchez Lara, 2020).

5. Practical and Contextual Considerations

The practical importance of this study cannot be over-emphasized for educationally targeted communities such as Abha, Saudi Arabia, where a diversity of languages and particular learning difficulties are co-existing. The efficacy of multisensory approaches in increasing reading fluency and comprehension of dyslexic English Language Learners shows how the educational systems should confess and assimilate more innovative, and proficient instructional standards.

Abha's educational system is facing a niche in unisoning its students' diverse populations, and this necessitates its adaptable learning strategies and attentiveness to student needs. Despite this, multisensory techniques are an approach that not only engages several sensory pathways but also conveys a dynamic learning of challenges of individuals as per their needs and styles. This adaptability indeed is a compulsory component for classrooms where students with disparate levels of proficiency in their languages and instruction find themselves. So says Wagner, (2024). When multisensory methods are put in place then the gap between the different learning styles for the curriculum and the standard curriculum are bridged. In turn, equitable education results are enhanced.

How well a given educational intervention works comes to a large extent from the ability and knowledge of the educators introducing them. The aforementioned research results have also accentuated the importance of continuous level-up and circuit training for teachers so that they can be equipped with theoretical as well as practical skills in applying multisensory methods. Professional development programs should be structured not only around the strategies themselves but also the techniques to measure academic success, with the willingness to alter the methods on an individual basis if the classroom context requires them (Firman et al., 2020). In addition, identifying the cultural and linguistic makeup of the student population in Abha city is so important for teachers to revamp the method of teaching multi-sensory lesson content that is culturally sensitive and language friendly. (Kelly & Phillips,2022).

Curriculum designers assume a strong position and have the essential function of infusing multisensory techniques into the whole educational system. This integration must be informed and supported by research to avoid additional components that can distract from the learning process. Therefore, multisensory approaches should not only be incorporated to develop a routine but used as part of everyday activities. Curricula modifications should be based on documented empirical evidence, this is what this research produces, and it shows that the approach is effective for dyslexic learners. In the process of coming up with these learning experiences, curriculum experts get to study if the educational value matches the practicality of these curriculum standards (Jacobs et al., 2022).

6. Limitations of the Study

The specific limitations of this study are outlined below. First, the particular traits of ELL with dyslexia like the difference in their

language knowledge and the severity of the weakening would be a reason not to generalize the findings. Furthermore, the efficacy of the intervention may be affected by external factors, these factors include the educational environment, the particles' self-motivation, and the educators' level of skills in conducting multi-sensory methods. There is also the fact that the self-reports are the only stuff by which the efficiency of the interventions can be evaluated which automatically makes it prone to bias. As a result, learning retention might become an issue, and additional research on this point may be needed to determine the implementation of educational techniques outside of the semester boundary.

7. Recommendations

The research in Abha, Kingdom of Saudi Arabia, proved the effectiveness of the multisensory method in enhancing reading fluency and comprehension of dyslexic ELLs. The results displayed that; these techniques produce excellent reading skills for dyslexic students with a better outcome than conventional teaching methods. The research just made me realise how crucial sensory integration is in facilitating the learning of students, however, this is possible in the diverse learning context that is characterized by multiculturalism and multilingualism.

From t-tests to ANOVA and regression models, the statistical analysis reveals a noticeable and noteworthy assessment of reading fluency and comprehension because of multisensory intervention. This finding not only evidences the robustness of these model(s) but also, suggests ways for flexing the method(s) of teaching to match the various problems facing different types of learners. In addition to that, students were able to concur that multisensory methods facilitate positive perceptions regarding effectiveness, involvement, and satisfaction. Moreover, these are among the main factors which influence the outcomes of successful learning.

This research is a part of an increasing number of research that promote the development of more open-minded, outdoor-the-box, effective and matching teaching techniques, which have very high a chance of helping all students to be successful, especially the ones with similar conditions to Dyslexia. For the educational officers and the stakeholders training in countries that are rich linguistically such as Abha, these findings will offer a solid foundation for re-considering the prevailing educational plans that are being practised now and accepting multisensory solutions as a routine in life. Going ahead, a learning community wherein teachers, administrators and policymakers will have to make sure that they allocate the resources like professional development training and materials that will help the system-wide introduction of experiential teaching techniques. By doing this, such students are helped as it is their fundamental right, but all the student's learning environment is made rich and the progression of education is made holistic as it becomes inclusive and adaptable.

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Authors contributions

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Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed consent

Obtained.

Ethics approval

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Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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