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Effectiveness of Video Self Modelling (VSM) in Improving the Reading Fluency of Students with Reading Difficulties

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KEYWORDS Experimental Design. Improving Learning. Learning Disability. Oral Reading, Single-Subject

ABSTRACT The study aimed to identify the effectiveness of video self-modelling in improving reading fluency of students with reading difficulties and measuring the effectiveness of this procedure in retaining this skill. The study used a single-case design approach represented by a multiple investigation design. The subjects of the study were four students with reading difficulties. The study concluded that using video self-modelling can be effective in improving the elements of oral reading fluency, thus enabling students to raise their reading accuracy rate and reach their respective age-appropriate averages in reading. The results indicated that using video self-modelling contributed to students retaining the elements of reading fluency. The study also showed that the intervention method was socially acceptable by the teacher and parents. The results of the study also showed a high effect size of video self-modelling in improving reading accuracy and a medium effect size in increasing the reading rate.

INTRODUCTION

Reading difficulties are among the most important challenges facing students in the primary stage (Vaughn et al. 2024). They are also one of the most widespread academic issues among students enrolled in the reading difficulties program, representing the main reason for failure in many academic subjects. The failure to acquire reading skills not only impacts the students' future from an academic standpoint, but also has a negative psychological impact upon the students, as it is the most basic skill around which the educational process revolves. Mastering such a skill is a necessary requirement for success in other academic subjects (Schunk 2023). Again, addressing reading difficulties early on is crucial for preventing long-term academic struggles and fostering a positive self-concept in students. Therefore, identifying effective interventions that target the core components of reading proficiency, particularly reading fluency, is essential for supporting students with reading difficulties. This study investigates the efficacy of video self-modelling (VSM), a technology-based intervention strategy grounded in social learning theory, in improving oral reading fluency among primary school students with reading difficulties.

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Background

The key to assessing whether a student has reading difficulties lies in evaluating the skill of reading fluency, not only because it represents one of the necessary elements of reading and a manifestation of students' mastery of such a skill, but also because it plays an important role in helping students to understand various subjects, as there is a strong relationship between fluency and reading comprehension. According to Wang et al. (2023), reading fluency helps the student understand the meaning of the material being read and represents one of the goals of early intervention programs that aim to prevent reading failure. Reading fluency is evaluated based upon two dimensions, that is, the ability to learn words quickly and accurately, and the ability to assemble words into meaningful units (Shaaban and Mohamed 2023).

Kusumarasdyati (2023) emphasized the significance of reading fluency, viewing it as a key and essential element of all reading abilities. Indeed, it is so important that it has become a key yardstick when assessing students' level of performance in primary reading skills. Since reading fluency is one of the elements that contribute to the success or failure of reading performance, it is clearly related to many other reading skills.

Laying the foundation for reading fluency involves repeated reading and re-reading of familiar texts to help build early recognition and aware-

ness (Barwasser et al. 2021). Teaching reading in schools is plagued with problems, including the tendency of some teachers to use a dry, stereotypical, and largely traditional approach to teaching, especially at the primary level, even though teaching reading is now heavily reliant upon modern, more effective techniques (Sadusky et al. 2022).

Indeed, there is an unmistakable correlation between reading fluency and comprehension, as affirmed by a study conducted by Piper et al. (2016). A review of the literature and studies that addressed reading difficulties showed that reading fluency and its constituent dimensions, including fast recognition of words and accuracy in reading them, are key to improving reading skills. Burns (2023) conducted an experimental study with a sample of 223 second- and third-grade students, found that both accuracy and rate scores were significant indicators of reading fluency development, supporting the learning hierarchy model in reading instruction.

Considerably, Ward et al. (2022) identified an urgent need to provide balanced instruction in reading, which includes five interconnected core skills of phonemic awareness, phonics, vocabulary, reading fluency, and comprehension, which must be mastered by students before they can become competent readers. Video self-modelling (VSM) is one of the technology-based strategies through which the academic skills of students with reading difficulties can be improved and further developed, as it is one of the forms of observational learning where students observe themselves successfully displaying a certain behaviour on video, imitate it, and eventually perform it successfully and independently. This method, which relies on the use of technology, serves as a motivation and incentive for the students to repeat their attempts to achieve full mastery of reading (Darling-Hammond et al. 2022).

Satsangi et al. (2021) described video modelling as a technology that increases self-efficacy, as it provides clear information about how best to perform certain tasks and enhances self-confidence. As an intervention, video modelling distinctly differs from other strategies in this respect. The approach depends mainly on the student watching video clips, without requiring reinforcement or entailing punishment. Videos can also be watched repeatedly, thus helping the student to recognise their behaviour or the level of performance of a given skill. Modern technology such as iPads can also be used to facilitate access to relevant videos (Morris et al. 2022).

By allowing students to observe themselves successfully reading fluently, VSM has the potential to enhance motivation, self-confidence, and ultimately, reading performance. This innovative approach aligns with the need for balanced and comprehensive reading instruction that addresses the interconnected core skills necessary for reading competency, as highlighted by recent research. As such, investigating the effectiveness of VSM in improving oral reading fluency among students with reading difficulties holds significant implications for educational practice and student achievement.

Objectives

i. To examine how Video Self-Modeling (VSM) improves reading accuracy in students with reading difficulties based on the principles of observational learning theory.
ii. To investigate how Video Self-Modeling (VSM) increases the reading rate in students with reading difficulties by applying observational learning concepts.
iii. To explore how Video Self-Modeling (VSM) helps students with reading difficulties retain reading fluency skills once acquired, considering the mechanisms of self-regulated learning.

Research Questions

While the theoretical foundations and empirical evidence suggest the potential efficacy of VSM in improving reading fluency, there remains a need for further investigation into its specific impact on students with reading difficulties. Addressing the persistent challenges faced by this population requires a focused examination of interventions tailored to their unique needs. By employing a rigorous single-subject experimental design, the present study aims to contribute to this area of inquiry and provide insights into the following research questions:

1. How does VSM improve reading accuracy among students with reading difficulties based on the principles of observational learning theory?
2. How does VSM increase the reading rate among students with reading difficulties drawing from observational learning concepts?
3. How does VSM help students with reading difficulties retain the skill of reading fluency

once acquired considering the self-regulated learning mechanisms?

Theory of Learning Through Observation and Imitation (Observational Theory)

Observational theory was first introduced by Albert Bandura and is based on the premise that learning occurs through imitating others or imitating a model under certain conditions. This theory emerged because of the growing interest in the role played by the media in shaping behaviours. The experiments conducted by Bandura proved that when a child watches a certain behaviour, they tend to imitate it, which is called learning by imitation, simulation, modelling, or observation, according to social learning theory. Bandura noted that modelling is the best teaching method when the response to be taught is totally new (Doak 2021).

According to Bandura and Adams (1977), the process of observational learning involves four key components of attention, retention, motor reproduction, and motivation. Individuals must first attend to the modelled behaviour, then retain the information in their memory, translate the symbolic representations into appropriate actions, and possess the necessary motivation to reproduce the behaviour. Bandura further proposed that observational learning is facilitated by factors such as the perceived similarity between the model and the observer, the functional value of the behaviour, and the perceived consequences of the modelled behaviour (Rafiola and Ramlib 2018).

The foundations of VSM were laid through Bandura's social learning theory, which reflects Bandura's belief that by observing others, one can develop a working concept as to how to implement new behavioural patterns (Rumjaun and Narod 2020). On the one hand, this strategy relies on self-imitation and self-simulation, meaning that the learner sees himself displaying a desired behaviour after correcting any mistakes made during taping. On the other hand, this strategy is based upon Skinner's effective behaviour theory, which proposes that individuals are capable of self-monitoring and distinguishing between their positive and negative behaviours. It is also considered one of the more effective behaviour modification techniques, which, in turn, increases the learner's self-confidence through repeated views. Although videos are the most used method for this procedure, audio tapes, photographs, printed stories, or role-play can also be used (Kellems et al. 2022). Modern technology has introduced a new conceptual reality where teaching methods are concerned, and indeed, such technology has brought about so many changes in learning concepts and theories that the teaching and learning processes have become heavily reliant upon it. Teaching reading is an arduous task, as affirmed by many of those involved in education, hence the important role of technology in overcoming these difficulties.

Within the framework of Social Learning Theory, VSM serves as a powerful tool for observational learning and self-modelling. By creating videos that depict the successful performance of a desired behaviour, such as reading fluently, students are provided with a model that is highly like themselves. This self-modelling approach can enhance attention, retention, and motivation, as students are more likely to identify with and seek to emulate their own successful behaviours. Additionally, the functional value of reading fluency and the positive consequences depicted in the videos (praise, applause) can further reinforce the desired behaviour through vicarious reinforcement (Rafiola and Ramlib 2018).

METHODOLOGY

Research Design

The study used a single-subject design following the experimental approach. Such designs play an important role in the field of special education and are used to study the functional relationships between independent variables and dependent variables (Kim et al. 2020). The study was based on the multiple probes across participants, designed to verify the functional relationship between the independent variable (VSM) and the dependent variable (reading fluency).

Participants

The study included four students enrolled in the reading difficulties program, of whom two were fourth-grade students and two were fifth-grade students. Their ages ranged from 10 to 11 years, and they were chosen intentionally according to the fulfilment of several criteria. These criteria included receiving a formal diagnosis of a reading disability from a certified educational psycholo-

gist, scoring below the 25th percentile on a standardised reading assessment, and having no comorbid conditions such as intellectual disabilities, sensory impairments, or severe emotional/behavioural disorders that could confound the intervention's effects. The participants were recruited from a pool of students receiving specialised reading instruction at the school, and informed consent was obtained from their parents or legal guardians. To maintain anonymity, pseudonyms were used in place of the students' real names throughout the study. Table 1 shows the details regarding the participants' data.

Oral Reading Fluency

The dependent variables were oral reading accuracy and reading rate, which are key components of oral reading fluency. Reading accuracy was calculated as:

(Number of words read correctly / Total words) x 100

The reading rate was the number of words read correctly per minute.

Curriculum-Based Measurement (CBM)

CBM procedures were used to establish baseline performance and compare participants' reading skills to classroom norms. Three separate reading probes of equivalent difficulty were administered, with the median score used as the initial baseline data point.

The following is an explanation of the reading texts and the procedures for applying VSM.

Reading Texts

Several reading stories designed for primary-stage students with reading difficulties were initially analysed. The analysis involved reading all the texts in the Arabic book curriculum for the first and second semesters of the second to the fourth grades of primary school, which totaled 44. From the analysis, 12 reading texts were subsequently chosen and divided into four levels, ensuring that such texts were equivalent in terms of the approximate number of words, level of difficulty, and proportion of included linguistic skills. These texts were then presented to a panel of arbitrators to verify their validity and suitability to achieve the desired goal. The arbitrators agreed that the texts were linguistically sound, the vocabulary included was clear, and the proportion of linguistic phenomena included in each reading text was equal. The percentage of agreement ranged from 90 percent to 100 percent.

A pilot test was also carried out using a sample of 80 students from the second to the fifth grade of primary school, with 10 students being presented with the same two texts to ensure the suitability and clarity of the wording of the topics and the equivalence of the written texts. In addition, its reliability was verified using the Pearson correlation coefficient, and the resulting value was 0.887, which is a statistically significant value at the significance level of $0.05e^{>cc}$, thus indicating that the written texts applied in this study had a high degree of reliability.

Procedures Followed for Applying VSM

VSM was designed as a systematic intervention method to teach oral reading fluency. Having previously reviewed the relevant studies and literature, the reading texts were then distributed so that each session contained one text, with the levels of such texts being commensurate with the difficulties that each student experienced. This procedure is followed in the reading difficulties program with all students as stated in the reading difficulties teachers' guide. The severity of the difficulties is determined according to the data obtained about the student before the intervention by the language subject teacher and the reading difficulties teacher. The strategy was applied to the students participating in the study at a rate of five sessions per week for each student. Each session lasted 20 to 30 minutes, during which the reading of each student was videotaped and subsequently edited using the iMovie program so that it was edited to contain only the student's performance of the correct reading while deleting errors. The duration of the videos ranged from two to three minutes. The video was shown to the student in a quiet place so that she could pay attention and focus. At the beginning of each session, that is, before teaching began, the video, containing an introduction bearing the student's name, was shown using an iPad with headphones, while at the end it contained the sound of applause as an additional motivation and reinforcement for the student.

Table 1: Participant data

Name	*Diagnosis*
Souad	She is 10 years old, in grade four, she has a twin sister in the same grade, and both are the second eldest of their 4 siblings, she has difficulties in reading and maths. Souad's family is of average economic level, and her developmental history is normal. Her mother's intra-gestational health, intrapartum and postpartum health was good. She was delivered in the seventh month of pregnancy.Souad has delayed speech and language unlike her twin sister, received all vaccinations and enjoys normal hearing and visual abilities Souad is thriving with a stable emotional and psychological development, and does not have any health problems or behavioural disorders.Sweets and stickers top the student's dietary preferences, as a form of social reinforcement, and also tends to acquire material things (such as three-dimensional toys, accessories, story books), and the preferred activity is drawing.
Hadeel	Hadeel is an 11-year-old fifth grade student with reading and maths reading difficulties, having been classified as academically poor in both subjects according to her evaluation and diagnosis report. She has a younger brother. Hadeel's family is a tight knit one and is of average economic level. Hadeel's developmental history is normal. Her mother's intra-gestational health, intrapartum and postpartum health was good. She was delivered by NVD at full term.Hadeel has normal hearing abilities but suffers from myopic vision (near-sightedness). Her teacher recommended her as a good candidate for the study because of her high motivation to learn. Hadeel is thriving with a stable emotional and psychological development. She does not have any health problems or behavioural disorders. Chocolate, milk and sweets top Hadeel's dietary preferences, while stickers and thank you cards top her symbolic preferences. She likes shoulder patting as a form of social reinforcement. She also tends to acquire material things (such as three-dimensional toys, accessories, story books). Finally, her preferred activity is watching animated movies.
Samia	Samia is an 11-year-old fifth-grade student with reading difficulties, having been classified as academically poor in both subjects according to her evaluation and diagnosis report. She has 6 siblings (3 brothers and 3 sisters) of whom she is the third eldest. None of Samia's siblings suffers from a similar reading difficulty. Samia's family is a tight knit one and is of average economic level. Samia's developmental history is normal. Her mother's intra-gestational health, intrapartum and postpartum health was good. Samia was delivered by NVD at full term and has normal hearing and visual abilities. Her teacher recommended her as a good candidate for the study because of her high motivation to learn. Samia is thriving with stable emotional and psychological development. She does not have any health problems or behavioural disorders. Chocolate, juice and sweets top Samia's dietary preferences, while star shaped stickers top her symbolic preferences. She likes verbal praise as a form of social reinforcement. She also tends to acquire some material things (such as three-dimensional toys, accessories, story books). Finally, her preferred activity is watching animated movies and drawing.
Boshra	Boshra is a 10-year-old fourth-grade student with reading difficulties, having been classified as academically poor in oral reading according to her evaluation and diagnosis report. She has 5 siblings (4 sisters of whom one is her twin). None of Boshra's siblings suffers from a similar reading difficulty. Boshra's family is a tight knit one and is of average economic level. Boshra's developmental history is normal. Her mother's intra-gestational health, intrapartum and postpartum health was good. Boshra was delivered in the eighth month of pregnancy and has normal hearing and visual abilities. Boshra is thriving with a stable emotional and psychological development. She does not have any health problems or behavioural disorders. Chocolate tops Samia's dietary preferences, while cardboard figures top her symbolic preferences. She likes shoulder patting as a form of social reinforcement. She also tends to acquire some material things (such as three-dimensional toys, accessories, story books). Finally, her preferred activity is watching animated movies.

The study was conducted over two stages wherein the first stage was dedicated to the collection of curriculum-based measurement data, while the second stage was dedicated to the implementation of the VSM technique.

Procedures

Stage 1

At the beginning, the research focused on the curriculum-based measurement standards with the

aim of comparing the performance of the students participating in the study with the performance of their classmates. The teacher administered a brief test to the students, involving the academic subjects that they had learned as part of the curriculum. This approach has been utilised by many researchers in measuring and monitoring the progress of students with reading difficulties, such as Legg's (2013) study.

Gifford (2016) explained that curriculum-based measurement in the field of reading provides a valid and reliable method that can be used to identify students at risk of failure in reading and to determine their actual level of learning. The reading texts used in the curriculum-based measurement of oral reading fluency should be different, but equivalent in terms of the number of words, with each text containing at least 200 words. It should also be grade-appropriate, as the skills included in the text should be the same skills that students are expected to master during a specific grade year. Typically, reading texts are chosen by the end of the school year or even at the beginning of the next school year. When the curriculum-based measurement is applied for the first time, three different reading pieces should be used per session, and the median score is then used to calculate the first data point on a graph.

Accordingly, this study conducted such a comparison over a period of approximately three weeks from the beginning of the second semester of 2022. Initially, three reading texts were selected from a different language curriculum and were equivalent in terms of difficulty and did not exceed 200 words. The three reading texts were presented simultaneously to each individual participant, who was asked to read it, and then their respective reading accuracy was calculated according to the following equation:

Number of correct words ÷ Number of words in the text x 100

The average number of correct words per minute was calculated for each reading text, and then the median score was used to calculate the reading average per class. The data from all 236 students were then collected.

Table 2 shows the scores of the students participating in the study compared to the reading average of their class.

Stage 2

This stage involved three consecutive phases of the baseline phase, the intervention phase, and the retention phase.

Baseline Phase

During baseline, each participant's oral reading fluency was assessed individually using CBM reading probes, with no intervention implemented. The baseline continued until a stable pattern was observed or countered by introducing the intervention, following multiple probe design logic. The initial CBM median score served as the first baseline data point for all participants. The baseline phase sessions were administered separately to each participant who was then examined on an individual one-to-one basis. These sessions were only dedicated to measuring the pre-intervention level or the real/actual level of the oral reading fluency skill. In the baseline phase, the median score for the curriculum-based measurement was used as the first data point for all students, and then the data recording process continued for the first student only over three consecutive sessions, thus giving four baseline points, one of which was the investigation point and other three the baseline predictor points.

Intervention Phase

The independent variable was a video self-modelling (VSM) intervention aimed at improving

Table 2: Results of the curriculum-based measurement of oral reading fluency

Student	*Average reading accuracy of class*	*Pre-intervention average reading accuracy of student*	*Average reading rate per class*	*Pre-intervention reading rate of student*
Souad	89%	34%	56 words	12 words
Boshra	89%	50%	56 words	27 words
Hadeel	92%	68%	69 words	14 words
Samia	92%	67%	69 words	10 words

oral reading fluency. During intervention sessions, the following steps occurred:

1. The participant read a text passage aloud while being video recorded.
2. The video was edited using iMovie to remove any errors, showing only correct reading.
3. The edited video clip was presented to the participant on an iPad with headphones in a quiet setting.
4. After watching the video, the participant re-read the same passage aloud.
5. The researcher recorded reading accuracy and rate data during this reading. The following equation was used: number of correctly read words ÷ total number of text words x 100.
6. The reading rate was also calculated as the number of words correctly read by the student per minute.

Intervention sessions were conducted 5 times per week for 6 weeks, with each participant receiving 7 sessions. The intervention was staggered across participants in a multiple probe sequence based on baseline patterns.

Retention Phase

The participants' reading was evaluated after the intervention to observe any change in their reading abilities by presenting them with new texts that they had not read before. A week after the end of the intervention, the first student's retention session was videotaped, as she was presented with a new reading text that she had not read before in the baseline or intervention sessions. She was asked to read it aloud to ascertain whether the oral reading fluency skill had been retained. At this time, the recording of the intervention data for the second student and the baseline measurements for the third student were still ongoing. This process continued for each student consecutively.

Interobserver Agreement (IOA)

IOA was calculated for 33 percent of all sessions to ensure the reliability of scoring the dependent variables. The overall IOA was 99 percent for reading accuracy and 99.5 percent for reading rate across sessions.

Visual Analysis

Participant data was graphed and visually analysed using conventional single-case design techniques of examining changes in level, trend, variability, immediacy of effect, and overlap across phases. This provides an evaluation of the functional relation between the intervention and the dependent variables.

Effect Size

The Tau-U effect size was calculated to provide an additional quantitative analysis of the intervention effects for each participant, supplementing the visual analysis.

Reliability of Agreement Between Observers

The reliability of agreement between observers was measured to verify the reliability of the recorded students' responses during the baseline, intervention, and retention sessions. The reliability rate of the recorded responses was 33 percent of the sessions for all participants according to the observers. The observation recording process took place at the same time without any interference or influence from any other parties. The number of sessions consistent with this percentage was determined using the following equation: total number of sessions x 0.33.

Accordingly, the total number of sessions with 33 percent agreement was 19, calculated by applying the following equation:

$57 \times 0.33 = 18.81$ H≈ 19 sessions

The reliability of agreement between the observers per session was determined by dividing the lesser result by the higher result and multiplying by 100. The reliability rate of agreement between the observers in the study variable per session ranged from 95.8 percent to 100 percent. The overall average reliability rate of agreement between the observers with respect to the reading accuracy skill during all sessions was 99 percent, and the overall average concerning the reading rate skill was 99.5 percent. This is a strong indicator of the accuracy of the researcher's recording of the results of the dependent variable in this study. Table 3 shows the results of the reliability of agreement between the observers.

RESULTS

This section presents the results of the study evaluating the effectiveness of the video self-mod-

Table 3: Reliability of agreement between observers

Total No. of sessions	*No. of 33% of 1st sessions*	*Session No.*	*Percentage*	
			Agreement: Reading accuracy	*Agreement: Reading rate*
57	18.81 H= 19	1st Session	97.8	100
		2nd Session	100	97
		3rd Session	95.7	100
		4th Session	97.8	100
		5th Session	95.8	100
		6th Session	100	97
		7th Session	98.9	100
		8th Session	100	100
		9th Session	100	100
		10th Session	100	97
		11th Session	98.9	100
		12th Session	99	100
		13th Session	100	100
		14th Session	100	100
		15th Session	98.8	100
		16th Session	97.7	100
		17th Session	100	100
		18th Session	100	100
		19th Session	100	100
Total			1881.5%	1891
Average			99%	99.5

elling (VSM) intervention for improving oral reading fluency in students with reading difficulties. The data are organised by the three research questions, analysing each student's reading accuracy and reading rate scores across baseline, intervention, and retention phases. Effect sizes quantifying the VSM intervention's impact are reported. Visual analysis techniques were used to examine data patterns and determine functional relationships between VSM and the dependent variables. Connections to observational learning theory and the intervention's social validity are discussed. Overall, the results illuminate the efficacy of VSM as an evidence-based practice for enhancing reading fluency skills.

Scores

Research Question 1: How does VSM improve reading accuracy among students with reading difficulties?

The changes in students' reading accuracy scores from baseline to intervention and retention phases demonstrate how VSM improved this key component of reading fluency.

Souad: The scores showed a marked improvement in Souad's reading accuracy, bringing it up to the average reading accuracy level of her classmates as of the second intervention session. Recording the student's performance data during the baseline stage began as of the first week over three consecutive sessions. This procedure serves as a basis for subsequent logical judgement if the effect of other variables is controlled, as it indicates the existence of a correct functional relationship between the independent variable (VSM) and the dependent variable (improving the reading accuracy component). The relative stability in the student's baseline results was noted, with a slight increase in the second session. This may have been due to the student's delay in starting to read aloud, so at that time, she was reading silently. The reading accuracy rate at this phase ranged between 34 percent and 40 percent, with an average of 36 percent. This result indicates a decrease in Souad's reading accuracy, which confirms the importance of the intervention.

The intervention phase began at the end of the first week, where VSM was used to increase Souad's reading accuracy. The intervention demonstrated the effectiveness of the VSM approach in improving Souad's reading accuracy, as she responded to the intervention method and achieved the required standard independently and without assis-

tance. The student's reading accuracy rate stabilised during the sessions at 92 percent but then increased in the last intervention session to 95 percent. This may have been due to a change in the scheduled time of the session because it coincided with the student's activity class. The last session was conducted in the third period before recess, where the student came on her own to the learning resources room and expressed her desire to start the session. She appeared so highly motivated that even after the end of the intervention sessions, she continued to visit the learning resources room daily to read and even asked to be evaluated and to have her results recorded.

The researchers calculated the effect size using Tau-U, and the result was 0.96 (CI90 % [0.343, 1], p=0.0107), which indicated that the effect size of the VSM intervention on improving the student's reading accuracy was high, and the improvement she achieved must be logically judged as being attributable to VSM. Souad's scores can be observed in Table 4.

Table 4: Souad's reading accuracy during the intervention session

Phase	*Session No.*	*Student's score (%)*
Baseline Phase	1st Session	34
	2nd Session	40
	3rd Session	35
	4th Session	35
Intervention Phase	5th Session	68
	6th Session	90
	7th Session	92
	8th Session	92
	9th Session	92
	10th Session	92
	11th Session	95

Hadeel: Hadeel showed a noticeable improvement in her reading accuracy, reaching the level of her classmates after seven intervention sessions. The researcher made an initial measurement of the baseline phase to identify the student's pre-intervention level. When the performance of the first student (Souad) stabilised in the intervention phase, specifically in the fifth session, the researchers started to record the data for Hadeel's performance at baseline. The student's recorded result was lower than the first session. This may have been due to the text being too difficult for her, as she tended to spell a lot and made too many mistakes when reading. However, her reading accuracy increased slightly in session 11, which may be due to the teacher for reading difficulties praising Hadeel before starting the session. Overall, it can be said that her performance was stable at this stage, as the percentages she obtained ranged between 60 percent and 68 percent with an average of 60 percent This indicates a decrease in the student's level of reading accuracy compared to her class, which confirms the importance of intervening to improve it. If the effect of other variables is controlled and the strategy is applied, Hadeel's skill level should improve.

The intervention phase began for this student in the third week, where VSM was used to improve her reading accuracy. In general, the VSM technique was proven to be effective, and her reading accuracy improved independently and without assistance. Hadeel responded to the intervention as she achieved the required standard, namely, the average reading level of the students in her class. As per Table 5, the student showed remarkable progress, as the percentages she obtained ranged between 89 percent and 97 percent with an average of 95 percent indicating an increase in her reading accuracy compared to the baseline phase. In session 15, which corresponds to the fourth session of the intervention, the student obtained the highest result (99.5%). This may have been attributable to the fact that her friend attended the session, watched the video with her, and then watched her read, at her request, which may have increased her motivation and self-confidence. On the other hand, upon calculating the effect size using Tau-U, the result was 1 (CI90 % [0.378,1], p= 0.0082), indicating that the size of the effect of VSM on improving the student's reading accuracy was high. The student's scores can be seen in Table 5.

Table 5: Hadeel's reading accuracy during the intervention phase

Phase	*Session No.*	*Student's score (%)*
Baseline Phase	1st Session	68
	9th Session	58
	10th Session	56.5
	11th Session	60
	12th Session	89
Intervention Phase	13th Session	97
	14th Session	96
	15th Session	99.5
	16th Session	96
	17th Session	95
	18th Session	97

Samia: Samia's scores showed a clear improvement in her level of reading accuracy up to the

reading average of the students in her class. Samia's reading in the baseline phase was followed by five sessions. In the second week, the second investigation point was recorded for the student, and when the performance of the second student (Hadeel) stabilised in the intervention phase, specifically in session 16, the researchers moved to the phase of recording Samia's data on the baseline over three consecutive sessions (16, 17 and 18), during which her performance was relatively stable. The percentages she scored in this phase ranged between 67 percent and 61 percent, with an arithmetic average of 63 percent, which was considered relatively low compared to the average reading level in her class, which was 92 percent. It became clear to the researchers that based upon the student's scores at this phase, which originally aimed at predicting the student's reading accuracy without the strategy being applied, her reading accuracy level was low and required intervention.

In the intervention phase, the VSM approach was used to raise Samia's reading accuracy. In general, the effectiveness of VSM in improving the student's reading accuracy independently without providing any further assistance was proven. The student responded to the intervention method as reflected by the fact that the required standard, which was the average reading level of the students in her class, was achieved. The student's reading accuracy stabilised between 96 percent and 98 percent in the intervention sessions, with an average reading accuracy of 95 percent.

On the other hand, upon calculating the effect size using Tau-U, the result was 1 (CI90 % [0.421,1], p = 0.0045), which indicated that the effect size of VSM was high and the student's reading accuracy was improved. The student's scores are shown in Table 6.

Table 6: Samia's reading accuracy during the intervention phase

Phase	*Session No.*	*Student's score*
Baseline Phase	1st Session	67
	8th Session	69
	16th Session	61
	17th Session	60
	18th Session	61
Intervention Phase	19th Session	90.7
	20th Session	94
	21st Session	96
	22nd Session	97
	23rd Session	96
	24th Session	98
	25th Session	96

Boshra: Boshra was highly motivated and exhibited a strong desire to participate in the study. The reason may have been that she was influenced by the participation of her twin sister in the study, which reflected positively upon her level of reading accuracy, which improved up to the average reading level of the students in her class after seven intervention sessions. When the performance of the third student (Samia) stabilised in the intervention phase, the researchers began recording Boshra's performance data on the baseline over three consecutive sessions (23, 24 and 25). The student's performance fluctuated between the two sessions (23 and 25), potentially due to a discrepancy in the level of difficulty of the two texts presented to the student. Table 7 clearly shows that the scores she obtained in the baseline stage ranged between 46 percent and 64 percent, with an average of 54 percent. These percentages demonstrate the student's low level of reading accuracy compared to the reading level of her class. This reflects the importance of the intervention to improve the student's reading accuracy, and that controlling the impact of other variables and applying VSM will have a positive effect on improving her skill level.

In the intervention phase, VSM was used to raise the reading accuracy component for Boshra. Given the exceptional circumstances experienced during the COVID-19 pandemic, during which in-person studies were suspended in all public schools, the intervention sessions were continued with Boshra through the Teams platform, being one of the technical platforms that guarantee academic quality. The first and second intervention sessions were administered before the study was suspended, while the last sessions were administered in the sixth week through the Teams platform, where the researcher, in cooperation with the student's mother, sent an audio clip of the student reading the text and then applied the procedures followed by VSM as previously mentioned.

In general, the VSM technique was shown to be effective in improving Boshra's reading accuracy, which was achieved independently without the provision of any further assistance. The student responded to the intervention and achieved the required standard, which was to reach the average reading accuracy level of the students in her class. Her reading accuracy stabilised during sessions 28, 29 and 30, achieving 97 percent and 96 percent

during the last two sessions respectively, with an average post-intervention reading accuracy of 95 percent. When the effect size was calculated using Tau-U, the result was 1 (CI90 % [0.452,1], p = 0.0027), indicating that the size of the effect of the VSM approach on improving the student's reading accuracy was high. Based on Boshra's performance, it can be said that this improvement is attributable to the VSM intervention. Boshra's scores are shown in Table 7.

Table 7: Boshra's reading accuracy during the intervention phase

Phase	*Session No.*	*Student's score*
Baseline Phase	1st Session	50
	8th Session	60
	16th Session	51
	23rd Session	64
	24th Session	55
	25th Session	46
Intervention Phase	26th Session	90
	27th Session	95
	28th Session	97
	29th Session	97
	30th Session	97
	31st Session	96
	32nd Session	96

To summarise the overall intervention effects, the average Tau-U effect size across all four students was calculated for both reading accuracy and reading rate. For reading accuracy, the average effect size was 0.99 (95% CI [0.73, 1.00]), indicating a high overall effect of the VSM intervention on improving students' reading accuracy. For reading rate, the average effect size was 0.66 (95% CI [0.38, 0.94]), suggesting a moderate overall effect on increasing students' reading fluency rate. These results provide additional evidence that the VSM approach was highly effective in enhancing reading accuracy, while having a somewhat smaller but still meaningful impact on reading rate for the students with reading difficulties in this study. Figure 1 illustrates the reading accuracy scores of various students participating in the reading activity. The various steps involved are illustrated.

Inferential Statistics

Friedman Test

The Friedman test statistic is 10.8333, and the corresponding p-value is 0.0045, which is less than the commonly used significance level of 0.05. Table 8 suggests that there is a statistically significant difference in reading accuracy scores across the different phases (baseline, intervention, and retention).

Table 8: Reading accuracy scores

Students	*Baseline*	*Intervention*	*Retention*
Souad	36	88.7	94.75
Hadeel	60	95.6	94
Samia	63.6	95.4	96.5
Boshra	54	95	98

Friedman's Test Statistic: 10.8333
p-value: 0.0045

The Friedman test statistic is 10.8333, and the corresponding p-value is 0.0045, which is less than the commonly used significance level of 0.05. Table 9 suggests that there is a statistically significant difference in reading rate scores across the different phases (baseline, intervention, and retention).

Table 9: Reading rate scores (words per minute)

Students	*Baseline*	*Intervention*	*Retention*
Souad	12.5	35	46
Hadeel	14.5	42	57
Samia	10	49	64
Boshra	27.5	65	70

Friedman's Test Statistic: 10.8333
p-value: 0.0045

Research Question 2: How does VSM increase the reading rate among students with reading difficulties?

Students' reading rate data across the study phases illustrates the influence of the VSM intervention on increasing another critical aspect of oral reading fluency, their words read correctly per minute. The results showed an increase in the number of correctly read words per minute among the students participating in the study during the intervention phase when compared to the baseline phase. The level of progress differed for each student.

Souad: The number of correct words Souad read per minute increased from a baseline of 9-15 words (average 12.5) to 18-44 words (average 35) in the intervention phase, but she still did not reach the average reading level of the students in her class. This may have been attributable to the fact that the student was late in starting to read aloud. Her performance was somewhat stable during the

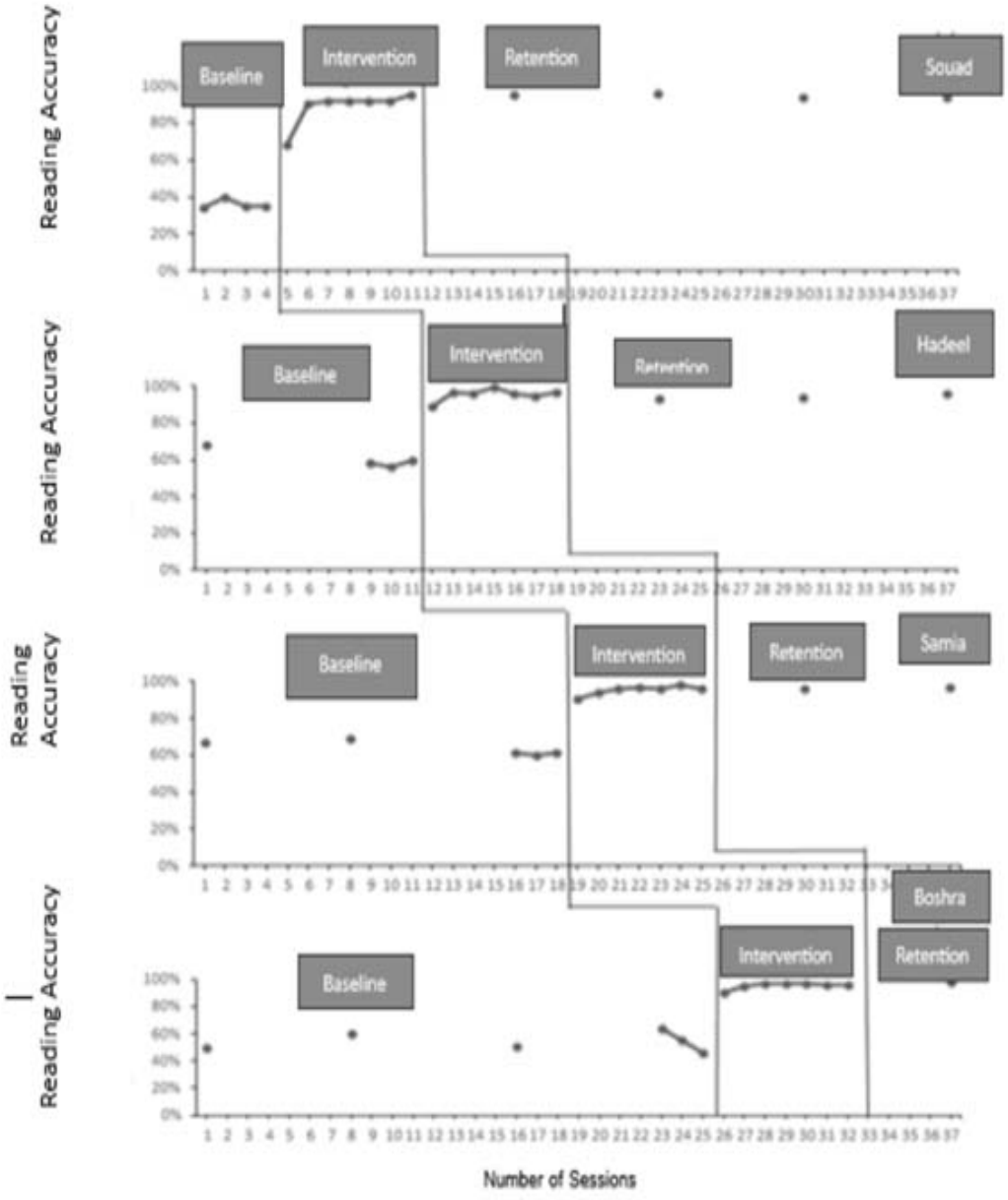

Fig. 1. Participating students' reading accuracy scores during the various phases of the study

baseline phase. The number of correct words she read per minute ranged between 9 and 11 words, with an average of 12 words. This demonstrates her low reading rate compared to the average reading rate of other students in her class, which was 56 words per minute, as previously mentioned. The results showed that Souad's reading rate was low and relatively reliable (Table 10). The number of words correctly read by Souad per minute during the VSM intervention sessions ranged between 18 and 43, averaging 35 words. This indicated a significant increase in the number of words correctly read by the student per minute compared to her performance in the baseline phase. This showed that she responded well to the intervention method. The Tau-U effect size of 0.62 (CI90 % [0.114, 1.00], p=0.0227) indicated a moderate effect of VSM on increasing Souad's reading rate. Based on these results, the increase in the reading rate is attributable to VSM.

Table 10: Souad's reading rate during the intervention

Phase	*Session No.*	*Student's score*
Baseline Phase	1st Session	9
	2nd Session	11
	3rd Session	15
	4th Session	15
Intervention Phase	5th Session	18
	6th Session	31
	7th Session	38
	8th Session	32
	9th Session	39
	10th Session	44
	11th Session	43

Hadeel: Hadeel's reading rate improved from 11-18 words per minute (average 14.5) at baseline to 25-65 words (average 42) during the intervention. This can be clearly seen based upon the difference between her performance in the baseline phase and that in the intervention phase, as mentioned previously. The goal after providing the intervention was to be able to logically judge the existence of a functional relationship between the VSM intervention and the student's reading rate. Based on her initial scores, it became clear to the researchers that Hadeel's reading rate decreased, but her performance was relatively stable over two sessions (9 and 10). However, her reading rate increased in the fourth session. As mentioned previously, the reason may have been that the independent observer praised Hadeel before starting the session, and this positively affected her motivation and self-confidence. The number of correct words that the student read per minute during this stage ranged between 11 and 18, with an average of 14 words. This result reflects the important role played by the intervention in increasing her reading rate (Table 11).

Table 11: Hadeel's reading rate during the intervention

Phase	*Session No.*	*Student's score*
Baseline Phase	1st Session	11
	9th Session	13
	10th Session	16
	11th Session	18
Intervention Phase	12th Session	25
	13th Session	34
	14th Session	29
	15th Session	65
	16th Session	46
	17th Session	45
	18th Session	48

However, despite the progress made by Hadeel, she still failed to reach the average reading rate of the students in her class. One reason could be that she often stopped reading to ask questions such as, 'Am I reading correctly?' or 'How many mistakes have I made?'

The student obtained the highest score of 65 words, in session 15. As previously mentioned, the reason may have been that her friend attended the session, and this increased her motivation and self-confidence. The Tau-U of 0.71 (CI90% [0.165, 1.00], p=0.0139) suggested a moderate effect of VSM on Hadeel's reading rate.

Samia: Samia's reading rate increased from a baseline of 3-13 words per minute (average 10) to 38-63 words (average 49) in the intervention phase, though still below class average. Samia's pre-intervention reading rate was very low, as she tended to read slowly and hesitated before pronouncing each word. During the baseline sessions, the student's performance was stable, but her reading rate was far below the average for her class at an average of 10 words per minute.

The intervention phase for Samia began at the end of the fourth week, and her scores for these sessions are presented in Table 12. The effectiveness of the VSM intervention is clear, as the difference between her performance in session 18 dur-

ing the baseline phase and that during the first intervention session is remarkable. However, despite the progress that Samia made, she failed to reach the average reading rate of the students in her class, possibly due to her slower reading style. Again, the Tau-U effect size of 0.77 (CI90% [0.200, 1.00], p=0.0108) indicated a moderate effect of VSM on increasing Samia's reading rate.

Table 12: Samia's reading rate during the intervention

Phase	*Session No.*	*Student's score*
Baseline Phase	1st Session	11
	8th Session	3
	16th Session	11
	17th Session	13
	18th Session	12
Intervention Phase	19th Session	44
	20th Session	38
	21st Session	43
	22nd Session	40
	23rd Session	53
	24th Session	63
	25th Session	62

Boshra: Boshra exhibited the greatest improvement in reading rate, increasing from 14-37 words per minute (average 27.5) at baseline to 47-76 words (average 65) during intervention, reaching her class average rate. She was highly motivated and reached the required standard, that is, the average reading rate of the other students in her class, over seven intervention sessions. The scores during the baseline phase clearly showed that Boshra's reading rate was lower than the average for her class, indicating the need for the intervention to improve her performance.

In the intervention phase, VSM was used to raise the student's reading rate component. As previously mentioned, only the first and second intervention sessions were administered before the study was suspended. The other sessions were administered using the Teams platform, and the resulting scores are presented in Table 13. Overall, it can be said that Boshra responded positively to the intervention, which proved its effectiveness in increasing her reading rate. However, even though her performance stabilised during this phase, it dropped in sessions 29, 30 and 31. This may have been attributable to the fact that she read the text too quickly, which made her skip some words or even some lines. The Tau-U of 1.00 (CI90 % [0.379, 1.00], p=0.0060) showed a high effect of VSM on improving Boshra's reading rate.

Table 13: Boshra's reading rate during the intervention

Phase	*Session No.*	*Student's score*
Baseline Phase	1st Session	20
	8th Session	33
	16th Session	14
	23rd Session	37
	24th Session	33
	25th Session	28
Intervention Phase	26th Session	47
	27th Session	76
	28th Session	71
	29th Session	65
	30th Session	71
	31st Session	60
	32nd Session	63

Figure 2 is illustrated and shows the reading rates for the students who participated in the study. The various steps included are shown for each student.

Research Question 3: How does VSM help students with reading difficulties retain the skill of reading fluency once acquired?

The retention phase scores showcase how VSM helped students maintain their reading fluency skills over time after the intervention ended. Ten retention sessions were conducted a week after the end of the intervention to measure the reading accuracy and reading rates for all students participating in the study. The results indicated that applying VSM at this phase proved effective. Table 14 shows the results of the retention sessions for each student.

Souad: Souad received a total of four retention sessions. Retention was measured during the first two sessions before the study was suspended due to the COVID-19 pandemic lockdown, and then the last two retention sessions were administered through Teams. The researcher then met with the student and presented her with a new reading text that she had not read before. She was asked to read the text and her reading was evaluated using the same evaluation method used in the intervention sessions. Souad's scores were positive in the retention sessions, as neither her reading accuracy nor reading rate decreased at this phase compared to her performance in the intervention stage (Table 14).

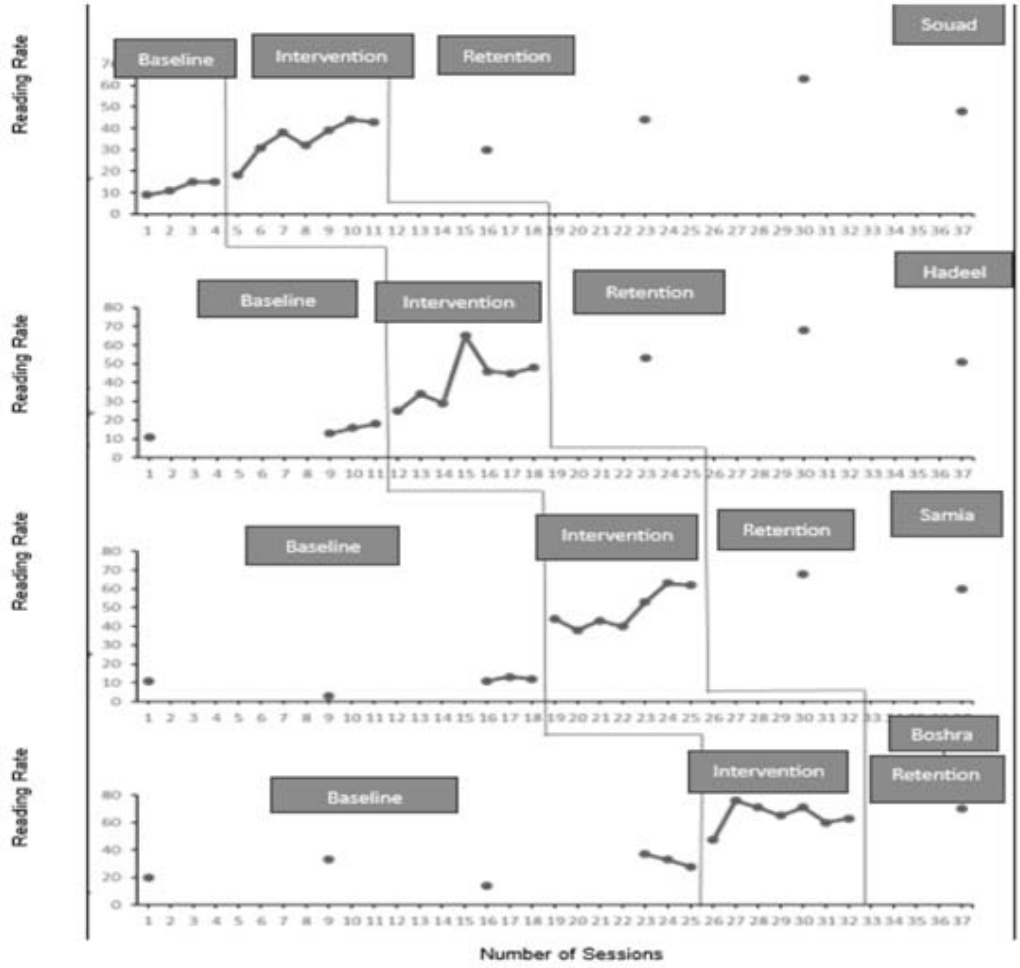

Fig. 2. Students' reading rate scores during the various study phases

Hadeel: Hadeel showed positive results in the three retention sessions she received. The first session was conducted before the study was suspended due to the pandemic, and the last two sessions were administered through Teams. The researcher met with the student and presented her with a new reading text that she had not read before. She was then asked to read the text and her reading was evaluated using the same evaluation method used in the intervention sessions. Hadeel's performance in terms of reading accuracy and reading rate did not decrease in this phase compared to the intervention phase, as shown in Table 12.

Samia: Samia achieved positive results in the retention sessions. Her two retention sessions were administered and measured via the Teams platform. The researcher met with the student and presented her with a new reading text that she had not read before. She was then asked to read the text and her reading was evaluated using the same evaluation method used in the intervention sessions. Samia's performance in terms of reading accuracy and reading rate also did not decrease in this phase compared to the intervention phase (Table 14).

Boshra: Boshra received one retention session, which was administered and measured via Teams.

The researcher met with the student and presented her with a new reading text that she had not read before. She was then asked to read the text and her reading was evaluated using the same evaluation method used in the intervention sessions. Boshra achieved high scores in the retention session and her reading accuracy and reading rate did not decrease compared to her performance in the intervention sessions (Table 14).

Table 14: Students' reading accuracy and reading rate scores during the retention phase

Student name	*Session No.*	*Reading accuracy (%)*	*Reading rate (%)*
Souad	16th Session	95	30
	22nd Session	96	44
	30th Session	94	63
	37th Session	94	48
Hadeel	22nd Session	93	53
	30th Session	94	68
	37th Session	96	51
Samia	30th Session	96	68
	37th Session	97	60
Boshra	37th Session	98	70

Social Validity Results

A social validity questionnaire was emailed to the students' learning difficulty teacher after the completion of the study. The teacher's answers indicated the effectiveness of the intervention and the achievement of a high level of social validity, averaging 4.5 out of 5. She further reported having observed a positive change in the participating students' reading ability. The teacher praised the effectiveness of the VSM-based intervention. She also expressed her desire to apply this strategy later to any of her students who experience reading difficulties. Table 15 shows the teacher's responses to the social validity questionnaire. Furthermore, each student was separately met with after completion of the intervention sessions in the learning resources room and handed a copy of her own social validity questionnaire, except for Boshra, to whom the questionnaire was emailed.

All participating students agreed that this strategy was useful and beneficial to them in terms of improving their reading. They also said that they enjoyed watching themselves in video clips and that these videos helped them to read more effectively. The participating students even expressed their sadness that the intervention sessions ended because they would not be able to film any more video clips. Table 16 shows the participating students' responses to the social validity questionnaire.

Finally, a social validity questionnaire was emailed to the parents at the end of the study. The results showed that the parents of the students who participated in the study were all pleased with their daughters' participation in the study and that they favored the intervention with an average of 4.95 out of 5. All parents agreed that they noticed an improvement in their daughters' reading ability and an increase in their motivation. Table 17 shows the parents' responses to the social validity questionnaire. Upon the collection of data from the questionnaires, it was clear that all participants favoured the procedures used and were satisfied with the results. The second approach to measuring social validity, as per Schlosser et al. (2020), is to compare the performance of the students participating in the study with that of their peers. The social valid-

Table 15: Questionnaire to measure the social validity of the reading difficulties teacher

1	The VSM strategy had an impact in improving students' reading fluency.	5
2	The VSM strategy achieved its effectiveness in improving students' reading fluency.	5
3	I suggest teachers use such a strategy.	4
4	I am willing to use this strategy with my students.	4
5	The intervention using the self-modelling will be effective with other groups of students.	4
6	The VSM strategy is easy to use in classrooms.	3
7	I like the procedures used in VSM.	5
8	This strategy is consistent with strategies you have used previously in class.	4
9	This strategy is considered an appropriate way to deal with students with reading difficulties.	5
10	I noticed an improvement in the students' reading level after a short period of intervention.	5
11	In the future, I will use VSM with other students who have reading difficulties.	5
12	The intervention proved effective in improving the reading fluency of students.	5
	Total score	54
	Average score	4.5

Table 16: Students' social validity measurement questionnaire

Questions	*Choices*			
	Souad	*Hadeel*	*Samia*	*Boshra*
1) I enjoyed watching the video clips of my reading.	4	4	4	4
2) Watching videos helped improve my reading.	4	4	4	4
3) I can read now without fear or hesitation.	4	4	4	4
4) I would like to tell my colleagues who have reading difficulties to try this strategy.	4	4	4	4
5) I am happy to participate in this experiment.	4	4	4	4
Total score	20	20	20	20
Average score	4	4	4	4

ity of the intervention is proven if the performance of the students participating in the study is close to that of the students in the control group. This was achieved by the current study, as can be observed upon comparing the scores obtained by the students participating in the study during the intervention phase with the results of the curriculum-based measurements of the oral reading fluency of their classmates. The researchers can therefore say that, based upon the results of the intervention phase, this study was indeed socially valid.

Overlap Analysis

Percent of Non-Overlapping Data (PND)

The PND between baseline and intervention phases was calculated for each student's reading accuracy and reading rate data. The study shows that PND and NAP values indicate a high degree of separation between baseline and intervention data paths, with minimal overlap, for both reading accuracy and reading rate across all participants. This provides further evidence that the VSM intervention produced differentiated effects compared to baseline performance levels.

Additionally, the Tau-U effect sizes previously reported align with these overlap metrics. The high PND/NAP values for reading accuracy correspond to the large Tau-U effects, while the moderate PND/NAP values for reading rate align with the medium-large Tau-U effects in that domain.

Interpretation

The combination of robust non-overlap statistics along with the previously reported visual analysis and effect size estimates offers strong converging evidence for functional relations between the VSM intervention and improvements in the key reading fluency components of accuracy and rate. These analyses quantify the differentiation between phases that was apparent in the data paths.

DISCUSSION

A notable strength of the study lies in its use of a rigorous single-subject experimental design, which allowed for the systematic evaluation of the intervention's effects at the individual level. The multiple probe design across participants further strengthened the internal validity of the findings

Table 17: Parents' social validity measurement questionnaire

Questions	*Souad's parent*	*Hadeel's parent*	*Samia's parent*	*Boshra's parent*
1) The intervention had an impact on improving my daughter's reading fluency.	5	5	5	5
2) My daughter's reading level has improved.	5	5	5	5
3) My daughter's motivation to read has increased.	5	5	5	5
4) My daughter has become a more confident reader.	5	5	4	5
5) I am happy for my daughter to share this experience.	5	5	5	5
Total score	25	25	24	25
Average score	5	5	4.8	5

by establishing a staggered baseline pattern and ruling out potential confounding variables. The inclusion of retention probes also provided valuable insights into the durability of the intervention's effects, suggesting that the acquired reading fluency skills were maintained over time. Additionally, the meticulous implementation of the single-subject experimental design ensured a comprehensive examination of the intervention's impact on each participant, offering insights into individual responsiveness. By incorporating a multiple probe design across participants, the study not only bolstered internal validity but also enhanced the generalisability of the findings by demonstrating consistent effects across diverse individuals. Furthermore, the utilisation of retention probes not only assessed the immediate effects of the intervention but also gauged its long-term efficacy, contributing to a more nuanced understanding of the intervention's lasting benefits.

The study's results align with and extend previous research highlighting the benefits of VSM for enhancing academic skills in students with learning disabilities (Darling-Hammond et al. 2022; Satsangi et al. 2021). By leveraging the principles of observational learning and self-modelling, the VSM approach enabled students to attend to, retain, and reproduce fluent reading behaviours through the powerful mechanism of observing their own successful performances. This self-reflective process likely enhanced students' motivation, self-efficacy, and self-regulated learning strategies, contributing to the observed improvements in reading fluency. Moreover, the study builds upon existing literature by elucidating the underlying mechanisms through which VSM facilitates academic skill development, shedding light on the transformative potential of self-reflective processes in educational interventions. The findings underscore the importance of leveraging observational learning and self-modelling techniques not only for skill acquisition but also for fostering key psychological attributes such as motivation and self-efficacy. This holistic approach to intervention design holds promises for addressing multifaceted challenges faced by students with learning disabilities, paving the way for more inclusive and effective educational practices.

Furthermore, the finding that VSM led to substantial gains in reading accuracy for all participants is particularly noteworthy. Accurate word recognition is a foundational component of reading fluency and a prerequisite for effective comprehension (Shaaban and Mohamed 2023). By improving students' ability to recognise and decode words accurately, the VSM intervention may have facilitated a positive feedback loop, where increased accuracy reinforced fluency, which in turn supported better comprehension and overall reading proficiency. This improvement in reading accuracy highlights the intervention's potential to address fundamental skill deficits that can significantly impact overall reading proficiency. Through the establishment of a positive feedback loop between accuracy and fluency, the VSM intervention not only enhances basic reading skills but also lays a robust foundation for more advanced comprehension abilities.

While the improvements in reading rate were somewhat more variable across participants, the overall moderate to large effect sizes observed suggest that VSM can effectively increase the speed and automaticity of reading, another critical aspect of fluent reading (Burns 2023). The self-modelling experience may have helped students internalise the pacing and prosody of fluent reading, leading to faster word recognition and more efficient integration of words into meaningful units (Barwasser et al. 2021). Despite variability in reading rate improvements among participants, the study's findings underscore the potential of VSM to enhance the speed and automaticity of reading, crucial components of fluent literacy. Through the self-modelling experience, students may have assimilated the rhythm and intonation of fluent reading, facilitating quicker word processing and more seamless comprehension. These findings align with theories of skill acquisition, emphasising the role of observation and self-referential processing in refining cognitive processes related to reading fluency.

The study's findings also underscore the social validity and acceptability of the VSM intervention from the perspectives of teachers, parents, and students. The positive ratings and qualitative feedback indicate that the intervention was perceived as beneficial, enjoyable, and feasible for implementation in educational settings. This alignment with stakeholder values and preferences is crucial for the successful adoption and sustainability of evidence-based practices (Schlosser et al. 2020).

Notably, the results of this study contribute to addressing recent calls for balanced and comprehensive reading instruction that targets the interconnected core skills of phonemic awareness, phonics, vocabulary, reading fluency, and comprehension (Ward et al. 2022). By specifically targeting reading fluency, a critical yet often overlooked component, the VSM intervention can complement and enhance existing reading interventions and instructional approaches, fostering a more holistic and effective approach to reading instruction.

The present study makes a significant contribution to the literature by providing empirical evidence for the efficacy of VSM as an evidence-based practice for enhancing reading fluency among students with reading difficulties. By grounding the findings in established theoretical frameworks and highlighting practical implications, this study has the potential to inform and shape future research, instructional practices, and professional development efforts in the field of reading intervention and special education The results of the current study are, therefore, largely consistent with Rumjaun and Narod (2020) studies that confirmed the effectiveness of VSM in helping students acquire reading skills in general and reading fluency skills in particular. These results provide strong evidence for the effectiveness of the video self-modelling (VSM) intervention in improving oral reading fluency among students with reading difficulties. The findings confirm the positive functional relationship between VSM and the acquisition of reading fluency skills, as demonstrated by the substantial improvements in reading accuracy and rate across all four student participants as shown in Table 14.

LIMITATIONS

Despite some of the positive results, this study must be interpreted deeply, even though the function of mutually treatments single-subject design is to compare interventions by comparing more than one condition within a stage likely that there was a carryover effect between the intervention conditions. As reading skills could be learned after being exposed to one of the intervention conditions thus, assessment of oral reading of a student's fluency in every condition could be affected by previous sessions. This presents a challenge to comparing reading interventions utilising an VSM, as both the present and previous studies were probably influenced by a carryover effect. As well as there are prominent concerns with generalisation, it is uncertain if the impact of the intervention can be generalised to unpracticed reading probes. The current study only aimed to identify the effectiveness of video self-modelling in improving the reading fluency of students with reading difficulties, as they were directly impacted by the intervention. Future studies should be looking at the generalisation impacts in oral reading fluency intervention.

Another notable limitation of this study is the small sample size, which comprised only four students with reading difficulties. While single-subject experimental designs are inherently focused on individual participant data, a larger sample size would have provided more robust evidence and increased the generalisability of the findings. The limited number of participants restricts the study's ability to account for individual differences and potentially limits the detection of smaller effect sizes with greater statistical power.

Another limitation lies in the potential carryover effect between intervention conditions. As reading skills could be learned after being exposed to one intervention condition, the assessment of oral reading fluency in subsequent conditions might have been influenced by the previous sessions. This presents a challenge in comparing reading interventions utilising video self-modelling

Table 18: Average scores of student participants during the various study phases

Name	*Baseline Reading accuracy (%)*	*Intervention Reading rate (words/ minute) accuracy*	*Retention Reading (%)*	*Reading rate (words/minute)*	*Reading accuracy (%)*	*Reading rate(words/ minute)*
Souad	36	12.5 words	88.7	35 words	94.75	46 words
Hadeel	60	14.5 words	95.6	42 words	94	57 words
Samia	63.6	10 words	95.4	49 words	96.5	64 words
Boshra	54	27.5 words	95	65 words	98	70 words

(VSM), as both the present and previous studies were likely affected by such carryover effects.

Furthermore, the study focused solely on the direct effects of the VSM intervention on the participants' reading fluency skills. However, it did not explore the generalisation of these effects to unpracticed reading probes or other academic domains. The lack of generalisation data limits the understanding of whether the acquired reading fluency skills would transfer to novel reading materials or broader reading comprehension abilities.

Finally, the study did not include a comparison group or alternative intervention condition, which could have provided a more direct comparison of the effectiveness of VSM relative to other evidence-based reading interventions or standard instructional practices. Such a comparison would have strengthened the evaluation of the VSM approach's relative efficacy and potential advantages over alternative interventions.

Despite these limitations, the study contributes to the existing literature on the use of technology-based interventions for improving reading fluency among students with reading difficulties. However, future research addressing these limitations could further solidify the evidence base and inform the practical implementation of VSM in educational settings.

Future research should aim to replicate and extend these findings with larger and more diverse samples, explore the generalisation of reading fluency gains to broader academic domains, and investigate the potential moderating effects of individual differences on the effectiveness of VSM interventions. Comparative studies examining the relative efficacy of VSM against other evidence-based reading interventions or traditional instructional methods would also be valuable in informing the selection and implementation of appropriate interventions for specific student populations and instructional contexts.

CONCLUSION

This paper described a video self-modelling (VSM) based intervention meticulously designed to improve the reading skills of four carefully selected students identified as having significant reading difficulties. The comprehensive single-subject experimental study rigorously evaluated the efficacy of the VSM approach through a multiple probe design across participants, enabling a systematic examination of the functional relationship between the intervention and the targeted reading fluency outcomes. The robust results resoundingly affirmed the VSM intervention's effectiveness in substantially enhancing oral reading fluency, as evidenced by the remarkable improvements observed in the critical components of reading accuracy and reading rate. Notably, all four student participants demonstrated the ability to successfully acquire and retain the reading fluency skills facilitated by the intervention, showcasing the durability and lasting impact of the VSM approach.

Moreover, the study's findings extended beyond mere academic outcomes by exploring the crucial aspect of social validity. Through comprehensive questionnaires and qualitative feedback, the intervention garnered overwhelmingly positive endorsements from the key stakeholders directly involved, that is, the students themselves, their parents, and the teacher overseeing their educational journey. This high level of social acceptability underscores the intervention's alignment with the values, preferences, and real-world feasibility considerations of those most intimately connected to the implementation process. The enthusiastic reception from students, who expressed enjoyment and a desire to continue the intervention, reinforces the motivational and engaging qualities of the VSM approach, potentially contributing to its effectiveness.

While the study's findings are compelling, the researcher acknowledges the need for further research to substantiate the comparative effectiveness of the VSM approach relative to other established teaching strategies commonly employed for students with reading difficulties. Rigorous comparative investigations contrasting VSM with interventions such as group choral reading, repeated reading, or listening while reading could provide valuable insights into the unique strengths, limitations, and potential complementary roles of these various instructional methods. Such comparative evidence would contribute to a more comprehensive understanding of best practices and inform the judicious selection and integration of interventions within a balanced and comprehensive reading instruction framework.

The researcher remains optimistic about the potential for future studies to solidify and expand

upon the evidence base surrounding VSM interventions for reading fluency. Continued research efforts, driven by a commitment to empirically validated practices and a deep understanding of the diverse needs of students with reading difficulties, hold promise for refining and disseminating this innovative intervention approach. Ultimately, the goal is to empower educators with a broader array of effective tools and strategies to address the persistent challenges faced by students struggling with reading, a foundational skill that profoundly impacts academic success and lifelong learning trajectories.

RECOMMENDATIONS

Based on the findings of this study, it is recommended that video self-modelling be implemented more widely as an effective intervention to support students with reading difficulties. Educators should consider integrating this approach into their literacy programs to enhance the development of reading fluency, with a specific focus on improving both accuracy and reading rate. Efforts should also be made to strengthen the social validity and acceptability of this intervention by involving teachers, parents, and students in the process. Additionally, ongoing use of evidence-based practices like video self-modelling should be encouraged to align with modern educational trends and improve academic outcomes for struggling readers.

DECLARATIONS

INSTITUTIONAL REVIEW BOARD STATEMENT

For this study, the researcher did obtain the approval of the Ministry of Education to implement the study. Moreover, all the participants in the study signed a research ethics agreement in which they were authorised to agree on their institutional position and all the data obtained during the study.

INFORMED CONSENT STATEMENT

Not applicable.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTION

Faris Algahtani: Conceptualisation, investigation, writing the original draft, methodology, validation, writing, review and editing, and formal analysis.

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REFERENCES

Bandura A, Adams NE 1977. Analysis of self-efficacy theory of behavioral change. *Cognitive Therapy and Research*, 1(4): 287-310.

Barwasser A, Urton K, Grünke M 2021. Effects of a peer-tutorial reading racetrack on word fluency of secondary students with learning disabilities and emotional behavioral disorders. *Frontiers in Psychology*, 12: 671385. DOI: 10.3389/fpsyg.2021.671385

Burns MK 2023. Examining the learning hierarchy with accuracy and rate scores for reading fluency among second-and third-grade students. *Journal of Behavioral Education*, 1-13.

Darling-Hammond L, Schachner AC, Wojcikiewicz SK, Flook L 2022. Educating teachers to enact the science of learning and development. *Applied Developmental Science*, 1-21. DOI: 10.1080/10888691.2022. 2130506

Decker MM, Buggey T 2014. Using video self-and peer modeling to facilitate reading fluency in children with learning disabilities. *Journal of Learning Disabilities*, 47(2): 167-177. https://doi.org/10.1177/0022219412450618

Doak L 2021. 'To start talking phonics is crazy': How parents understand 'literacy' in the lives of children with learning disabilities. *Pedagogy, Culture and Society*, 1-19.þ DOI: 10.1080/14681366.2021.2010121

Gifford TA 2016. *Predictive Validity of Curriculum-Based Reading Measures for High-Stakes Outcome Assessments with Secondary Students Identified as Struggling Readers*. Albany: State University of New York.

Kellems RO, Yakubova G, Morris JR, Wheatley A, Chen BB 2022. Using augmented and virtual reality to improve social, vocational, and academic outcomes of students with autism and other developmental disabilities. In: Information Resources Management Association (Ed.): *Research Anthology on Inclusive Practices for Educators and Administrators in Special Education*. Hershey, PA: IGI Global, pp. 737-756. doi.org/10.1177/01626434221094793

Kim D, An Y, Shin HG, Lee J, Park S 2020. A meta-analysis of single-subject reading intervention studies for struggling readers: Using Improvement Rate Difference (IRD). *Heliyon*, 6(11). DOI: 10.1016/j.heliyon. 2020.e05024

Kim MK, Bryant, DP, Bryant BR, Park Y 2017. A synthesis of interventions for improving oral reading fluency

of elementary students with learning disabilities. *Preventing School Failure: Alternative Education for Children and Youth*, 61(2): 116-125.þ DOI: 10.1080/1045988X.2016.1212321

Klubnik C, Ardoin S 2010. Examining immediate and maintenance effects of a reading intervention package on generalization materials: Individual verses group implementation. *Journal of Behavioral Education*, 19: 7-29. doi:10.1007/s10864-009-9096-3

Kusumarasdyati K 2023. Reading Comprehension in EFL: An overview. In: *International Joint Conference on Arts and Humanities 2022 (IJCAH 2022)*, Atlantis Press, March, pp. 782-791.

Lee T, Pham K, Crosby A, Peterson JF 2021. Digital collaboration in design education: How online collaborative software changes the practices and places of learning. *Pedagogy, Culture and Society*, 29(2): 231-245.þ DOI: 10.1080/14681366.2020.1714700

Legg DE 2013. *The Utility of Curriculum-Based Measurement within a Multitiered Framework: Establishing Cut Scores as Predictors of Student Performance on the Alaska Standards-Based Assessment.* Los Angeles County, California: Pepperdine University.

Morris JR, Hughes EM, Stocker JD, Davis ES 2022. Using video modeling, explicit instruction, and augmented reality to teach mathematics to students with disabilities. *Learning Disability Quarterly*, 45(4): 306-319. doi.org/10.1177/07319487211040470

Piper B, Schroeder L, Trudell B 2016. Oral reading fluency and comprehension in Kenya: Reading acquisition in a multilingual environment. *Journal of Research in Reading*, 39(2): 133-152.þ doi.org/10.1111/1467-9817.12052

Rafiola RH, Ramlib M 2018. Shaping a student self efficacy academic through live modeling technique (A synthesis of observational learning in Social Cognitive Theory). *GUIDENA: Jurnal llmu Pendidikan, Psilologi, Bimbingan dan Konseling*, 8(1): 1-9.

Rumjaun A, Narod F 2020. Social Learning Theory Albert Bandura. In: Ben Akpan, Teresa J Kennedy (Eds.): *Science Education in Theory and Practice: An Introductory Guide to Learning Theory*. Springer, pp. 85-99. https://doi.org/10.1007/978-3-030-43620-9

Sadusky A, Freeman NC, Berger E, Reupert AE 2022. Psychologists' diagnostic assessments of adults with dyslexia: An Australian-based survey study. *Educational and Developmental Psychologist*, 39(2): 151-160.þ DOI: 10.1080/20590776.2021.2011202

Satsangi R, Billman RH, Raines AR 2021. Comparing video modeling to teacher-led modeling for algebra instruction with students with learning disabilities. *Exceptionality*, 29(4): 249-264.þ DOI: 10.1080/09362835. 2020.1801436

Schlosser RW, Shane HC, Allen AA, Benz A et al. 2020. Coaching a school team to implement the Visual Immersion System in a classroom for children with autism spectrum disorder: A mixed-methods proof-of-concept study. *Advances in Neurodevelopmental Disorders*, 4: 447-470. doi.org/10.1007/s41252-020-00176-5

Schunk DH 2023. Self-regulation of self-efficacy and attributions in academic settings. In: Dale H Schunk, Barry J Zimmerman (Eds.): *Self-regulation of Learning and Performance: Issues and Educational Applications.* Routledge, pp. 75-99.

Shaaban TS, Mohamed AM 2023. Exploring the effectiveness of augmented reality technology on reading comprehension skills among early childhood pupils with learning disabilities. *Journal of Computers in Education*, 1-22.þ doi.org/10.1007/s40692-023-00269-9

Vaughn S, Boardman A, Klingner JK 2024. *Teaching Reading Comprehension to Students with Learning Difficulties.* New York: Guilford Publications.

Wang L, San Juan FMZ 2023. Study on teaching techniques to improve Chinese children's early reading fluency. *Pacific International Journal*, 6(2): 131-139.

Ward N, Vines N, Gabriel R 2022. Early reading instruction: Politics and myths about materials and methods. In: Rachael Gabriel (Ed.): *How Education Policy Shapes Literacy Instruction: Understanding the Persistent Problems of Policy and Practice*. Cham: Springer International Publishing, pp. 89-119.þ doi.org/10.1007/978-3-031-08510-9_4

Wu S, Gadke DL, Stratton KK 2018. Using video self-modeling as a small group reading fluency intervention for elementary school students. *Journal of Applied School Psychology*, 34(4): 297-315.þ DOI: 10.1080/15377903.2018.144398496.5

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