The Effectiveness of a Cognitive-plus-Motivational Reading Intervention: A Multiple-Baseline Study with Four Pupils At-Risk for Reading Difficulties

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Abstract

Aims: We aimed to examine the impact of supplementing cognitive reading intervention with supports for reading motivation on the reading motivation (reading interest and self-efficacy) and reading fluency of four Year four pupils at-risk for reading difficulties.

Method/Rationale: Case studies of four pupils at-risk for reading difficulties were conducted using a multiple-baseline across-participants design. The effects of a combined Cognitive-plus-Motivational intervention (experimental phase) were compared to those of a Cognitive-Only intervention (baseline phase) using probes for reading fluency, interest, and self-efficacy. Scores on each probe were plotted and analysed by combining visual analysis and the Process Control Chart method of analysis.

Findings: Results suggest that compared to a Cognitive-Only intervention, the Cognitive-plus-Motivational intervention improved the fluency of three participants, and the interest and self-efficacy of two out of four participants. Findings provided insight into individual patterns of response to the intervention, with the greatest impact on fluency observed for students with the lowest initial reading skills.

Limitations: Caution is needed in generalising findings due to the study's small sample size, the lack of a control group and the potential presence of experimenter bias.

Conclusions: The findings presented here provide preliminary support for the benefits of supplementing reading intervention with instruction to foster reading motivation on the outcomes of pupils at-risk for reading difficulties and provide insight into patterns of individual response to motivational intervention.

Keywords: Reading motivation, Self-efficacy, Interest, Intensive intervention, Motivational intervention

The Effectiveness of a Cognitive-plus-Motivational Reading Intervention: A Multiple-Baseline Study with Four Pupils At-Risk for Reading Difficulties

Research suggests that reading motivation contributes to reading development (e.g., Park, 2011). Reading motivation has been linked to enjoyment, strategy use, and achievement during reading (Guthrie & Wigfield, 2000) and may partly mediate the impact of intensive reading interventions on achievement (Bates et al., 2016). It is notable then that for pupils with reading difficulties, reading motivation tends to decline with age (Nelson & Manset-Williamson, 2006). These pupils are more likely to feel disinterested or helpless during reading instruction, which in turn may exacerbate pre-existing difficulties (Morgan et al., 2008). In England, the most recent Progress in International Reading Literacy Study report found that 20% of pupils report they don't like reading, and, on average, these pupils scored 45-points lower than those who reported liking to read the most (DfE, 2016).

These findings suggest that when designing reading programmes, it is important to consider their impact on reading motivation in addition to considering their impact on cognitive factors involved in reading, such as decoding or comprehension. A recent systematic review and meta-analysis of motivational reading interventions indicated these may have a positive impact on both reading achievement (g = 0.20) and motivation (g = 0.30) (McBreen & Savage, 2021). However, the review revealed two important gaps. First, most studies fail to explicitly and thoroughly situate their intervention within a theoretical understanding of motivation (Conradi et al., 2014). Failure to situate intervention research within a solid understanding of theory may limit the development of effective and comprehensive reading interventions (Compton et al., 2014). Second, most studies examined the impact of motivational interventions on comprehension, but not on other aspects of reading, such as fluency. This limits researchers'

ability to provide concrete instructional recommendations that target the needs of students experiencing a range of reading difficulties, as motivation may impact these skills in different ways, for example through increasing engagement and strategy use during reading for comprehension or through increasing time spent engaging with text for fluency (Guthrie & Cox, 2001).

This research aimed to address these gaps by evaluating the impact of a motivational reading intervention on the reading fluency and motivation of pupils at-risk for reading difficulties. Findings from a previously published evaluation of the intervention proposed here, using a quasi-experimental pre-test/post-test efficacy design, indicated that pupils who received the motivational intervention made greater gains in phonological awareness and reading comprehension than those who received a 'best practice' intervention (McBreen & Savage, 2020). Notably, while no differences across groups were found for reading motivation, observations suggested that pupils were more engaged in the motivational condition. This was hypothesized to have contributed to the observed gains in reading skills, as higher engagement has been argued to foster learning through a positive impact on learning behaviors, e.g., by increasing time spent on-task and strategy use (Guthrie et al., 2004).

This paper complements and extends McBreen and Savage's (2020) findings through a second evaluation of the programme, conducted using a multiple-baseline design. Research indicates that there exists significant individual variation in pupils' responses to reading intervention, for example due to family background or initial ability level, and highlights the need for more research examining individual patterns of responsiveness (Dale et al., 2018). Thus, a multiple-baseline design was used to provide greater insight into how reading motivation and fluency fluctuated throughout the course of the intervention and into individual variations in

response. An overview of how the intervention was created, including its theoretical and empirical backgrounds, is first presented.

Theoretical Background: Motivational Systems Theory

Motivational Systems Theory (MST), which integrates elements of 32 theories of motivation to provide an overarching framework of motivation, was created in response to concerns that the field of motivation theory lacked consensus, cohesion, and integration (Ford, 1992). This concern has been echoed more recently by Anderman and Wolters (2006), who suggest that to fully describe learning motivation, multiple theories must be integrated as they build upon one another to explain a given achievement situation. Because of MST's capacity to account for the multi-faceted nature of motivation, it was chosen as the theoretical rationale for this intervention.

MST subdivides motivation into three interrelated components: goals, emotions, and self-efficacy beliefs. MST proposes that together, these components underlie motivated behavior, which in turn generates opportunities for skill development (Deci & Ryan, 1985; Ford, 1992). Support for this comes from findings linking goals, emotions, and self-efficacy beliefs to classroom achievement (Campbell, 2007). Correspondingly, MST suggests that to promote learning motivation, classrooms should enable students to (1) progress towards clear, personally relevant, and realistic goals; (2) experience positive learning emotions, such as interest or pride; and (3) develop a sense of self-efficacy, i.e., confidence in their abilities (Ford, 1992). A review of the intervention literature further provides practical guidelines that complement MST's recommendations.

Empirical Background: Motivational Reading Instruction

A recent systematic review and meta-analysis of motivational reading interventions suggests they may have a beneficial effect on both reading achievement (g = 0.20) and motivation (g = 0.30) (McBreen & Savage, 2021). The authors identified five broad categories of motivational instruction that have received support: (1) interest-enhancing practices, which capitalise on pupils' interests to generate sustained reading motivation (Guthrie et al., 2004) (2) self-regulatory practices, which teach pupils skills designed to make them more self-directed during learning (Cantrell et al., 2014) (3) autonomy-supportive practices, which give pupils opportunities for independence in their learning (Marinak, 2013) (4) attribution/goal orientation training, which guides pupils to adopt a progress-oriented learning mindset (Toste et al., 2017) and (5) multi-component motivational interventions, which combine two or more of the above approaches. To design the motivational components of the intervention assessed here, the above practices were integrated within MST's theoretical framework.

Designing a Motivational Reading Intervention

It has been noted that teaching design should build upon a solid understanding of theory and knowledge of effective practices (Snowling & Hulme, 2011). This approach was used to create the intervention assessed here, through combining theoretical and empirical recommendations within a comprehensive intervention designed to target the three components of motivation identified by MST: goals, emotions, and self-efficacy beliefs.

The first component involved teaching pupils to set individual, progress-oriented learning goals, and to contribute to the creation of the learning agenda covered during subsequent lessons. This included determining skills to be learned, classroom goals, and methods for assessing progress. It drew upon autonomy-supportive practices, self-regulatory goal setting instruction, and attribution training.

The second component aimed to foster positive learning emotions. Pupils received motivational self-regulatory instruction focused on identifying strengths, self-modeling success, and brainstorming ways to cope with negative emotions. Interest-based practices were used to elicit interest-based motivation. The third component taught pupils to self-track their progress towards goals. Teachers and pupils then engaged in discussions centered on progress made and subsequent steps to be undertaken. This built upon self-regulatory instruction in goal setting, progress monitoring, and attribution training.

Additionally, autonomy-supportive practices were integrated throughout lessons to foster pupils' independence and feelings of competence. The intervention content was informally validated with experienced teachers. Further detail and template lesson plans are provided in Appendix A.

Research Questions and Hypotheses

The research presented here sought to examine the impact of a motivational reading intervention on the reading motivation and achievement of pupils at-risk for reading difficulties. To evaluate this, a Cognitive-plus-Motivational reading intervention developed based on the principles above was implemented with four pupils at-risk for reading difficulties and its effect was compared to that of a Cognitive-Only reading intervention, looking at the following questions:

a. How does supplementing cognitive reading instruction with supports for motivation impact reading motivation (i.e., interest and self-efficacy beliefs for reading)?
b. How does supplementing cognitive reading instruction with supports for motivation impact reading fluency?

It was hypothesized that compared to a Cognitive-Only intervention, the Cognitive-plus-Motivational intervention would lead to greater gains in pupils' reading fluency, interest and self-efficacy.

Method

Design

Case studies were conducted using a concurrent AB multiple-baseline across-participants design to assess the effects of the Cognitive-plus-Motivational reading intervention on the reading fluency and motivation of four pupils in Grade three (roughly equivalent to Year four in the UK education system) at-risk for reading difficulties. Multiple-baseline designs have been deemed appropriate for research in educational settings in which effects are not expected to return to baseline after intervention delivery (Neuman & McCormick, 1995). As reading ability tends to improve with age provided pupils receive adequate reading instruction, reading fluency was not expected to decrease at any point over the course of the study. Concurrent designs, in which data collection begins simultaneously for all participants, have been argued to promote internal validity (Christ, 2007).

The length of the baseline phase and the start of the experimental phase were staggered across participants, to ensure that changes were due to changes between conditions rather than to factors extraneous to the intervention. This also helped control for the possibility that changes between conditions occurred because by the time they were in experimental phase, pupils had simply received more reading intervention. To further control for this, the amount of direct reading instruction was kept constant across baseline and experimental phases. All lessons were delivered one-on-one by the primary researcher, who also designed the intervention. Lessons lasted 40-45 minutes, and took place two to three times a week either during or after school

hours. In total, pupils received between 10 and 14 hours of reading intervention, which is consistent with previous research showing measurable effects of intensive intervention on standardized reading measures (National Reading Panel, 2000). All pupils received between seven and nine hours of the motivational intervention. On-going data was collected by the primary researcher at the end of each lesson using probe measures (i.e., short, quick-to-administer methods which provide a snapshot of a given skill) for reading motivation and fluency.

Participants

Participant selection. The study was reviewed and approved by a university research ethics board. Year four pupils were selected because by Year four, a decline in motivation has typically begun to occur for students who are experiencing reading difficulties (Nelson & Manset-Williamson, 2006). Participant selection began only once written parental consent was obtained. All pupils underwent universal screening on measures of reading achievement and motivation. Guidelines for identifying pupils at-risk for reading difficulties recommend using a cut-off point for multiple measures of early literacy (Connor et al., 2014) and a cut-off point at the 30th percentile has been used as an operational definition of at-risk status (e.g., Savage et al., 2018). Thus, the selection criterion was scoring below the 30th percentile on one or more measure of reading ability. All screening measures were administered and scored by the primary researcher.

Sample description. Pupils were selected from an all-boys private elementary school in large urban city in Canada. Written consent was obtained for 16 pupils, four of whom met eligibility criteria and were selected to participate (M_{age} = 8.54 years, SD = 0.18). All pupils in the school participate in an early French-immersion program, where all Year one and two instruction is provided in French. English is introduced in Year three, accounting for 15% of

instructional time, and is gradually increased until reaching 70% in Year seven. Research on English-speaking pupils in similar programs in this city has reported that they attain similar levels of English language competence as students in all-English programs (Genesee, 2004). The socio-economic status of families who attend this school tends to be higher than the provincial average.

Student A. Student A was 8.66 years old when the study began. Main languages spoken at home were Chinese and English. During universal screening, he scored 45% on the value for reading subtest and 50% on the self-efficacy for reading subtest. His reading performance was above the 19th percentile for accuracy, the 16th percentile for fluency, and the 22nd percentile for comprehension.

Student B. Student B was 8.42 years old. Main languages spoken at home were Chinese and English. During universal screening, he scored 82.5% on the value for reading subtest and 67.5% on the self-efficacy for reading subtest. His reading performance was above the 4th percentile for accuracy, the 7th percentile for fluency, and the 3rd percentile for comprehension.

Student C. Student C was 8.75 years. Main language spoken at home was English. During universal screening, he scored 67.5% on the value for reading subtest and 70% on the self-efficacy for reading subtest. His reading performance was above the 13th percentile for accuracy, the 7th percentile for fluency, and the 23rd percentile for comprehension.

Student D. Student D was 8.33 years old. Main language spoken at home was English. During universal screening, student C scored 90% on the value for reading subtest and 60% on the self-efficacy for reading subtest. His reading performance was above the 9th percentile for accuracy, the 1st percentile for fluency, and the 3rd percentile for comprehension.

Measures

Universal screening.

Reading accuracy. English word reading accuracy was assessed using the word reading subtest of the Wide Range Achievement Test-4 (Wilkinson & Robertson, 2006), which includes letter recognition (15 items) and word reading (55 progressively more difficult words presented in list format). The test is discontinued after 10 consecutive errors. Wilkinson & Robsertson (2006) report test-retest reliability of .86 and internal validity ranging from .60 to .63 for this subtest.

Reading fluency. The Dynamic Indicators of Early Literacy Skills Oral Reading Fluency test (DIBELS ORF 6th Edition; Good & Kaminski, 2007) was used to assess oral reading fluency. Children are asked to read three year-level passages aloud for one minute. The number of words read correctly on the three texts are compiled to provide an average fluency score. Omissions, substitutions, and hesitations lasting more than 3 seconds are scored as errors. Good et al. (2001) report alternate-form reliability of .94 and criterion validity of .79.

Reading comprehension. The Group Reading Assessment and Diagnostic Evaluation (Williams, 2001) grade three (equivalent to UK Year 4) reading comprehension subtest was used to assess reading comprehension. Pupils must read short stories and answer a series of questions assessing their comprehension. Alternate-form reliability ranges between .81-.96 and criterion validity ranges between .69-.90 (American Institutes for Research, 2017)

Reading value and reading self-efficacy. The *Motivation to Read Profile-Revised* (MRP-R; Marinak et al., 2016) was used to assess reading motivation. The test was designed for use in pupils in second to sixth grade. It calculates motivation to read as a composite of value for reading and self-efficacy for reading. Cronbach's alpha reliability ranges from α = .81 to .87

(Marinak et al., 2016). Given that the scale for the survey items is ordinal, nonparametric analysis using a root mean square error of approximation (RMSEA) was used to assess validity (Malloy et al., 2013). Analysis yielded a RMSEA estimate of .089 with a confidence interval of .081-.098, and a probability of RMSEA being less than or equal to .05 of $p < .001$ (Malloy et al., 2013).

Probe measures.

Reading fluency. A modified version of the DIBELS ORF test (Good & Kaminski, 2007) was used to probe oral reading fluency (see above). For this probe measure, only one text was presented, rather than three.

Reading interest. Reading interest was assessed using a 5-point observer-based Likert scale adapted from Koegel et al. (2010), which ranged from *0 = the child looks bored and attempts to leave the activity* to *5 = the child attends readily to the task and is alert, eager and involved in the activity*. A 5-minute shared book-reading episode was broken down into one-minute intervals to code the level of interest shown by the student during each interval. Ratings were then added and divided by the number of intervals to obtain an average score for the session examined. Koegel et al. (2010) report inter-rater reliability of .85-.99. Validity scores for this measure do not exist.

Reading self-efficacy. Reading self-efficacy was assessed using a protocol adapted from Wang and Pape (2007). To elicit self-efficacy beliefs, a chart with five stars was presented before shared book reading and administration of the fluency probe. Children were asked to choose a star to indicate how well they believed they could accomplish the task. The largest star indicates “can do it very well”, while the smallest star indicates “unable to do it”. In the first lesson, students were provided with instructions on how to respond to the self-efficacy star chart.

Visual analog scale self-assessments have been shown to have parallel-form reliability of .76 to .82 in children aged 6 to 18 (Lærhoven et al., 2004). An investigation into multiple VAS measures for clinical phenomena (e.g., mood, pain) have reported criterion validity ranging from .42 to .91 (Wewers & Lowe, 1990).

Procedure

Independent variable. Reading profiles were created based on pupils' performance on screening measures of reading ability. In both conditions, profiles were used to ensure that optimally challenging tasks were provided and 75% of instructional time was dedicated to direct reading instruction. This included systematic instruction in synthetic phonics and shared book reading with direct mapping, which have been shown to positively impact the reading performance of pupils at-risk for reading difficulties (e.g., Savage et al., 2018; Yeung & Savage, 2019).

Prior to beginning the intervention, pupils were told they would be having one-on-one sessions to support their reading. In the experimental condition, reading tasks were combined with the motivational components outlined above. Pupils were given choice over reading materials and games to support autonomy, and tasks were tailored to their interests. Additionally, instruction in self-regulation and attribution training took up 25% of each session. During this time, pupils received no direct reading instruction. To balance the amount of direct reading instruction in both conditions, students completed non-verbal math fluency exercises in 25% of each baseline session. Baseline and experimental template lessons plans are provided in Appendix A. All baseline and experimental sessions were delivered by the primary researcher, who also designed the interventions used in both phases.

Analysis plan. Data for outcome probes was graphed for each student after each session (see Figures 1, 2, and 3). Data were analysed using visual analysis combined with the "Process Control Chart" method. During visual analysis, six types of changes were evaluated: changes in value, variability, data trends, immediacy of effect, and consistency (Kratochwill et al., 2013). The "Process Control Chart" method consists of delimiting a confidence area whose lower and upper limits are set to 2 standard deviations below or above the mean for baseline observations; when two or more data points of the experimental phase fall outside the bounds of the confidence area, the average of the experimental phase is deemed to be significantly different from that of the baseline phase (Juhel, 2008). To ease interpretation, the upper limit of the confidence area is represented using dotted lines in pupils' progress graphs.

Results

Ceiling and Language Effects

Interest and self-efficacy probes were measured on a scale from 0-5. During baseline, Student D reached ceiling on the self-efficacy probe and Students B and D reached ceiling on the interest probe, precluding the potential for observable change. In these cases, the impact of the experimental condition on self-efficacy or interest was only assessed through visual analysis. It is worth noting that while the primary language spoken at home differed across pupils (50% English, 50% Chinese), no distinct pattern of responsiveness related to the primary home language emerged during analysis. Outcomes on probe measures are presented in Figure 1 (reading fluency), Figure 2 (reading interest) and Figure 3 (reading self-efficacy).

Student A

Visual analysis indicates that Student A's reading fluency was similar across phases. While his reading fluency reached a higher point during the experimental phase, the data in both

conditions followed a slightly increasing trend and was variable and inconsistent, overlap between phases was present, and there was no immediate effect of introducing the experimental phase. However, analysis using the process control chart method suggests a significant impact on fluency, as two data points exceed the baseline phase's upper boundary.

Visual analysis indicates that Student A's reading interest increased and was at a higher overall level during the experimental phase. In the experimental phase, the trend is stable, with slight fluctuations. A positive effect on interest appears immediately after introduction of the experimental phase, no overlap is present, and interest remains consistently high. Analysis using the process control chart method suggests a significant effect on interest, as all observations exceed the baseline phase's upper boundary.

Visual analysis indicates that Student A's self-efficacy increased during the experimental phase. Overall, the level is higher and, while a decreasing trend is seen during the baseline phase, it increases during the experimental phase. Following introduction of the experimental phase, an immediate effect is visible, the trend becomes more stable, data remains consistently high, and overlap is present only at the beginning of the phase. Analysis using the process control chart method suggests a significant effect on self-efficacy, as five data points exceed the baseline phase's upper boundary.

Student B

Visual analysis indicates that Student B's reading fluency increased during the experimental phase. Overall, the level is slightly higher and while the baseline phase's trend shows a steep initial decrease followed by a slight increase, the overall trend is increasing during the experimental phase. While there is no immediate effect on fluency, the trend becomes more stable during the experimental phase and there is only one point of overlap between phases.

Analysis using the process control chart method suggests a significant effect on reading fluency, as two data points exceed the baseline phase's upper boundary.

Visual analysis indicates that Student B's interest did not increase during the experimental phase. Overall, the level is similar between both phases, the trend fluctuates slightly in both, there is no immediate effect of introducing the experimental phase, and there is overlap between phases. However, the data in the experimental phase are more stable. As the upper boundary of the confidence area exceeded ceiling during the baseline phase, analysis using the process control chart method was not possible.

Visual analysis indicates that the experimental phase did not impact Student B's self-efficacy. While the overall level is higher during the experimental phase, the trend in both phases is positive overall, there is overlap between data across phases, there is significant variability in each phase, and there is no immediate effect on self-efficacy following the introduction of the experimental phase. Analysis using the process control chart method suggests there was no significant effect on self-efficacy, as no data points exceed the baseline phase's upper boundary.

Student C

Visual analysis indicates that Student C's reading fluency did not increase during the experimental phase. In both phases, the level was similar, and the trend was slightly increasing. There is overlap between phases, no immediate effect of introducing the experimental phase, and the data in both phases is variable, though slightly more consistent in the experimental phase. Analysis using the process control chart method indicates no significant effect on reading fluency, as no data points exceed the baseline phase's upper boundary.

Visual analysis indicates that Student C's interest increased during the experimental phase. The overall level is higher, the trend becomes stable and consistently high whereas it

fluctuates during baseline, there is no overlap between phases, and an effect is visible immediately following introduction of the experimental phase. Analysis using the process control chart method indicates a significant effect on interest, as 11 data points exceed the baseline phase's upper boundary.

Visual analysis indicates a small effect of the experimental phase on Student C's self-efficacy. Overall, the level is higher during the experimental phase, and while there is some overlap between phases, data in the experimental phase is more consistently high and stable, especially in later lessons. While the effect does not appear immediately following introduction of the experimental phase, the data overall is less variable in the experimental phase. As the upper boundary of the confidence area exceeded ceiling during the baseline phase, analysis using the process control chart method was not possible.

Student D

Visual analysis indicates that Student D's reading fluency increased during the experimental phase. Overall, the level is higher during the experimental phase, and while the trend is positive in both phases, the slope is steeper during the experimental phase. In both phases, there are slight variations in the data, and there is no immediate effect of introducing the experimental phase. Data in the experimental phase only overlaps with the baseline phase at early stages. Analysis using the process control chart method indicates a significant effect on fluency, as nine data points exceed the baseline's upper boundary.

Visual analysis indicates that Student D's interest underwent a slight increase during the experimental phase. Overall, the level is higher, and while the trend fluctuates in the baseline phase, it is stable during the experimental phase. An immediate effect occurs following introduction of the experimental phase, interest remains consistently high throughout the phase,

and there is minimal overlap between phases. As the upper boundary of the confidence area exceeded ceiling during the baseline phase, analysis using the process control chart method was not possible.

Visual analysis indicates that Student D's self-efficacy increased during the experimental phase. Overall, the level is higher during the experimental phase, and there is no overlap across conditions. While the trend in the baseline phase is slightly increasing, it is variable. In the experimental phase, the trend continues to increase slowly, but remains stable and consistently high, which occurs immediately following introduction of the experimental phase. Analysis using the process control chart method suggests a significant impact on self-efficacy, as four data points exceed the baseline phase's upper boundary.

Discussion

This research sought to assess whether supplementing remedial cognitive reading intervention with a motivational intervention based on MST had an impact on the reading fluency and motivation of four Year four students at-risk for reading difficulties. It was hypothesized that compared to a Cognitive-Only reading intervention, the Cognitive-plus-Motivational intervention proposed here would lead to greater improvements in reading fluency, interest, and self-efficacy. Findings from the case studies presented here provide preliminary support for this hypothesis and provide insight into patterns of individual variation based on pupils' characteristics. However, caution is needed in interpreting these results.

Reading Fluency

The combined visual and process control chart analyses revealed that three participants made greater gains in fluency during the experimental relative to the baseline phase. Notably, those who demonstrated the most improvement were those with the most pronounced initial

reading difficulties, scoring between the 1st and 9th percentiles on the screening measures of reading ability. While caution is needed given the small sample size, this is in line with previous results showing that motivation contributes the greatest variation in outcomes for students with the most pronounced reading difficulties (e.g., Logan et al., 2011) and that motivation-focused interventions are most effective for these students (van Steensel et al., 2017). While the difference across conditions may in part be explained by prolonged exposure to best practice reading instruction, Student D was in the baseline condition almost twice as long as Student B, suggesting that at least some of the observed discrepancy may be due to differences in motivational instruction between conditions.

While the process control chart analysis indicated no observable effect of the intervention on Student C's reading fluency, visual analysis indicated his average fluency increased slightly in the experimental phase. Here, it is possible that the gains in motivation observed for Student C would eventually lead to gains in reading ability, but that this was not observable during the timeframe of the intervention.

Reading Motivation

Overall, results can be cautiously interpreted to suggest that the intervention had a positive impact on both reading interest and self-efficacy. For Students B and D, the upper boundary for interest reached ceiling during baseline, precluding the possibility of a significant effect on interest. However, visual analysis suggests their interest may have become more stable during the experimental phase. For Students A and C, who had low value for reading at pre-test, visual and process control chart analysis of the interest probe indicated that interest significantly increased once the experimental phase began. During the experimental phase, pupils were asked to choose the books and learning games that would be used, while these were chosen by the

instructor in the baseline phase. Potentially, giving pupils choice made it more likely that they were choosing materials they found interesting, and contributed to more stable interest. This is in line with self-determination theory's claim that when students are given opportunities to be autonomous, they are more likely to be engaged (Deci & Ryan, 1991) and findings linking autonomy-supportive practices to increased value for reading (e.g., Marinak, 2013).

Analysis using the process control chart method suggest that the Cognitive-plus-Motivational intervention improved the self-efficacy of half the participants, while visual analysis indicates that for all pupils, self-efficacy became more stable during the experimental phase. This may in part be due to gains in reading ability, as all pupils made gains in reading throughout the intervention, and to the fact that during the experimental phase, pupils were instructed to self-track their progress. This is consistent with findings that progress-oriented teaching makes students more likely to adopt mastery orientations (e.g., Anderman et al., 2010) and achievement goal theory's claim that mastery-oriented students have more resilient self-efficacy beliefs (Schunk et al., 2008).

Limitations

Several limitations should be addressed when interpreting results. First, all students expressed dislike of the probe measures and resistance to completing them. However, as probe measures were administered identically in both baseline and experimental lessons, this cannot explain differences across conditions. Second, it is possible that differences between phases were due to the cumulative effect of reading instruction. Namely, that reading instruction received during baseline and regular classroom instruction had effects on fluency or motivation that only became manifest during the experimental phase. However, as baseline and experimental phases were staggered across participants, this partially controlled for delayed intervention effects

manifesting at different moments. Third, as the instructor was the primary researcher and treatment fidelity was not assessed, it is possible that experimenter bias was present both in delivery of the intervention (e.g., higher enthusiasm during the experimental phase). This may also have affected interpretation of probe measures (e.g., in completing measures of interest that rely on observation). In future assessments, treatment integrity measures as well as second coding of probe measures should be included. Fourth, some pupils' scores on the self-efficacy and interest probes reached ceiling during the baseline phase, limiting the potential for observable change. However, evidence from other pupils provides evidence that is more readily interpretable. Outcome measures without ceiling effects are needed.

Fifth, the intervention sought to increase reading motivation during the intervention but did not target motivation in pupils' classroom or home environments. Thus, interpretation of the observed effects should be limited to the context of intensive one-on-one reading intervention and further research is needed to assess the impact of incorporating these practices in other contexts, including within the practice of educational psychologists. Additionally, this study has all the limitations generally associated with controlled case studies, including generalization and replicability. Further, the sample used was not representative of the general population in terms of income, gender distribution, primary language, and school type. Finally, the design used did not allow for causality to be established, as all students received both interventions.

Conclusion

Despite the above limitations, results from the four case studies reported here provide preliminary evidence that a combined Cognitive-plus-Motivational reading intervention may be effective for improving both the reading motivation and fluency of at least some pupils experiencing reading difficulties. Findings indicate that the added motivational components of

the intervention had a positive impact on the stability of motivation across intervention sessions, which in turn may have contributed positively to learning. Results also support a theoretical framework of motivation in line with MST, which proposes that to foster motivation and subsequent achievement, goals, emotions, and self-efficacy beliefs should be addressed within a comprehensive framework, as well as for using MST as a guiding framework to foster motivation, through providing instruction and intervention that anchors learning in concrete and specific goals, fosters positive learning emotions, and promotes adoption of progress-oriented goals.

Findings also provide preliminary insight into patterns of individual variation in the response to interventions which targets reading motivation. Notably, the greatest impact on reading fluency was observed for pupils with the lowest pre-intervention scores on measures of reading achievement, suggesting targeting motivation during intervention may be especially important for these pupils. Differences in the motivational profiles of students were also found, with some students showing high self-efficacy for reading but low value for reading and others showing the opposite pattern. Understanding how different components of motivation influence reading and response to intervention may help guide future recommendations for practice. Future evaluations that include measures more sensitive to small changes in motivational subcomponents, as well as qualitative analysis of participants' views and experiences of the intervention, would enrich the present study's finding by allowing for a more detailed understanding of the intervention's impact on motivation.

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Figure 1

Reading Fluency

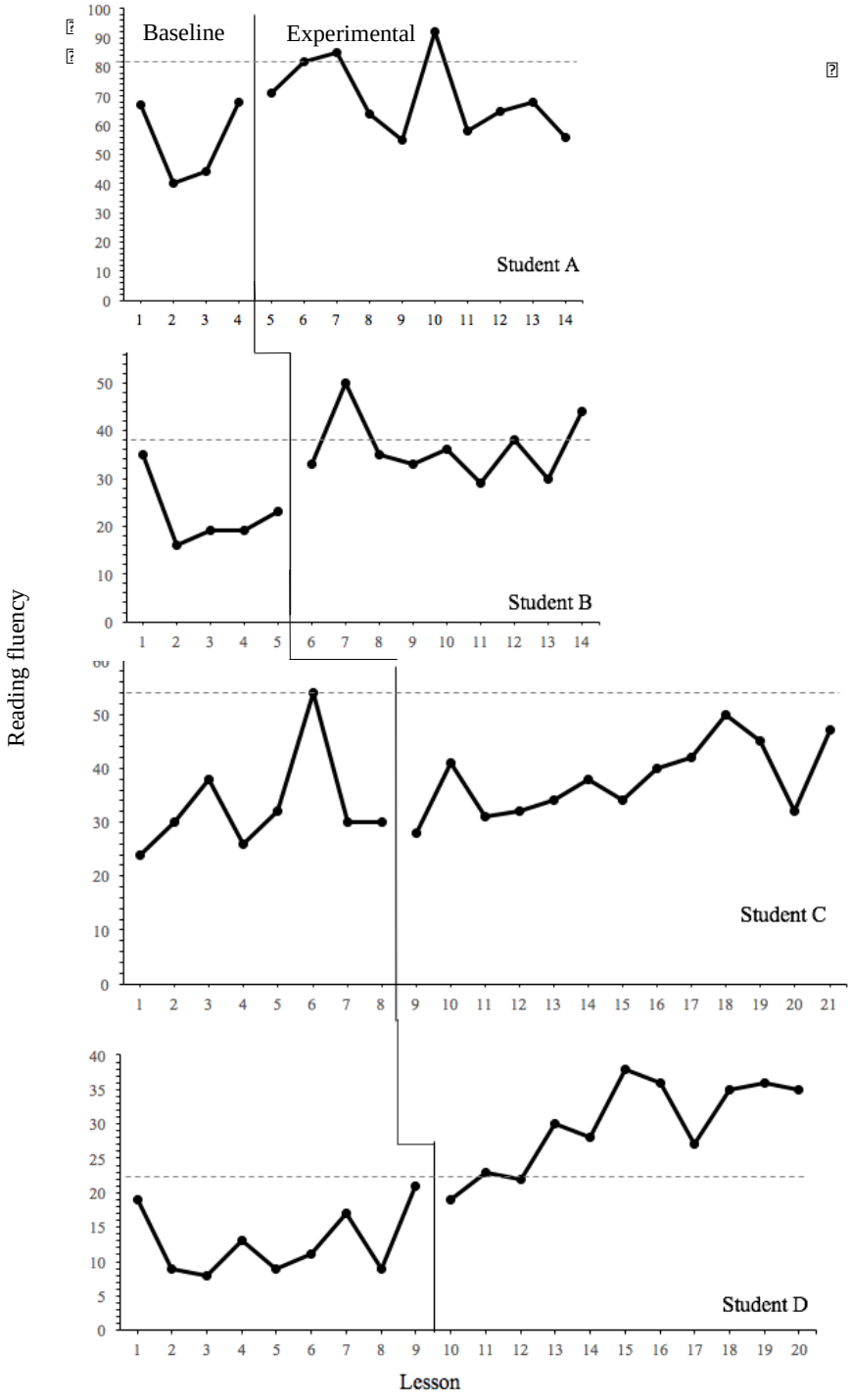


Figure 2

Reading Interest

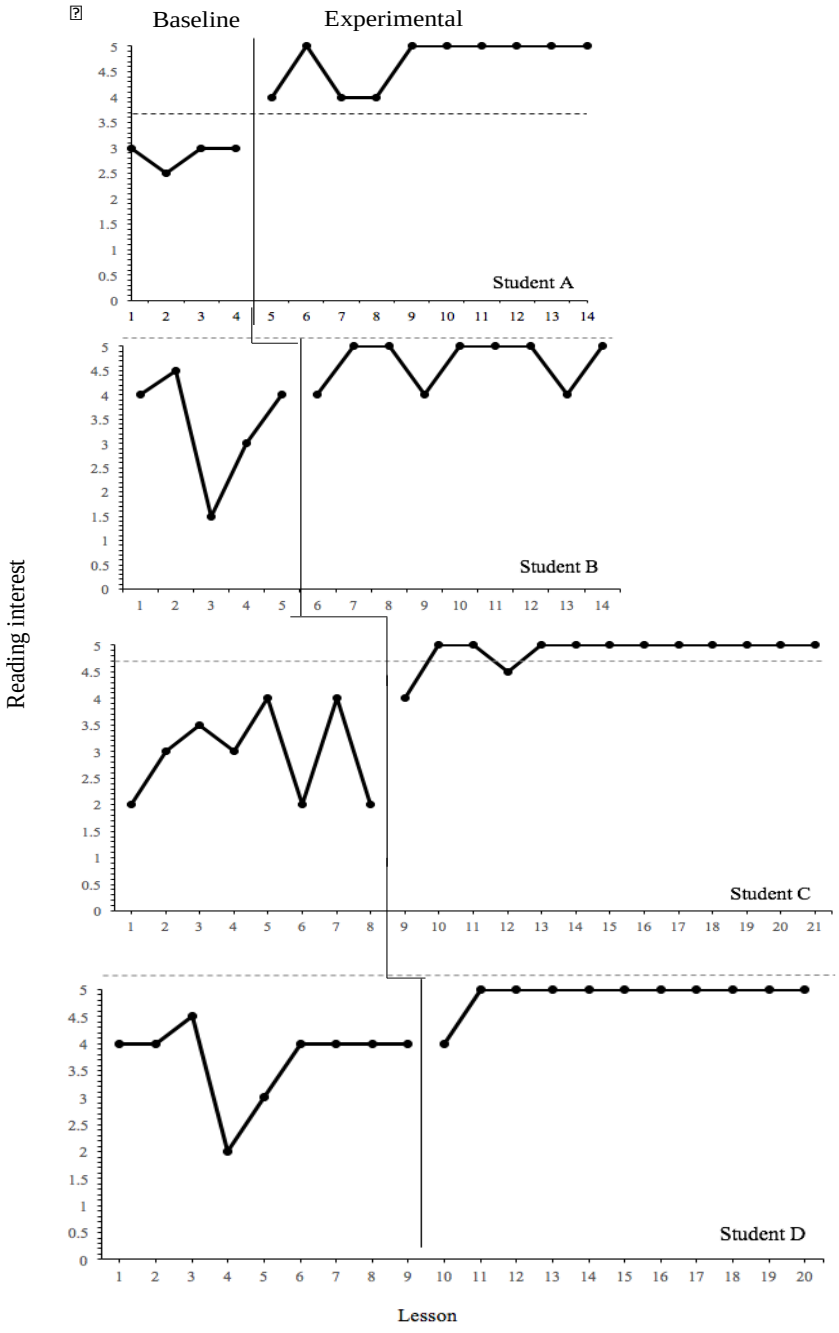
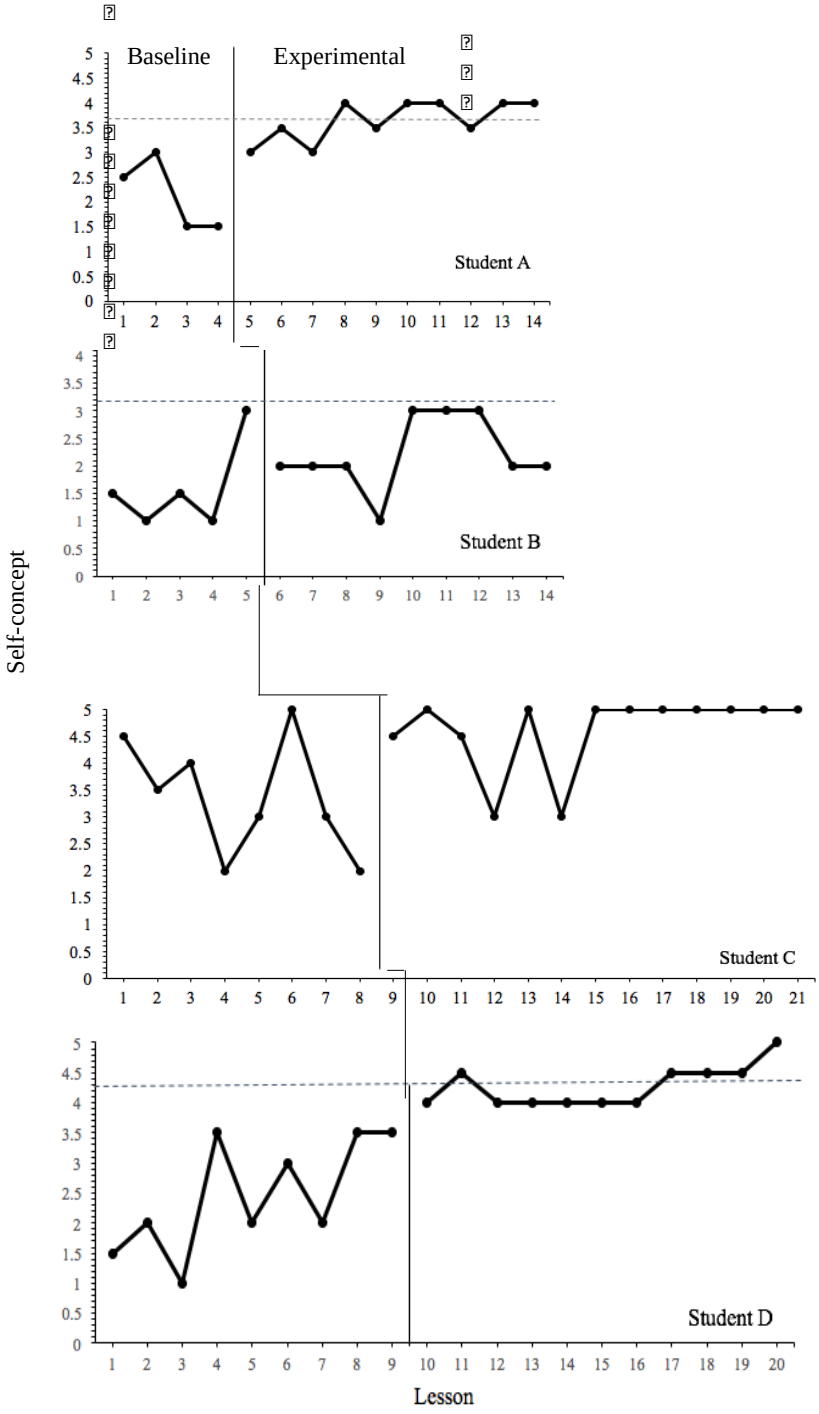


Figure 3

Reading Self-Efficacy



Appendix A

Intervention Overview

Summary of the two conditions

Baseline	Experimental
Aspects that differ across conditions	
Non-verbal math fluency exercises	Motivation-fostering practices
Instructor-selected books and reading games	Student-selected books and reading games
General, positive feedback	Specific, goal-directed feedback
Aspects that are matched across conditions	

Student Characteristics: As all students received both the baseline and the experimental condition, conditions are matched on all student characteristics.

Methodology: Participant sampling, length, frequency, and duration of intervention lessons

Pedagogy: One-on-one instruction, PI delivery, differentiation by student level, game-based learning, best-practice reading instruction elements

Shared pedagogy: Evidence-based reading instruction

All lessons included a review and introduction to the day's lesson (2-5 minutes), direct instruction using evidence-based reading instruction (5-10 minutes), an application game using the concepts learnt during the day's lesson (10-15 minutes), and shared book reading (10-15 minutes). The evidence-based cognitive components used included synthetic phonics, analogic phonics, shared book reading, and shared book reading with direct mapping. The learning goals targeted during lessons were to teach students grapheme-phoneme correspondences, digraphs, blending sounds into words, using blending to write words, learning common sight words, and

building fluency. These practices have been shown to have positive effects on the reading achievement of students at risk for reading difficulties in previous intervention studies (e.g., Savage et al., 2018). Teaching of grapheme-phoneme correspondences and digraphs followed the simplicity principle, in which letter-sound correspondences are taught in order of most common occurrence in children's books (Chen & Savage, 2014). Each lesson built upon previous lessons, with a review of previously seen concepts. Time dedicated to each sound or sight word was adjusted based on students' ability. Lessons were designed to allow for differentiation, i.e., students with the most severe reading difficulties were given easier versions of the same task, and those who were more advanced were given more difficult versions. Games were used to create an active-learning atmosphere. For example, one board game asked students to give an example of a word containing the sound of the day when they landed on a yellow square, read a word when they landed on a green square, write a word when they landed on a red square, and write a sentence when they landed on a blue square. In every lesson, students read books taken from their school library, and the instructor scaffolded reading as needed. In this and all activities, children were encouraged to read words at their level, and instructors helped when necessary.

Differing pedagogy

Baseline lessons: Non-verbal math exercises

In all baseline lessons, students completed non-verbal math fluency exercises for 25% of instructional time. Students were provided with worksheets drawn from the Grade 3 *Everyday mathematics* guide of the University of Chicago (UChicago STEM education, 2017), and were given short instructions on how to complete the tasks. Topics covered included ordering numbers, double-digit addition, fact extensions, partial sums, subtraction, estimation,

multiplication, division, comparing numbers, fractions, and decimals. Tasks were differentiated so that students with weaker mathematics skill completed easier worksheets such as addition and subtraction, and stronger students completed more difficult worksheets such as multiplication and division. All math worksheets involved minimal reading, and instructions were delivered orally by the instructor.

Experimental lessons: Motivational components

In all experimental lessons, students received motivational instruction for approximately 25% of instructional time. Below is an outline of the different motivational components taught.

Two lessons: Goal setting. The instructor introduced learning goals for the length of the intervention and invited students to provide their input. The instructor asked students to set personal learning goals. Guidance was provided to help students set goals that were realistic, clear, challenging, and focused on attainable targets. Students were asked to write down their goals in their personal notebook and encouraged to add/amend goals in subsequent lessons.

Eight lessons: Socio-emotional coaching. Exercises drawn from Solution-Focused Brief Therapy for use in children (National Society for the Prevention of Cruelty to Children, 2014) were used. These included asking students to say what they would like to change about their school life, to imagine their ideal future at school, to write/draw their strengths and interests, to identify things they are already doing to reach their goals and identify their solution team. Props such as blocks, steps, and drawing were used to visualize progress.

All lessons: Positive attribution beliefs. Students were given progress charts and taught how to self-track their progress towards their goals. In all subsequent lessons, students were asked to track their progress, and to identify ways in which to continue. Students and instructors discussed the progress students made, the setbacks students had, and how to move forward by focusing on

effort and growth. To support students' autonomy and develop feelings of competence, students were given choice over the books, games, and other activities, as well as provided with books leveled so they could read them independently.

Lesson plan outline

Baseline condition lesson plan template

All lessons.

10-15 minutes: Non-verbal math fluency exercises.

2-3 minutes: The instructor introduced the book and the day's lesson.

5-10 minutes: Direct instruction in areas of student weakness using best practices.

10-15 minutes: Teacher-chosen application reading game of concepts learnt.

10-15 minutes: Shared book reading of instructor-selected book. Probes for reading interest.

0-5 minutes: Probes for reading fluency and reading self-efficacy.

Experimental condition lesson plan template

Lessons 1 & 2: Goal setting.

2-3 minutes: The instructor introduced the plan for the day's lesson and subsequent lessons and invited students to provide their input on what they like/don't like, want to do/don't want to do.

5-6 minutes: The instructor asked students to set personal learning goals. Guidance was provided to help students set goals that were realistic, clear, challenging, and focused on attainable targets.

- Potential script: *Now we're going to set out together what your goals are for our lessons, and you and I will write down what we decide. First, what would you like to be able to do by the end of our time together? Be specific: for example, "I want to be able to read more words"; "I'm going to try reading a whole page on my own and use strategies I learn to*

read words I don't know"; "I'm going to participate in all the learning activities". Second, how are you going to decide whether you've achieved your goals?

2-3 minutes: Students were asked to write down their goals in their personal class notebook.

- Potential script: *Now, write down your goals and how you will evaluate them. If you don't know how to spell any words, let me know and I will help.*

5-10 minutes: Direct instruction in areas of student weakness using best practices.

10-15 minutes: Student-chosen application reading game of concepts learnt.

10-15 minutes: Shared book reading of student-selected book. Probes for reading interest.

0-5 minutes: Probes for reading fluency and reading self-efficacy.

Lessons 3, 4, 5, 6, 8, 9, 10, 11: Socio-emotional coaching.

2-3 minutes: Review and introduction of the day's lesson.

8-10 minutes: Solution-Focused Brief Therapy for use in children exercises (National Society for the Prevention of Cruelty to Children, 2014).

2-3 minutes: Students were encouraged to look over their goals and amend / add goals.

5-10 minutes: Direct instruction in areas of student weakness using best practices.

10-15 minutes: Student-chosen application reading game of concepts learnt.

10-15 minutes: Shared book reading of student-selected book. Probes for reading interest.

0-5 minutes: Probes for reading fluency and reading self-efficacy.

Lessons 6, 10, 12: Positive attribution beliefs.

2-3 minutes: Review and introduction of the day's lesson.

5-10 minutes: Direct instruction in areas of student weakness using best practices.

10-15 minutes: Student-chosen application reading game of concepts learnt.

10-15 minutes: Shared book reading of student-selected book. Probes for reading interest.

5 minutes: Students were given progress graphs and taught how to self-track their progress towards their goals. In all subsequent lessons (i.e., lessons 7-12), students were asked to self-track their progress.

- Potential script: *Now I'd like you to write down, make a graph, or draw, the progress you've made towards your goals. We're going to be writing down how much progress you've made after each lesson we have together.*

8-10 minutes: The instructor and student discussed the graphs: where progress was made, where setbacks occurred, and why in both cases. Students were guided to observe that progress is made due to effort, and that learning is a gradual process.

- Potential script: *Let's take a look together on all the progress you've made this week. At the beginning of the week, you said you wanted to do X, Y, and Z. How do you feel you've progressed towards those goals? Why do you think you improved? / Didn't improve?, What do you think you could do better next week? You've made good progress this week on X, Y, Z. Next week we're going to take a look at W, which will help you understand the texts better. Good job this week, I appreciate your hard work!*

0-5 minutes: Probes for reading fluency and reading self-efficacy.