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The Effects of Schema-Based Instruction on Students At Risk for or with Learning Disabilities

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ABSTRACT

The Effects of Schema-Based Instruction on Students At Risk for or with Learning Disabilities

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The purpose of this study was to examine the effects of schema-based instruction (SBI) on the correct response of 2 second-grade students at risk for or already determined to have a learning disability (LD) of comparison difference word problems. The study was a multiple probe across participants. Although the students did not use the RUN Strategy, one student's ability to solve the word problems improved significantly after learning the strategy. Even though time was a factor in completing everything, the other student's score did begin to improve after learning the RUN Strategy.

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Chapter 1. Introduction

According to The Nation's Report Card (2019), 45 percent of 4th grade students without disabilities performed at or above proficient on mathematics assessments, in comparison to only 17 percent of students with disabilities in fourth grade who performed at or above proficiency. This is a 28 percent discrepancy. This discrepancy can be reduced by providing students with disabilities new techniques to use in order to solve math problems. One technique that can be used is schema-based instruction (SBI). SBI is identifying the type of word problem based on the structure of the problem or the schema (The IRIS Center, 2017). Several studies have been conducted on the effectiveness of SBI for students at risk or identified with a disability.

Griffin and Jitendra (2009) implemented a study to investigate the effects of SBI in comparison to general strategy instruction (GSI). The study examined these effects on 60 third-grade students in an inclusive classroom with five students having a learning disability. The study was a between-subjects, experimental, pretest-to-posttest-to-delayed-posttest group design. The results showed that SBI and GSI were equally effective in improving the students' understanding of word problems. The authors recommended that future studies work to determine if there is a difference in effectiveness between SBI and GSI.

Aside from looking at SBI in comparison to GSI, SBI can be combined with other strategies. Fuchs et al. (2020) conducted a randomized control trial study to investigate the effects of SBI with embedded language comprehension instruction versus the effects of word-problem intervention without embedded language comprehension instruction for at-risk 1st graders. The researchers assigned the students to a random condition across four conditions to measure their word problem performance. Results indicated that schema-based word problem

interventions do improve students' understanding of word problems, and SBI was more effective when it embedded language instruction about word problems.

Besides combining SBI with language comprehension instruction, there are also studies that have focused on modified SBI for students with more extensive support needs. For example, Root et al. (2017) conducted a study to investigate the effects of modified SBI on 3 students with autism and moderate intellectual disabilities in an elementary school. They used a multiple probe across participants with alternating treatment design to measure the total points that the students' received from performing the nine steps of the task. The task steps were: read the problem, circle the hats, find the label in the question, use my rule, circle the numbers, fill in the number sentence, determine if it is addition or subtraction, make sets, and then solve and write the answer. Results indicated that all three students were better at solving word problems after the intervention was implemented both virtually and with concrete materials.

Whereas the previous studies focused on either modified SBI or SBI with another intervention, Rockwell et al. (2011) focused on SBI only. The authors conducted a study to investigate the effects of using SBI on a student with autism in the fourth grade. They used a multiple probe across behaviors single-case design to measure the impact of SBI on one-step addition and subtraction word problems. The results showed that the student's ability to solve one-step addition and subtraction problems improved, and the results also showed the student was better able to generalize this skill even after the intervention had been completed. The authors felt that future research was needed to determine if there is confidence in using SBI for students with autism.

In a similar manner, Hughes and Cuevas (2020) conducted a study to investigate SBI exclusively. The study investigated how SBI impacts the frequency at which students use

strategies to solve word problems in a second-grade resource class with students who have individualized education programs. They used a single-subject research to measure the impact of schema-based instruction on word problems and how the students solved these word problems. The results showed that the students were better at solving word problems, and they were better at using the correct strategy to solve the problem. Due to the sample size of this study, the authors stated that research is needed to determine if SBI is effective for students with disabilities in second-grade.

As most of the research surrounding schema-based instruction pertains to combine, compare, and change problems, there is limited research on the problem types individually as they are traditionally taught together. Teaching these problems together limits the ability to examine how techniques for one type of problem generalizes to other problem types. As with the Fuchs et al. (2020) study, many studies combine the SBI with some other factor such as embedded language comprehension instruction or virtual and concrete manipulatives. There was more than one independent variable in these studies.

To address some recommendations and limitations of previous literature, this study will focus exclusively on SBI for second-grade students at risk for or with learning disabilities. SBI will be used to instruct the students on how to solve comparison difference problems. The research question for this study included the following:

1) What is the effect of SBI on the correct response to comparison difference problems for second graders at risk for or with learning disabilities?
2) How does SBI for comparison difference problems generalize to combine and change problems?

Chapter 2. Literature Review

The discrepancy, mentioned in Chapter 1, between the percentage of students with disabilities versus the percentage of students without disabilities who scored at or above proficient on mathematics assessments is significant (NAEP, 2019). This chapter will discuss relevant literature on general education mathematics instruction of word problems, students at-risk and with disabilities in mathematics, and schema-based instruction (SBI) to provide a rationale of the purpose of this study.

General Education Mathematics Instruction of Word Problems

Word problems are often tricky for students. Whether it is attempting to understand what the problem is asking, or it is figuring out how to solve them, word problems can be difficult. Pongsakdi et al. (2020) looked to determine if the linguistic difficulties associated with reading a word problem and then comprehending it impacted students' ability to solve the problem. This study used multiple assessments regarding literacy comprehension, mathematical word problems, and arithmetic skills. The results concluded that there was not a significant relationship between word problems, the ability to comprehend them, and the ability to solve them. However, they do discuss that previous literature demonstrated that there is a correlation between word problems and literacy comprehension. This study extended the literature because the word problems that were used were not straightforward and required a deeper understanding of the concept.

Apart from understanding a students' literacy needs regarding understanding and solving word problems, students may just have no interest in the content of the word problems. Thus, Bates and Wiest (2004) examined the effects of personalizing word problems. They predicted that, if students were interested in the subject of the problem or saw their names in the problems,

then that would increase the likelihood they solved the problem correctly. The students were given multiple assessments over the course of several weeks where there were ten problems total with five of them being problems designed with their interests in mind. The results showed that the students were no more successful on the interest problems than they were on the regular problems. However, the authors did indicate that most other research has shown that personalizing word problems is effective.

Literacy needs and personalization of word problems are all factors that go into supporting students in solving word problems. However, thus far, neither of those methods have demonstrated consistent results. In the studies discussed, they were examining these effects on students who do not have disabilities and are not considered at risk. More methods on a wider range of students need to be examined to determine what is effective in supporting students with mathematics and word problems.

Students At-Risk and With Disabilities in Mathematics

There are a number of factors that impact student difficulties in math such as comprehension, number sense, and working memory. Doabler and Fien (2013) indicate that explicit instruction, or direct instruction, is the best possible method to use when teaching students with math difficulties. They say, "it serves as a method for increasing the number of instructional opportunities that at-risk learners receive both in small-group interventions and in core instruction" (Doabler & Fien, 2013). Doabler and Fien (2013) say explicit instruction has three main elements: teacher models, guided practice, and academic feedback. Teacher models are when the teacher clearly demonstrates the method or solution that is the focus. This is clear and direct, and it does not leave room for the students to misunderstand something. Guided practice is the initial support that is given after the student learns a new skill. It is slowly

withdrawn as the student improves their understanding and ability level. Academic feedback gives student guidance as to what they are doing correctly and what they need to try again. Consistent feedback gives students insights into their misunderstandings, and it helps to deepen their understanding.

Working memory is one area that can influence students' abilities in math and especially in word problems. The students must simultaneously remember what the problem said while attempting to understand what they are meant to do. Swanson et al. (2008) examined the effects of working memory on problem solving. They determined that working memory is a huge part of the students' ability to store and process problems. However, the authors noted that while their results showed that the working memory of students at risk for or with disabilities in mathematics is an integral part of solving problems, they discuss how many studies have not found this to be the case.

Jitendra et al. (1996) compared the effects of a schema-based strategy to a traditional strategy for word problems. The study focused on second, third, fourth, and fifth graders who were at-risk or who had disabilities. Each student was randomly assigned to either receive the schema-based strategy or the traditional strategy, and both groups showed that the scores of the students increased from the pretest to the posttest. One aspect of this study focused on how the two strategies maintain over time, and the results indicated that the students who received the schema-based strategy intervention maintain their understanding over time better than the students who received the traditional strategy intervention.

Thus far, the literature examined in this review has discussed strategies that have uncertain outcomes for students. In the Jitendra et al. (1996) article, there was clear indication that the schema-based strategy generalized and maintained its effectiveness. Literature

surrounding schema-based instruction (SBI) must be examined further to determine the validity of the results of the Jitendra et al. (1996) study.

Schema-Based Instruction (SBI)

If literacy difficulties, personalization of word problems, and working memory are not sufficient to solve the deficit in mathematics, further methods must be examined to support not only students with disabilities but also those without. Schema-based instruction (SBI) is a well researched method that has shown positive results (Fuchs et al., 2020; Hughes & Cuevas, 2020; Powell & Fuchs, 2018; Rockwell et al., 2011; Root et al., 2017).

Sarah R. Powell and Lynn S. Fuchs are two common names associated with the schema-based instruction (SBI) method. Powell and Fuchs (2018) discussed how schemas are determined based on the problem's structure. They discussed two different categories of schema: additive and multiplicative. Within the additive schema, there are three different types: compare, change, and combine. Compare is described as "sets compared for a difference." Change is described as "an amount that increases or decreases." Combine is described as "parts combined for a sum" (Powell & Fuchs, 2018). Each of these three definitions refer to specific word problems that have that underlying structure. There are also three different types of multiplicative schema: equal groups, comparison, and proportions. Equal groups are "a number of equal sets or units." Comparison is "one set as a multiple or part of another group." Proportions are the "relationships among qualities" (Powell & Fuchs, 2018). Each of these refers to how to identify the structure or schema of the word problem.

Hughes and Cuevas (2020) conducted a study to determine the effects of schema-based instruction with seven second-grade students with disabilities. This study was conducted in a

small group setting where the students first received the traditional word problem instruction and then received SBI. SBI was implemented in two phases: one, where the focus was on determining the schema and two, where the focus was on solving the problem. The study resulted in the students correctly solving the problems more, but there was minimal change in their use of the SBI strategy. The results of this study indicate that, while the students may not use the SBI strategy more, the knowledge of the strategy does support them in solving the problems more.

Fuchs et al., (2020) took a similar approach with a group of first-grade students who were considered at-risk. This study also involved embedded language comprehension instruction. The students were divided into four groups with one of them being the control group. The other groups included SBI with the embedded language comprehension, SBI without the embedded language comprehension, and a number knowledge intervention with word problem instruction. The results indicated that the students who received the SBI with the embedded language comprehension intervention performed significantly better with word problems than any of the other groups.

Rockwell et al., (2011) focused their attention on one student with autism. They utilized SBI and focused on the three types of additive schema: compare, change, and combine (group). They introduced the student to a modified version of the RUNS strategy where the student was instructed to Read the problem, Use a diagram, create a Number sentence, and State the answer. The student received direct instruction meant to support her in differentiating between the three problem types. The results showed for all three types of problems that the student significantly improved in her ability to solve them. The results also showed that she was able to use the correct diagram for support for each type of problem.

While Rockwell et al. (2011) focused on all three types of additive schema, Root et al., (2017) focused only on compare word problems. This study took place with three elementary students with autism. The goal was to see how effective modified SBI was and to see how effective it was with concrete versus virtual manipulatives. In both concrete and virtual format, the students were given a task analysis or a student self-instruction sheet. This was used to support the students in going through the steps of the SBI. The results show that all three students' scores jumped up significantly after receiving the instruction, and it continued that way through maintenance and generalization. The results also showed the two of the students performed better with virtual manipulatives, and one student performed better with concrete manipulatives.

Few studies have been done on how schema-based instruction (SBI) effects students with disabilities or those at-risk. Even fewer studies have been done about how SBI on one type of word problem might generalize to other types of word problems. Future research is warranted to fill these gaps and determine if SBI is an effective strategy for students with disabilities.

Chapter 3. Methods

Participants

The study included 4 second-grade students who were at-risk for or had been identified with a learning disability. Additionally, to participate in the study, parents had to provide consent, the students had regular attendance (i.e., students were present for 90% of the school year), students had adequate hearing and vision, and were at risk-for or are already identified with a learning disability. Those who were at-risk for a math learning disability had to have received a score at or below the target score on the math portion of the TCAP test at the end of their first-grade year. The students' literacy scores on the TCAP were also taken into consideration. They were also considered at-risk by their teacher.

Setting

The school was a K-12 laboratory school for a regional University in the Southeastern United States. This school had a direct connection with the university's education program, so the school had the traditional staff along with many student teachers and volunteers fulfilling their program requirements. The school had an enrollment of approximately 600 students with only one classroom per grade. The school was on a year around schedule with three week breaks intermittently throughout the school year.

According to Niche (2021), the student body is made of approximately 51% females and 49% males. Approximately 85.4% of the population is white, 7.2% is Asian, 3% is African American, 2.8% is Hispanic, 0.5% is Native American, and 1% is considered multiracial.

This intervention took place during morning work time in the second-grade classroom that these students received instruction. There were twenty students in the classroom with one aid to assist and one student teacher. The classroom was made up of tables that the students share

with cubbies and windows on one side of the classroom. At the front of the classroom was the whole group section with a rug for the students to sit on. The teacher's desk was also toward the front of the classroom. There were two storage rooms at the front of the classroom. Baseline and intervention sessions took place in one of these storage rooms. There was a small table with two chairs and several bookshelves in the storage room. The door remained open during all sessions, and the teacher would often be engaged in whole class instruction with the Smart Board right outside of the open door.

Materials

The probes were created using problems from a bank of comparison difference problems, which were created by the experimenter. The classroom teacher and a content expert validated examples of the probes. Throughout these probes, there were five problems total. Four of the problems were the comparison difference problems. One problem was either a change or combine problem which was used to help determine if SBI generalizes. None of the word problems required regrouping but were all 2-digit.

Over the course of the intervention, the students completed problems during the probes and for practice during the intervention. All the problems were compare, change, or combine problems. Some of the problems were personalized with the students' names or with features they enjoy. They had a task analysis of the steps of the strategy to help them solve the problems. This task analysis included the five steps of the RUN Strategy (Fuchs et al., 2014). It was organized as a checklist, so the students could check off each step as they made their way through the strategy.

Experimenter

The experimenter was the author of the study. She was pursuing a master's in special education advanced studies track. She held a bachelor's degree in early childhood development. The experimenter had primarily worked with students without disabilities, but she did have some experience with at-risk students and students with learning disabilities.

The experimenter was well versed in the literature on schema-based instruction but had never implemented it in practice. For the purposes of this study, before beginning the intervention, the interventionist was thoroughly trained in the procedures and had to demonstrate this with 90% or higher fidelity of implementation to the research team.

Dependent Variable

The dependent variable was the number of correct comparison difference word problems. A comparison difference word problem is when two sets are compared to determine the difference between the two sets (Powell & Fuchs, 2018). For example,

> Winston drew 31 pictures in a week. Spencer drew 65 pictures in a week. How many fewer pictures did Winston draw than Spencer?

These problems were created by the experimenter and validated by a content expert and the classroom teacher to ensure similar complexity across all problems. These problems were from a bank of problems created prior to the beginning of the experiment. The students were evaluated on problem representation and problem solution.

The students had a task analysis of the steps to solve the problems. These steps were adapted from Fuchs et al., (2014) and are called the RUN Strategy. The task analysis was used to

determine how well the students performed. The first step was the students reading through the problem with the teacher. Next, the students underlined the question. Then, they determined the schema and wrote the appropriate equation with blanks where the numbers will go. Next, they reread the problem out loud and filled in the blanks of the equation. Finally, the students solved the problem. The students were assessed based on them following these steps and on them solving the problem correctly, which would then determine whether there was a functional relation for using SBI.

Inter-Rater Reliability

Inter-rater reliability (IRR) was collected for 20% of the sessions by a member of the research team. The target was 80% or better. Item by item IRR was used. IRR was calculated by determining the number of times the two observers agreed, and it was divided by the number of agreements plus the number of disagreements and then multiplied by one hundred. This was done for each observer individually and compared to the interventionist's data. If the total percentage agreement fell under 80%, the research team would meet to determine the cause of the discrepancies.

Independent Variable

The independent variable was schema-based instruction. According to the IRIS Center, schema-based instruction identifies the structure and looks for patterns. A key part of schema-based instruction is the use of schemata diagrams to show the relationship within the problem. According to Powell and Fuchs (2018), there are two different schemas additive and multiplicative with each having three different types within their category. The focus of this

study was on the additive schema comparison difference problems which is when sets are compared to determine a difference.

SBI was taught using three phases that were used to support the students' learning of the RUN Strategy. During Phase 1, the students learned the three different types of additive schema. There were three days of instruction for Phase 1. During day one of Phase 1, the students learned the combine schema. They learned the definition, examined example problems, and discussed key indicators and parts of combine word problems. During day two of Phase 1, the students learned the change schema. They learned the definition, examined example problems, and discussed key indicators and parts of combine word problems. During day three of Phase 1, the students learned the compare schema. They learned the definition, examined example problems, and discussed key indicators and parts of compare word problems. During Phase 2, the students reviewed the definitions of the three different types of additive schema, and they used those definitions to determine the schema in a variety of combine, change, and compare problems. This phase lasted until the students were well versed in how to identify the schema and were doing it correctly 4 out of 5 practice problems, since this was an integral part of the RUN Strategy. During Phase 3, the students learned the RUN Strategy. They still reviewed the definitions of all three different types of additive schema, but the students only learned to use the RUN Strategy with compare problems. This was to help determine if the RUN Strategy would generalize to the other types of additive schema problems. During this phase, students discussed with the teacher how to use the RUN Strategy to solve example problems.

Procedural Fidelity

Procedural fidelity (PF) was collected by members of the research team for 33% of the intervention sessions. They used a checklist of the steps of each phase to determine procedural

fidelity. PF was determined by dividing all the procedural steps correctly implemented by the total number of steps and then multiplied by 100. The interventionist was expected to maintain a procedural fidelity of at least 80%. If the interventionist did not maintain a fidelity of implementation of at least 80%, then the research team would retrain the interventionist on the procedures.

Experimental Design

This study was a single case, multiple probe across participants design (Ledford & Gast, 2018). During baseline, all students were initially probed for 5 sessions on their ability to do comparison difference problems without feedback for a minimum of three data points. The student who performed the lowest and had the most stable data began the intervention first. Once a change in trend and/or level was consistently demonstrated, the other students were probed again to identify if their data was still low and stable with their prior baseline data. A second student with low and stable baseline data then entered the intervention. This process continued until all students are in the intervention.

To determine how SBI generalizes, during each probe in baseline and intervention, the students received one question that was not a comparison difference problem. This helped to determine if the steps of SBI could be generalized to other types of schema problems. The data from baseline and the intervention were compared to determine if participants were able to generalize the skills they learned.

Data Analysis

Data were collected on all probes. This data was graphed after each probe, and visual analysis was used to evaluate changes in data patterns across phases. Each participants' data was

graphed individually to determine if a functional relationship existed. The researcher conducted visual analysis on graphed data to determine level, trend, consistency, immediacy of the effect, variability, and overlap. It was not expected that there would be an immediate change since the students were not learning how to solve word problems for the first time. It was also not expected that the students would show a change until Phase 3 when they began to learn the RUN Strategy. However, it was expected that there would be a positive trend and a change in level. Additionally, percentage of nonoverlapping data (PND) was used to calculate effect size. For calculating PNDs for each participant, a PND calculator was used (Tarlow & Penland, 2016). PND scores range from 0%-100%. Scores 90% and above indicated that the intervention was very effective, 70%-89% indicated that the intervention was effective, 50%-69% indicated a questionable effect, and below 49% indicated an ineffective intervention (Rakap, 2015).

Social Validity

At the completion of the intervention, the students completed a survey of their feelings regarding the intervention. The experimenter read the statements to the students. There were five statements that the students were able to answer the survey by saying they agree, disagree, or a maybe. The statements were: I liked learning about schema, I feel like knowing about schema helps me solve word problems, I would use the RUN Strategy again, I feel like the RUN Strategy helps me solve word problems, and I feel like I know how to solve word problems better than I did before this experience.

Chapter 4. Results

This chapter discusses the results of each student using and learning about SBI, procedural fidelity, and social validity. The results from the study are in relation to the research questions which were:

1) What is the effect of SBI on the correct response to comparison difference problems for second graders with learning disabilities?
2) How does SBI for comparison difference problems generalize to combine and change problems?

The results for each student will be shown in Figure 1. As discussed in the method section, the study began with four students. However, due to each students' baseline results, only two students were in the appropriate score range to continue. The two students who continued into the intervention consistently scored at zero problems correct during baseline, with one student scoring one problem correct on one day. The other two students scored consistently at four to five problems correct for most of baseline as seen in Figure 1. For the problems that these two students missed, they were missed due to computation and not due to problem set up. Since the focus of this study was on problem set up, the students were removed from the study. The two students who received intervention are referred to as S and H in the following results section.

Procedural Fidelity

For S, procedural fidelity was measured on 18% of the phases overall. While the goal was 33% of the phases, time was a factor. The results of these fidelity check shows that the interventionist maintained between 95% and 100% of fidelity with an average of 97.5%. For H,

procedural fidelity was measured on 36% of the phases overall. The results showed that the interventionist maintained between 81% and 100% of fidelity with an average of 92.3%.

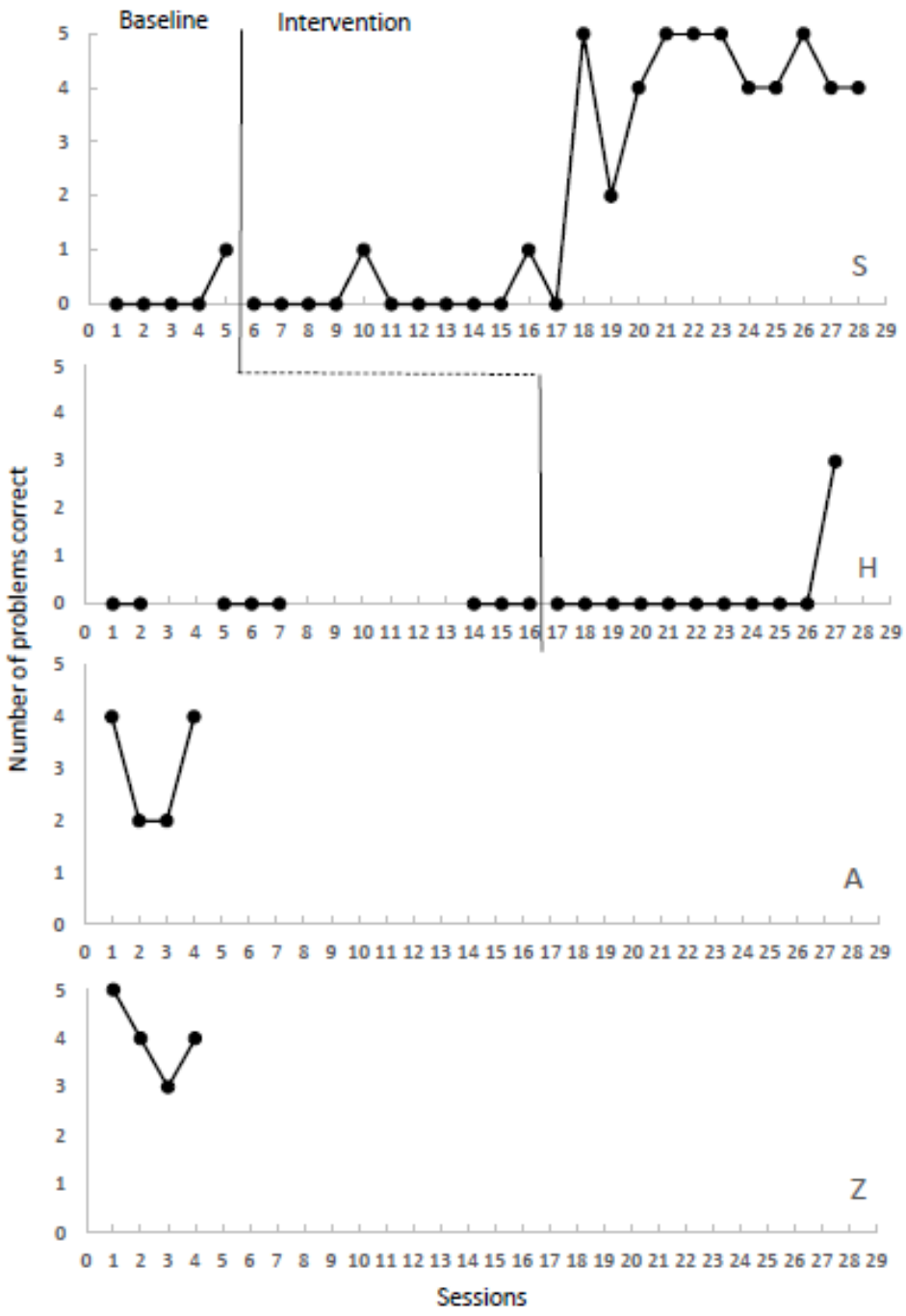
Inter-Rater Reliability

The goal for IRR was for it to be collected on 20% of session with at least 80% IRR. IRR was collected for 23% of S's phases. The results showed 100% IRR. For H's phases, IRR was collected for 21% of phases and showed 100% IRR.

In Figure 1, the results for all 4 students are shown. As discussed above, only 2 students continued into the intervention, but the other students' baseline data is shown.

Figure 1

S, H, A, and Z Results



S Results

As shown in Figure 1, S began the phases and intervention first. In Phase 1, S began by learning the three different types of additive schema and how to identify that schema in word problems. This is a key part of the RUN Strategy and needed to be included, but Phase 1 is not the intervention. S did not learn about how to solve the problems thus it was expected that she would remain at zero correct answers. In Phase 2, S used the knowledge of identifying schema and began practicing how to identify the schema. However, this phase specifically focused on the comparison type of schema, which was the focus of this study. During this phase, S mostly maintained the zero correct answers, with one exception where she answered one problem correct. Overall, she stayed the same as in baseline and Phase 1. This was expected due to the RUN Strategy still not being the focus of this phase. During Phase 3, when S was introduced to the RUN Strategy, she showed a significant change in trend and level. In regard to effect size, the PND was 78.57% ($\boldsymbol{p}$ = 0.0036), indicating the intervention was successful.

H Results

As shown in Figure 1, H's timeline was stunted in comparison to S due to COVID-19. This significantly hindered the time spent in the school. As a result, Phase 2 and Phase 3 were shortened. As a result, he did not have as good of a comprehensive understanding as S did by the end of Phase 3, and as a result, he stayed consistently at zero correct answers throughout all of baseline, Phase 1, Phase 2, and most of Phase 3. He did have a jump in level on the very last day of Phase 3 where he answered three correct. PNDs were not analyzed since H did not have enough time in the intervention to run this analysis

Social Validity

The social validity checks consisted of five statements that the students could respond with agree, disagree, or maybe. H agreed that he would use the RUN Strategy again. However, he did not feel that knowing schema helped him solve word problems nor did he feel that he knows how to solve word problems better now than he did before this experience. But, he did feel that maybe he liked learning about schema and maybe the RUN Strategy would help him solve word problems. In comparison, S liked learning about schema and felt like it helped her solve word problems. She also felt like the RUN Strategy helped her solve word problems and that she can solve word problems better now than she did before this experience. However, she did not feel like she would use the RUN Strategy again because she stated that it takes too long.

Chapter 5. Implications and Limitations

In this chapter, the limitations of the study will be examined and discussed. These will give insights into how this study could have been improved and provide ideas of what could be done differently for future researchers. This chapter will also discuss what implications this study has practitioners and on future research.

This study examined two research questions:

1) What is the effect of SBI on the correct response to comparison difference problems for second graders at risk for or with learning disabilities?
2) How does SBI for comparison difference problems generalize to combine and change problems?

Due to time constraints, it could not be conclusively said if SBI was able to generalize to the other problem types. Due to there not being 3 demonstrations of effect, there was no functional relation. This study had protentional to fill gaps previously mentioned in the research because it addressed schema-based instruction (SBI) without any added independent variable, and it did SBI with students at-risk and with learning disabilities. While it had the potential, the results were inconclusive due to being unable to determine a functional relation.

Limitations

There were several limitations to this study. The biggest limitation was the timing. The study was meant to begin earlier in the school year but did not start until right before winter break. Upon returning from winter break, the study was put on halt for three weeks due to COVID-19. Then, the study was cut short due to the three week break the students take in March. These events severely hindered the study, and as a result, one of the students did not

complete the study. Because of this, the time was significantly shorter than what was needed. For H, he did not stay in Phase 2 as long as he needed, which likely hindered his understanding of schema and the compare problems. He also did not stay in Phase 3 as long as he needed. It is likely, as shown in the last day of his intervention, that he would have continued to grow and could have potentially shown growth like S.

Another limitation of this study was the number of students included in the study. When the two students who scored high in baseline were removed, a replacement student was vetted, but unfortunately, no replacements could be found who were suitable for the study. The lack of having three participants meant that the study could not demonstrate a functional relationship.

The timing and limited number of students were huge hinderances to this study. Due to both of these limitations, it is also hard to determine if SBI would generalize to other problem types. An important note about S's results is that she did not miss the change or combine problems more often than the compare problems. If she did miss them, it was due to a computation error not because she did not know how to set them up. This indicates that SBI would have likely shown to generalize if this study had been able to continue and been with the appropriate number of participants.

Implications for Practice

While the study did not show a functional relation due to the limitations mentioned, the RUN Strategy would likely be helpful to practitioners. The RUN Strategy's focus is not on how to do addition and subtraction, but it does breakdown the parts of each of the word problem. The students read through the problem several times which can help with their comprehension. When reading through the problem, the students also focus in on what the problem asking. Then, before

they are solving the problem, they focus on if the problem is meaning for them to add or subtract. Each of these parts of the RUN Strategy makes the student slow down and focus on the problem. They stop to determine what the question is, so they know for sure what they are looking for. They stop to determine if the problem needs adding or subtracting, and they focus on this at a time when they are not concerned with solving the problem.

Knowing schema and how to identify schema in the word problems can also help practitioners. Identifying schema is all about understanding what the problem is asking and how to set the problem up to solve it. Schema is knowing the structure of the problem, and this helps support students in how to solve the problem. Teachers should use schema in the classroom to further students' understanding of the word problems. Considering this study only focuses on additive schema, this could be continued even further by introducing students to the multiplicative schema.

Finally, though there was not significant enough data from this study to say conclusively, it is likely that SBI and the RUN Strategy would generalize. The RUN Strategy is broad enough that it could easily be applied to multiple problem types. Being able to apply one strategy to multiple problem types, eliminates the need for teachers to teach multiple strategies. This helps teachers to focus on one strategy that can then be applied to multiple problem types. Another benefit to this is that students only need to know one strategy. They do not need to search their memory to determine which strategy might work. They automatically know the one strategy that works for all problems.

Implications for Future Research

Since there were only two participants no functional relationship between the RUN Strategy with SBI and correctly solving word problems was demonstrated. This is a limitation that should be addressed by future researchers. Since this study was also limited in time and participants, future researchers should replicate this study to determine the functional relationship and determine how well the RUN Strategy with SBI generalizes to the change and combine word problems. In turn, this would showcase the effectiveness of the RUN Strategy with SBI if it was able to work with compare problems and generalize to the change and combine word problems. The potential was there in this study when examining S's results. Her change from baseline to the end of Phase 3 was significant and showed that SBI worked for her.

A key part of this study was working with second graders who had already learned how to solve these types of word problems, so they had strategies to help them solve the problems. It would be interesting for future researchers to examine the RUN Strategy with SBI with students who are just learning how to solve these types of word problems for the first time. Thus, they would have no prior knowledge and no prior strategies to help them solve the problems. This would show the effectiveness of the RUN Strategy with SBI, and it would eliminate any possibility that the students can solve these problems because they have done it before.

Conclusion

This study examined the effects of schema-based instruction on two second-grade students who were at-risk or had a learning disability. The intervention was done in three phases. In Phase 1, the students learned the three different types of additive schema. In Phase 2, the students applied that knowledge and identified the schema of different word problems. In Phase

3, the students used the RUN Strategy, which involved identifying schema, to solve compare word problems. While the results are inconclusive about if there was a functional relation since there were not enough participants, one student showed significant change in Phase 3. Future researchers should consider doing this study again with enough participants and the necessary amount of time.

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