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Research Article

The effects of cognitively guided phonetic instruction on achievement and self efficacy in elementary students in a response to intervention program

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Cognitively Guided Instruction (CGI) is a mathematics instructional strategy that focuses on students using problem-solving strategies to construct their own understanding. Little research has been conducted to help determine what CGI could look like in other subject areas. The purpose of this study was to investigate ways to apply CGI to a phonics lesson and determine if cognitively guided phonetic instruction could have a positive impact on the achievement and self-efficacy of tier two and three special education students. A pre and post assessment and survey were administered and compared student achievement and self-efficacy. The study concluded that cognitively guided phonetic instruction allowed students in these tiers to achieve similar growth in their phonetic abilities and self-efficacy when compared to their higher achieving gifted and on-level peers.

Keywords: Cognitively guided instruction; Phonics; Cognitively guided phonetic instruction; Self-efficacy; Phonics instruction

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1. Introduction

Cognitively Guided Instruction (CGI) is an instructional strategy used in mathematics that allows students to construct their own understanding through the use of problem-solving strategies. During CGI, students are presented with a word problem, and they use their prior knowledge to arrive at a solution. As the students discuss the different problem-solving strategies, connections are made and students identify the most efficient way to solve the problem. When students use their prior knowledge to create new strategies, they internalize and take ownership of the methods that they use to solve the problems. They remember the strategy they used and they feel confident when they apply it to future problems because they made the connections on their own. A teacher did not instruct them to memorize a method that they were shown and then allowed them to practice. If students can construct their own math strategies, can they also construct rules or strategies that can be used in other subjects? Many phonics curriculums have teachers present a rule to students, have students practice the rule, then expect them to memorize and continually

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apply it. CGI suggests that students could use their prior knowledge to create their own phonics rule and that students would retain this information better than if the rule was given to them. This paper will look at current phonics instruction, determine the key elements of CGI, and investigate whether there is a way to apply this instruction to a phonics lesson.

1.1. Current Phonics Instruction

Before delving into new phonetic instructional practices, existing practices must be taken into consideration. Morrow and Tracey (1997) identify three categories of phonics instruction, explicit instruction, contextual instruction, and combined approach. They contend that explicit instruction was most common in kindergarten, first, and second grade, but very few teachers used the combined approach. Fredrick et al. (2013) tested a combined approach based on a 2-part instructional sequence when they examined the growth of phonics understanding with students who have moderate intellectual disability [MoID]. They found that students showed growth from their baseline. Kernaghan and Woloshyn (1995) used different instructional strategies and measured the effects on the spelling component of phonics. They compared three types of spelling instruction, multiple strategy instruction with metacognitive information, multiple strategy instruction, or traditional language arts instruction. The results showed that the multiple strategy instruction with metacognitive information, which consists of phonetic, imagery, and analogy instruction along with a teacher-led discussion about the words, increased their spelling performances the most. However, while these studies contributed to the instructional practices that teachers use, they each had limitations as well. The effects of the strategies suggested by Morrow and Tracey and Kernaghan and Woloshyn (1995) have not been measured consistently. Fredrick et al. (2013) showed growth in achievement but could not determine definitively if the growth was a result of the strategy.

Many of the studies that examine instructional strategies' impact on student achievement look specifically at phonemic awareness of basic letter sounds and letter recognition. Vadasy and Sanders' (2010) study focused on student achievement in alphabetics, word reading, spelling, passage reading fluency, and comprehension. The researchers were able to conclude that students who scored low in phonics and alphabetic skills performed poorly on the literacy sections. This emphasizes the importance of phonetic understanding as it relates to a child's reading ability. While Vadasy and Sanders (2010) looked at additional phonetic instruction, Carson et al. (2013) studied children receiving phonological awareness instruction from their teachers. In their study, one group received phonological awareness program instruction and the other received a regular reading program that included some phonetic instruction. The researchers were able to conclude that the children who received phonological awareness instruction demonstrated better literacy skills than students who only received the regular literacy instruction. Both Carson et al. (2013) and Vadasy and Sanders (2010) focused on students at the age of five and under. As students progress through their phonetic learning we must look at what is cognitively appropriate. They move from basic memorization of letter names and sounds to understanding more complex concepts such as spelling and phonetic rules.

As a shift in student cognitive ability occurs, the instruction must shift to match the new ability. Hatcher et al.'s (2004) study serves a reminder that every child learns at a different pace. They concluded that children at risk of reading delay need additional phoneme awareness instruction. Noltemeyer, et al. (2013) concluded that it was beneficial for students to understand the phonetic skills behind a word rather than memorizing the words. The conclusion that Noltemeyer et al. (2013) reached is similar to the main premise of the math instructional strategy of Cognitively Guided Instruction [CGI]. These studies show that students need explicit phonics instruction to create a foundation of phonemic awareness or basic letter names and sounds, but that they benefit from understanding the "why" behind the phonetic skill. The same is true when it comes to understanding and counting numbers; a baseline of number sense must be formed before students can begin to add or subtract with the numbers. Unlike most phonics instruction, in CGI once the

baseline of understanding is established, students are exposed to word problems that allow them to use their existing knowledge to solve new problems. In most phonetic instruction, once the baseline of letter understanding is established, students are presented with rules that they need to memorize. If the same CGI approach continued into the phonics instruction, students would construct their own understanding of the various phonetic skills, instead of memorizing a rule.

1.2. Cognitively Guided Instruction

One strategy that has caught the attention of math instructors is Cognitively Guided Instruction (CGI). Carpenter et al., (2000) examined the existing research on CGI, determined the key elements of the instruction, and analyzed student achievement results from the studies. They organize CGI as a four-part professional development mathematics program: 1) development of student thinking, 2) instructional strategies that guide development, 3) teacher knowledge-based instruction, and 4) the way that teachers' knowledge, beliefs, and instruction are influenced by their students' thinking. Carpenter et al. note that the program has been researched and implemented in an elementary setting, but they do not make any claims about the efficacy of this instructional strategy in secondary education or in other subject areas. Villaseñor and Kepner (1993) applied the concept as a professional development program in a study to determine if providing research to teachers about CGI would influence teachers' instruction and student achievement. They found that the treatment group, whose teachers learned about CGI, showed more growth on the 14-item arithmetic word problem test than the control group. The teachers in the study agreed that training on understanding concept development in children heavily impacted their instructional strategies. But again, there was no indication of whether this approach would be beneficial in other content areas. To look into applying this type of instruction to other areas, a better understanding of instruction based on student thinking must be established.

While both studies tested CGI in a mathematics setting, Carpenter et al. (2000) note that the strategy they promote has been researched and implemented in an elementary setting and they do not make any claims about what this instructional strategy would look like in other subject areas. When interviewed, the teachers in Villaseñor and Kepner's (1993) study agreed that the workshops and support for understanding concept development in children heavily impacted their instructional strategies. If understanding concept development in children had a positive impact on student achievement in mathematics, can it be applied to other content areas? To look into applying this type of instruction to other areas, a better understanding of instruction based on student thinking must be established.

1.2.1. Instruction based on student thinking in mathematics

Carpenter et al. (1996) describe CGI as a model or a way of using the knowledge that students come to school with to its fullest potential. They explain CGI as a method to systematically determine students' prior knowledge on a given math topic so that teachers can use this preexisting knowledge to guide their instruction. Specifically, teachers examine the strategies students use when problem solving and guide students to make connections with more efficient strategies. The strategy does not focus on providing students with a method but letting them come to a method by building on their prior knowledge. Moscardini (2014) conducted a study that aimed to improve teachers' understanding of their students' mathematical thinking by providing professional development training on Cognitively Guided Instruction. Although the study did not focus on student achievement, it was successful, as teachers were able to recognize growth within themselves and their instruction. A separate study conducted by Villaseñor and Kepner (1993) concluded that teachers growing in their instructional strategies contributed to student achievement and growth.

Baker and Harter's (2015) meta-ethnography explores six qualitative studies that were conducted on CGI. The study determined three main factors that all studies seemed to focus on. First, teachers determine what students already know and what they might be missing. Second, there is more than one method that students can use to demonstrate their understanding. Third,

the learning and teaching process can become more in depth and complex. The study also determined that CGI provides ample opportunities for differentiation. It also points out a few flaws with this type of instruction. CGI can take time for teachers and students to adjust to, and teachers might require a lot of professional development support. Also, if the students' thinking is truly being considered, the curriculum would also require flexibility in the amount of time that can be spent on a topic, since this would be determined by student understanding.

Encouraging student discussion is one strategy that Franke et al. (2009) suggest that teachers can use to better understand student thinking. The more comfortable students are with discussing their thinking, the more information the teacher will have to be able to guide instruction. Franke et al. (2009) determined that the key to the discussion in these classrooms was specific teacher prompts. At every point during the problem, presentation, solving, and presentation of the solution, the teachers asked the students to explain their thinking. If a student could not achieve this on their own, guiding questions were asked to help the student explain their thought process. The process of explanation gets all students involved in the problem solving process and provides the teacher with valuable information on how to move forward.

Fennema et al. (1993) focused on a teacher whose students were exceeding based on standards for that time. A reoccurring theme seemed to present itself in her knowledge and beliefs, instructional methods, mathematics curriculum, and observations of student knowledge. She stressed the importance of using the research-based knowledge of student thinking to guide the structuring of her instruction.

Fennema et al. (1996) wanted to determine if teachers changing their teaching methods to base them on student thinking would affect student achievement in mathematics. The instruction would change based on the strategies that the students were using to solve their problems. The teachers received professional development and support on implementing CGI in their classrooms. After observing and monitoring teaching practices and assessing students on problem solving abilities, conceptual understanding, and computational skills for four years, the researchers determined that the new instructional strategies impacted student achievement in a positive way. The most impactful statistic from this study showed a strong positive correlation between the amounts of time a teacher devoted to cognitively guided instruction and the achievement of the students.

1.3. Using Student Thinking in Subjects other than Mathematics

While many of the studies that have been conducted on CGI focus on mathematics, a few studies have been conducted that bring attention to students developing their own understanding of a rule or process in other content areas. The process of students developing their own understanding can also be considered student thinking. Student thinking can be observed by watching the steps a student takes when solving a new type of problem. Students use their prior knowledge to come up with a new strategy or adjust a previous strategy to solve a new kind of problem. One study, conducted by Hushman and Marley (2015), examined the effects of three types of instruction on self-efficacy and performance. The types of instruction were direct instruction, guided instruction, and minimal instruction. The students who received guided instruction had the highest change in self-efficacy, while the students who received direct instruction had the lowest. When it came to measuring performance by evaluating the design of experiments, guided instruction was a better instructional strategy than the other two instructional strategies. When performance was measured by multiple-choice assessments, guided and direct instruction produced similar results while students who experienced minimal instruction performed significantly lower.

CGI can be mistaken for inquiry-based learning or discovery learning because both strategies build upon at how learning occurs when students are presented with problems and use prior knowledge to create a solution. However, inquiry-based learning is not teacher guided, but it can be guided by a set of steps or procedures. CGI is more teacher-guided because teachers look at each individual step that students take in the process of forming a solution. Chen et al. (2017)

wanted to determine how teaching literacy using inquiry-based learning strategies could affect students' memory and comprehension of literacy instruction. Students who started off scoring low ended up with the greatest progress made in memory and comprehension. Based on the data collected, inquiry based learning was an acceptable method for all levels of learners. However, in addition to the inquiry-based instruction, low achieving students still need time and scaffolding to be successful. Yurniwati (2017) conducted a study on discovery learning. Yurniwati assessed students' achievement in mathematics after using guided discovery learning and determined that students did show growth in achievement after receiving the instruction.

Rittle-Johnson et al. (2016) investigated the retention of conceptual and procedural knowledge when using various forms of instruction. This team of researchers conducted a study that compared conceptual based instruction and a combination of conceptual and procedural based instruction. They found that it is not better to try to mix conceptual and procedural instruction but focus solely on conceptual instruction for better conceptual understanding, procedural understanding, and knowledge retention. While the researchers did not use CGI in their study, the type of instruction used mirrored CGI as it provided support for students to obtain a conceptual understanding and then allowed students to make connections to the procedural understanding.

1.4. CGI Components to Consider for Other Subjects

While teachers examine the strategies that students use to problem solve, students must also be confident and comfortable in their ability to solve problems that are placed before them. This can stem from high self-efficacy. Bulut (2017) found a positive and very high correlation between writing attitude and writing self-efficacy, and between writing self-efficacy and summary writing. If students can see themselves as having the tools they need to be successful problem solvers, they will be more willing to try. Boakye (2015) found a relationship between self-efficacy and reading proficiency. Based on the data collected, the researcher suggested that reading instruction programs should include the development of self-efficacy by focusing on learning goals, providing feedback on progress, and developing explicit strategy instruction. CGI is goal-oriented, and teacher instruction provides students with feedback on the progress they are making while also developing ways to guide students into new strategies. If students lack self-efficacy, they will not progress forward into trying new strategies and will be hesitant to attempt problem solving.

The key principle Carpenter et al. (1989) encourages teachers to use is to assess student thinking by looking at the strategies and prior knowledge the students use to solve new problems. The teachers then guide their instruction based on the connections and strategies that students create through the use of their prior knowledge. The teachers follow the students' line of thinking to present new strategies. If this principal is the key to student success in this study, how can it be applied to other subject areas?

1.5. Purpose of Study

Cognitively guided instruction is based on the idea that children are naturally curious and want to make sense of the world in which they live. One way students do this is through problem solving. When problem solving, students use their prior knowledge to create a solution to a given problem. Cognitively guided instruction is based on the idea that through the use of prior knowledge, discussion, and teacher guidance, students can construct a procedure that will serve as the most efficient way to solve a given problem. Studies have been conducted to determine the effects of cognitively guided instruction in a mathematics setting. However, very little research has been conducted to help determine what cognitively guided instruction could look like in other subject areas. Can students use problem solving strategies, like cognitively guided instruction, to construct their own understanding of phonics?

The purpose of this study was to determine if cognitively guided phonetic instruction has a positive impact on student achievement and self-efficacy. There are three main parts to cognitively guided instruction, individual problem solving, group discussion, and teacher guidance. These three strategies were used daily to present new phonics instruction to students during the

treatment phase of the study. A pre and post assessment and survey were administered and used to compare student achievement and self-efficacy. The assessments and surveys that were administered to all students measured how the lesson impacted the students' ability to read phonetically, write phonetically, remember phonics rules, and measure student self-efficacy. Successes in these skills are essential to phonetic understanding. By analyzing student growth in these skills, the essential questions of this study were answered.

1.5. Research Questions

The following questions guided the research study: Can students who are in tier two and tier three interventions show growth at the same pace as their high achieving and gifted peers in their ability to read phonetically, write phonetically, and remember phonics rules when all students receive cognitively guided phonetic instruction? Do tier two and three students show similar levels of self-efficacy as high achieving and gifted students when all students receive cognitively guided phonetic instruction?

2. Method

2.1. Participants

The study was conducted at a public elementary school in rural north Georgia that had approximately 350 students. The county had a population of 22,939, a median income of $59,265, and 13.4% of the county lived in poverty. The elementary school in this study was a Title 1 school, and the teacher to student ratio was 1:14. The school was made up of 80% Caucasian students, 18% Hispanic students, and 2% of mixed or other nationalities. The school had 49% of students qualify for free or reduced lunches.

The participants consisted of all 62 first grade students at this school. The grade was split into 3 classes by the school based on students' needs. One class consisted of all students with a 504, special education requirements, and Response to Intervention (RTI) tier 3 status. All English Speakers of Other Languages (ESOL) students and students with Early Interventions Program status (EIPs) were placed in another classroom. All gifted and high achieving students were placed in a third classroom. On-level students were dispersed throughout the classrooms to complete the rosters.

For the rest of the study, the classes are referred to as class 1, class 2, and class 3. Class 1 was composed of gifted and high achieving students with a few on-level students for a total of 23 students. It consisted of 11 girls and 12 boys. Class 2 consisted of 20 students, 10 male and 10 female. This class received ESOL services since 50% of the students spoke English as their second language. Seven of the students had Individual Education Plans (IEPs) and received services through the reduced class size model. Class 3 was composed of students with a 504, special education requirements, and RTI tier 3 statuses with a few on-level students. There were total of 18 students with 10 being female and 8 being male. In all classes the age of the students ranged from 5 to 7 years old. The racial demographics for this grade were closely aligned to the racial demographics for the school.

2.2. Materials and Measures

2.2.1. Content materials

The Saxon Phonics curriculum served as the pacing guide and provided the supplemental material needed for instruction. This curriculum was adopted by the county and provided teachers with resources and materials to guide phonics instruction. The 16 skills covered in this study are skills 91-94, 96-99, 101-104 and 106-109. The lessons that end with a 5 or 0 are assessments. The skills that were assessed in this study include but were not limited to, vowel consonant pattern words, endings -tion and -es, vowel teams ue, au, oa, ey, oi, oy, and ou, letter pairs ou, ow, aw, ph, and soft g. All students in the study completed the daily practice worksheets provided by Saxon Phonics. The daily practice review sheet consisted of 10 words that were given for students to spell

as review of previous skills, 5 words for students to review reading and coding previously covered skills, 5 blanks for students to practice spelling using the skill of the day, 5 words for students to practice reading and coding words using the skill of the day, and a reading passage with comprehension questions that focused on the skill of the day.

2.2.2. Achievement measures

Student achievement was measured through a pre and post assessment that was modeled after the weekly assessments found in the Saxon Phonics curriculum. The assessment consisted of four parts and measured 1) students' ability to decode and read individual words using phonics rules, 2) their ability to read a paragraph that includes words that use the same phonetic skill, 3) their ability to write and spell words that fall under the phonetic skill, and 4) their ability to recall a specific phonics rule. Each one of these abilities was assessed in separate sections of the test. These skills were analyzed individually and as a whole overall score. In order to calculate the overall score, the raw scores on each of the subsections were simply added together to produce a total raw score which was then used for comparative analysis. The questions in the assessment were taken from the weekly assessments in the Saxon Phonics curriculum. The skills that were assessed in this study include but were not limited to, vowel consonant pattern words, endings -tion and -es, vowel teams ue, au, oa, ey, oi, oy, and ou, letter pairs ou, ow, aw, ph, and soft g.

2.2.3. Self-efficacy measures

Student self-efficacy was measured through the use of the Self-Efficacy Questionnaire. The questionnaire was developed in 2015 by Research Collaboration, a part of the University of Kansas Center for Research on Learning (Erickson et al., 2016). When it was tested for reliability using Cronbach's coefficient alpha it was found to be highly reliable (13 items; $\alpha = .90$). It consisted of 13 statements that students rate on a Likert Scale from one "not very like me," to five "very like me." The survey was developed for children and was read aloud to the students in the study. The scale can be found in Appendix A.

2.3. Procedures

Three first grade classes participated in this study. Each of the three groups were taught by a different teacher, all of whom followed the same standards and curriculum throughout the intervention phase. Each class had 30 minutes of their day devoted to phonics instruction. All groups received 4 weeks of cognitively guided phonetic instruction. A pre-test and survey were administered at the beginning of the four weeks to determine students' prior knowledge and current self-efficacy. A posttest and survey were administered at the end of the four weeks. The assessment and survey results were compared and analyzed to determine student growth in academic skill and self-efficacy.

The three classes received cognitively guided instruction for 4 weeks. The cognitively guided instruction consisted of 4 days of instruction and one day of assessment each week. A new phonics rule was presented on each instructional day. When using cognitively guided instruction, first the teacher orally presented the students with a list of words and asked them to identify a common sound. The teacher then visually presented students with a list of words and asked them to identify patterns that they saw within the words. Using the patterns they saw and heard, the students worked together to create a phonics rule. The teacher guided the discussion by presenting words to the students that might point out a flaw or exception to the rule that the students created. Students participated in discussions to decide ways to adjust the rule for these exceptions. Once the teacher felt that the student-created rule was sufficient, the students practiced spelling and identifying words that followed the created rule on the provided worksheet. On the fifth day, the students were given an assessment. The assessment required students to apply the rules that they had been taught that week. It assessed the students' ability to read and write phonetically and evaluated the four phonics rules that were taught during the four preceding days. There were sixteen phonics skills that were taught during this study. This resulted in 16 of the 140 phonics

skills in First Grade Saxon Phonics being measured in this study. The teachers planned together and had access to the same resources to ensure that each lesson was the same.

The pre and post assessment and survey were compared to one another. The assessments measured the students' ability to decode and read individual words using phonics rules, their ability to read a paragraph that includes words that use the same phonetic skill, their ability to write and spell words that fall under the phonetic skill, and their ability to recall a specific phonics rule. Each one of these abilities was assessed in separate sections of the assessment. These skills were analyzed individually and as a whole overall score. The survey that measures students' self-efficacy was analyzed as a total score and was not broken down into component parts. An increased number from the pre to post survey would indicate positive growth in self-efficacy.

3. Results

Descriptive statistics showing the pre and post achievement and survey data per group are shown in Table 1 below.

Table 1
Descriptive Statistics Showing Pre and Post Data by Group

Group	*Pretest (M)*	*Posttest (M)*	*Pre-Survey (M)*	*Post-Survey (M)*
On Level	9.89	20.78	32.56	32.11
Tier 2 & 3	5.71	15.35	30	29.88
Gifted	19.36	29.5	32.64	32.79

The first analysis conducted tested for a significant difference between growth that different groups made from the pre-test to the post assessments. Since the pre and post-test encompassed all of the skills, this analysis was conducted to answer whether students who were in tier two and tier three interventions showed growth at the same pace as their high achieving and gifted peers in their ability to read phonetically, write phonetically, and remember phonics rules when all students receive cognitively guided phonetic instruction. An ANCOVA was run with the overall post assessment as the dependent variable and the overall pre assessment as the covariate to control for initial ability level. There was not a significant difference between RTI groups, $F(2, 36) = .13$, $p = .877$, indicating that one group did not make significantly more growth than another from the pre to post assessments. When pairwise comparisons were examined, there was not a significant difference between any of the different ability groups. See Table 2 below.

Table 2
Pairwise Comparisons: Overall Post Assessment

Group	*Comparison*	*Mean Difference*	*SD*	*p*
On Level	Tier 2 & 3	1.177	2.424	.630
	Gifted	.893	2.949	.764
Tier 2 & 3	On level	−1.177	2.424	.630
	Gifted	−.283	3.212	.930
Gifted	On level	−.893	2.949	.764
	Tier 2 & 3	.283	3.212	.920

After analyzing the overall assessment, additional analyses were completed to examine individual pieces of the test that measured students' reading, spelling, rule recollection, and reading comprehension. The second analysis that was conducted tested for a significant difference between the ability groups for part one of the assessment, which measured the students' ability to read words in isolation whose phonetic rules were taught during this study. An ANCOVA was run with the post assessment part one as the dependent variable and the pre assessment part one as the covariate to control for initial ability level. There was not a significant difference between RTI groups, $F(2, 36) = .078$, $p = .925$ which means that one group did not show significantly more

growth than another. When pairwise comparisons were examined, there was not a significant difference between any of the ability groups. See Table 3 below.

Table 3
Pairwise Comparisons: Readings Words in Isolation Post Assessment

Group	*Comparison*	*Mean Difference*	*SD*	*p*
On Level	Tier 2 & 3	.544	1.381	.696
	Gifted	.298	1.774	.868
Tier 2 & 3	On level	−.544	1.381	.696
	Gifted	−.246	1.792	.892
Gifted	On level	−.298	1.774	.868
	Tier 2 & 3	.246	1.792	.892

The third analysis tested for a significant difference between the ability groups in the second part of the assessment, which measured the students' ability to spell a given word. The words were chosen based on the skills taught during this study. An ANCOVA was run with the second part of the post assessment as the dependent variable and the second part of the pre assessment as the covariate to control for initial ability level. There was a significant difference between the groups, $F(2, 36) = 3.41$, $p = .044$, with the growth between the groups being significantly different overall. When pairwise comparisons were examined, there was a significant difference between the high achieving/gifted group and the Tier 2 and 3 groups, $p = .026$. There was also a significant difference between the high achieving/gifted group and the on level group, $p = .030$. There was not a significant difference between the on-level group and the Tier 2 and 3 groups. See Table 4 below.

Table 4
Pairwise Comparisons: Spelling Post Assessment

Group	*Comparison*	*Mean Difference*	*SD*	*p*
On Level	Tier 2 & 3	.078	.877	.930
	Gifted	−2.068	.916	.030
Tier 2 & 3	On level	−.078	.877	.930
	Gifted	−2.146	.921	.026
Gifted	On level	2.068	.916	.030
	Tier 2 & 3	2.146	.921	.026

The fourth analysis tested for a significant difference between the ability groups in the third part of the assessment, which measured the students' ability to recall phonetic rules that were taught during this study. An ANCOVA was run with part three of the post assessment as the dependent variable and part three of the pre assessment as the covariate to control for initial ability level. There was a significant difference between the groups, $F(2, 36) = 4.36$, $p = .020$, with at least one group's growth being significantly different. When pairwise comparisons were examined, there was a significant difference between the Tier 2 and 3 group and the high achieving/gifted group, $p = .008$. There was not a significant difference between the on-level group and the Tier 2 and 3 groups or the high achieving/gifted group. See Table 5 below.

Table 5
Pairwise Comparisons: Recall Ability of Phonetic Rules Post Assessment

Group	*Comparison*	*Mean Difference*	*SD*	*p*
On Level	Tier 2 & 3	1.672	.851	.057
	Gifted	−.609	.891	.498
Tier 2 & 3	On level	−1.672	.851	.057
	Gifted	−2.281*	.806	.008
Gifted	On level	.609	.891	.498
	Tier 2 & 3	2.281*	.806	.008

Note. * The mean difference is significant at the .05 level.

The fifth analysis tested for a significant difference between the ability groups in the fourth part of the assessment, which measured the students' ability to answer comprehension questions about a given text. In order to read and comprehend the text, the students had to use the phonics skills that were taught during this study. An ANCOVA was run with the fourth part of the post assessment as the dependent variable and the fourth part of the pre assessment as the covariate to control for initial ability level. There was a significant difference between the groups, $F(2, 36) = 3.824$, $p = .031$ with at least one group's growth being significantly different. When pairwise comparisons were examined, there was a significant difference between the Tier 2 and 3 groups and the high achieving/gifted group, $p = .010$. There was not a significant difference between the on-level group and Tier 2 and 3 groups or the high achieving/gifted group. See Table 6 below.

Table 6
Pairwise Comparisons: Comprehension Post Assessment

Group	*Comparison*	*Mean Difference*	*SD*	*p*
On Level	Tier 2 & 3	.714	.408	.089
	Gifted	−.352	.413	.400
Tier 2 & 3	On level	−.714	.408	.089
	Gifted	−1.067*	.393	.010
Gifted	On level	.352	.413	.400
	Tier 2 & 3	1.067*	.373	.010

Note. * The mean difference is significant at the .05 level.

The sixth analysis examined whether tier two and three students showed similar levels of self-efficacy as high achieving and gifted students when all students received cognitively guided phonetic instruction. The analysis investigated if there was a significant difference between the ability groups' self-efficacy. An ANCOVA was run with the post survey as the dependent variable and the pre survey as the covariate to control for initial self-efficacy. There was not a significant difference between the groups, $F(2, 36) = .905$, $p = .414$. There was not a group whose growth was significantly different from the others. When pairwise differences were examined, none of the groups showed more significant growth than any other group. See Table 7 below.

Table 7
Pairwise Comparisons: Self-Efficacy Survey

Group	*Comparison*	*Mean Difference*	*SD*	*p*
On Level	Tier 2 & 3	1.609	1.891	.400
	Gifted	−.582	1.903	.762
Tier 2 & 3	On level	−1.609	1.891	.400
	Gifted	−2.191	1.675	.199
Gifted	On level	.582	1.903	.762
	Tier 2 & 3	2.191	1.675	.199

4. Discussion

The purpose of this study was to determine if using cognitive guided instruction (CGI), consisting of problem solving strategies, group discussion, and teacher guidance, had a positive impact on the development of reading skills and self-efficacy. It was designed to determine if students who are in Tier 2 and Tier 3 interventions could show growth at the same pace as their higher achieving peers in their ability to read phonetically, write phonetically, and remember phonics rules when all students received cognitively guided phonetic instruction. This study also investigated the growth of self-efficacy among these groups when CGI was used.

A number of studies in recent years have indicated that by implementing specific instructional strategies with struggling learners, teachers can reduce the achievement gap between those students and their higher-achieving counterparts (Chen, et al., 2017; Fredrick, et al., 2013; Hatcher,

et al., 2004). Thus, we hypothesized that as a result of CGI, students in Tier 2 and 3 would make similar gains on the assessment and survey as their higher achieving peers. In a normal classroom setting with traditional instruction, it would be expected that Tier 2 and 3 students would show less growth than their higher achieving, gifted, and even on-level peers. In this study, however, when examining the scores of the assessment as a whole, none of the groups significantly outperformed the others in terms of gains. This means that the Tier 2 and 3 students showed similar growth to the higher achieving students.

The assessment in this study was comprised of four parts. Each part had a different skill that it assessed. The first part measured the students' ability to read words phonetically in isolation. The second part analyzed their ability to write phonetically. The third part required them to recall phonics rules. The fourth part had students apply their ability to read phonetically by assessing their comprehension of a passage that required the use of their phonetic skills. As the assessment's parts were analyzed, additional interesting outcomes were discovered. While on the overall score of the assessment there was no significant difference in the amount of growth made between the groups, some students did show significant differences in growth between the groups on some parts of the assessment. On the second, third, and fourth part of the assessment that measured students' ability to write phonetically, recall phonics rules, and apply phonics to obtain comprehension, the gifted and high achieving group showed more growth than the Tier 2 and 3 students. However, the growth that the on-level group made was similar to the high achieving group and similar to the Tier 2 and 3 groups. This suggests that even though the Tier 2 and 3 groups did not make as much growth as the gifted and high achieving groups, they still made as much growth as the on-level students.

Each section of the assessment measured different skills that were developed through phonetic learning. The assessment results showed that all students made the same amount of growth on the section that measured the students' ability to read words in isolation. Carpenter et al. (1989) explains the key principle of CGI is that the teachers guide the students to make connections and use strategies to solve new problems by activating their prior knowledge. The students in this study were able to successfully show growth and read words using the phonics rules that they created from their prior knowledge. In the parts that measured the students' ability to answer comprehension questions about a given text, recall phonetic rules, and spell a given word, the Tier 2 and 3 students did not make the same amount of growth as the gifted and high achieving students. However, the Tier 2 and 3 students did make the same about of growth as their on-level peers, which is a notable achievement for these students.

According to the results from the self-efficacy surveys, all groups of students showed similar growth in their self-efficacy. Bulut (2017) claims that if students can see themselves as having the tools they need to be successful problem solvers, they will be more willing to try. Throughout this study, students were enabled to solve problems by identifying patterns that they then used to create phonics rules. Based on the findings of Bulut's study, the students' positive self-efficacy could be connected to their ability to create the tools that they needed to be successful in reading and writing.

Noltemeyer et al. (2013) concluded that it was beneficial for students to understand the phonetic skills behind a word rather than memorizing the words. This study focused on students developing their own understanding behind a phonetic skill using CGI. Although individual groups did not show the growth that was predicted in every instance, CGI was still successful for the Tier 2 and 3 students in the other areas because they were able to make similar gains in their abilities as the on-level students.

5. Limitations

The sample size of each individual group and the overall number of students was small, with groups ranging from 9 to 17 and the total number of participants being 40. Part of the small sample size can be attributed to the fact that not all parents allowed their child's test scores to be used in

the study. The duration of the study could have also limited the results. The study lasted four and a half weeks with 16 lessons, four informal assessments, and a pre and post assessment and survey. This is a fairly short amount of time when compared to a whole school year.

Additionally, the self-efficacy measure could have been affected by the students' inability to relate numbers to their emotions and self-efficacy. The number system was explained to the students, however the teachers involved felt that a different scale could have produced more accurate results.

6. Implications and Future Research

Many recent studies have explored interventions designed to enhance learning for elementary and middle grades students across a variety of content areas (Baker & Cuevas, 2018; Dalton & Cuevas, 2019; Doster & Cuevas, 2021; Hannel & Cuevas, 2018; Jennings & Cuevas, 2021; Liming & Cuevas, 2017; Sides & Cuevas, 2020). There are also many researchers who have sought to improve reading outcomes for K-12 students (Cuevas, et al., 2014, Cuevas, et al. 2012), with some focusing specifically on reading development for elementary-level students (Tankersley & Cuevas, 2019; Zavala & Cuevas, 2019). Still other studies have concentrated on bridging the learning gap for young students with special needs (Hendy & Cuevas, 2020; Hughes & Cuevas, 2020; Pounds & Cuevas; 2019). It could be argued that the present study addresses a crucial area of education by distilling its focus down to addressing the reading ability of elementary-aged children with special needs. Reading instruction is so vital in these early years because students who fall behind academically during this stage are likely to struggle long-term, throughout their years of school, since limitations in reading comprehension negatively impact outcomes across all subject areas. If effective interventions can be identified at these early stages, it could have a profound impact on the educational outcomes for countless struggling students.

While this study provided some insight into the benefits of cognitively guided phonetic instruction, it is clear that there is still more research to be done. Future research on this topic should to compare this instructional strategy to other strategies. Do students have higher achievement and self-efficacy with CGI or direct instruction? Comparing these two strategies would provide a more concrete argument for the use of Cognitively Guided Phonetic Instruction. It would also be important for future studies to collect data for longer periods of time. The study only took four weeks and captured a small snapshot of a very large phonics curriculum. The current study also took a curriculum that was already in place and modified the instructional strategy but kept similar assessments. Some parts of the assessments did not seem as relevant to phonetic instruction and could be removed from the assessment for future studies.

Rittle-Johnson et al. (2016) emphasized the impact that conceptual understanding had on knowledge retention. Since this study was only four weeks, there were no results to demonstrate how Cognitively Guided Phonetic Instruction impacted the students' ability to retain the information that they gained during this point in time. An additional longer study could be conducted to reveal if Rittle-Johnson et al.'s conclusions are also true for this instructional strategy.

Cognitively Guided Phonetic Instruction allowed all levels of students to show growth in their phonetic understanding by strengthening their ability to read, write words, and recall phonics rules. Developing these skills allows students to progress in their abilities to read fluently and write confidently. Although this study focused on how Cognitively Guided Phonetic Instruction benefited Tier 2 and 3 students, there are many different components that need be examined to determine this strategy's ultimate potential to help all students develop a better phonetic understanding.

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Appendix A. Self-Efficacy Questionnaire

Please **CHECK ONE** response that best describes you. Be honest, since the information will be used to help you in school and also help you become more prepared for college and careers. There are no right or wrong answers!

Student ID_____ **Date** _____

	Not very like me → Very like me				
	1	2	3	4	5
1. I can learn what is being taught in class this year.	☐	☐	☐	☐	☐
2. I can figure out anything if I try hard enough.	☐	☐	☐	☐	☐
3. If I practiced every day, I could develop just about any skill.	☐	☐	☐	☐	☐
4. Once I've decided to accomplish something that's important to me, I keep trying to accomplish it, even if it is harder than I thought.	☐	☐	☐	☐	☐
5. I am confident that I will achieve the goals that I set for myself.	☐	☐	☐	☐	☐
6. When I'm struggling to accomplish something difficult, I focus on my progress instead of feeling discouraged.	☐	☐	☐	☐	☐
7. I will succeed in whatever career path I choose.	☐	☐	☐	☐	☐
8. I will succeed in whatever college major I choose.	☐	☐	☐	☐	☐
9. I believe hard work pays off.	☐	☐	☐	☐	☐
10. My ability grows with effort.	☐	☐	☐	☐	☐
11. I believe that the brain can be developed like a muscle.	☐	☐	☐	☐	☐
12. I think that no matter who you are, you can significantly change your level of talent.	☐	☐	☐	☐	☐
13. I can change my basic level of ability considerably.	☐	☐	☐	☐	☐

Source: Gaumer Erickson, A.S., Soukup, J.H., Noonan, P.M., & McGurn, L. (2016). *Self-Efficacy Questionnaire*. University of Kansas, Center for Research on Learning.