

Granite School District

Research Applications During the 2020-21 School Year

Improving Reading Comprehension using Fountas and Pinnell's Literacy Intervention

Investigator: Shauna Christensen

Proposal ID: TJ0001

Status: **Approved 09-09-2020**

Anticipated Completion Date: 11-09-2020

Results:

<p>Describe the purpose of your research. What concern, problem, or curiosity did your research investigate?</p>	<p>An exploration of Woodrow Wilson's assessment data showed that many of the students designated as struggling readers were well below proficiency in reading comprehension. Even though many of these same readers were at or near proficiency in fluency and accuracy, they still struggled to understand what they were reading. I researched several reading intervention curricula to find one that would improve reading comprehension while promoting growth in fluency and accuracy. The Fountas and Pinnell Leveled Literacy Intervention (LLI) program seemed to fit the bill. After the school's purchase of the program, my purpose for conducting research was to discover how much the LLI program would increase the reading ability of the reading intervention students at my school, especially reading comprehension.</p>
<p>Describe your research method(s). Provide a brief description of the participants, the timeline of what was done, and the data that was collected.</p>	<p>The participants in my research were the intervention students with whom I worked who were in grades three through five, consisting of around 32 students. The timeline of the research consisted of seven weeks. The beginning-of-year Acadience Reading benchmark was the data used for the starting point of each student's reading skills. The Acadience Reading progress monitoring system provided the data needed to track reading improvement. The second data collection tool was the use of running records that are helpful in assessing student strengths and weaknesses. Finally, the third data tool was the use of test preparation lessons given as actual tests. These 'tests' are comparative to state reading tests and were useful in tracking reading comprehension.</p>
<p>Summarize your expectations and the results. Provide a brief description of your findings and compare those to what you were anticipating.</p>	<p>See attached graphics for reading outcomes.</p> <p>After concluding my research, I found the Fountas and Pinnell LLI program to be a very useful tool in improving the reading comprehension of my students while the program still promoted growth in fluency and accuracy. My students loved the engaging books and activities. I loved the design of the lesson plans.</p>
<p>Benefit to Granite School District. Describe how your research will benefit Granite School District.</p>	<p>Overall, I recommend the LLI program for improving reading comprehension. However, for the last three months I have been using the 95% Library that our school principal purchased to go along with the LETRS endorsement courses that is currently being taught to the teachers in our school. The 95% Library of intervention materials is even more targeted than the F&P LLI resources. Furthermore, the 95% Library includes three decodable stories that go with each week of intervention lessons. While I love the engaging books included with the F&P LLI resource, the phonics program is more hit and miss. The 95% lessons are definitely more targeted to student gaps in reading.</p>
<p>Additional Information</p>	

Granite School District

Research Applications During the 2020-21 School Year

Problem Solving Mathematics

Investigator: Emily Pace

Proposal ID: TJ0002

Status: **Approved 09-09-2020**

Anticipated Completion Date: 10-02-2020

Results:

Describe the purpose of your research. What concern, problem, or curiosity did your research investigate?	The problem that I noticed was that students of all proficiency levels struggle to solve basic and complex word problems. I investigated what type of routine would help students become more proficient when solving word problems.
Describe your research method(s). Provide a brief description of the participants, the timeline of what was done, and the data that was collected.	<p>The participants in this study included 15 third graders. I began my study in September 2020 and completed the data section by December 2020. I focused on word problems that included triple-digit addition and subtraction, as well as single digit multiplication and division. The data I collected included an attitudinal survey, pre and post-test with word problems, a graphic organizer used to help students work through a specific routine and anecdotal notes throughout the study. Ideally, students would have had more time to become familiar with the routine and process.</p> <p>We began by using numberless word problems to help students recognize what operation(s) would be necessary and discussed reasonable estimations of an answer. Students were then introduced to the graphic organizer they would be using to help identify the question and relevant information they would need to solve. Students were expected to create a visual representation of the problem as well as a written equation to solve.</p>
Summarize your expectations and the results. Provide a brief description of your findings and compare those to what you were anticipating.	Overall, the results showed that most, but not all students made growth in their ability to solve word problems when using a graphic organizer as a tool. The data also agreed with prior research that problem solving is a skill that requires time and many opportunities to practice in order to become better at understanding the problem.
Benefit to Granite School District. Describe how your research will benefit Granite School District.	The research will benefit Granite School district because it offers a protocol that teachers could implement to help their students have a specific routine to follow to help them pull out and use all relevant information in a word problem correctly. It also offers a brief introduction into using numberless word problems.

Engaging the Gifted Child

Investigator: Kirsten Federico

Proposal ID: TJ0003

Status: **Approved 09-09-2020**

Anticipated Completion Date: 11-09-2020

Results: 1st request on 04/20/2022

2nd request on 05/03/2022

WestEd Loomvue Feasibility Research Study

Investigator: Kimkinyona Cully

Proposal ID: TJ0004

Status: **Approved 09-11-2020**

Results: **Study canceled due to COVID-19**

Granite School District

Research Applications During the 2020-21 School Year

The Effects of Explicitly Teaching Summarization Skills on the Reading Comprehension of Students with Specific Learning Disabilities.

Investigator: Sherri Lay

Proposal ID: TJ0005

Status: **Approved 09-11-2020**

Anticipated Completion Date: 10-09-2020

Results:

<p>Describe the purpose of your research. What concern, problem, or curiosity did your research investigate?</p>	<p>The purpose of this study was to research the effect of a specific, explicit instruction strategy in summarization on reading comprehension skills in students with an Individual Education Plan (IEP) receiving specially designed instruction in reading as defined by the Individuals with Disabilities Education Act. The research question was: To what extent will GIST explicit instruction in summarization increase reading comprehension of expository text in seventh and eighth-grade students receiving specially designed instruction in reading comprehension as measured by (a) reading comprehension assessment scores, and (b) written summaries?</p>
<p>Describe your research method(s). Provide a brief description of the participants, the timeline of what was done, and the data that was collected.</p>	<p>Baseline: Students were given one high-interest low reading level science passage. The passage was at a 4th-grade reading level, between 115 and 130 words, with three paragraphs. Baseline was collected as follows: After reading the passage students were instructed to write a summary of not more than 20 words per paragraph of what they read 26 in the passage. They received no further instructions. Using easyCBM.com, students were assigned two 4th -grade level reading comprehension assessments over two sessions. The easyCBM.com scores were averaged to assess reading comprehension skills prior to treatment intervention. The researcher conducted instruction (treatment) sessions every Monday, Tuesday, Wednesday, and Thursday for 40 min per session across 12 sessions. Sessions one and two were teacher modeling how to create a GIST paragraph. Sessions three through eight included guided practice. The researcher continued explicit instruction on the GIST method but guided students through the process. Sessions nine through 12 were independent practice. Entire paragraphs were presented at once instead of one sentence at a time. This was done because the students in this study are older and were able to better process an entire paragraph than one sentence at a time. Students were also asked to create GIST statements that were 15-20 words per paragraph instead of strictly 15 words per paragraph. This was done to allow students flexibility in creating GIST statements. Feedback was provided to students daily. If a student received twos or ones in the areas of main idea, detail, or originality according to the rubric, during sessions six through eight one-on-one guided practice was implemented. Sessions nine through 11 were independent practice days with feedback provided. Session 12 was an independent practice day with no feedback provided to collect post-treatment scores. Following Christmas Break, 21 days after the last session, students were given a social studies passage and given instructions to write a GIST summary to determine if students retained their summary writing skills.</p>
<p>Summarize your expectations and the results. Provide a brief description of your findings and compare those to what you were anticipating.</p>	<p>The result of this study was inconclusive. Participants demonstrated small amounts of growth in their summarizing skills, but the growth could not be adequately attributed to the introduction of the GIST strategy.</p> <p>In the future this study should be done with more than one special education reading class. This would allow a larger group of potential participants. A larger group of participants to select from would allow the researcher the opportunity to make sure each student falls within the parameters set to be a participant. A larger group of participants would also allow the researcher to disqualify anyone that is involved in extracurricular activities that may cause them to miss a session. If I were able to run this study again in the future, I would not be the teacher. I would train another teacher and have them teach the GIST strategy. Doing this would allow me to add additional data collection points, such as participation data, how much time the teacher spent in working in small groups or one-on-one with student and how that impacted the next written summary. Firmer guidelines on who can and cannot participate should be set. Guidelines such as scoring a three or higher in any area of the baseline should disqualify a participant. If the participant can already score a three, they have demonstrated their ability to do the task set forth in the rubric, and there is limited room for growth.</p>
<p>Benefit to Granite School District. Describe how your research will benefit Granite School District.</p>	<p>This research will benefit Granite School District because it added to available research on reading comprehension in the secondary setting involving Special Education students.</p>

Granite School District

Research Applications During the 2020-21 School Year

The SafeUT Student Research Survey for Distribution

Investigator: The SafeUT Marketing & Outreach Team

Proposal ID: TJ0006

Status: **Approved 09-29-2020**

Anticipated Completion Date: 05-28-2021

Results: Report provided to the Utah State Board of Education in December 2021.

An Embedded and in-Context Professional Learning Platform for Math Problem-Solving Instruction

Investigator: Dr. Sam Rhodes

Proposal ID: TJ0007

Status: **Denied 10-19-2020 due to COVID-19**

Poverty and Education

Investigator: Yuliya Lynch

Proposal ID: TJ0008

Status: **Denied 10-19-2020 due to COVID-19**

Culture and Child Physical Activity & Nutrition in Schools

Investigator: Lori Spruance

Proposal ID: TJ0009

Status: **Denied 10-19-2020 due to COVID-19**

Granite School District
 Research Applications During the 2020-21 School Year

Envision Utah Student Values Study

Investigator: Jason Brown

Proposal ID: TJ0010

Status: **Approved 11-11-2020**

Anticipated Completion Date: 11-30-2020

Results:

<p>Describe the purpose of your research. What concern, problem, or curiosity did your research investigate?</p>	<p>Our goal was to understand what factors most influence high school students' decisions about pursuing post-secondary education. Particularly, we were interested in understanding the barriers that Utah students perceive when considering post-secondary education. Our hope to be able to find ways to overcome those barriers in our post-secondary institutions.</p>
<p>Describe your research method(s). Provide a brief description of the participants, the timeline of what was done, and the data that was collected.</p>	<p>The research was conducted through an online survey that was distributed to high school students. The survey took about 10 minutes to complete and included a series of multiple-choice questions, scale-rating questions, agree-disagree questions, and free response questions. The questions covered issues like students' satisfaction with different aspects of their education, what they'd hope to gain from post-secondary education, what kind of post-secondary education they plan to pursue, what they see as the barriers to post-secondary education, and other issues related to post-secondary education. The survey was completed by students in fall and winter 2020.</p>
<p>Summarize your expectations and the results. Provide a brief description of your findings and compare those to what you were anticipating.</p>	<p>These were our most significant findings:</p> <ol style="list-style-type: none"> 1) Students perceive costs and student loans as the biggest barriers to post-secondary education. This is true for every demographic group. Students also over-estimate the amount of debt college graduates carry and have relatively low tolerance for college debt. 2) The process of applying for college and financial aid is a significant barrier to post-secondary education. Less than half of students feel confident navigating the application/financial aid process. Students think that simplifying the application /financial aid process would have a bigger impact than making college free. 3) Students of color do not feel like campuses are welcoming. 4) More students plan to pursue post-secondary education than actually do. <p>These findings are generally in line with what we were anticipating, although we were somewhat surprised by the degree to which students seem to view costs as a barrier to post-secondary education — especially considering how low the costs of post-secondary education are in Utah compared to other states.</p>
<p>Benefit to Granite School District. Describe how your research will benefit Granite School District.</p>	<p>The results of this research have been shared widely with policymakers and education leaders throughout the state in order to shape policy priorities. For example, these results were shared with the Utah Board of Higher Education and helped members of that board further their agenda to move toward strategies that would lower some of the barriers to post-secondary education. These results were also shared with the Salt Lake P-20 Alliance (which serves Granite students) and has informed discussions and initiatives there. The research is also being used to develop outreach that will help students and their families navigate some of the complexities of post-secondary education.</p>

Exploring Teacher Collaboration for Inclusive Instruction in Elementary Mathematics

Investigator: Laural Dias

Proposal ID: TJ0011

Status: **Denied 11-11-2020 due to COVID-19**

Granite School District

Research Applications During the 2020-21 School Year

Fine Arts Assessment Survey

Investigator: Alysso B. Galarza

Proposal ID: TJ0012

Status: **Approved 11-03-2020**

Anticipated Completion Date: 05-28-2021

Results:

<p>Describe the purpose of your research. What concern, problem, or curiosity did your research investigate?</p>	<p>The purpose was to investigate traditional art room assessment modalities and their effectiveness compared to more open modality or choice-based assessments in the arts, especially during distance learning.</p>
<p>Describe your research method(s). Provide a brief description of the participants, the timeline of what was done, and the data that was collected.</p>	<p>Participants were chosen from an online learning art course. The timeline was one unit of instruction over the course of 4 instructional modules. Approximately 6 hours of instruction in an already existing unit of the curriculum.</p>
<p>Summarize your expectations and the results. Provide a brief description of your findings and compare those to what you were anticipating.</p>	<p>Less learners chose the alternate assessment modality for the formative assessment; however this group showed an initial higher proficiency level. While students who worked in the traditional assessment modality on average scored lower initially, then showed more growth by the summative assessment. For all modalities offered students scored on average above an 80% proficiency score by the end of the unit.</p> <p>The most surprising part of my findings was that offering a combination of traditional and open modality assessment seems to be the best combo for all learners. The traditional assessment methods did provide greater overall growth numbers.</p>
<p>Benefit to Granite School District. Describe how your research will benefit Granite School District.</p>	<p>This research reinforces the effectiveness of offering assessments in multiple modalities.</p>

Granite School District
 Research Applications During the 2020-21 School Year

The Effects of Reading Interventions

Investigator: Yonus Miranda

Proposal ID: TJ0013

Status: **Approved 11-12-2020**

Anticipated Completion Date: 05-28-2021

Results:

What did you do to effect change? A brief description of the intervention or treatment.	The first thing I did was give each student a survey to ask them what their favorite book was, who their favorite author was, if they read for at least 20 minutes each day, and if they had a lot of books at home. I then gave each student a core phonics survey to see where their deficits were. For five weeks, I worked with them on short CVC words that had the vowels they were missing. I had cards with the CVC words on them. I would show them one letter at a time, and they would sound it out. Then they would say the whole word. I then had CVC word games for them to play. The student would roll the dice then move the number of spaces that the dice said. Then they would read the word they landed on. For the last five weeks, I did the Haggerty reading program with them. Each small intervention group was made up of 3 students. I worked with each small group for 10 minutes, Monday through Thursday.
What did you expect to happen as a result of this intervention or treatment?	I expected their reading fluency and accuracy to go up.
How did you measure the effects?	I measured the effects of the interventions by doing a DIBELS progress monitoring with them at the end of each week. At the end of the 10 weeks, I also did a core phonics survey with them again to see if they had made any improvements.
What were the results?	The results were that every student went up in their abilities in the core phonics survey. However, only 64% of the students went up in their fluency after the first intervention. Only 55% of the students showed growth in their fluency after the second intervention. 27% of the students showed a regression after the first intervention. 18% of the students showed a regression after the second intervention.
What are your recommendations for the effective replication, or use, of this intervention or treatment?	I would recommend that a combination of the first and second intervention be done. During the last month of school, I implemented the District's Core Phonics Template in my whole group instruction. 83% of my students went up in their DIBELS scores at the end of the year. Therefore, I would also recommend that the District's Core Phonics Template be used as well.

Granite School District
 Research Applications During the 2020-21 School Year

Literacy Techniques for Students with Severe Cognitive Impairment

Investigator: Connor Armstrong

Proposal ID: TJ0014

Status: **Approved 11-19-2020**

Anticipated Completion Date: 12-14-2020

Results:

<p>Describe the purpose of your research. What concern, problem, or curiosity did your research investigate?</p>	<p>I conducted research into the vocabulary acquisition of students with severe cognitive impairments.</p>
<p>Describe your research method(s). Provide a brief description of the participants, the timeline of what was done, and the data that was collected.</p>	<p>I was able to secure permissions for only four students to be included in my research. The research was conducted over a single chapter in the science class. This equated to three weeks of calendar time. The data collected was a chapter vocabulary pre and posttest, each was an eight multiple choice question quiz. This chapter I implemented the Frayer Model while reading the chapter, the students completed a Frayer model three for each vocabulary work. Once at the beginning of the chapter, the second time when we encountered it the first time while reading through the chapter, and the third time at the end of the chapter while preparing for the test.</p>
<p>Summarize your expectations and the results. Provide a brief description of your findings and compare those to what you were anticipating.</p>	<p>I expected the vocabulary acquisition to be more with the Frayer model, but not as much as what actually occurred. When compared to the first two chapters without the Frayer model where the average change was +19%, the Frayer model made a change of +43.75% which accounts for a +24.74% difference when using the Frayer model. My expectation was 10%-15% more, but the results show a 24.74% change.</p>
<p>Benefit to Granite School District. Describe how your research will benefit Granite School District.</p>	<p>If implemented in severe CI or Special FA classrooms, the Frayer model would most likely boost the vocabulary acquisition of students.</p>

Exploring Teacher Collaboration for Inclusive Instruction in Elementary Mathematics – Revised

Investigator: Laural Dias

Proposal ID: TJ0015

Status: **Approved 11-19-2020**

Anticipated Completion Date: 03-31-2021

Results Requested: 04/20/2022 → email delivery error; email address on file is not valid

Granite School District

Research Applications During the 2020-21 School Year

Punctuation, Prosody, and Syntax: Connecting Clauses Cognizantly

Investigator: Ryne Steinacker

Proposal ID: TJ0016

Status: **Approved 11-18-2020**

Anticipated Completion Date: 12-17-2020

Results:

<p>What did you do to effect change? A brief description of the intervention or treatment.</p>	<p>Many of my students were not proficient with clausal sentence punctuation. Some students were even deficient in basic usage of periods. The research question was “What effect does learning both syntactic and prosodic approaches (with an emphasis on syntax) have on students’ punctuation?” The instructional unit contained a pretest and five lessons with formative assessments and data collection tools, taking place over a period of three weeks. Instruction used novel metaphors and object lessons to help students “unfreeze” prior attitudes/incorrect knowledge about punctuation and then solidify a new level of proficiency, engagement, and understanding. Instruction was given to six ninth-grade students sampled from three different classes. Participants came from diverse backgrounds and had a variety of reading levels and prior experience with punctuation instruction.</p> <p>Unit Overview:</p> <ol style="list-style-type: none"> 1. Subject and Verb Phrases 2. Independent and Dependent Clauses 3. Compound vs. Complex Sentences 4. “Stop and Go” (making punctuation choices by identifying sentence type) 5. Editing and Revision Strategies (revising our own writing)
<p>What did you expect to happen as a result of this intervention or treatment?</p>	<p>In this action research project, the unit intervention was intended to teach students skills with syntax and sentence structure that potentially were lacking and may have contributed to poor punctuation usage. The researcher’s hope was that this unit would improve the rate at which students used punctuation proficiently when editing and writing.</p>
<p>How did you measure the effects?</p>	<p>DATA INSTRUMENT SUMMARY</p> <ol style="list-style-type: none"> a) A pretest (given before instruction in the unit) with three sections. Open-ended survey questions qualitatively coded students’ attitudes and knowledge about punctuation. A “find and fix the errors” editing exercise tracked correct edits qualitatively. Students free-wrote in response to a prompt and the types and quantity of correct punctuation instances were noted. b) A “Kahoot” multiple-choice assessment given partway through the unit, written in the style of the ACT test and asking students to make punctuation editing choices. c) An exit ticket administered on the same day as the Kahoot asking for students’ knowledge about the function and purpose of punctuation d) A final assessment consisting of students finding and fixing errors in their own writing. Data was tabulated regarding number of acceptable edits, instances of syntactic vs. prosodic punctuation usage, and types of correct vs. incorrect edits (e.g. commas, periods). e) A post-reflection about the unit that coded students’ responses for quantitative data (in the form of correct vs. incorrect punctuation usages and types of punctuation used correctly) and qualitative data (regarding potentially changed attitudes or knowledge about punctuation). <p>DATA ANALYSIS SUMMARY</p> <ul style="list-style-type: none"> • Data was compiled and analyzed using descriptive statistics. • Quantitative data related to punctuation editing proficiency was compared between the pretest, Kahoot, and final self-editing exercise to measure any potential student growth. • Quantitative data was compared between the Stop and Go Kahoot vs. exit ticket to compare students’ ability to edit for punctuation with their ability to describe its function. • Quantitative data was compared between the pretest (Part 3) and the post-reflection to note changes (if any) in students’ use of punctuation in their own freewriting. • Qualitative data was compared between the pretest (Part 1) and the post-reflection free-write to note changes (if any) in students’ attitudes and perceived ability in regard to the topic of punctuation.
<p>What were the results?</p>	<p>The data tools suggest that the short punctuation unit was able to have a statistically significant effect on students’ ability to identify and correct punctuation errors in both their own and others’ writing. (The percentage of correct edits rose from 47% to 63%–76% accuracy depending on whether an outlier student was included.)</p> <p>The short unit as implemented did not have a statistically significant impact on students’ punctuation abilities when doing original freewriting. The rate of correct punctuation usage and errors remained similar for the five students who completed the free writes for the pretest (4.2 average correct uses and 1.2 average errors for 4 sentences) and the post-reflection (4.2 average correct uses and 1.0 average errors for 4 sentences).</p> <p>Based on student responses to the unit, the unit appears to have succeeded in positively changing some students’ attitudes or confidence with punctuation.</p>

Granite School District

Research Applications During the 2020-21 School Year

What are your recommendations for the effective replication, or use, of this intervention or treatment?	<p>The unit's strengths include its novelty (relating sentence structure to concepts like cookies, zombies, cars, etc.) and order of instruction. Each lesson also builds soundly upon the one preceding it. Students were gaining knowledge within a cohesive, logical framework to help them to use punctuation correctly. The focus of transferring punctuation knowledge to real-life writing tasks was key; far too often are students given isolated editing exercises but do not receive enough time to edit their own writing for punctuation.</p> <p>The two main areas of this unit that I would revise relate more to that real-world writing. If I were teaching this unit again, I would spend additional time practicing punctuation editing after the "Stop and Go" lesson. I would also spend additional time working with students and practicing the editing of their own writing before giving the students a final assessment. When I completed this study in December, I was working within limited time constraints, but a teacher could normally take extra class periods to review or intervene where he/she noticed students were struggling.</p>
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Missing Assignments: A study on how to get Jr. High students to consistently submit online

Investigator: Deborah Corbridge

Proposal ID: TJ0017

Status: **Approved 01-22-2021**

Anticipated Completion Date: 03-25-2021

Results: 1st request on 04/20/2022

2nd request on 05/03/2022

Note: researcher responded that results should be available 05/06/2022

Mindset Interventions in a High School Biology class

Investigator: Crystal Brooke Funk

Proposal ID: TJ0018

Status: **Approved 02-03-2021**

Anticipated Completion Date: 03-24-2021

Results:

What did you do to effect change? A brief description of the intervention or treatment.	Did a Mindset intervention in class to shift the mindsets of students to become more growth oriented? Six 20-minute Mindset Sessions with a pre and post mindset instrument. Interviews of individual students.
What did you expect to happen as a result of this intervention or treatment?	I was hoping to shift the mindsets of my students towards mindsets that are more growth oriented. I was hoping to change the culture of my classroom to one that supports students taking risks while they are learning. I was hoping to shift my own mindset towards one that is more supportive of developing growth mindsets in my classroom.
How did you measure the effects?	I used a Pre-Intervention and Post-Intervention Mindset Survey to measure a change in the mindsets of my students. I used an interview format to detect any culture shifts in my classroom.
What were the results?	THEY WERE SIGNIFICANT! HA! The mean mindset scores of my students showed a significant shift in the growth-oriented direction. When I grouped the students based on their starting mindsets, the data showed that the mindsets of those who had been more fixed to start had the largest shift in mindset. The only group that did not have a significant shift was the group that already had a strong growth mindset. Interview data showed that my culture was already pretty positive, so we could not say that the mindset intervention had any effect on classroom culture. I did a significant amount of learning during this research, too. Mostly about how important emotions are to learning and how to really value the culture of my classroom.
What are your recommendations for the effective replication, or use, of this intervention or treatment?	We thought we could change up the interview situations, make them more panel-like instead of 1 on 1 interviews. It would be interesting to keep running counts of the mindset messages displayed by my students (and myself!) throughout the duration of this intervention. As far as the intervention, it would be best if you spread that out for when your students really seem to be needing these messages. Taken all at once, in a six-week period, the students started to not enjoy the lessons as much. Spread those out over 3 months, though, and I think the value of the lessons will be greater.

Granite School District
 Research Applications During the 2020-21 School Year

The relationship of adaptive clothing on the social participation and self-esteem of adolescents with disabilities.

Investigator: Emalee Brown
 Proposal ID: TJ0019
 Status: **Approved 02-11-2021**
Anticipated Completion Date: 03-15-2021
 Results: 1st request on 04/20/2022
 2nd request on 05/03/2022

Improving fluency through repeated reading of informational text and explicit vocabulary instruction.

Investigator: Katelyn M Baum
 Proposal ID: TJ0020
 Status: **Approved 02-26-2021**
Anticipated Completion Date: 02-19-2021
 Results:

What did you do to effect change? A brief description of the intervention or treatment.	This reading intervention was crafted around informational text at a sixth grade reading level or a Lexile of 925-1070 chosen by the teacher. This text was the basis that this intervention was planned. Each week, a one-hour lesson on vocabulary was taught to participants. This vocabulary lesson began with an introduction to the words. In this introduction, students were exposed to prefixes and suffixes and any spelling rules that confuse reading the word. For example, in the word "unknown," participants will be exposed to the prefix "un" as well as the spelling rule that causes the k in the word "unknown" to remain silent. The spelling rules that were implemented were determined based on the word. Next, students were taught the definition of the word. Students were then given 5-10 examples of the word used in different sentences after learning the definition. This step was meant to help students gather meaning from the word given through contact with it in literature and gain further understanding through context clues. Words chosen for this portion of the reading intervention were decided by the teacher based on words they deemed difficult or needed to better comprehend the text. After the vocabulary lesson, a 15-minute thrice-weekly intervention was put in place. On Monday, the informational text from which the vocabulary was selected was provided to every student in the class. A whole class choral reading of the text was then completed. The teacher read the text aloud along with students in order to offer a fluent pace for students to match, and the teacher walked around the room, ensuring that students participated and read the text aloud. On Tuesday, students were broken into partnerships of students. Partnerships read the same text (the one given on Monday) aloud at the same time while sitting side by side with one another. During this time, the teacher walked around, ensuring the participation of all partnerships. On Wednesday, the student completed their final repeated reading of the text by themselves. They were asked to read the same text aloud for one whole minute. During this time, the teacher walked around the room, ensuring all students' participation and that all students were reading aloud for the entire duration of the minute. Thursday was reserved for the data collection on student fluency. This intervention took place over four weeks for approximately 1 hour and 45 minutes a week, totaling 7 hours at the end of the research period. If there was a non-student attendance day on Thursday, the recording took place on Wednesday. If there was a non-student attendance day on a Monday, the vocabulary lesson took place on the Tuesday following the holiday.
What did you expect to happen as a result of this intervention or treatment?	The expectation as a result of this intervention was to improve student reading fluency on grade level. Specifically, the goal of the intervention was to increase students' words read per minute when reading grade-level text, increase correct words read per minute when reading grade-level text, and improve student reading accuracy over the course of the intervention.
How did you measure the effects?	At the start of the research study, a pre-test was given to students. This pre-test was an article at 1130 Lexile, within the range recommended for sixth-grade learners/readers. This article was 277 words long. Students participating in the study were told before receiving the article that they should read the article as quickly and accurately as possible for one minute. Students then read the article for one minute. At the end of the one minute, the number of words read total in one minute was counted, and the errors made during the reading. The following was determined from this collected data: total words read, total words read correctly, and reading accuracy. On the final face-to-face day of each week (during the intervention period), students were asked to pull up the camera application on their Chromebook and get ready to record a video. Once their Chromebooks were set up, students were handed a passage within the Lexile range of 925-1200 and asked to read the entire article as quickly and accurately as they could. After recording their video, students were asked to submit the video to the researcher through Google Classroom. The researcher then trimmed each video from where the student began reading to the one-minute mark. This one-minute reading was analyzed to determine the words read in a minute and any mistakes made by the student during that time. As with the pre-test, the following was determined: total words read, total words read correctly, and reading accuracy. At the end of the research period, students are given a post-test following the pre-test criteria. Students are given an article at 1130 Lexile. This article is 280 words long. Students participating in the study were told before receiving the article that they should read the article as quickly and accurately as they can for one minute. Students then read the article for one minute. At the end of

Granite School District

Research Applications During the 2020-21 School Year

	<p>the one minute, the same data as collected in the pre-test was collected, and the same information was determined from this data as the previous assessments</p>
<p>What were the results?</p>	<p>When considering the effect that explicit vocabulary instruction, paired with thrice-weekly repeated reading, had on correct words read per minute, there is an interesting distinction between the data collected throughout the research study. When first considering the pre and post-test data, it can be stated that overall, explicit vocabulary instruction and thrice-weekly repeated reading had a negative effect on correct words read per minute. The data supports this: 80% of students saw a significant decline in total words read in a minute in the post-test compared with the data collected from the pre-test. Of this group, the decreased in correct words per minute was also reasonably large. According to the data collected, Of the total students that participated in the study, 20% saw a decrease of <20 words per minute, 20% saw a reduction of 20-30 words per minute, 30% saw a decline of 30 – 40 words per minute, and 10% saw a decrease of 40< words per minute. This data set gives the impression that explicit vocabulary instruction, paired with thrice-weekly repeated reading, has a negative effect on correct words per minute for most of the subject pool that opted to participate in this research study. However, this data could be contested based on the data analysis gained from the research project's weekly assessments. When considering that research, 100% of participants improved their scores for the four weeks. Of the entire participant pool, 10% improved by ≤10 words, 10% increased their correct words read per minute by 10-20 words, 10% improved by 20-30 words, 50% improved by 30-40 words, and 20% increased their correct words read by 40<. So, when considering the effect that explicit vocabulary instruction paired with thrice-weekly repeated reading had on correct words read per minute, it could be argued that students did improve their correct words read per minute over four weeks when tested on this aspect of reading fluency weekly.</p>
<p>What are your recommendations for the effective replication, or use, of this intervention or treatment?</p>	<p>My recommendation for further intervention or replication of this data is that it should be modified and re-assessed. Further investigation should be done on both the intervention conducted in this research project and additional aspects of fluency such as accuracy and total words read. When determining where further research should be done, this research should first be conducted again with the recommended changes noted in the strengths and weaknesses of chapter 5 and the influential factors mentioned in the previous section. This research should be performed once more to understand better the effects of explicit vocabulary instruction paired with thrice-weekly repeated reading on total correct words per minute. When this research is repeated, additional questions may also be answered, including the effects of explicit vocabulary instruction paired with thrice-weekly repeated reading on total words read and also on reading accuracy. Further investigation may also be done on the effects of explicit vocabulary instruction alone on reading fluency, specifically on total words read and total correct words read and reading accuracy. Additionally, research should be conducted on thrice-weekly repeated reading on these same aspects of reading fluency. Examining these alone and comparing them with their combined results may give insight into the most effective means of improving student reading fluency through specific interventions.</p>

Granite School District

Research Applications During the 2020-21 School Year

Differentiation and adaptations in alphabet knowledge instruction.

Investigator: Carrie Wheeler

Proposal ID: TJ0021

Status: **Approved 02-19-2021**

Anticipated Completion Date: **04-30-2021**

Results:

MARCH 2021

Capstone Presentation
Carrie A. Wheeler
Western Governors University

Data Collection and Methods

Quantitative Research Approach

- ◆ Pre-test upper and lowercase letter naming and sounds of the letters
- ◆ Adapted and differentiated instruction
- ◆ Tracking individual progress
- ◆ Post-test of upper and lowercase letter naming and sounds of the letter
- ◆ Determine the percentage change in correct responses comparing pre- and post-test responses
- ◆ Descriptive statistics used to find the mean, mode, and range from all students' scores

Strengths and Weaknesses

Strengths of this Study

1. Assessment tools were easy to administer
2. Pre- and post-assessments were easy to collect.
3. The data was easy to analyze and interpret.

Weaknesses of this Study

1. The sample size of the student participants may be too small.
2. The findings may not be as statistically meaningful compared to larger student sample size.
3. The study did not compare the improvement in scores to students not receiving the differentiated instruction.



Differentiation and Adaptations in Alphabet Knowledge Instruction

Research Study

Table 1: Uppercase, Lowercase, and Letter Sound Assessments

Student	Pre Test Uppercase	Pre Test Uppercase	Pre Test Lowercase	Pre Test Lowercase	Pre Test Letter Sound	Pre Test Letter Sound	Post Test Letter Sound	Dual Language Learner
1	6	10	4	7	3	7	7	No
2	5	8	3	6	2	5	5	No
3	8	12	4	8	4	4	5	No
4	6	8	3	6	4	4	5	No
5	3	10	10	14	8	13	13	No
6	3	6	1	5	0	3	3	No
Overall Average								
Pre Test Uppercase: 5.5								
Pre Test Lowercase: 6.3								
Pre Test Letter Sound: 4.5								
Post Test Letter Sound: 6.5								
Average Improvement								
Uppercase: 1.25								
Lowercase: 1.25								
Letter Sound: 2.0								
Letter Sound: 2.0								

◆ Pre-test assessment was used to learn what letters and sounds each student already knew.
◆ Post-test assessment was used to determine whether differentiated instruction could improve students' alphabet knowledge outcomes.

Future Application of Knowledge Gained

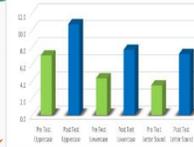
- It is important to help children learn alphabet letters and sounds as quickly as they are able so they will have a great start to learning how to read and write.
- Based on the results of this research study student delays in alphabet knowledge could be solved by providing the students who are delayed with individualized differentiated and adapted instruction.
- When students are provided with more alphabet knowledge learning opportunities that are adapted and differentiated to meet their learning needs, they will continue to improve and make progress with their alphabetic skills and these skills will make reading and writing easier for them to learn and remember.

Research Topic

Investigate the benefits of differentiation and adaptations in alphabet knowledge instruction to improve preschool students' letter learning outcomes.

Table 2

Overall Average Score Pre Test Vs. Post Test



◆ The bar graph visually demonstrates that providing the pre-test scores from differentiated and adapted instruction to the students' scores after differentiated and adapted alphabet knowledge instruction.

Thank You!

Carrie Wheeler

Research Problem

Students who are significantly behind their typically-developing peers in alphabet knowledge are at a higher risk of developing literacy delays.

*When a child cannot recognize at least 10 uppercase and 10 lowercase letters in the alphabet before they enter kindergarten, they will likely have a higher risk of lower literacy skills in first grade (Finch & Stanley, 2018).

Tables 3 & 4

Dual Language Learner Pre Test Vs. Post Test Average



◆ Both bar graphs show dual language learners' and non dual language learners' dual language learners' and non dual language learners' progress with differentiated instruction comparing dual language learners with their post test scores.

Differentiated Instruction

For a student demonstrating delays in letter naming and letter sound recognition, explicit instruction is imperative for them to overcome and make progress with their delays (Paige et al., 2018).

Differentiated and Adapted Instruction

- Initial instruction is provided in large groups.
- Brought to small group settings to differentiate and adapt to each student's learning level.
- After individualized one-on-one differentiated instruction will be provided.
- Continuous on-going instruction and assessments are necessary throughout the school year.

Results and Conclusion

The results and conclusion of this quantitative research study show that by giving students alphabet knowledge differentiated instruction and providing them with many learning opportunities to practice the letters, the preschool students were able to increase their alphabet knowledge in naming upper and lowercase letters and increase saying the sounds of the letters.



Granite School District

Research Applications During the 2020-21 School Year

Secondary to postsecondary articulation of dual language immersion: Tracking Bridge Program students' college access and success.

Investigator: Jill Landes-Lee

Proposal ID: TJ0022

Status: **Approved 02-19-2021**

Anticipated Completion Date: 12-01-2022

Results: 1st request on 04/20/2022

2nd request on 05/03/2022

Implementation of the flipped classroom in world language classes at the secondary level in the state of Utah.

Investigator: Sarah Hoppes

Proposal ID: TJ0023

Status: **Approved 02-26-2021**

Anticipated Completion Date: 04-30-2021

Results: 1st request on 04/20/2022

2nd request on 05/03/2022

Granite School District

Research Applications During the 2020-21 School Year

Problem Solving

Investigator: Jill Vantrease

Proposal ID: TJ0024

Status: **Approved 02-26-2021**

Anticipated Completion Date: **03-31-2021**

Results:

45	<p style="text-align: center;">Chapter 5</p> <p>Teaching mathematical word problem solving has always been a challenge for myself as a teacher as well as my students. Knowing how to solve the math problem is not the only skill used when solving math word problems. Students need to understand what the problem is asking, what is happening in the problem, and have strategies to solve these problems. This study tried to determine what would help students understand word problems and improve their accuracy in solving these types of problems. If their understanding of word problems increased, one could reason their scores on benchmark assessment scores would also increase. This chapter will go over the limitations and implications of the study as well as provide insight into what should happen next.</p> <p>My emphasis was working with low-income students. I expected the data to show that word problem solving increased substantially with explicitly teaching visual strategies to the students and show a teaching strategy that could be utilized in low-income schools to lessen the achievement gap and improve word problem skills. I also hoped that gaining confidence in math problem solving would transfer to other subjects as well as to life skills.</p> <p>Discussion of Results</p> <p>When I gave the pretest I assumed most of the students would do poorly on it, and that it would be a good point of reference for the rest of the study. Only one student scored 80% or better. I was surprised by this student because she came to school this year as one of my lowest readers. She did better than the students that are in my gifted cluster. Because of this test result, I had her tested for the gifted cluster next year and she ended up qualifying for it. Initially I was not going to compare DIBELS scores with the study results, but this student intrigued me, so I included it to identify any other outliers.</p>	47	<p>The questionnaire results between the pretest and the posttest were not significant enough to reach any conclusions. It was noted that 14 students on the posttest questionnaire compared with 10 students on the pretest questionnaire showed they could tell when to add or subtract in a math word problem. It also showed that student perceptions of math went up with more students answering with a smiley face on the posttest versus the pretest.</p> <p>The interviews helped me gain insight into the minds of a few of the students. Just because a student was not proficient in math, did not mean they didn't enjoy it. That gives me hope that they have not given up and will keep trying in the future to understand math concepts.</p> <p>I did find it disheartening that one student did not like math and it reminded me that I need to find other games or activities to help this student and others like him. This student has struggled with math since the beginning of the year. He was referred to special education based on failed interventions but did not qualify for math, only reading. I need to make math fun for him and add in more spiral review of concepts so he can maintain the skills he has learned. He has a hard time focusing on class and needs small group interventions with most concepts. This year I have several students like him. I believe focusing on what these students can do and boosting confidence will help. In past years I have played more learning games with lower students and made math into more of an activity. I seemed to have more "zest" in years passed than I have had this year.</p> <p>With the higher students, it reinforced for me that teaching math with manipulatives, games and being as hands-on as I can helps students learn. I also enjoyed hearing that students liked to be challenged and learning new concepts is exciting for them. Along with scaffolding instruction for my lower students, I also need to find new ways of extending the curriculum and challenging the higher students. My district does provide some extension activities that I have</p>	49	<p>how the soft closures of schools affected student academics, but I anticipate these soft closures will have far-reaching effects on students and their education. To help these students who are low, my district is offering summer tutoring for four weeks. Students will be signed up for one hour, four days a week, for small group reading interventions. However, nothing is planned for math deficits.</p> <p>After two months of doing both online and in person learning our grade level changed to have a set online teacher so three in person classes were combined into two in person classes and one online class. Because of the way the classes were split, I received ten new students that were low academically. Of the three teachers in my grade level, I had the most experience. The other in person teacher had a difficult year last year and I wanted her to feel success, so I volunteered to take the low students. Part way through the study our grade level switched again and two in person classes went to three. I lost six of my medium high students. I also had more behavior problems than in previous years. These added to more frustration and less teaching time with more time focused on classroom management. Although teachers were involved with the administration during each split, any time there is a big change, it takes time to settle back into routines and establish classroom culture again.</p> <p>This year there were added restrictions because of COVID-19. Students could not work together, time normally spent learning during the day was spent disfecting the classroom twice a day, student desks were further apart making proximity harder for me to accomplish and so I had to find a new way of teaching that was not comfortable for me, I was teaching both online students and in person students at the beginning of the year, and our district set aside Fridays for distant learning planning for teachers. This meant that teaching time got cut even more.</p>
46	<p>The results of the first common formative assessment (CFA) were promising with 11 students getting 80% or better on CFA #1. I believe reading the test to the students was beneficial because of the number of red students on DIBELS doing well. These results showed that students were understanding the strategies they had been taught.</p> <p>The results of CFA #2 were not as promising as only seven students scored 80% or higher. Most students who missed questions added on a subtraction problem. This showed me that although students could add correctly, they were not able to comprehend the word problem enough to understand whether they needed to add or subtract to get the correct solution.</p> <p>On the posttest, fourteen students showed growth which is more than half the class. Although the results were not as good as I had anticipated, I was pleased I had gains. This shows promise that teaching problem types and explicitly teaching word problem strategies helps students understand word problems. Although there was improvement in the overall scores, they were not to the caliber that I had expected, and I hoped that the lower students in the class would benefit more than they did. There was greater improvement with the addition word problems, but not as much with the subtraction problems. This could be because I felt rushed to get through what I had planned as well as catch students up for last year's shortened school year. I took my time at the beginning of the study to explore word problem solving with addition, but the final three weeks I spent mainly on subtraction and there were too many word problem types to cover in that short amount of time. One week should have been spent on each type, for instance, start unknown, change unknown, result unknown, and compare problems. I feel like I glossed over it hoping that some of the students would remember what was taught. I did not slow down because I wanted to cover as much of the assessment material as I could. More instruction was needed with subtraction.</p>	48	<p>used with my students in the past, but they are mostly collaborative activities and this year those activities have been discouraged.</p> <p>This study happened in the aftermath of COVID-19. Therefore, there were many unforeseen variables that could have contributed to the results and implications of this study.</p> <p>The COVID-19 pandemic required all schools in our state and district to go into soft closures the previous year for their final two months of first grade. Although students were given chrome books to take home, there was no accountability for incomplete work or missed classes. Teachers who had not been used to primarily using technology to teach were required to learn how to teach their students over Google meets. This brought forth complications for education. There were many students at our low-income school who did not have internet or did not have adequate bandwidth to participate in online learning. Those with limited bandwidth were forced to learn curriculum through unfamiliar platforms like Google slides. Teachers could provide limited help because students were not allowed at the school and teachers were cautioned not to go to student's homes. This school has a high number of students with limited English skills and even more parents with limited English skills. Teachers who were not bilingual could not communicate with parents to help without a translator and the translators were stretched thin, so it was difficult getting one at times. The ramifications of this pandemic were that some students missed two months of school and came to second grade further behind than they would have been in a normal year.</p> <p>This also led to a large gap between the lower students and the higher students based on observations. Those students with adequate internet and parents that could help their students came to my second-grade class knowing their first-grade skills while the students without either came to school this year further behind peers. I am not aware of any completed studies showing</p>	50	<p>Results Reflection</p> <p>Upon reflection and best teaching practices, problem solving skills is not something that can be taught in nine weeks. I reserved most of the problem-solving teaching to the study. In a regular year, I would plan for time at the beginning and throughout the year for exploration and collaborative work time involving math problem solving concepts. More time would be allowed to using manipulatives and breaking down math word problems. I felt rushed to get through what I had planned as well as catch students up for last year's shortened school year.</p> <p>I also was short sighted in what students needed during assessments. I read the word problems to them so that reading would not limit the students who were low readers. I learned through this that comprehension strategies are also needed in word problem-solving. Math and reading are more interdependent than I realized. This was probably my biggest <i>aha</i> of the entire study.</p> <p>This year our study flowed like I had planned. The gap between my high students and low students was greater than I had worked with in the past. Teaching the high students left the low students bewildered and teaching the low students left the high students bored. Normally I would have grouped students accordingly, but I felt I needed to provide the same instruction for all learners for the sake of a valid study. I provided scaffolded instruction to meet the needs of all learners by presenting simple and more complicated problems surrounding the same strategy, but the math computations required for the assessments were too difficult for many students in the class. Three of the students started the year learning to count to 20 with one-to-one correspondence. Computation aside, some students still were not able to distinguish between an addition word problem and a subtraction word problem on the assessment. This showed that more instruction and practice are needed.</p>

Granite School District

Research Applications During the 2020-21 School Year

Understanding FASFA Completion in Utah

Investigator: Wendy Noel Galovich

Proposal ID: TJ0025

Status: **Approved 03-31-2021**

Anticipated Completion Date: 04-16-2021

Results:

<p>Describe the purpose of your research. What concern, problem, or curiosity did your research investigate?</p>	<p>The primary purpose of the research survey was to create a research project that addresses the question of why Free Application for Federal Student Aid (FAFSA) filing is so low in Utah. We particularly wanted to identify why students who may be eligible for financial aid were not filing. Prior research has been done into the reasons why students may not file, but the little was performed specifically in Utah, where there may be unique circumstances.</p>
<p>Describe your research method(s). Provide a brief description of the participants, the timeline of what was done, and the data that was collected.</p>	<p>The main method of research was by conducting a survey. To create the survey, we started by looking at previously published research on the subject, noting the common trends in reasons why FAFSA filing is low in general. We then adapted these reasons into our survey. We wanted to encompass the uniqueness of Utah's FAFSA filing with reasons that we believed could impact Utah individually. We were able to include all of Salt Lake City School district as well as students from Kearns High School. Our target demographics were seniors aged 18 and up (to avoid necessitating parental consent). Our primary questions were: (question 1) reasons for completion and non-completion of FAFSA in Utah, (question 2) what factors are important in determining which students are more or less likely to complete the FAFSA, and (question 3) how does religion influence FAFSA completion in Utah. We ended up with around 125 completed surveys to include in our analysis.</p>
<p>Summarize your expectations and the results. Provide a brief description of your findings and compare those to what you were anticipating.</p>	<p><u>Question 1:</u> The most common reason for not completing the FAFSA among Utah seniors is that they do not believe they will qualify for aid. Among students who completed the FAFSA, the most common reason for FAFSA completion was to receive federal student aid. However, the second most common reason was that students did not know why they had to complete the FAFSA. Both of these findings suggest that high school students do not have a clear understanding of the benefits and purpose of FAFSA beyond accessing federal aid. It is also relevant to note that many students reported completing FAFSA because their school required FAFSA completion, or they were guided to complete FAFSA by their school. This supported our initial impressions of why FAFSA had a low rate of filing.</p> <p><u>Question 2:</u> To understand which factors influenced FAFSA completion the most, we used a simple decision tree analysis. A decision tree is essentially a model that aims to predict an outcome based on the most important factors in the data. We found the most important factors were guardians' level of education and whether a student is LDS or not. Other factors such as sex and race/ethnicity were less influential than guardian's level of education and LDS religious identity.</p> <p><u>Question 3:</u> We predicted that religious affiliation would have an impact on rates of filing. Through proportion testing it is clear that whether a student is LDS or not plays an important role in whether they will complete the FAFSA. To better understand this, the chart of FAFSA completion rate by religion shows that LDS students may file at a lower rate than non-LDS students. After testing this hypothesis, there was significant evidence to support this claim. However due to the low number of responses (roughly 125 students), a larger sample is needed to yield more reliable results. Also, since the majority of students classified in the decision tree by LDS affiliation did start the FAFSA, whether they were LDS or not, this result does not contradict what was found in the decision tree. In fact, it demonstrates that regardless of LDS affiliation, guardians' level of education is still the most important factor in determining whether a student will start the FAFSA.</p>
<p>Benefit to Granite School District. Describe how your research will benefit Granite School District.</p>	<p>From the results of this research, it seems clear that one way to improve completion rates is to better inform students of the applications of FAFSA outside of federal aid and aid options that are available to all students through the FAFSA. However, continuation of this study may be necessary to better understand the differences in rates of FAFSA filing in Utah compared to the rest of the country and identify ways to overcome the challenges that students may face when filing FAFSA.</p>

Granite School District

Research Applications During the 2020-21 School Year

Cooperative Learning on Student's Ability to Analyze Primary Source Documents

Investigator: Janae Hirschi

Proposal ID: TJ0026

Status: **Approved 04-19-2021**

Anticipated Completion Date: 04-30-2021

Results: (complete data will be forwarded in August 2021)

What did you do to effect change? A brief description of the intervention or treatment.	Students struggle analyzing primary source documents in AP social studies classes. The intervention that took place was an instructional unit that taught students how to analyze primary source documents using cooperative learning as the teaching strategy.
What did you expect to happen as a result of this intervention or treatment?	I expected that students would increase their test scores when analyzing primary source documents, as a result of cooperative learning being used in the classroom to teach analytical skills.
How did you measure the effects?	The effects of the instructional unit were measured through a quantitative 8 question multiple choice test. Students took a pre-test, and post-test to determine the effectiveness of the instructional unit. The pre-test was given before the instructional unit, and the post-test was given after the instructional unit. The pre-test and post-test were the same test. There were 37 students who participated in the instructional unit but only 25 returned permission slips and took the pre/posttest.
What were the results?	The results showed a one-point gain for the mean, or average score.
What are your recommendations for the effective replication, or use, of this intervention or treatment?	I would recommend that cooperative learning be used within instructional units when teaching analytical skills.