ACADEMIC ACHIEVEMENT WITH COOPERATIVE LEARNING USING HOMOGENEOUS AND HETEROGENEOUS GROUPS

by

Patricia Joanna Wyman

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

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ABSTRACT

Cooperative learning is a proven teaching strategy that teachers have been using for over 40 years. Teachers often group students heterogeneously so that students that are lower achieving are learning from higher achieving students and higher achieving students support and solidify their learning by restating and re-teaching to their lower achieving partners. The purpose of this study was to test homogeneous and heterogeneous grouping while using cooperative learning teaching structure. This dissertation aimed to answer the question, should students be grouped homogeneously or heterogeneously while participating in cooperative learning. The research design for this study was quantitative, quasi-experimental. A convenience sample of fifth-grade students was drawn from a Georgia Christian elementary school in the 2017-2018 school year. The data were analyzed using paired and unpaired *T*-test. The independent samples *t*-test was run to compare the scores from the FOSS Survey/Posttest, and the analysis showed no significant difference between the homogeneous and heterogeneous posttest scores. Both groups made significant gains, however in this study the grouping did not have a significant impact on the difference in posttest scores for the two groups.

Keywords: cooperative learning, homogeneous, heterogeneous

Dedication

This manuscript is first dedicated to my Lord and Savior, Jesus Christ. I know you walked with me throughout this process. This is dedicated to my husband without whom I would not have been able to raise our beautiful family and do the countless hours of work that went into this document all at the same time. It is dedicated to my four children, Avery, Ashlynn-Grace, Aleigh, and Knox that prayed for me and excused me from so much so that I could do this work. It is dedicated to my fifth-grade parents and students from the 2017 school year that allowed this study to take place. It is dedicated to former principal, Tamara Etterling, and assistant principal, Jeri Lynn Hutchins, who not only introduced me to cooperative learning, but more importantly took a chance and gave a teaching job to a young single mom because they saw something in her that she did not see in herself. Thank you all for the encouragement and the belief that I could accomplish what never seemed possible.

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Cooperative Learning (CL)

Full Option Science System (FOSS)

Georgia Performance Standards (GPS)

Georgia Standards of Excellence (GSE)

Zone of Proximal Development (ZPD)

CHAPTER ONE: INTRODUCTION

Overview

"Two people are better off than one, for they can help each other succeed. If one person falls, the other can reach out and help. But someone who falls alone is in real trouble" (Ecc. 4:9-10, New Living Translation). Working together is not only biblical, it is an essential element for success. Cooperation among students in a classroom allows for different people to blend their abilities to achieve goals set forth by the teacher. Collaboration, problem-solving, conflict resolution, and working together are all important life skills, but the question arises on how to group students. For example, it is not known if students should be grouped by ability, mixed ability, sex, interest, age, or intelligence, etc. Furthermore, it is not known if students should be grouped homogeneously or heterogeneously while participating in cooperative learning; it is this question that this dissertation aims to answer.

Background

People working together cooperatively is not a new concept, just as it is not a new idea for teachers. In the early 1900s, Dewey, an educational philosopher, believed that the job of an educator was to prepare students for democratic citizenship by submerging students in real-world problem solving by using collaboration and their imagination (as cited in Benson, Harkavy, & Puckett, 2007). There was a shift in American education away from collaborative work and into interpersonal competition in the late 1930s. This shift, later described as Darwinism in the classroom, then shifted yet again so that classrooms were influenced by John Locke (Johnson & Johnson, 1989). This did not change until the 1970s when cooperative learning had a huge push from researchers, and in the 40 plus years cooperative learning has been tested and proven as a useful learning tool in numerous studies (Essien, 2015; Ghorbani & Nezamoshari'e, 2012;

Hsiung, 2012; Igel & Urquhart, 2012; Ke & Grabowski, 2007).

Historical Overview

Cooperative learning has numerous definitions, but for this study it can be defined as students that work in "… groups toward a common goal or outcome, or share a common problem or task in such a way that they can only succeed in completing the work through behavior that demonstrates interdependence while holding individual contributions and efforts accountable" (Brody & Davidson, 1998, p. 8). There are just as many types of cooperative learning as there are definitions. Slavin (1981) provided a list of the following cooperative learning strategies: student learning teams, student teams-achievement divisions, team-games-tournament, team assisted individuation, cooperative integrates reading and composition, jigsaw, learn together, and group investigations. There are just as many benefits to cooperative learning as there are definitions and types.

Starting in the 1970s, educational researchers began examining the topic of cooperative learning and added numerous studies to the field. These studies demonstrated the many benefits of cooperative learning: academic, social interaction, self-esteem, behavior motivation, and organization (Johnson, Johnson, & Taylor, 2004; Slavin, 2014; Sulisworo & Suryani, 2014).

While the data on cooperative learning has been overwhelmingly positive, there have been studies that show that cooperative learning does not always increase learning more than traditional teaching (National Association for Gifted Students, 2006). Even though numerous studies have been conducted on cooperative learning, studies on groupings of students are inconclusive; specifically, whether heterogeneous groups or homogeneous grouping should be used in cooperative learning.

Some researchers show that heterogeneous groups should be utilized to support academic

and social achievements and may show higher gains in lower achieving students (Hooper & Hannafin, 1988; Johnson & Johnson, 1987; Wang & Lin, 2007; Zamani, 2016). However, there have been studies at the college level that show cooperative learning groups when grouped by academic levels, homogeneously, show growth for high achieving students and middle achieving students (Baer, 2003). To add to this, Baer (2003) explains that low-achieving students did equally as well as students not grouped homogeneously. It is also important to note that researchers have found that medium to higher achieving students have shown resentment at lower achieving group members being placed in the group (Slavin, 1981). While cooperative learning has been heavily researched for almost 50 years, there is still a lot to be learned about this teaching practice.

Social Overview

One social psychologist who contributed to the shaping of cooperative learning was Kurt Lewin. Lewin's research dealt in group work and the changes that resulted from it (Burnes & Cooke, 2013). Lewin's theories created the groundwork for developing effective relationships within groups and therefore changing the dynamics of the relationships within the groups while carrying out group objectives (as cited in Sharan, 2010).

A second social psychologist that played a significant role in shaping of cooperative learning was Morton Deutsch. Deutsch, a student of Lewin's, defined and refined the framework of positive interdependence, or when group members share common goals, to understand that working together is beneficial and that the success of the group depends on the participation of all the members. This distinction is a key component to cooperative learning (Deutsch, 1993).

Much later, Gillies, Ashman, and Terwel (2008) identified that there are two types of social interdependence; positive interdependence, when students must work together to achieve

goals, and negative interdependence or when students compete to obtain academic goals. In this dissertation, the researcher will use Kagan cooperative learning strategy, a positive interdependence teaching strategy.

Theoretical Overview

The constructivism theory developed by Vygotsky and Dewey explained education and child development as it relates to cooperative learning (as cited in Creswell, 2013). Vygotsky's theories placed importance on the social interactions as it directly related to cognitive growth (Vygotsky, 1978). Unlike previous social theorist, Vygotsky believed that first, the child must make social connections, and then the child will learn (Vygotsky, 1978). Vygotsky recognized that learners would make meaning from the information that was around them as they work inside the learning environment; construction in the classroom, therefore, created learning (as cited in Clapper, 2015).

John Dewey's theories also influenced cooperative learning in the classroom. Dewey believed that education was to be used to help society by preparing students to be citizens with the development of social skills (as cited in Essien, 2015). Essien (2015) continued that within Dewey's theory, students worked together cooperatively and guided their learning while teachers were seen as the facilitators. In a facilitator's role, the teacher's role changed from someone giving information to offering formal and informal support and procedural recommendations with the use of rhetorical questions (Donovan & Mason, 2014). Teachers are in the classroom to guide or lead students to their own understanding of the content; they develop learning environments that challenge and encourage students to think and solve problems critically (Spooner, 2015). Students were engaged, "in the learning process together rather than being passive receivers of information (e.g., teacher talking, students listening)" (Essien, 2015, p. 121).

These theories and principles are closely related to the present study because in cooperative learning students switch between different groups and act as both teachers and students. In one form of cooperative learning, the jigsaw method, the first group of students work independently to become experts, then meet in homogeneous groups on their expert topic to solidify answers to the presented questions. They then meet in heterogeneous groups to teach their topic to other groups, and finally work again independently, demonstrating their expertise in all topics (Berger & Hanze, 2015). Teachers are seen as facilitators and students guide their own learning in this type of classroom.

Problem Statement

The literature has not completely addressed the question of how to group students in a cooperative learning lesson. There is controversy over the mixed results of previous studies, and there are unexamined populations identified for future studies. Earlier studies on grouping, as mentioned previously, have focused on college-aged students. When one looks at studies on elementary-level grouping, there is a significant gap in the literature. This may be because of the different benefits, both social and behavioral, that outweigh the perceived academic benefits (Baer, 2003). Baer (2003) continued that students that do not usually interact in a classroom but are put together and are forced to interact in cooperative learning groups. Therefore, the other benefits of cooperative learning are seen as advantageous and outweigh the singular academic goal that is often cited.

Heterogeneous grouping in cooperative learning are often not studied because they are so widely used and accepted (Watson & Marshall, 1995). Slavin (1981) stated that students placed in groups are most often divided academically; however, sometimes they are divided by gender, age, race, or by learning style. It is still unclear if it is better for student achievement and

satisfaction if heterogeneous or homogeneous groups are used in the elementary school.

The problem is that there are studies that mention homogeneous grouping and positive impact. Conversely, there are also studies that report there is not a statistically significant impact. However, these studies were not conducted with elementary school-aged children, but on students in the college level (Baer, 2003; Miller & Polito, 1999). This further indicates that studies regarding grouping at the elementary level need to be considered. Therefore, there is not enough research available to provide closure to the question of which is more beneficial to students, heterogeneous or homogeneous grouping in cooperative learning at the elementary levels.

Purpose Statement

The purpose of this study was to evaluate the relationship of cooperative learning among fifth-grade students and their achievement, while taking into account how the students are grouped. A quasi-experimental research design was used to analyze student outcomes in science class. This was accomplished by comparing student outcomes from participants in these two cooperative learning models. The researcher determined this by comparing fifth-grade students grouped homogeneously and heterogeneously, the independent variables, by comparing test scores in achievement, the dependent variables. The independent variables, grouping, was determined by students' pretest scores. Thirty students were grouped homogeneously so students scoring high were paired with other high scoring students, and students scoring low were paired with other low scoring students, and so on. The other thirty-one students were paired heterogeneously; these groups had students of all ability or scorings paired together. The dependent variable is the Full Option Science System (FOSS) Pretest/Post Test Survey. The researcher chose the subject area of science because it is objective in the field of curriculum and

assessment. The purpose of this study was to determine if equity of learning exists between homogeneous and heterogeneous groups when teachers use cooperative learning in elementary school.

Significance of the Study

Limited research has been conducted on groupings at all grade and age levels, but the body of knowledge is most lacking at the elementary school level. Therefore, the importance of this study is to provide data, collected from a private, elementary environment, to determine if equity exists between homogeneous and heterogeneous academic groups while using cooperative learning.

The implications of this study are beneficial for the future instruction of teachers using cooperative learning in their classrooms. Cooperative learning has been proven effective in multiple classroom settings and subjects, but the assumption that students preform best when grouped heterogeneously has not been thoroughly tested at the elementary level. This study adds to the body of knowledge on how effective grouping students at the elementary level while using cooperative learning. The results are useful for teachers in the classroom because often teachers group students with mixed ability levels, with the belief that higher achieving students will help lower achieving students, but this research might show that grouping students differently could increase learning with all students, achieving the ultimate goal in teaching, which is learning. While grouping students for cooperative learning lessons is what this study focused on, it is also used in numerous other teaching strategies, and could benefit teachers across multiple lessons and in multiple subjects to consider or reaffirm their teaching and grouping structures.

Research Questions

RQ1: Is there a significant difference between fifth-grade students' *academic*

achievement in science when grouped homogeneously compared to those who are grouped heterogeneously while using cooperative learning strategy measured by the FOSS Survey/Posttest?

RQ2: Is there a difference between *pretest* and *posttest scores* as measured by the FOSS Survey/Posttest for the heterogeneously grouped and homogeneously grouped students during the treatment period?

Definitions

The following terms have been defined by the researcher to aid in the understanding of ambiguous terms found in the research.

1. *Cooperative Learning* – Cooperative learning is working together in small groups to help each other learn or accomplish a task (Slavin, 2014).
2. *Facilitator* - A teacher's interactions with students that are both formal and informal offering support and procedural recommendations; lesson format differs with the project but includes rhetorical questions rather than a particular direction or statement (Donovan & Mason, 2014).
3. *GPS* – Georgia Performance Standards provide parents and educators with expectations for instruction, assessment, and student work with implementation starting in 2004 and fully implemented in 2012 (Georgia Department of Education, 2004).
4. *GSE* – Georgia Standards of Excellence is the name given to the Georgia Performance Standards after February 19, 2015, when the State Board of Education (SBOE) voted to rename the ELA and Mathematics standards (Georgia Department of Education, 2016).
5. *Heterogeneou***s** – Heterogeneous grouping, groups students with a variety of different ability levels, talents, and/ or interests together to complete an activity (Zamani, 2016).

6. *Homogeneous* – Students grouped according to their abilities, genders, and/ or races so that everyone in the group is the same (Zamani, 2016).

CHAPTER TWO: LITERATURE REVIEW

Overview

This chapter reviews previous works, studies, and research that was done on the topic of cooperative learning and its foundation in theoretical frameworks. Cognitive stage, social cultural, and constructivism all demonstrate a connection to these frameworks that will allow the findings to be situated within a greater context. The literature on the benefits of cooperative learning teaching strategies and previous studies on heterogeneous and homogeneous grouping within the cooperative learning setting are included to establish that cooperative learning is a sound teaching method. Finally, in order to address the gaps in the literature, this section discusses what is not known about the topic. Specifically, the lack of studies done on groupings and elementary aged students are reviewed which further proves the problem and solidifies the need for this research.

Theoretical Framework

There are three theoretical frameworks that ground cooperative learning as a valid teaching strategy: the cognitive stage theory, the social-cultural theory, and the social cognitive theory. The cognitive stage theory states that hands on experience along with peer interaction helps students to progress (Miller, 2002). In the social-cultural theory it is believed that students move forward through areas of proximal development by working in groups and from modeling by facilitators (Fore, Riser, & Boon, 2006). Lastly, in the social cognitive theory, students learn from modeling and influence from others (Bandura, 1971).

Cognitive Stage Theory

Piaget's work in the field of psychology is one of the most noted, and because of the research Piaget conducted, implications are realized in numerous other areas, including

education. Piaget's work identified four different stages in which children move through to gain knowledge: sensorimotor, ages birth to two years old, preoperational, ages two to seven, concrete operational, ages seven to eleven, and formal operational, eleven to adulthood (as cited in Ojose, 2008). Within each of the different stages, children accomplish various learning goals as they develop their lifelong skills. For example, in the sensorimotor stage children recognize an object still exists even after it cannot be seen, object permanence; in the second stage, preoperational, students develop language, and it is in this stage that is often characterized as students thinking egocentrically, or only about themselves (Ojose, 2008). Ojose (2008) continued, in the last two stages, concrete and formal operational, students can solve problems logically, understand reversibility, and then in the last stage, formal operational, children can think abstractly using higher order thinking skills such as application, evaluation, and inference.

As students age, there are four factors that moved children through Piaget's various stages of development as were identified by Miller (2002); those four stages are "physical materialization, experience with physical objects, social experience, and equilibration" (p. 103). Put simply, a person's age, hands-on experience, and social interactions with peers and adults helped to develop students in Piaget's studies. Piaget's research stated that knowledge came from construction, and that as "people construct knowledge, they have an active part in the process of knowing and even contribute to the form that knowledge takes" (as cited in Miller, 2002, p. 33). In other words, people of all ages learn by doing instead of quietly taking in information that is simply presented to them.

In cooperative learning, students must work together to build their knowledge. Information is not given to students in a typical lecture led classroom; instead, students are actively involved in finding the knowledge, sharing information, and developing societal skills

(Johnson & Johnson, 2014). Piaget's belief was further explained in that adult interaction or lecture was less effective than peer instruction as seen in cooperative learning; "children's abilities to organize patterns of behavior and thought as they (f)ormulate and interact with their environment, parents, teachers, and peer groups develop more quickly when children interact with one another than when they interact with adults" (Fore et al., 2006, p. 4).

In conclusion, the specific research focus on cooperative learning and student grouping relates to Piaget's theory because in both, students guide their knowledge, construction leads to educational truths, and social skills are required to build knowledge.

The current research study may potentially advance or extend the theory by specifically looking at the last two stages, concrete and formal operational stages, ages seven to adulthood. The study includes students that are by age definition in both stages because students who participated in the study are ten to twelve years old. Indirectly, the students were observed working with their peers, and throughout the FOSS science kits, students solved problems with manipulatives and then solved problems abstractly. While measuring the social learning abilities is not what this researcher aimed to investigate, it can add to what is already known in this field. The students' content knowledge presentation changes from hands-on, concrete, in the learning phases when students are participating in the FOSS investigations, to more abstract presentation in the testing phases when students must apply their newly gained knowledge, so this study can provide some insight into the abstract learning growth in the last two developmental stages.

Social Cultural Theory

Piaget investigated how people interacted with their environment and biology, while Vygotsky looked at social and cultural interactions in addition to the biology (as cited in Miller, 2002). Vygotsky believed that a student's development was not able to be separated from their

social settings; specifically, that students could learn more than they could on their own by working with more capable peers or adults (as cited in Fore et al., 2006). In the student's zone of proximal development (ZPD) students can move past areas of knowledge that they could have obtained on their own by working with peers that use "prompts, clues, modeling, explanation, leading, questioning, discussion, joint participation, encouragement, and control of the child's attention" (Miller, 2002, p. 175). Teachers working "in line with the concept of Vygotsky's ZPD, the members of the group, and the facilitator can assist those learners with assimilating the new information" (Clapper, 2015, p. 154) and are therefore merging the ideas of cooperative learning and ZPD. In other words, students working cooperatively with peers can achieve more than students trying to learn additional information on their own, thus supporting Vygotsky and Piaget's work. In this way, the idea of how students should be grouped heterogeneously or homogeneously, arises.

Working with peers to achieve learning goals is a principal component of the cooperative learning model, and it has been shown that when peers work together to achieve a common goal, the student "produces higher achievement and greater productivity (than) working competitively or individualistically" (Johnson & Johnson, 2014, p. 843). When students participate in cooperative learning, students are working together instead of against each other, so they then are working in compliance for the "mutual benefit of a common cause" (Spooner, 2015, p. 37). This makes cooperative learning more effective than competitive groupings and learning. In this way, using scaffolding, students move from not able to solve problems to solving problems with help, and into the ZPD (Clapper, 2015).

This specific research may potentially advance or extend the social cultural theory because it aimed to answer how student grouping effects their learning outcomes. Specifically, if

grouping students with similar ability levels or mixed ability levels, effectively move students from disequilibrium, the area where students are able to learn information, to new equilibrium, the area where new knowledge is obtained, most efficiently.

Constructivism Theory

The constructionist theory claimed that knowledge is constructed through interaction with the environment and relationships (both with adults and peers) rather than social or traditional educational means (Aldridge & Goldman, 2007). So, students do not learn from only the teacher's words, but instead from educational experiences set up in the classroom (Spooner, 2015). Olusegun (2015) stated that constructivism was in direct opposition of traditional learning, or lecture, and students and teachers were in a continuous and active process of leaning. Thus, meaning or learning comes from students' construction of the environment, classroom, and interaction among peers. Teachers guide students to learning, and group members help each other reach their learning targets (Fernandez-Rio, 2016).

Dewey also had a theory, and even though his work predated both Piaget and Vygotsky, all three men are considered constructivists. However, Dewey's approach included a component of cooperative learning that the others did not- leadership. Both the physiological and social components were major aspects of Dewey's practices, but he called for students to be active in leadership roles in his school, believing that students would refine these skills in their youth and utilize them as adults (as cited in Rebore, 2000). Rebore (2000) continued, along with students having leadership roles, students were given opportunities to demonstrate and teachers promoted, "flexibility and resourcefulness, risk taking and experimentation…to develop problem-solving and leadership skills" (p. 158). Leadership, resourcefulness, and problem-solving skills are all different attributes found in cooperative learning (Kagan, 2013). When students individually and

cooperatively work together, then knowledge is constructed (Spooner, 2015).

In the current research, the hands-on instruction of the FOSS unit, the social aspects of the cooperative leaning teaching method, and the active learning that is an essential component to both, relates to the constructionist theory. This research will also advance the theory by first observing the constructionist view of education, because the cooperative learning activities build off of peer interaction, and secondly it will advance the theory by analyzing the academic success on FOSS pretest and posttest that traditional learning demands.

Social Learning Theory

Bandura's psychological theory states that the learned behaviors of children are controlled by their environment instead of internal forces (as cited in Social Learning, 2017). Bandura's idea that modeling, or children observing others in order to learn behaviors, such as cooperation, are learned through watching and modeling the observed behaviors. This theory is often cited as a link between cognitive and behavioral theories because the social aspect is heavily interwoven between the two.

Bandura's theory included three factors that affected students' ability to learn: "individual learners, peers, and learning situations" (as cited in Chen & Chang, 2014, p. 100). Cooperative learning students interact with each other to reach goals, and Bandura's research indicated that peers interact so that students obtain "desirable learning performance (that) requires social support from other peers and their understanding of learning situations" (as cited in Chen & Chang, 2014, p. 101). Students participating in cooperative learning are looking to the models, peers or teachers, to gain knowledge on more than just academics, things like behaviors and values are also internalized by interaction among these models (Bandura, 1971).

In this current research, the focus relates to the social learning theory because students

and teachers use the frameworks to shape learning on social behaviors within the cooperative learning lessons. It is cited throughout the literature about cooperative learning that modeling appropriate and desirable social behaviors is one benefit of the use of cooperative learning, and these skills must often be taught just like academic skills (Johnson & Johnson, 2014). In this way, this current research may advance or extend the theory by adding to the knowledge of social behaviors in relationship with academic success in the cooperative learning environments, because the success in both heterogeneous and homogeneous groups was dependent on the social interactions between peers.

Cooperative Learning Theory

Cooperative learning relates to all these theories, constructivist, social learning, and lastly, the cooperative learning theory. Whether the goal more closely aligns with Dewey's idea of leadership, Vygotsky's problem-solving skills or Piaget's learn by doing model, the common theme in each perspective is peer interaction, or learning cooperatively.

It is important to note that cooperative learning is not group work in the traditional sense, but instead, according to Kagan (2013), there are four components that must be present in a cooperative learning lesson that separate it from traditional group work: positive interdependence, individual accountability, equal participation, and simultaneous interaction.

Jolliffe (2007) stated positive interdependence is the feeling that group members need each other in order to complete the task at hand; it is the idea that only through everyone's individual success can the team succeed. Teachers may set the outcomes, but it is important that the students take ownership of the goals and ownership of their individual role in the group's success (Stahl, 1994).

Individual accountability, the second component, however, holds the individual

accountable for his or her own learning. Rather than assigning a group grade or a grade that would mask one student doing all of the work, with individual accountability, students must ensure that all group members master the content, because all students will be graded in their academic achievements on their own (Jolliffe, 2007). Because cooperative leaning is used most often so that students achieve greater leaning outcomes than if teachers taught in traditional classes, students must then be assessed in a way that looks at the individuals' achievement (Stahl, 1994).

With the third element, equal participation, students are expected to collaboratively and efficiently work together building trust and communication skills. Students must feel that through their participation in which ever group they are place, that the student will feel success. Stahl (1994) noted, "In other words, the student must not feel penalized academically by being placed in a particular group" (p. 2).

Lastly, in simultaneous interaction, students elaborate and evaluate the group, how it is functioning, all the while making changes to components that are not working to encourage the group's success (Jolliffe, 2007). In this debriefing time, students reflect on:

> (a) how well they achieved their group goals, (b) how they helped each other comprehend the content, resources, and task procedures, (c) how they used positive behaviors and attitudes to enable each individual and the entire group as a group to be successful, and (d) what they need to do next time to make their groups even more successful. (Stahl, 1994, p. 3)

All four of these components, in one way or another, depend on peer interaction. The question then becomes how to advance the knowledge in these areas when so much research has already been conducted.

Identifying the best way to create peer groups while implementing cooperative learning methods in a classroom will add to these theories. Therefore, putting students together should not be done by random assignment, but instead with deliberate, thoughtful planning so that students achieve the greatest amount of academic and social gain possible.

Cooperative learning allows for a student to be weak in one area, but help in other aspects of the group's learning (Clapper, 2015). Students may have gifts in leadership skills, artistic abilities, or speaking abilities, which all have a significant role in a cooperative learning lesson. Working together, students evaluate each other's ideas, ask questions, and use each other's gift and talents to make the most of each learning experience (Spooner, 2015).

The specific research focus, comparing homogeneous and heterogeneous grouping, relates to the cooperative learning theory because often teachers group students heterogeneously without considerations to other ways to group their students while teachers use the different cooperative learning methods. Educating teachers on the academic effects of the two groupings in a fifth grade, science class in a Christian elementary school while using the Kagan cooperative leaning method, will advance or extend the theory's knowledge base.

Related Literature

Cooperative learning can be defined as the use of small groups in instruction so that students work together in groups to maximize their own and each other's learning (Johnson & Johnson, 2014). The benefits of cooperative learning are diverse: social, emotional, and academic, and Johnson and Johnson (2014) continued that it can be implemented at any age and in any subject. The teacher's role, as previously mentioned, is to facilitate learning; teachers are "watching, listening, and praising. During facilitation, is the time teachers find out what their students already know and how their students learn" (Holubec, 1992, p. 182). Even with all of

the research on cooperative learning, there is still more that can be learned.

Cooperative Learning

Cooperative learning is a teaching method; it is a way to present information on any subject to students by students and a way for students to gain and share knowledge on a given topic. There are five elements that Johnson and Johnson (2014) identify in cooperative learning lessons: positive interdependence, individual accountability, interaction, development of social skills, and group processing. These five elements separate cooperative learning from traditional learning and traditional group work in a variety of ways, ensuring that students all work, succeed, and do their part.

Positive interdependence is the idea that group members' success comes from each member's individual success; the group does not do well unless everyone does well (Deutsch, 1949). It is in this way that students feel responsible for their teammates' work and success, in addition to their own. "Because students see themselves on the same side, they are motivated to encourage each other and to help their teammates by showing each other how to learn and how to solve problems" (Kagan, 2013, p. 51). The key for efficient groups is to strike a balance between working together in a group that depends on one another and individual accountability. Having students teach the lesson via cooperative learning allows for classmates to stop and reteach when confusion sets in, whereas when a teacher is teaching the whole group, it is often not possible for the teacher to stop the lesson and check for understanding with each student, and reteach on the spot (Kagan, 2013). Often students are given the learning outcomes with the freedom to gain knowledge in a way that is differentiated for them (Stahl, 1994).

The second element that is present in cooperative learning is individual accountability; this element differs from traditional group work because in cooperative learning students often

receive a group grade and an individual grade (Johnson & Johnson, 2014). Individual accountability may be structured by "giving an individual test to each student, having each student explain what they have learned to a classmate, or observing each group and documenting the contributions of each member" (Johnson & Johnson, 2014, p. 844). This element deters a solitary group member from doing all the work while other group members use the working individual for credit, but do not complete the work themselves.

Reflecting on a past psychological experience in which participants pulled on a rope, first by themselves, exerting much strength, and then with a partner, exerting much less strength, researchers, Igel and Urquhart (2012), noted that adults "loaf when they can get away with it. Why would they expect children to behave differently?" (p. 6). With individual accountability, each student must perform in some way apart from their group (Kagan, 2013). Working together and communicating with peers are both essential components of the learning process. It is important to note when researching about individual accountability, that researchers have reported that the larger the group, the less likely the group members see their contributions to the group as important to the success of the group. The more group members a group has, the less likely some members participate and therefore affecting the individual accountability component (Gillies et al., 2008).

The third element in cooperative learning is interaction among peers. Within this interaction, peers give feedback, encourage each other, challenge each other's comments, discuss problems, connect to prior learning, or schema, and in some cases, teach or reteach (Johnson & Johnson, 2014). When students perform in this way, it challenges them. It also moves students through the ZPD because students take meaning from information that challenges them through working with other students inside the learning environment.

The fourth element in cooperative learning is the development of social skills. This is often one of the most noted benefits of the use of cooperative learning (Chen & Chang, 2014). These skills must often be taught just like academic goals and can include appropriate communication, leadership, encouragement, compromise, and conflict management skills (Igel & Urquhart, 2012; Johnson & Johnson, 2014; Spooner, 2015; Stahl, 1994). Through the development of these social skills, students develop interpersonal and small group skills, like leadership, that will last a lifetime (Johnson & Johnson, 2014).

The fifth element that must be present in cooperative learning is group processing or an internal check on the group's dynamics to identify the skills the group is using that are benefiting it and which skills the group is using that are hindering the group's learning. Once these practices are identified, groups can decide what to continue to do and what needs to change so that all group members are participating and learning (Johnson & Johnson, 2014). Teachers acting in the facilitator role should assist in this area too by helping groups that are struggling socially or academically with the content in the lesson.

Twenty first century skills. Twenty first century skills, or skills that students learn for success in the world's current climate, have as many different definitions as cooperative learning itself. In this research, the author will use the Partnership for 21st Century Skills' definition that includes the 4Cs: creativity and innovation, critical thinking and problem solving, communication, and collaboration (Partnership for 21st Century Skills, 2011). Critical thinking, collaboration, and communication are three components common to the cooperative learning teaching strategy, and when students partake in cooperative learning, they are better prepared for skills needed later on in their careers and social areas of their adult lives (Igel & Urquhart, 2012). In cooperative learning students are paired up in groups with the idea that the backgrounds of all

students can be used to enrich the lesson and help students to reach the learning goals set forth by the teacher; within the structure of a cooperative learning lesson students are provided "opportunities in multiple interactions with diverse perspectives" (Huss, 2006, p. 20).

Achievement outcomes. There are numerous outcomes associated with cooperative learning. Johnson and Johnson (2014) cited three main categories that these benefits all fall into: "achievement, positive interdependence, and psychological adjustment" (p. 843). Academic achievement is well noted in studies at all ages, elementary (Vega & Hederich, 2015), middle school (Igel & Urquhart, 2012; Smith, Cornelius, & Hines, 2014; Zakaria, Solfitri, Daud, & Abidin, 2013), high school (Valdez, Lomoljo, Dumrang, & Didatar, 2015) and collegiate levels (Baer, 2003; Zamani, 2016). Researchers have even gone as far to say that since cooperation in learning leads to higher achievement, as compared to traditional or individualistic learning styles, that curriculum should be altered to include this teaching in the majority of lessons (Gillies et al., 2008).

Since cooperative learning is a teaching method, it lends itself to different subjects, and therefore many studies involve different subjects. Slavin (2001) reported that "research on a wide variety of innovations in curriculum, technology, and professional development have consistently found cooperative learning to be among the most effective of all strategies for elementary and secondary reading and mathematics" (p. 2). Mathematics has seen its fair share of studies showing higher achievement scores due to cooperative learning (Smith et al., 2014; Vega & Hederich, 2015; Zakaria et al., 2013). These studies indicated that cooperative learning methods benefit the students more than traditional learning environments.

Evidence from numerous studies reported that students on all academic levels benefited from cooperative learning (Antil, Jenkins, Wayne, & Vadasy, 1998; Fuchs et al., 1996; Slavin,

1996). High achieving students also learn by explaining, and because they are high achieving, they often get the chance to explain more (Slavin, 1996).

Higher-level reasoning. Cooperative learning teaching strategy is a shift away from traditional teaching and memorization of facts to demonstrate learning, and instead shifts learning and teaches students how to think critically (Chikh & Hank, 2016). Working cooperatively has shown that students generate more innovative ideas and are able to solve more problems than students who work individually or against each other (Johnson & Johnson, 2014). Because teachers often give the learning outcomes to the cooperative learning group and let students guide their own learning, often students learn more than what is going to be measured on the test. When students have access to learning material that align to the objectives, but also that are on their academic and interest levels, often a deeper and more meaningful learning experience occurs (Stahl, 1994).

Retention. One of the most effective ways to retain information or build schema on topics is to elaborate on the given topic or to explain the topic to peers (Fore et al., 2006). Zakaria et al. (2013) reasoned that when students clarify topics and have topics explained to them, they tend to retain the concepts for longer periods of time. Students who are actively engaged in their own learning process report that retention is easier (Leonard & McElroy, 2000). A study published by the Nondestructive Testing Resources Center found that immediate use of learning to teach others was the teaching method that held the greatest retention rate, over 90 percent, and this superseded learning practices such as practice by doing and discussion in groups (Spooner, 2015). In other words, talking to peers about what was just learned helped students retain what they just learned, more than any other teaching practice.

Self-esteem and attitudes. In several studies, cooperative learning has been shown to

increase the self-esteem of group members because students are able to understand other members' perspectives on a topic (Johnson & Johnson, 1989; Smith et al., 2014; Zakaria et al., 2013). Students' attitudes toward a given subject also "significantly increased at each level of group learning (low, moderate and high) when compared with the attitudes of children who did no group work in class" (Smith et al., 2014, p. 239). Cooperative learning, therefore, does enhance self-esteem and self-concept (Gillies et al., 2008; Spooner, 2015). Cooperative learning gives each child a voice, and because of this each child is significant.

Social skills. In numerous studies, cooperative learning has produced positive effects on social skills (Jenkins, Antil, Wayne, & Vadasy, 2003; Jurkowski & Hanze, 2015; Muhamad, Yusof, & Aris, 2014). Research showed that communication and group cooperation skills improved when students elaborated on partners' ideas and when their ideas were elaborated on by their partners (Jurkowski & Hanze, 2015). These conversations, which include listening and responding respectfully, supported the idea that students that communicate while they learn, move forward with academic goals.

When teachers establish that cooperative learning did not work in their class, it is predominantly with students who have disabilities and needed further training in appropriate social interaction; for example, these students needed direct teaching in receiving feedback and listening appropriately (Goodwin, 1999).

This leads to an important fact, social skills must be taught directly; teachers model and encourage students that "working toward a common goal (is) a satisfying experience for students, and working together is a way to motivate and engage students" (Igel & Urquhart, 2012, p. 18) but expectations of this is not enough. Skills that can and should be taught that encourage social skill building can be communication skills, group skills, leadership skills, and

conflict management skills (Spooner, 2015). Without direct teaching the social skills needed in cooperative learning can cause the lessons to fail in classrooms with students with disabilities, and also in general education classrooms too.

Once teachers have identified the several skills that should be taught so that groups avoid problems, O'Brien and Wood (2011) found how to teach the skills. Two-minute homemade movie clips that the teacher made bridged the social gaps between classroom peers. The clips showed students what teachers' expectations were in the classroom and during cooperative learning lessons as it gave students the support they needed to feel part of the group.

Goodwin (1999) suggested a three-step process to alleviate some of the pressure on how and what this social skill teaching should look like. Step one, the teacher identifies a social skill in which to observe and assess. In step two, the teacher will choose the cooperative learning lesson that contains a social component. Finally, in the third step, the teacher combines the social skill and the activity and assigns it to the students. The students and the teacher evaluate how the social skill was used in the cooperative learning lesson and then reflect on how individually they can improve (Goodwin, 1999). This is related to and supports Johnson and Johnson's (2014) fifth element, group processing, or evaluating what works and what does not work in a group as an important component in the cooperative learning teaching method.

The roles of group members and the distribution of group resources are candidates for direct teaching, and it is important to note that not all skills are academic or social. For example, teachers can remind students of important skills that peers have, even when they are not academic based, for instance, artistic or musical talents (Igel & Urquhart, 2012; Leonard & McElroy, 2000). In this way, all students are valued as group members, instead of only students that are academically inclined.

Social aspects that are also included in cooperative learning are interpersonal skills like teamwork, listening while others are speaking, giving constructive criticism without criticizing the individual, and respecting each other even when one does not agree with another's perspective (Igel & Urquhart, 2012). Teachers should model these skills and can facilitate them by making "eye contact, ask(ing) probing or clarifying questions, use(ing) wait time effectively, and use(ing) summary statements as comprehension checks" (Igel & Urquhart, 2012, p. 3). Other skills that students in cooperative learning processes frequently exhibit proficiency in include asking questions, encouraging classmates, answering questions with thoughtful explanations of the given topic, and motivating members (Vega & Hederich, 2015).

Inclusion. The inclusion of students with special needs in the classroom can present challenges for teachers. Frequently, students with diverse backgrounds and ability levels are placed in a single classroom. While considering individual differences, the cooperative learning teaching method structures ways to model, discuss, and give feedback to students with different academic needs (Goor & Schwenn, 1993). Goor and Schwenn (1993) continue by stating to be successful, cooperative learning activities should assist students in learning how to listen to others, to understand more than one point of view, and to critique a person's ideas, not the actual person.

Cooperative learning groups that include students with special needs provide an ideal time to teach students that tasks are completed more effectively in a group setting. "In cooperative learning, peers can clarify the nature of an assignment, interpret complex instructions, model performance, explain ideas, give feedback and corrections, take responsibility for difficult parts of the assignment, scaffold problem-solving efforts, and provide encouragement" (Jenkins et al., 2003, p. 280). Madden and Slavin (1983) found that the effects

of cooperative learning exceeded only academic expectations and strengthened relationships between learning disabled and nondisabled students. Fuchs et al. (1996) found that students with high achieving academic skills paired with learning disabled peers provided a deeper and more meaningful conversation than students with average abilities and learning-disabled peers (Antil et al., 1998).

Kagan Cooperative Learning. Kagan cooperative learning is similar to other cooperative learning strategies in that it is a teaching strategy that is not curriculum specific. Instead, it too is cross-curricular. The goal is the same as in other cooperative learning strategies; the teacher is the "guide on the side" (Chikh & Hank, 2016, p. 640) and students move from memorizing facts to thinking critically. The Kagan cooperative learning method is different from traditional teaching styles. For example, in traditional structures students are often discouraged from sharing answers (Kagan, 2013). In Kagan's cooperative learning structures, students are encouraged to share in a very structured way. In this way, Kagan cooperative learning is different from group work too. In group work, oftentimes, the cooperative part is unstructured, but Kagan (2013) offers up very structured time suggestions within each structure. There were five Kagan (2013) cooperative learning structures used in this study: Rally Robin, Timed Pair Share, Three-Step Interview, Quiz-Quiz Trade, and Numbered Heads Together.

In Rally Robin, group members take turns giving responses. Each group member speaks, and the initial group member may not offer another response until each person within the group has provided a response (Kagan, 2013). This method is best used for generating lists because all students respond, a lot of short answers can be given, and each member listens to other members and take turns providing input.

The second structure is Timed Pair Share. In a Timed Pair Share, the teacher asks a

question and gives students think time, partners are assigned “A” or “B”, partner “A” shares while “B” listens, “B” responds by repeating a fact that they learned, and then the steps are repeated until each member has spoken (Kagan, 2013). Kagan (2013) continued that Timed Pair Share also promotes academic benefits for students through practicing respectful listening, elaborating their responses, and taking turns.

In the Three-Step Interview, students get in groups of four, then in groups of two pairs to interview each other. The pairs then switch roles, and then at last meet with all four members and report what he or she learned from the interviews. In this structure, students learn to summarize other students’ thoughts and are exposed to different points of view, all while listening to others (Kagan, 2013).

In structure four, Quiz-Quiz-Trade, students pair up with one other student. Both students hold a card with a question on it. Partner “A” asks partner “B” the question. Partner “A” provides Partner “B” with feedback, praises if the question is answered correctly, and if it is answered incorrectly, the partner corrects his or her partner. Partner “B” then repeats the process with Partner “A” having the opportunity to respond to the question. Finally, students rotate around the room visiting with each student having the opportunity to ask or answer each question (Kagan, 2013). Kagan explained that the benefits of this structure are that students learn the content, practice coaching each other, and learn social skills while moving around the classroom (Kagan, 2013).

In the final structure, Numbered Heads Together, students work in groups of four to solve a problem independently. At the given time, all four students stand and take turns sharing their answers and explaining their results. Students sit once the group reaches consensus and all members know the answer. The teacher calls on one student in the group to answer the question

independently, and classmates provide encouragement to the group member answering (Kagan, 2013). In this structure, students learn and practice coaching and communication, and are held to individual responsibility while practicing interdependence (Kagan, 2013).

Kagan (2013) introduced seven keys for success that help teachers and students when implementing the structures. The first key is having teachers implement one structure at a time, for a period of time. The idea is to practice it so much that "the steps moved to procedural memory, freeing up our prefrontal cortex to think about other things" (Kagan, 2013, p. 33). These "other things" will become the task on hand, and students move from remembering the structure to instead the answer to the given prompt.

The second key is teams. Kagan (2013) suggested teams of four students; most of the structures require four people, so no one is left out. Kagan (2013) suggested groups be heterogeneous with one high, medium-high, medium-low, and low achieving student in each group, while groups should also represent gender and racial backgrounds too. It is also recommended that teams stay together for an average of six months.

The third key, management, helps to keep the classroom manageable; students are able to move, talk, and interact with each other, but teachers must have a way to get students attention quickly with the use of a quiet signal. Because students are working in groups and each group requires discussion of ideas, a cooperative learning classroom can be loud. Therefore, it is necessary for teachers to have attention grabbers so that he or she does not have to raise their voice (Jolliffe, 2007). Attention grabbers in the classroom can be clapping a series of patterns that the students repeat or flashing the classroom lights.

Kagan (2013) suggested teachers do some sort of class building, the fourth key, and teambuilding, fifth key, throughout the school year so that students feel safe and are able to

practice sharing with new people. Building a community throughout the year in the classroom and within every lesson helps encourage students to feel that their voice can be heard and that their ideas will be respected.

The sixth key to success is for teachers is to include social aspects into each and every lesson; social communication "should be internalized, and students practice social skills in a natural context, so they are more likely to transfer the skills to other life situations" (Kagan, 2013, p. 39).

The final key for successful implementation of cooperative learning is represented with the acronym PIES: positive interdependence, individual accountability, equal participation, and simultaneous integration (Kagan, 2013). These skills, while named differently from Slavin's (2014), are all within the five skills Slavin named previously.

Problems. According to Vaughn (2001), there are several problems that teachers face when implementing cooperative learning. Some teachers struggle to become the facilitator of learning instead of the instructor; implementing classroom management procedures; monitoring the interaction between content, growth of knowledge, and peers. Another problem cited by teachers was that cooperative learning is too time-consuming (Antil et al., 1998).

In some cases, teachers that once implemented cooperative learning stop because the new lessons are too time-consuming. Teachers explain their frustration with rewriting curriculum, and then when the curriculum changes, lessons are then nontransferable; and teachers feel frustration with trying to include interdependence, individual accountability, personal interactions, and then adding the skill that is supposed to be taught (Kagan, 2013). Trying to combine these elements into a lesson can be a daunting task for even the most seasoned professionals.

However, some problems that teachers mention are only problems because the teachers

are not implementing the cooperative learning strategy correctly. For example, Ingel and Urquhart (2012) used the example that some teachers act out of fear that student learning and work is not evenly distributed, that instead one student "carried" the group. Therefore, the teacher gives a group grade instead of holding students individually accountable. However, this same teacher reports frustration with the implementation of cooperative learning, while not following the main guidelines, then his or her own fears cause the frustration cited in the study (Ingel & Urquhart, 2012). If the element of personal interdependence and individual accountability at the end of a lesson are present, then these two problems actually take care of themselves. It is these two elements that differentiate group work from cooperative learning, and in the above case the cooperative learning lesson is changed into group work because of the teacher's fear and lack of understanding of these two key elements.

In one study, it was found that only two teachers out of the eighty-five surveyed used all of the Slavin's elements, positive interdependence, individual accountability, interaction, development of social skills, and group processing in their cooperative learning lessons. Also, that teachers surveyed were using only portions of the cooperative learning models and then excepting the full range of benefits in their classrooms (Antil et al., 1998).

Gillies et al. (2008) found that when looking at teachers that complained about cooperative learning it was often because support for the age and experience level for students were not taken into account. Students needed help with "internal organization of group processes, that is, social interaction between group members, and they need support on the individual level to avoid adverse experiences when they are challenged with controversial suggestions, ideas, and strategies in their learning teams" (Gillies et al., 2008, p. 112). Often when the support for students in these nonacademic areas were present, the teachers using

cooperative learning groups reported higher levels of satisfaction.

Another concern brought to the forefront of the cooperative learning world was found in Berger and Hanze's 2015 study. In this study, when the cognitive demand for students was too great, success was dependent on the activation of student's prior knowledge, not motivation from the group and not students being expert teachers; this means that teachers must be careful when selecting content for a cooperative learning lesson (Berger & Hanze, 2015). No matter how hard the group wanted the group member's success, the ability to scaffold new learning by building off prior learning was not achieved by students, even the high-achieving ones. Having appropriate content, both academically and by interest level, must be taken into account as students build their knowledge.

Cooperative learning is inexpensive and easily adopted, "yet 30 years after much of the foundational research was completed, cooperative learning remains at the edge of school policy" (Slavin, 2001, p. 26). The question then becomes for teachers, how do they implement it into a teaching practice that works best?

Heterogeneous and homogeneous grouping. There is much discussion on grouping in cooperative learning. However, there are differing opinions on the number of members that best fulfill the goal in a cooperative learning lesson. Cooperative learning groups of two to six students are most common (Chikh & Hank, 2016; Holbec, 1992; Slavin, 1996; Stahl, 1994). Jolliffe (2007) stated that when students are grouped with six or more peers that members end up dividing themselves into smaller subgroups of two or three, and the group loses the structure or cohesion. As mentioned previously, when groups are too large the members are less likely to participate (Gillies et al., 2008). In other words, "the smaller the size of the group, the greater the individual accountability can be. It is more difficult for students to hide in a group of four

than in a larger group" (Huss, 2006, p. 21).

Johnson and Johnson (1999) prefer groups of three to five members. Kagan (2013) uses heterogeneous groups of four, while AbuSeileek (2011) found that five members outperformed groups ranging from two to seven members. In the current research, the researcher used four members in cooperative learning groups using the Kagan methods.

There are three main ways to divide students for a lesson. The first is by student choice, the second is at the teacher's discretion, and the third is by random assignment. There have been studies that cited problems with all three of these types of groupings. When students chose their own groups, "the risk of further isolating some learners or creating cliques within the class as a whole" (Chikh & Hank, 2016, p. 641) can become problematic; high students tend to be friends and chose each other while lower learners tend not to be as social and do not get picked.

Often students that pick their own groups have off task behaviors resulting from teaming up with friends. In these cases, social stigmas and cliques can also be reinforced in these situations, but teachers can avoid this problem if groups are chosen by topic. Jolliffe (2007) suggested that students write on a piece of paper their favorite color, favorite type of music, favorite food and then match up based on these criteria. "The situation of inappropriate learning partners assigned by instructors or self-selecting learning partners often occurs in cooperative learning environments" and can reduce the "learning effectiveness and leads to cooperative learning losing its meaning" (Chen & Chang, 2014, p. 100). When teachers select the student's groups, there are two ways to group students- heterogeneously and homogeneously.

Heterogeneous groups. There are two types of heterogeneous groupings that students experience in cooperative learning: cooperative base groups and constructive controversy. Cooperative base groups are long-term, and are there to provide support both academically and

socially, meet regularly, and encourage each other; base groups have shown to improve attendance and learning (Johnson & Johnson, 2014). In a constructive controversy, students are in groups and must pick opposing sides of an issue and defend it; students gain research skills, persuasive techniques, discussion and reasoning techniques (Johnson & Johnson, 2014). In this study, the teacher and students used the cooperative base groupings.

Heterogeneous grouping of students is a "widely accepted element of cooperative learning and is often included as part of the definition" (Watson, 1992, p. 85). Stahl (1994) suggested that students first be grouped heterogeneously by academic level, and then by race, ethnic backgrounds, and gender. In heterogeneous cooperative based groups, students realize several gains: students have a more realistic and positive views of each other, successful ethnic integration and inclusion of handicapped peers, relationships become more positive, commitment to goals increase, personal responsibility increases, motivation increases, satisfaction increases, commitment to each other's success increases, and productivity increases (Johnson & Johnson, 2014; Stahl, 1994). There are cases that show lower ability students actually did better, although not significantly, when grouped heterogeneously. Heterogeneous groups usually include members that are high achieving, average level achieving, and low achieving (Huss, 2006; Jolliffe, 2007). It is within this grouping that students receive a "richness of ideas and perspectives, as well as the shared learning help to benefit each learner in the group" (Chikh & Hank, 2016, p. 641).

The "consensus in the education community is to have groups that are heterogeneous" (Chen & Chang, 2014, p. 639); in fact, it is often just assumed that grouping students heterogeneously is the only way to group children (Chikh & Hank, 2016; Watson, 1992). The idea is that lower students are helped by higher students, and high students become more aware

of their own learning, strengthening and deepening the understanding of materials by explaining the material to lower academically achieving students.

However, researchers point out that "heterogeneous groups are not a necessary condition for effective CL when the focus is on individual learning" even though instructors work very hard to place lower achieving students and higher achieving students together (Van der Smith & Spindle, 2007, p. 163). In some cases, students placed in heterogeneous groups, especially gifted students, have been cited as frustrated, bored, and anxious when grouped with peers that are not on a similar level. This is because the gifted student's grade might be affected by lower performing group members, or the gifted child was not given ample time to explore the topics deeper with higher-end questioning that they enjoy (Coleman & Gallagher, 1995; Huss, 2006).

Huss (2006) suggested, one solution to these problems was to use heterogeneous grouping for lessons that have the goal of basic levels of knowledge, like recall and memorization of facts, and instead use homogeneous cooperative learning groups on tasks that require critical thinking, creativity, and communication. This way the higher learning members of the group are not depended on just to reteach basic levels information because those lessons are not done through cooperative learning groups, but instead, these group members are being challenged in higher order tasks when cooperative learning is more appropriate.

Homogeneous groups. In some cases, homogeneously grouped students based on academic abilities may have reported more success than their heterogeneously grouped peers. Johnson and Johnson (2014) reported that even in homogeneous grouping, students are more committed to the success and well-being of group members when working cooperatively. In some cases, homogeneous grouping for higher achieving students had statistically higher performance than their heterogeneous counterparts (Baer, 2003; Van der Smith & Spindle,

2007). Huss (2006) reported to teachers that gifted children should work together in homogeneous groups in their area of proficiency so that topics of interest can be explored upon.

Moody and Gifford's (1990) study found that there was no difference in achievement gains of homogeneous and heterogeneous groups, and that gender-homogeneous groups performed better than mixed gender groups; meaning that homogeneously grouping students by their sex may be more beneficial than grouping students by ability. In the study that researchers Miller and Polito (1999) carried out using homogeneous groups, they too found that grouping by learning style at the collegiate level did not acquire higher scores, and students did not report higher rates of satisfaction than groups that were placed randomly or heterogeneously.

However, Zamani's (2016) recent study showed that heterogeneous and homogeneous students that were deemed academically low both showed improvements when grouped in cooperative learning strategies, but the low academically achieving students in the heterogeneous group performed much higher than their homogeneous grouped low students. It then stands to reason that if homogeneous cooperative learning groups are going to be used, teachers must be prepared to assist and scaffold lessons for lower achieving students, so that these lower achieving students reach their highest levels of potential for the given lesson.

It is important to note that there are studies that show that the homogeneous groups with low achieving students showed no difference. In Baer's (2003) research, it was found that low-achieving, homogeneously grouped students did equally as well as their heterogeneous grouped students, while their average and high achieving students did significantly better being grouped homogeneously, giving worth to the claim that there is still much research left to be done in this field.

Georgia Performance Standards

The Georgia Performance Standards (GPS) were adopted in 2004, and used the National Research Council's *National Science Education Standards* and The Project 2016's *Benchmarks for Science Literacy* to develop and implement science standards that guide instruction (Georgia Department of Education, 2004). The standards were formulated so that "hands-on, student-centered, and inquiry-based approaches" (Georgia Department of Education, 2004, p. 1) were used in instruction. The Georgia Performance Standards are made up of both standards and elements, or learning goals. The standard associated with this study are:

> Students will explain the difference between a physical change and a chemical change.
>
> a. Investigate physical changes by separating mixtures and manipulating (cutting, tearing, folding) paper to demonstrate examples of physical change.
> b. Recognize that the changes in state of water (water vapor/steam, liquid, ice) are due to temperature differences and are examples of physical change.
> c. Investigate the properties of a substance before, during, and after a chemical reaction to find evidence of change. (Georgia Department of Education, 2004, p. 6)

The GPS's final year was the 2016-2017 school year, and the standards were replaced by the Georgia Standards of Excellence (GSE).

Georgia Standards of Excellence

The GSE were adopted and in 2015 after the State Board of Education voted to change and recoded all standards from GPS to GSE; the new GSE were implemented in the 2017-2018 school year. The curriculum design was created to be multidisciplinary and increase student scientific inquiry. The standards are "hands-on, student-centered, and inquiry-based approaches" (Georgia Department of Education, 2016, p. 1) that were created to encourage teachers in the

classroom. While these standards are meant to be mastered, it is also stated that the standards are the minimum for learning opportunities, but the greatest standard that will be evaluated on the Georgia Milestones Assessments; to clarify, teachers at the minimum should have students master the GSE to pass the Georgia Milestones Assessment. The Georgia Milestones Assessment "is designed to provide information about how well students are mastering the state-adopted content standards in the core content areas of English Language Arts, mathematics, science, and social studies" (Georgia Department of Education, 2015, p. 4). The standards associated with the current study are as follows:

> Obtain, evaluate, and communicate information to explain the differences between a physical change and a chemical change.
>
> a. Plan and carry out investigations of physical changes by manipulating, separating and mixing dry and liquid materials.
>
> b. Construct an argument based on observations to support a claim that the physical changes in the state of water are due to temperature changes, which cause small particles that cannot be seen to move differently.
>
> c. Plan and carry out an investigation to determine if a chemical change occurred based on observable evidence (color, gas, temperature change, odor, new substance produced. (Georgia Department of Education, 2016, p. 2)

Both the GPS and GSE have students investing physical changes, but the GSE has students planning their investigations. Students must also "construct an argument based on observations" (Georgia Department of Education, 2016, p. 2) while the GPS has students identifying the changes. The GSE has used the language of the higher levels of Bloom's Taxonomy, evaluation, application, and synthesis (Bloom, 1956).

In cooperation the GPS, the GSE, and FOSS kits, used the *Benchmarks for Scientific Literacy* to develop their standards of learning and therefore the results of this study can be beneficial to other science teachers (FOSS, 2017; Georgia Department of Education, 2004; Georgia Department of Education, 2016).

FOSS Survey/Posttest

Full Option Science System (FOSS) is a "research-based science curriculum for grades K-8 developed at the Lawrence Hall of Science, University of California, Berkeley" (FOSS, 2017, p. 1). Originally, the curriculum was developed for students with special needs, and the School Specialty at Berkeley committed themselves to have a program that emphasized that all students could learn science in a meaningful way. It is for this reason that so many of the investigations use multisensory methods to "accommodate students with physical and learning disabilities and also to maximize information gathering for all students" (Regents of the University of California, 2016, p. 4). It is evident in the FOSS (2017) curriculum that,

> scientific knowledge advances when scientists observe objects and events, think about how they relate to what is known, test their ideas in logical ways, and generate explanations that integrate the new information into understanding of the natural and designed worlds. (p. 1)

This program uses theoretical foundations of cooperative learning, social theory, and schema theory as a basis for the units. Forty years after the first FOSS kit, it is being used throughout the United States in schools in California, Texas, and Georgia. Science lessons in this study are from the Mixtures and Solutions unit from the FOSS kit.

Summary

In summary, there is a lot of research that shows that cooperative learning is an important teaching strategy. Study after study shows that when implemented correctly students have social and academic gains. The gaps in the literature are found in how to group students, either heterogeneously or homogeneously, and if there is a significant difference in the two. Because most teachers in the studies make the assumption that heterogeneous groups are the way to organize the groupings, there is not a lot of research on homogeneous grouping by academic levels, and it is this gap in the research that this study addresses. It will be beneficial for teachers to know about the structure of groupings in the classroom to influence greater learning gains and will be applicable to others in the teaching field because while the standards addressed are from the state of Georgia, both the states standards and the FOSS standards of learning were created using the national science standards.

CHAPTER THREE: METHODS

Overview

The purpose of this study was to evaluate the effects of cooperative learning on fifth-grade classrooms on all students using the FOSS Survey/Posttest science scores. In this chapter the procedures, research design, and analysis for the present research study are presented.

Quantitative Design

The research design for this study was quantitative, quasi-experimental. Specifically, the researcher chose the a static-group comparison design for this study. The study was originally designed using a nonequivalent control-group design. However, after examining the pretest it was determined that the scores for the two groups were nearly identical, and that the use of ANCOVA for analysis was not necessary. This led to the change to a simpler static-group comparison design. According to Gall, Gall, & Borg (2007), quantitative research should be used for "collecting numerical data on observable behaviors of samples and by subjecting these data to statistical analysis" (p. 651). Quasi-experimental research methodology is most appropriate because the students are not randomly assigned to the experiment and control groups (Gall et al., 2007). The students' FOSS Survey/Posttest scores were used to identify differences in students' ability and place students into groups.

In experimental research, the independent variable is manipulated. In this case, using pretest scores the independent variables were grouped both homogeneously and heterogeneously. The three classes were grouped homogeneously and heterogeneously as determined by the students' scores on the FOSS Pretest Survey. In all classes, Class A, Class B, and Class C, students used cooperative learning. Homogeneously grouped students were grouped by levels, high, medium, and low scoring, using the FOSS Pretest Survey Scores. Heterogeneously

grouped students also used cooperative learning, but leveled students were grouped heterogeneously in groups mixed with a high, high-medium, medium-low, and low scoring students. Kagan's (2013) cooperative learning strategies were used daily in both classes.

Research Questions

This study included two research questions. The research questions pertain to grouping students in cooperative learning lessons. Specifically, the research questions focus in on heterogeneous and homogeneous groups and the academic impact of these groups and gain scores while being grouped heterogeneously and homogeneously.

Research Questions

RQ1: Is there a difference between fifth-grade students' *academic achievement* in science when grouped homogeneously compared to those who are grouped heterogeneously while using cooperative learning strategy measured by the FOSS Survey/Posttest?

RQ2: Is there a difference between *pretest* and *posttest scores* as measured by the FOSS Survey/Posttest for the heterogeneously grouped and homogeneously grouped students during the treatment period?

Hypotheses

The null hypotheses for this study are as follows:

$H_0$1: There is no statistically significant difference between fifth-grade students' academic achievement in science when grouped homogeneously compared to those who are grouped heterogeneously while using cooperative learning strategy measured by the FOSS Survey/Posttest.

$H_0$2: There is no statistically significant difference between pretest and posttest scores for heterogeneously grouped students as measured by the FOSS Survey/Posttest.

$H_0$3: There is no statistically significant difference between pretest and posttest scores for homogeneously grouped students as measured by the FOSS Survey/Posttest.

Participants and Setting

The participants for the study were drawn from a convenience sample of fifth-grade elementary school students located in north Georgia during the 2017-2018 school year. The school is a private, Christian school that serves students in kindergarten through twelfth grade. The specific grade studied was fifth-grade. This school was chosen because there is a lack of research in cooperative learning, specifically in elementary schools and Christian schools. The student sample size was also desirable, as was the school's administration as they put forth new curriculum changes and growing expectations for teachers and students.

Student Participants

Twenty-six students are the required minimum for a large effect size with the statistical power of .5 at the .05 alpha level (Gall et al., 2007). The sample available to the researcher in this research study were 59 fifth-grade science students taught by one teacher, five days a week in three different 45-minute class periods.

In the 2017 school year, students in science were taught about the dynamics of weather and water cycling in Earth's atmosphere, properties of the atmosphere and the energy transfer from the Sun to Earth, to use models to understand Earth's place in the solar system, about the interactions of the Earth, Sun, and Moon to reveal predictable patterns, about natural cycles: elements, water, carbon and oxygen, nitrogen, and pollution, about life cycles including: bacteria, fungi, plants, salmon, and malaria, about cell structure, genetics, organization, and mutations, about both primary and secondary ecological succession, about measuring solids and liquids to compare the mass of a mixture to the mass of its parts, to use a balance to determine

relative concentration, to plan and conduct saturation investigations, to identify an unknown substance based on the properties of solubility and crystal form, and to observe and compare reactants and products of several chemical reactions (Georgia Department of Education, 2016). All fifth-grade classes included students from different sexes, races, and ethnic and economic backgrounds.

Three fifth-grade classes were included in the treatment groups. Class A, B, and C received at least one of the five Kagan cooperative learning teaching structures daily in their science class. Students were evenly distributed into five groups of four students in two classes and four groups of four and one group of five in one class, a total of 61 students. Thirty of the students were male and thirty-one of the students were female. There were three levels of homogeneously grouped students; two groups of students with four students in each group that scored high grouped together, three groups of students with four students that scored an average score grouped together, and two groups of four students that scored low grouped together. These seven groups are the homogeneous groups; students grouped with peers who scored similarly on the survey.

The next groups also received cooperative learning daily in their science class, but students were grouped with peers unlike themselves, heterogeneously, from their score on the FOSS Survey. In these groups, students were paired with one high achieving student, two average scoring students, and one low achieving student, except for one student group of five. This exception group had one low achieving student, one high achieving student, and three average achieving students as measured by the FOSS Survey/Posttest.

Teacher Participant

The science teacher for all three classes of students included in the study was the same. She was a veteran, 13-year teacher that held a Bachelor's of Science in Education with a T-4 certification (Pre-K -5th) and gifted certified (K-12th). She went through cooperative learning training in her degree program and her professional development. She has trained again in Kagan cooperative learning in 2016 and 2017. Her students also were trained in the Kagan cooperative learning strategies before the unit and during the unit.

Instrumentation

In the FOSS science kits, students learn about engineering, learn how to think like a scientist, investigate, and analyze all while actively engaging in the science process through hands-on science (FOSS, 2017). There is an expectation when using the FOSS curriculum; students should work cooperatively to construct knowledge and build on the student's schema. As a result, deeper understanding should then occur; "learning involves individuals in actively constructing schemata to organize new information and to relate and incorporate the new understanding into established knowledge" (Regents of the University of California, 2016, p. 4).

The FOSS creators understand that there is a discord between what is being taught and what a child can understand, similar to Vygotsky's ZPD. Therefore, "through social processes of interacting with peers and adults, students construct an understanding of the natural world and their relationship to it" (Regents of the University of California, 2016, p. 5). This program uses theoretical foundations of cooperative learning, social theory, and schema theory as a basis for the units.

Science lessons in this study were from the Mixtures and Solutions unit from the FOSS kit. The FOSS units were adopted in 2015 in the elementary school where the study took place. One of Kagan's cooperative learning strategies were integrated into every lesson during the

twelve-week unit. The FOSS Mixtures and Solutions Survey/Posttest reliability number are 0.895 according to the revision committees that established the initial content validity of the test. Statistical analyses that will provide indicators of validity will not be completed until later in 2018 (K. Long, personal communication, January 30, 2017).

The instrument that will be used to measure each variable is the FOSS Survey/Posttest. Kennedy (2010) found the:

> Survey/Posttest instrument is used in two ways; it is administered first before instruction begins, as a survey of student knowledge of the content to be covered in the module. Teachers use this information to inform their lesson planning. The same test is administered after the module has been completed to assess student progress on the concepts taught in the module. (p. 1)

Item Separations Reliability is reported at 0.993 (Kennedy, 2010). The posttest included seven multiple choice questions, two matching questions, and two open response questions. Students are scored on a numerical scale, zero to two on the multiple-choice questions and matching questions. These are questions one through nine, with question five and six having two parts each; a total of twenty-two points available. On question ten, an open response question, the score ranges zero to three on parts A and B: a total of six points available. The second open response question is scored zero to four on part A and a maximum of three points on part B; a total of seven points available. The procedure for scoring the test questions is laid out in the teacher directions. A maximum of 35 points can be awarded, and the minimum score of zero can be awarded.

Procedures

After obtaining permission from the proposed school and Liberty University's Institutional Review Board (IRB), data were collected from the school. Participants were elicited for the study by first contacting the school's head of school. Once permission was given, the elementary school's principal was contacted, and she put the researcher in contact with the classroom teacher. The consent of the classroom teacher participating in the study was given, and data were collected on the consenting classroom teacher: on her teaching experience, degrees held, and years teaching. The researcher and the classroom teacher drafted a letter to parents and students. Parents were asked to only sign the consent document if they did not wish for their child's scores to be used in the study. The teacher involved in the study has used FOSS science kits to teach science for two previous years, so no further training was given in FOSS teaching methods. The classroom teacher involved was refreshed on the five cooperative learning strategies used in this study. The teacher was asked to submit lesson plans weekly to ensure exposure to the cooperative learning structures and that heterogeneous and homogeneous groups were used in each class studied.

Data Analysis

An independent samples *t*-test was used to test hypothesis one and paired-samples *t*-test were used to test hypotheses two and three. After collecting and organizing data, the researcher used Microsoft Excel and SSPS to analyze all data.

Null Hypotheses

For hypothesis one, the researcher used an Independent samples *t*-test to see if there was a statistical difference in the two groupings. The pretest FOSS Survey/Posttest scores in science were the covariate or controlled variables, because the pretest scores in both groups were so similar, and it was decided that an ANOVA was not necessary. An Independent samples *t*-test

was used to test the null hypothesis, there is no statistically significant difference between fifth-grade students' academic achievement in science when grouped homogeneously compared to those who are grouped heterogeneously while using cooperative learning strategy measured by the FOSS Survey/Posttest, because it was done on two independent subjects.

Paired samples *t*-test was used to test the second and third hypotheses, because the means of two subjects are equal, and a paired test is a measurement on the same individual. To test for outliers, a Box and Whisker plot for each variable was made. To test Assumptions of Normality, a Shapiro-Wilk test was conducted because the sample size is under 50. The Levene's test was conducted to assess the assumption of homogeneity of variances. No violation was identified; therefore, the assumption of homogeneity was met. Last, the researchers analyzed the paired samples *t*-test.

CHAPTER FOUR: FINDINGS

Overview

The purpose of this study was to examine the impact of how teachers group students while participating in cooperative learning teaching strategies, specifically heterogeneous and homogeneous grouping and the academic impact on fifth grade students in the 2017-2018 school year. Data collected from students on the FOSS Survey/Posttest Mixtures and Solutions were analyzed and presented in Chapter Four.

Research Questions

RQ1: Is there a difference between fifth-grade students' *academic achievement* in science when grouped homogeneously compared to those who are grouped heterogeneously while using cooperative learning strategy measured by the FOSS Survey/Posttest?

RQ2: Is there a difference between *pretest* and *posttest scores* as measured by the FOSS Survey/Posttest for the heterogeneously grouped and homogeneously grouped students during the treatment period?

Null Hypotheses

$H_0$1: There is no statistically significant difference between fifth-grade students' academic achievement in science when grouped homogeneously compared to those who are grouped heterogeneously while using cooperative learning strategy measured by the FOSS Survey/Posttest.

$H_0$2: There is no statistically significant difference between pretest and posttest scores for heterogeneously grouped students as measured by the FOSS Survey/Posttest.

$H_0$3: There is no statistically significant difference between pretest and posttest scores for homogeneously grouped students as measured by the FOSS Survey/Posttest.

Descriptive Statistics

Sixty-one students took the FOSS Survey/Posttest however; 57 students' scores were used for analyses. Two students and parents opted out of participation in the study, and two student's scores presented as extreme outliers and were removed before further analysis took place. Of the students' scores that were analyzed, 27 students were male and 30 of the students were female. All students' ages ranged from 10 to 12 years old. The fifth-grade classes included students from different races, ethnic backgrounds, and economic backgrounds.

The study was originally designed using a nonequivalent control-group design; however, after examining the pretest results (see Table 1) it was determined that the scores for the two groups were nearly identical, and that the use of ANCOVA for analysis was not necessary.

Table 1

Pretest Descriptive Statistics

Grouping	Mean	N	Std. Deviation
Heterogeneous	18.594	32	2.474
Homogeneous	18.160	25	3.158
Total	18.404	57	2.777

Notes. [a] *. This is a lower bound of the true significance.
[b] Lilliefors Significance Correction.

Descriptive statistics obtained for the student grouping and academic achievement are found in Table 2. There were 32 heterogeneously-grouped and 25 homogeneously-grouped participants. The posttest scores were slightly higher for homogeneously grouped students (M = 28.760, SD = 2.788) than heterogeneously grouped students (M = 28.469, SD = 3.302).

Table 2

Descriptive Statistics

	Grouping	*N*	*M*	*SD*	SE Mean
Posttest	Heterogeneous	32	28.469	3.302	.584
	Homogeneous	25	28.760	2.788	.558

Results

Hypothesis One

For hypothesis one, (there is no statistically significant difference between fifth-grade students' academic achievement in science when grouped homogeneously compared to those who are grouped heterogeneously while using cooperative learning strategy measured by the FOSS Survey/Posttest), the researcher first checked for outliers using a Box and Whisker Plot (see Figure 1). There were no outliers in the data, as assessed by inspection of the boxplot.

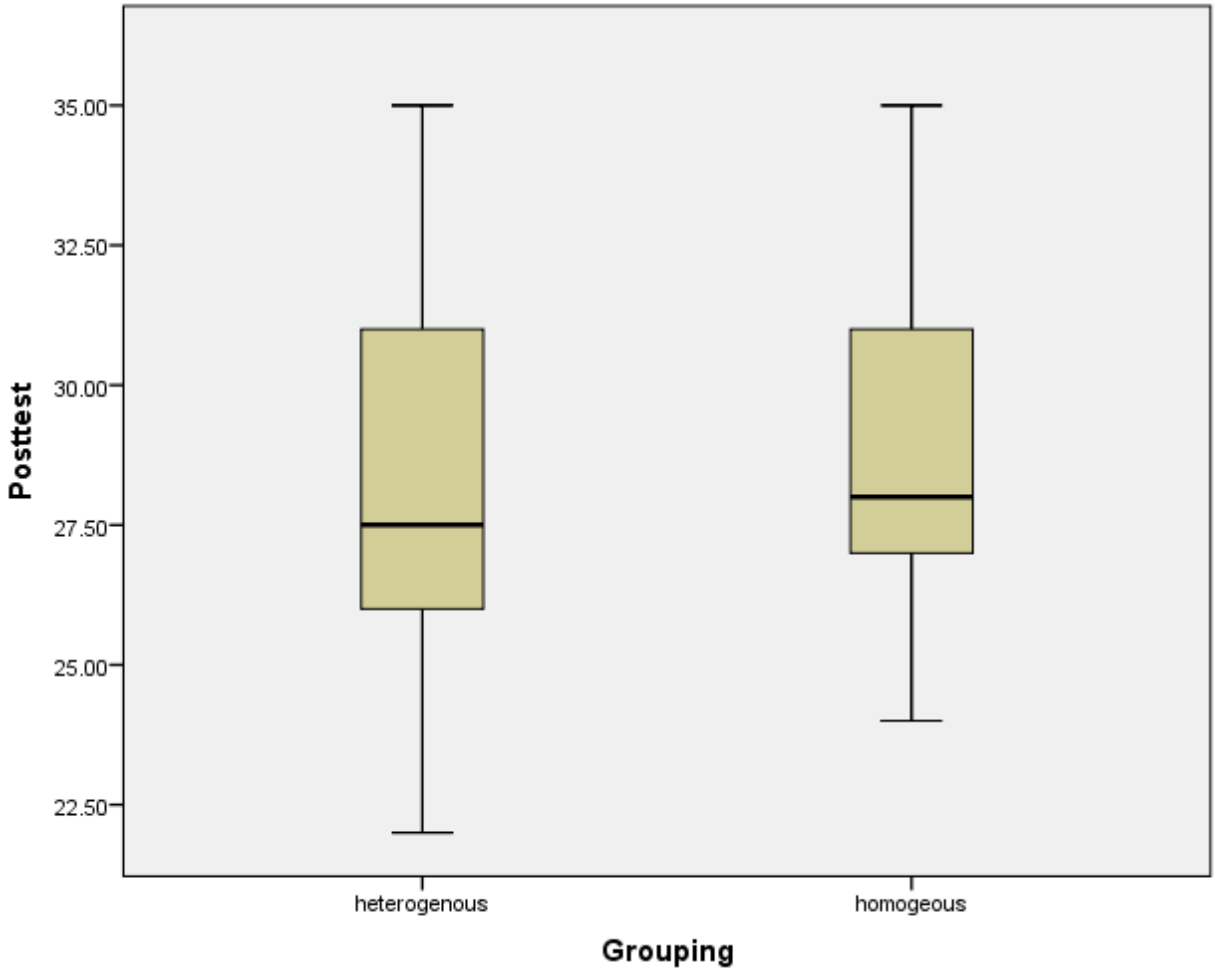

Figure 1. Box and whisker plot for posttest scores and grouping.

Grouping scores were normally distributed, as assessed by the Shapiro-Wilk test ($p > .05$). The Shapiro-Wilk test was used because the sample size for heterogeneous and homogeneous groups were under 50 (see Table 3).

Table 3

Shapiro-Wilk Test of Normality

	Grouping	Statistics	df	Sig.
Posttest	Heterogeneous	.960	32	.275
	Homogeneous	.974	25	.742

Notes. [a]*. This is a lower bound of the true significance.
[b] Lilliefors Significance Correction

The homogeneity of variances for posttest scores for homogeneous and heterogeneous grouping were assessed by Levene's test for equality of variances. No violation (p = .132) was identified (See Table 4 for Levene's Test for Equality of Variances). Next, an independent samples *t*-test was run to determine if there were differences between posttest scores in heterogeneous and homogeneous grouped students.

Table 4

Test of Equality of Variances

	Grouping	*F*	Sig.	*t*	Sig. (2-tailed)
Post-test	Equal variances assumed	2.344	.132	-.353	.725
	Equal variances not assumed			-.361	.720

Homogeneously-grouped students' mean posttest scores were slightly higher (M = 28.760, SD = 2.788) than their heterogeneously-grouped students (M = 28.469, SD = 3.302). There was not a statistically significant difference between means (p = .725), and therefore, the researcher failed to reject the null hypothesis (see Table 5 for group means).

Table 5

Group Means and T-tests Results for Homogeneously and Heterogeneously-Grouped Students

		M	*N*	SE	SE Mean	*t*	*p*
Posttest	Heterogeneous Group	28.469	32	3.302	.584	-.353	.725
	Homogeneous Group	28.760	25	2.788	.558		

Hypothesis Two

The researcher checked for outliers within the second hypothesis, comparing the means of pretest and posttest scores of the heterogeneously grouped students using a Box and Whisker Plot. There were no outliers in the data, as assessed by inspection of a boxplot (see Figure 2 for Box and Whisker Plot).

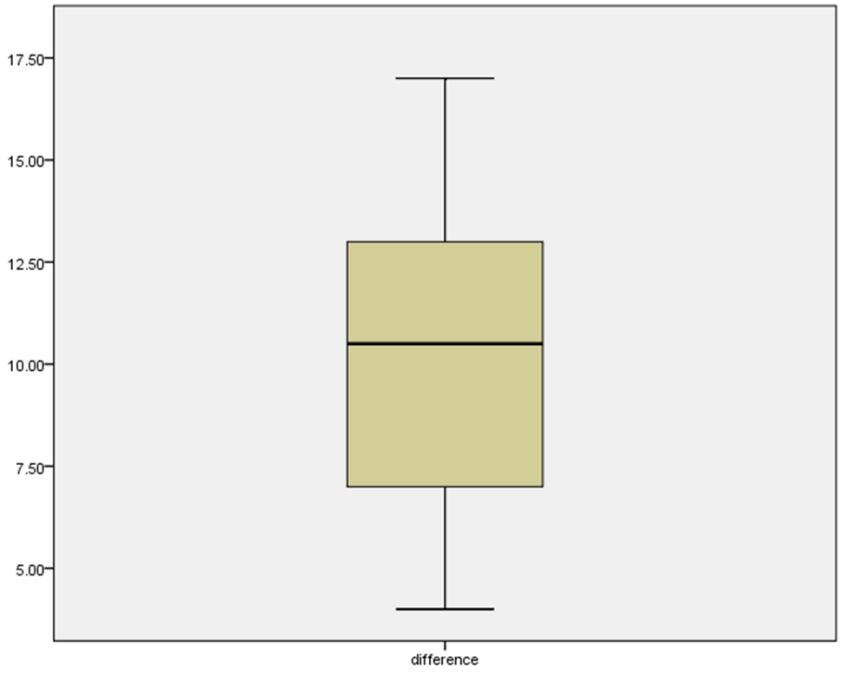

Figure 2. Box and Whisker Plot of Difference Scores for the Heterogeneously-Grouped Students.

The Shapiro-Wilk test was used to test normality. The sample size for heterogeneous and homogeneous groups were under 50. The difference scores for the pretest and posttest for the heterogeneous group were normally distributed, as assessed by Shapiro-Wilk test (p = .310). See Table 6 for Test of Normality.

Table 6

Test of Normality

Statistic	df	Sig.
.962	32	.310

Notes. This is a lower bound of the true significance.

Students made large gains from their pretest scores means of 18.584 to the posttest scores gains of 28.469. The posttest heterogeneous group elicited a mean increase of 9.875, in the

posttest scores as compared to the pretest scores. The analysis indicated a significant increase in points as compared to the pretest scores, $t(31) = 15.484$, $p = .001$. Therefore, the null hypothesis was rejected. See Table 7 for Paired Sample Test Descriptive Statistics.

Table 7

Descriptive Statistics and T-test Results for Paired Difference Scores and Heterogeneous Grouping

		M	*N*	*SD*	SE Mean	*t*	*p*
Pair	Pretest Heterogeneous Group	18.593	32	2.474	.437	15.484	.000
	Posttest Heterogeneous Group	28.469	32	3.302	.584		

Hypothesis Three

The researcher checked for outliers within the third hypothesis, comparing the means of pretest and posttest scores of the homogeneously grouped students, using a Box and Whisker Plot. There were no outliers in the data, as assessed by inspection of a boxplot. See Figure 3 for Box and Whisker Plot.

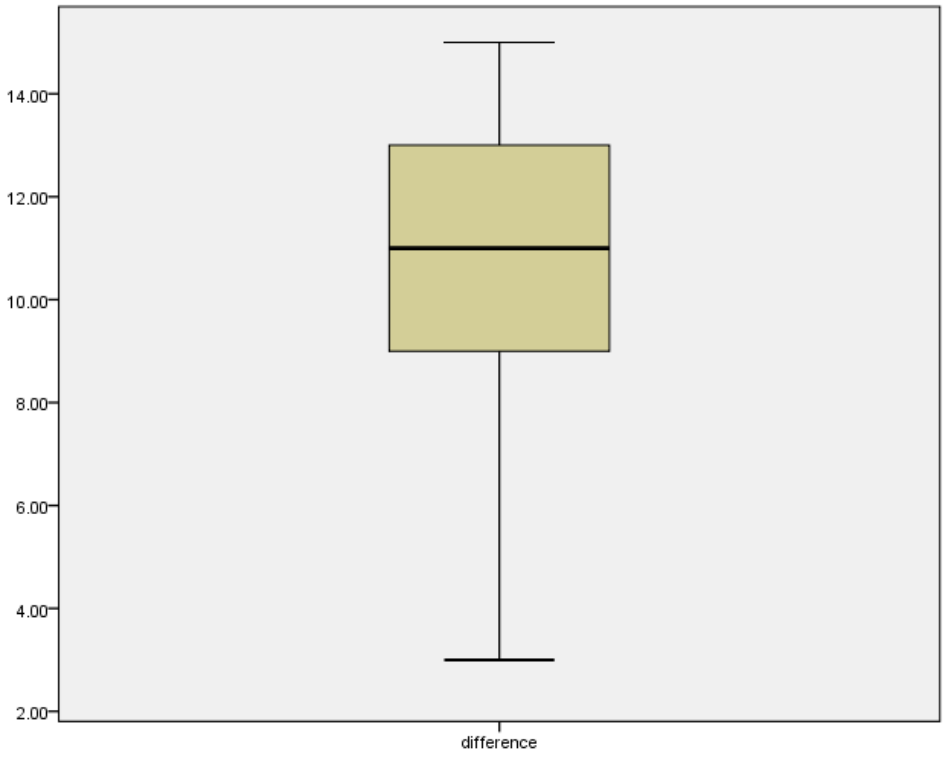

Figure 3. Box and Whisker Plot of Difference Scores for the Homogeneous Grouped Students.

The posttest scores were normally distributed, as assessed by Shapiro-Wilk's test (p = .300). See Table 8 Normality test.

Table 8

Normality Test Shapiro-Wilk

	Statistic	df	Sig.
Difference	.963	25	.300

Note. This is a lower bound of the true significance.

Students made large gains from their pretest score means of 18.169 to the posttest score means of 28.760. The posttest homogeneous group elicited a mean increase of 10.600, as

compared to the pretest homogeneous group. The analysis indicated a significant increase in points as compared to the pretest scores, $t(25) = 17.047$, $p = .001$. Therefore, the null hypothesis was rejected. See Table 9 Paired Samples Statistics.

Table 9

Descriptive Statistics and T-test for Paired Difference Scores and Homogeneous Grouping Results

		M	*N*	*SD*	SE Mean	*t*	*p*
Pair 1	Pretest Homogeneous Group	18.160	25	3.158	.632		
						17.047	.000
	Posttest Homogeneous Group	28.760	25	2.788	.558		

CHAPTER FIVE: CONCLUSION

Overview

Cooperative learning is a proven method of teaching (Kagan, 2013; Johnson & Johnson, 2014; Slavin 1996). However, how to group elementary-aged students is still a question in need of further study. The goal of this study was to identify if there was a difference in homogeneously and heterogeneously grouped students' posttest scores, so that teachers would have additional information on how to group students when implementing cooperative learning.

Discussion

The purpose of this study was to investigate the effectiveness in terms of achievement of whether students in cooperative learning groups are grouped heterogeneously or homogeneously by previous test results. Two research questions helped guide this study:

RQ1: Is there a significant difference between fifth-grade students' *academic achievement* in science when grouped homogeneously compared to those who are grouped heterogeneously while using cooperative learning strategy measured by the FOSS Survey/Posttest?

RQ2: Is there a difference between *pretest* and *posttest scores* as measured by the FOSS Survey/Posttest for the heterogeneously grouped and homogeneously grouped students during the treatment period?

Fifty-eight subjects participated in the study. They began by taking the Foss Survey (pretest), and they were grouped (heterogeneously or homogeneously). They were then instructed using the FOSS curriculum for a period of nine weeks, followed by the Foss Survey as a posttest. The first null hypothesis (there is no statistically significant difference between fifth-grade students' academic achievement in science when grouped homogeneously compared to

those who are grouped heterogeneously while using cooperative learning strategy measured by the FOSS Survey/Posttest) was not rejected. An independent samples *t*-test was run to compare the scores from the FOSS Survey/Posttest. The analysis showed no significant difference between the homogeneous and heterogeneous posttest scores.

Both groups made significant gains; however, in this study the grouping did not have a significant impact on the difference in posttest scores for the two groups. This finding supports research by Miller and Polito (1999), Moody and Gifford (1990), and Baer (2003). In these studies, it was found that there was no difference in achievement gains of homogeneous and heterogeneous groups (Miller & Polito, 1999; Moody & Gifford, 1990; Baer, 20003). However, the significant gains made supports the majority of research on cooperative learning being a viable teaching strategy (Baer, 2003; Igel & Urquhart, 2012; Smith et al., 2014; Valdez et al., 2015; Vega & Hederich, 2015; Zakaria et al., 2013; Zamani, 2016). This research contradicts the findings from Baer (2003),Van der Smith and Spindle (2007), and Zamani (2016) that all found that grouping techniques did make a significant impact on student achievement. For example, in one study, homogeneously-grouped students' academic abilities reported more success than their heterogeneously grouped peers (Johnson & Johnson, 2014).

The second null hypothesis, there is no statistically significant difference between pretest and posttest scores for heterogeneously grouped students as measured by the FOSS Survey/Posttest, was rejected. Paired samples *t*-test revealed that there was a significant difference in pretest and posttest score, $t(31) = 15.484$, $p = .001$, $d = 2.74$. This research also supports research that indicated that learning increases when students are using cooperative learning and are grouped heterogeneously (Johnson & Johnson, 2014; Stahl, 1994).

The third null hypothesis (there is no statistically significant difference between pretest and posttest scores for homogeneous grouped students as measured by the FOSS Survey/Posttest) was also rejected. A paired samples *t*-test was used to analyze the data. The homogeneous group showed a statistically significant mean increase in points as compared to the pretest scores with a large effect size, $t(25) = 11.883$, $p = .001$, $d = 6.959$. This research supports the previous research done by Zamani (2016), that indicated that both heterogeneously and homogeneously grouped students who scored academically low showed improvements when grouped in cooperative learning strategies, and Baer's (2003) research, that also found that low-achieving, homogeneously grouped students did equally as well as the heterogeneously grouped students.

Implications

The implications of this study include academic achievement by using cooperative learning, adding to body of knowledge on grouping in the classroom, and confirming that students benefit from the cooperative learning teaching method. The difference between the means homogeneous and heterogeneous group scores was only 0.291 points, with the homogeneous group scoring slightly higher. While the difference was not statistically different, both groups did show large gains on their posttest from their pretest scores.

Students participating in cooperative learning are talking, working together to solve problems, discussing and analyzing content, and with the individual accountability that is essential to cooperative learning, the gain outcomes are just one benefit to be considered. Techers become facilitators and encourage students to take charge of their learning.

The development of the social skills required to make cooperative learning lessons effective are also an added benefit to this teaching strategy. Students learn to listen and speak

respectfully to peers. In some studies, it was found that social skills not only built relationships that were long lasting, but also encouraged higher academic achievement (Johnson & Johnson, 2009). These social skills are lifelong skills, these lessons are life-long lessons, and these learners become life-long learners. Creating and encouraging students to be life-long learners is a goal for teachers.

Based on the results of this study, schools should include cooperative learning strategies and training to teachers and students. There is a robust body of research that touts the benefits of cooperative learning, and yet it is not used in all classrooms. While it has been recently reported that teachers still hold off on using this teaching method because of limited classroom time and curriculum requirements by states and administration, the real question is how schools can continue not to use it in the classroom (Baloche & Brody, 2017).

Limitations

The first limitation in this study was sample size. The researcher used only one school, however the researcher had a 96% participation rate. Although the sample size was satisfactory for this study, a larger sample size would have allowed the participants' scores to be representative of the population (Gall et al., 2007). Data were collected from 59 students, but scores from 57 students were included in the researcher's analysis.

The study took place in a medium size Christian school in the southeastern part of the United States. Data collected from this group may not be able to be generalized on the population, and therefore may not represent other areas of the country.

Recommendations for Future Research

After considering the results of this study, there are several recommendations for future research. The first recommendation would be to do a similar study but increase the sample size.

Increasing the sample size would increase the chance of finding a significant difference in means.

Biological sex was not a consideration for this research, however it could be considered for future research. In future studies it would be interesting to see if male students and female students gain scores were significantly different while considering homogeneously and heterogeneously grouped students.

A third recommendation for further research would be to look at posttest gain scores in students that scored high, medium, low on the pretest scores to see which group made more gains when using the cooperative learning teaching method. Then compare those scores to homogeneous and heterogeneously grouped students.

The last recommendation for future research is to consider a control group for the study that would show mean differences in the groups' posttest scores. This might add to the body of knowledge that cooperative learning is a superior teaching strategy compared to traditional teaching methods.

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APPENDIX A

IRB Approval

LIBERTY UNIVERSITY.
INSTITUTIONAL REVIEW BOARD

August 8, 2017

Patricia Wyman
IRB Approval [redacted] Academic Achievement with Cooperative Learning Using Homogeneous and Heterogeneous Groupings

Dear Patricia Wyman,

We are pleased to inform you that your study has been approved by the Liberty University IRB. This approval is extended to you for one year from the date provided above with your protocol number. If data collection proceeds past one year, or if you make changes in the methodology as it pertains to human subjects, you must submit an appropriate update form to the IRB. The forms for these cases were attached to your approval email.

Thank you for your cooperation with the IRB, and we wish you well with your research project.

Sincerely,

[redacted]

G. Michele Baker, MA, CIP
Administrative Chair of Institutional Research
The Graduate School

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APPENDIX B

Parent/Guardian Consent Form

The Liberty University Institutional Review Board has approved this document for use from 8/8/2017 to 8/7/2018
Protocol # [redacted]

PARENT/GUARDIAN CONSENT FORM

Academic Achievement with Cooperative Learning Using Homogeneous and Heterogeneous Groupings

Patricia Joanna Wyman
Liberty University
School of Education

Your child is invited to be in a research study of cooperative learning and how students are grouped while working together on classroom assignments. Your child was selected as a possible participant because he or she is a fifth-grade student working in groups using the FOSS curriculum. Please read this form and ask any questions you may have before agreeing to allow him or her to be in the study.

Patricia Wyman, a doctoral candidate in the School of Education at Liberty University, is conducting this study.

Background Information: Cooperative learning is a proven teaching strategy that teachers have been using for over forty years. It differs from group work because students show their learning individually versus a group grade. The purpose of this study is to discover whether while using cooperative learning, it is better to group students heterogeneously, students that are lower achieving are grouped with higher achieving students so that higher achieving students support and solidify their learning while restating and re-teaching their lower achieving partners, than homogeneously grouping students, grouping students with like abilities so that higher achieving students are pushing each other to think deeper and lower achieving students are able to get more time with the teacher to insure mastery of the content.

Procedures: If you agree to allow your child to be in this study, I would ask him or her to do the following things:

1. All fifth-grade students will take a science pretest in their science classroom on their current unit of study. This test will not count as a grade, but instead aide teachers in grouping students. All students, even those not participating in the study, will take this pretest as it is part of the curriculum used by the school. Students will be given a fifty-minute class period to finish the pre-test and turn it in to their science teacher.
2. Fifth grade students will be grouped for the unit based on pretest scores. Half of the students will be paired homogeneously with partners who scored like them. Half of the students will be placed in groups heterogeneously in groups with mixed ability levels. All students will learn the exact same curriculum for the duration of the unit. Students that are not participating in the study will still be grouped for instruction. The unit is estimated to last six weeks.
3. All fifth-grade students will take posttest at the conclusion of unit as directed by the curriculum that is used in this fifth-grade classroom. The students will have the fifty-minute class period to complete the test and turn it in to their science teacher.

Risks and Benefits of being in the Study: The risks involved in this study are minimal, which means they are equal to the risks you would encounter in everyday life. Participants should not expect to receive a direct benefit from taking part in this study.

Compensation: Participants will not be compensated for participating in this study.

Confidentiality: The records of this study will be kept private. In any sort of report I might publish, I will not include any information that will make it possible to identify a subject. Research records will be stored securely, and only the researcher will have access to the records.

Students must write their names on their tests; however, to protect each student's identity, the student's pretest and posttest will also have a number assigned to them by the researcher. After the pretest is given, the number will be assigned, and the child's name will be removed. Then the posttest will be given, the students number will be matched using the number code key, data will be recorded, and their names will be removed from the posttest. The number codes will be kept in a secure filing cabinet.

Student information and the privacy of the participants will be protected because data will be stored in a secure filing cabinet and on a password protected computer. After three years, all electronic records will be deleted per federal regulations.

Voluntary Nature of the Study: Participation in this study is voluntary. Your decision whether or not to allow your child to participate will not affect his or her current or future relations with Liberty University or Hebron Christian Academy. If your child decides to participate, he or she is free to not answer any question or withdraw at any time without affecting those relationships.

How to Withdraw from the Study: If you or your child choose to withdraw from the study, please contact the researcher at the email address/phone number included in the next paragraph. Should you choose to withdraw, data collected from your child will be destroyed immediately and will not be included in this study.

Contacts and Questions: The researcher conducting this study is Patricia Joanna Wyman. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact her at [redacted] You may also contact the researcher's faculty advisor, Dr. Scott Watson, at [redacted]

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, **you are encouraged** to contact the Institutional Review Board, 1971 University Blvd, Green Hall 1887, Lynchburg, VA 24515 or email at irb@liberty.edu.

Please notify the researcher if you would like a copy of this information for your records.

Opt Out Statement: I have read and understood the above information. I have asked questions and have received answers. I **do not** consent to allow my child to participate in the study.

(NOTE: DO NOT AGREE TO ALLOW YOUR CHILD TO PARTICIPATE UNLESS IRB APPROVAL INFORMATION WITH CURRENT DATES HAS BEEN ADDED TO THIS DOCUMENT.)

Signature of Parent Date

Signature of Investigator Date