The Relationship between Multigrade Classrooms and Reading and Mathematics Achievement in WELS Elementary Schools

by

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Abstract

The purpose of this study was to examine the relationship between the size of the class of third-grade students and classroom type (multigrade versus single grade) and academic achievement in third-grade students. The participants in this study were 273 third grade students from 22 elementary schools in the Wisconsin Evangelical Lutheran Synod across the United States.

There was a response rate of 12.94% of schools who participated in the study. The data were analyzed with correlation coefficients to determine the relationship between the number of third-graders in the classroom, type, and academic achievement. Results showed a moderate negative correlation (r = -.32) between the size of the third-grade class and mathematics achievement scores. There was a weak negative correlation (r = -.148) between the number of students and reading achievement for the whole group. There was a weak positive correlation (r_{pb} = 0.159) between multigrade classroom type and reading achievement for the whole group and a weak positive correlation (r_{pb} = 0.156) between multigrade classrooms and mathematics achievement.

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Chapter I: Introduction

Problem Statement

A multigrade learning environment is commonly found in the Wisconsin Evangelical Lutheran Synod (WELS) elementary schools according to the WELS Commission on Lutheran Schools (Commission on Lutheran Schools, personal communication, September 14, 2018). Little (2005) defines a multigrade classroom as one in which students from two or more grades are taught by one teacher at the same time. Reasons for implementing a multigrade classroom include size, location, population, and economic considerations. The multigrade class structure is also known by various names such as composite, combination, or vertically grouped classes.

At first glance, the skills needed to teach effectively well in the multigrade classrooms and the single-grade classrooms look to be very similar. However, many teachers do not feel confident in their ability to prepare to teach a class with more than one grade level. If a teacher fails to address differences among students, the effectiveness of instruction suffers (Miller, 1996). Many teachers and parents wonder whether a multigrade classroom education has a negative effect on student performance (Miller, 1990).

Purpose of the Study

Teaching in a classroom with multiple grades involves planning for whole class instruction as well as planning instruction for groups and peer tutoring (Hoffman, 2003). The teachers are expected to be adaptable and employ different strategies to make learning meaningful and effective for all students in the classroom, no matter what individual differences may exist among the students. This leads to debates in the

education community whether or not multigrade classrooms provide an environment where students can adequately meet academic standards.

Mason and Burns (1996) and Engin (2018) discovered there were similar findings in research literature stating that negative perceptions and attitudes of the multigrade classrooms are common especially among teachers. Teachers commonly say they prefer a single-grade classroom because multigrade classrooms require more planning, preparation, and work. Parents are mainly concerned about student achievement (Russell, Rowe, & Hill, 1998). Research literature has also stated positive effects in multigrade classrooms. The positive perceptions included better social development, enrichment and support opportunities for the students, and opportunities for children to learn through peer tutoring (Mason & Burns, 1996; Veeman, 1995).

Blum's (2009) found mixed results due to the location of the classrooms. In many societies across the world, multigrade classrooms are the only viable option. Multigrade classrooms in European countries are more popular than in North America, and studies in Europe show positive results. Studies performed in North America have had mixed results showing little to no impact or even a negative influence on academic achievement (Brinegar, 2010). Student achievement results in the multigrade classrooms compared to the traditional monograde classrooms are inconclusive and inconsistent. The varying research results offer a justification for more research to determine if classroom organization influences student performance (Linehan, 2012).

Herrera, Zhou, and Petscher's (2017) conducted a study which focused on the achievement of third-grade readers. Their research shows that reading proficiently by the end of the third grade is crucial to success in school and later in life. After third-grade,

students are exposed to a broader range of texts. The students need to be able to successfully extract and analyze new information and enhance their vocabulary through reading texts. Hernandez (2011) noted that students who were struggling with reading rarely caught up to their peers academically and were four times more likely to drop out of school before graduating high school. Students must have a strong understanding of the alphabet and the phonemic awareness to be able to read fluently. Phonemic awareness has been found to be a strong predictor of reading success. When students developed these literacy skills, reading unknown words became effortless, and students then focused on comprehension. Early readers were more likely to become lifelong learners and were willing to attempt to understand a variety of texts and succeed in multiple academic areas (Dorsey, 2015).

The National Parent Teacher Association stated that third grade was an important year for students because they learned new ideas and skills. Mathematics was one of the areas third-grade students needed to master for the future. Third-grade students learned multiplication, division, fractions, and percentages that were essential for future mathematics skills. (National PTA, 2011). Mathematics in third grade involved more complex word problems. The students needed to understand and had to use numerous mathematic operations to solve the problem. Number sense at the end of third grade was an indicator for future mathematics academic achievement. (Jordan, Glutting, Ramineni. 2010).

Fite (2002) reviewed the literature on mathematics and reading connections. He reviewed ten different studies and concluded that reading and mathematics required very similar cognitive skills at a symbol processing level. He stated, "The student must be able

to read before they can be successful at any other academic endeavor. A student who can read fluently must be taught how to be successful in the other academic domains" (p. 11). Similarly, Grimm (2008) showed a positive connection between high academic reading ability and high mathematics ability. Grimm analyzed students in third through eighth grade in the Chicago Public Schools District. He used the students' test scores on the Iowa Test of Basic Skills. The results of his research revealed a small significant effect of reading skills on mathematics achievement. Grimm stated, "students who have greater reading capacity in third grade tended to show greater increases in mathematics skills for a given level of early mathematics achievement." (p. 424). The National Center for Education Evaluation and Regional Assistance published an article in 2017 regarding reading and mathematics proficiency and growth changes. The study found the students who scored proficient in reading and mathematics continued to increase in academic achievement in high school. The students who were not proficient in reading and mathematics had achievement gaps in a variety of subjects and in future grades (Herrera, Zhou, & Petscher, 2017).

Research Questions

Although studies were conducted across denominations, there have not been studies conducted exclusively within the WELS schools. The aim of this project was to determine to what extent the results of studies in other settings also apply to WELS schools. This project sought to determine whether the multigrade classroom influences a student's academic achievement in mathematics and reading in WELS elementary schools. Research showed third grade to be a critical year for reading and mathematics achievement (Fite, 2002; Herrera, Zhou, & Petscher, 2017; Grimm, 2008). This project

compared the conditional growth index in mathematics and reading on Measures of Academic Progress (MAP Growth) tests. The project looked at two groups of students. One group of participants was comprised of third-grade WELS elementary school students who were in multigrade classrooms. The other participant grouping was a single-grade third-grade classroom in a WELS elementary.

Specific Research Questions

1. What is the relationship between reading and mathematics achievement scores and third-grade class size in WELS schools?
2. What is the relationship between reading and mathematics achievement scores and the type of classroom (single-grade verses multigrade) for third-graders in WELS schools?

Definition of Terms

Multigrade. A multigrade classroom is a single classroom that is made up of students in multiple grades. The students can be of different ages or of the same ages but in different grade levels. There is usually only one teacher, or a teacher and an assistant, per room. Students in these classrooms are taught the curriculum that is required for their grade level. Multigrade classrooms are also called multiage classrooms, combination classrooms, and split-grade classrooms.

NWEA. NWEA stands for Northwest Evaluation Association. NWEA is a research-based, non-profit organization that produces an assessment that precisely measures students' growth and proficiency. These assessments provide teachers a snapshot of the students' understandings to help modify instruction (NWEA 2018).

Measures of Academic Progress (MAP) Growth Testing. MAP Growth is a computer adaptive test created by NWEA. Students test two to three times per school year. The results help the teacher understand each student's academic needs. The teachers are also able to track the student's growth throughout the year (NWEA, 2018).

Conditional Growth Index. Compares growth between any students. This information compares student's growth with the growth patterns of matching peers within the NWEA norms study (same grade, starting RIT score, and weeks of instruction before testing). This gives a snapshot of students' growth in the same national situation and compares them. A value of zero (0) corresponds to the mean (typical) growth, indicating that growth exactly matched projections. Values above zero indicate growth that exceeded projections, and values below zero indicate growth below projections (NWEA, 2018).

RIT scores. The NWEA MAP Growth test uses a scale called RIT to measure student achievement and growth. RIT stands for Rasch UnIT. It is an equal-interval scale used to calculate scores, this simplifies the reading of test scores. RIT scores range from about 100 to 300. Students typically start at the 180 to 200 level in the third grade and progress to the 220 to 260 level by high school. RIT scores make it possible to follow a student's educational growth from year to year (NWEA, 2018).

Ex Post Facto. Ex post facto means after the fact. This is research that uses data from a test that has occurred at a previous date without the researcher (Salkind, 2010).

Descriptive Correlational Design. This is a type of research which determines whether or not two variables are related, and if so, in what way. The studies look to discover whether an increase or decrease in one variable corresponds to an increase or

decrease in the other variable. Correlation does not imply causation. There are three possible results of a correlational study: a positive correlation, a negative correlation, and no correlation.

Point Biserial Correlation Coefficient. A point biserial correlation is used to measure the strength of a relationship that exists between one continuous variable (achievement growth) and one dichotomous variable (multigrade and single grade classrooms). Point biserial correlation coefficient measures on a linear scale using a numerical scale between +1 and -1. A coefficient close to +1 shows a strong positive correlation. A coefficient close to -1 indicates a strong negative correlation. A coefficient near zero shows that the variables are not connected.

Coefficient of Determination. The coefficient of determination takes the correlation coefficient (*R*) and squares it (R^2). The coefficient of determination is calculated into a percent. It indicates how much variation (as a percent) in one variable can be explained by variation in the other variable.

Assumptions and Limitations of the Study

This study was conducted under the assumption that participants would answer honestly due to the anonymity and confidentiality of the Google Forms survey. The participants are volunteers who could withdraw from the study at any time and with no ramifications. The Google Form survey was sent to 170 WELS schools who take the MAP Growth test. This list was obtained from the Commission on Lutheran Schools.

There may be several limitations to this study. There could be unknown conditions or factors at the school where the students were testing that may have biased the data. The time frame could be another limitation of the study as principals are asked

to enter data from a previous year. The study's results also depended on the number of principals willing to fill out the survey. This study could be limited by a small sample size making it difficult to draw conclusions.

Overview

This study sought to determine whether there is a relationship between achievement in mathematics and reading and the multigrade classroom. Principals in WELS elementary schools were sent surveys to gather information from the MAP Growth test scores. The principals reported the conditional growth index for mathematics and reading of third-grade students. The data was analyzed, and the results are presented in Chapter IV. Recommendations for further study are presented in Chapter V.

Chapter II: Literature Review

Introduction

Supporters of multigrade classrooms claimed that students in multigrade classrooms performed better academically than those in a single-grade classroom (Kolstad & McFadden, 1998). Multigrade supporters also stressed grouping several grades in one room offered the chance for students and teachers to grow, discover, and work together. The students felt safe and comfortable because they were familiar with the expectations, rules, procedures, and routines of the classroom (Pratt, 2009). Small groups were based on different abilities, resulting in higher achievement in multigrade classrooms (Lester, 2005). Engin (2018) stated,

> As for the advantages, it is seen that some points such as an increase in cooperation between students and learning from each other, improvement of self-regulated learning skills, taking responsibilities and sharing the leadership, increase in in-class respect, peer tutoring and latent learning from upper or lower-class lectures (p. 195).

Critics maintained that there were several disadvantages in multigrade classrooms. They stated that spending years with one teacher may be detrimental if standards were not maintained. Administrators reported difficulties with scheduling, budget constraints, and parental concerns (Engin, 2018).

Miller (1990) compiled research data from twenty-one quantitative research studies that evaluated multigrade classrooms. The quantitative studies assessed student achievement and student attitudes. Miller used thirteen of these experimental studies for his conclusion. These thirteen studies focused on numerical data from test scores. Miller

stated some research suggested there may be significant differences in achievement depending on the subject or grade level. Multigrade classes did not appear to negatively affect reading achievement but may have boosted scores for average to high-achieving students. Students' mathematics achievement might have been negatively affected by placement in a multigrade classroom, especially in third grade. However, the overall data showed no significant difference in student achievement in a multigrade classroom when compared to students in a single-grade classroom.

Havens, Thayer, and Kido (2015) conducted a study called the CognitiveGenesis Project. The CognitiveGenesis Project collected data on achievement from small schools in the years 2006-2010. The data was used to compare the achievement of students in different multigrade Adventist schools to students in single-grade classrooms. The research from the CognitiveGenesis data suggested that yearly achievement growth in multigrade classrooms in small schools in the United States were equal to or superior in achievement to single-grade classes, large classes, and large schools. Pawluk (1993) found no specific difference in achievement between the students in the multigrade and single-grade classrooms. Another study done by White (2009) found a very small difference between multigrade and single-grade class achievement. The study showed a positive difference in academic achievement in multigrade classrooms. The CognitiveGenesis findings were consistent with other researchers who stated any differences were not significantly higher or lower than single-grade classrooms.

Checci and De Paola's 2017 research of multigrade classrooms in Italy showed a different picture. Their paper discussed the impact of multigrade classrooms on student achievement in literacy and mathematics. Italy used multigrade classrooms to sidestep

laws that limited the number of students in a class and classroom. Multigrade classrooms allowed more students in a room than single-grade classrooms. Therefore, they also looked to find a correlation between achievement and the class size and configuration. Their results showed the students in multigrade classes did not perform significantly lower in mathematics standardized tests. The multigrade classroom also had a smaller negative effect on reading standardized tests but not statistically significant." They also stated there was no significant impact on class size for either literacy or mathematics. However, they did say the lower grades; specifically, second-grade students were more negatively impacted than the students in fifth grade and higher.

Similar to Checci and De Paola's (2017) study in Italy, Leuven and Ronning (2014) conducted a study in Norwegian junior high schools. They found that students who were in a multigrade class performed slightly better than in single-grade classrooms. They attributed these results to the positive influence on students who benefited from sharing a classroom with older students and learning from older peers. They also discovered a connection between upper and lower grades in a multigrade classroom. Upper-grade student academic achievement might have been negatively impacted by having lower grade students in the same classroom.

Mariano and Kirby (2009) investigated the multigrade classrooms in Los Angeles and compared multigrade achievement to the achievement in the single-grade classrooms. They did a study for six consecutive school years from 2002-2008. They collected data from over 380,000 students in the district. They focused on the students' scores in the third through the fifth grades in reading and mathematics. The multigrade classroom configurations most often placed the second-grade students with the third-grade students

and the fourth-grade students with the fifth-grade students. They found the students in the multigrade classrooms performed lower than the students in the single-grade classrooms on both reading and mathematics tests. Mariano and Kirby suggested the configuration may have led to different outcomes. “For example, fourth graders in a grade 3-4 configuration may not have the same experiences as fourth graders in a grade 4-5 configuration” (p. 8). They also suggested the groupings and instructional practices may have led to the slightly lower test scores in the multigrade classrooms compared to the single-grade classrooms.

Russell, Rowe, and Hill (1998) reviewed and compared the quantitative data reported by Veenman (1996) and by Mason and Burns (1996) and added qualitative data from a research study they performed in 1992 called the Victorian Quality Schools Project (VQSP). The VQSP study used quantitative data from student test scores but also used interviews of students, teachers, and parents. The researchers acknowledged that students were aware of what happens in classrooms and could give insight into how certain experiences impacted their learning. The results from the data collected in 1993 showed a strong and significant negative effect on the achievement of students in multigrade classrooms. However, the data collected from 1994 showed a reduction in the significance, there was now a moderately negative effect on classroom achievement. The results indicated the ease or difficulty of learning was dependent on more factors than the structure of the class. The researchers concluded that many of the interviews suggested they did not see the multigrade classroom alone as the deciding factor in the level of student achievement.

Veenman (1995) stated multigrade classrooms were “simply no worse and simply no better” than the single-grade classrooms when it comes to academic achievement. In this meta-analysis, Veenman found both positive and negative effects in the multigrade classrooms. He also recognized that most of the multigrade classrooms were a necessity due to varying enrollment numbers.

Veenman reviewed studies done by Rule (1983), Stone (1986), and Lincoln (1981). Rule’s study showed that multigrade student achievement in mathematics and reading did not appear to be impacted by the classroom configuration. Stone (1986) also showed no significant difference when he compared multigrade students to single-grade students in either subject. Lincoln (1981) conducted a study on reading achievement and noted there was not a significant difference in reading between the multigrade and single-grade classrooms in first and second grades. However, there was a slight difference favoring the multigrade classrooms in the older grades. Veenman concluded in his meta-analysis there were no significant differences in achievement between the multigrade classrooms and the single-grade classrooms.

Veenman’s article spurred an academic debate with Mason and Burns (1996). Mason and Burns were compiling their data at the same time Veenman’s article was released. They were dismayed when they found their conclusion was slightly different than Veenman’s. They argued that Veenman was biased in his conclusions because he was an administrator at a multigrade school. They also claimed that Veenman did not have evidence to support his conclusion. Mason and Burns commented that Veenman’s review was based on his beliefs rather than empirical evidence.

Mason and Burns' (1996) research and literature review led to their conclusion that multigrade classrooms produced a small negative effect on achievement. The article stated student achievement was impacted because of the teachers' abilities and attitudes. Teachers found multigrade classrooms to be difficult classroom environments to manage and became "jaded" (p. 319) due to the lack of time and training. Mason and Burns had similar results and concluded that there was no significant impact on student achievement in multigrade classrooms in comparison to single-grade classrooms. They stressed the importance of and need for more large-scale comparison field experiments to determine a relationship between achievement and multigrade and single-grade classrooms.

Veenman (1996) responded to Mason and Burns' (1996) review of his previous article in 1990. Veenman commented on his background and the reasons he started his research on multigrade classrooms. As chairman on a board of a multigrade elementary school, he wanted to find answers about the effects of multigrade classroom organization to make an informed decision.

Veenman went through his previous study conducted in 1990 and addressed all the issues Mason and Burns (1996) had with his findings. He removed or explained the issues that Mason and Burns identified. Veenman recalculated his findings and confirmed his initial findings that the multigrade classroom did not impact achievement and showed no significant difference than a single-grade classroom. Veenman stated he agreed with Mason and Burns that more research needed to be done on the characteristics of the multigrade students and teachers to offer further insight into the advantages and disadvantages of the multigrade classrooms.

Burris (2000) conducted a descriptive study that compared the achievement of students in multigrade classrooms and single-grade classrooms. The study looked for links between the classroom organization, gender, ethnicity (Hispanic), and Title 1 students and achievement. Burris used data from standardized testing of 615 third-grade students from three different school districts to get a large sample. The test scores showed that the students in multigrade classrooms performed significantly higher in mathematics and reading but showed no significant difference in writing. The author concluded from the results that although student achievement was higher in the multigrade setting, the students who were non-Hispanic benefited the most.

Multigrade classrooms are utilized for several reasons. A common reason that multigrade classrooms are implemented is student enrollment. Proehl, Douglas, Elias, Johnson, and Westsmith (2013) created a study in response to having to transition from single-grade classrooms to multigrade classrooms. The transition was implemented in response to decreased enrollment. Researchers assessed the impact of multigrade classrooms on students, parents, and teachers in a small urban school.

Their research looked at several different sources to collect data. The research team collected data from parent surveys, parent and teacher interviews, and school statistics, such as absenteeism, tardiness, and standardized test scores. The analysis of the data collection showed the parents were overwhelmingly satisfied with the transition. The student data was collected from students who were enrolled before and after the transition. The students' records and achievements were not impacted. The teachers and parents also felt that the student's behavior had improved. Overall, the study found the transition to multigrade classrooms did not have a significant impact on academics. This

also agreed with Veenman (1995, 1996). The finding of the study was not generalized due to the small sample group size. The research team also stated similar thoughts to Veenman (1996) and Mason Burns (1996) that there needed to be further studies done to find out if similar results would occur in other schools' atmospheres (Proehl, Douglas, Elias, Johnson, & Westsmith, 2013).

Summary

The results of several studies that compared multigrade and single-grade classrooms showed mixed results. Veenman (1995) reviewed several research studies and concluded that multigrade classrooms were "simply no worse and simply no better" when it came to academic achievement. He stated the differences found were not significant enough to draw conclusions about the effect on students' achievement. Mason and Burns (1996) were on the other end of the spectrum and said that Veenman "may be simply wrong." They believed Veenman was biased in his research and directed his groupings to favor multigrade classrooms. Mason and Burns argued in their research that multigrade classrooms had a slight negative effect on student achievement. Veenman answered the argument and reviewed his research studies by removing the variables Mason and Burns mentioned. Veenman still concluded that there is no significant difference in academic achievement (Veenman, 1996). Other studies showed that there were significant positive differences in multigrade classrooms in mathematics and reading but not in writing. The significance of the differences was also dependent on grade combinations (Burriss, 2000).

Chapter III: Methodology

Introduction

This project was conducted to determine whether the multigrade classroom influences student's academic achievement in mathematics and reading in WELS elementary schools. Research showed third grade to be a critical year for reading and mathematics achievement (Fite, 2002; Herrera, Zhou, & Petscher, 2017; Grimm, 2008). This study compared the conditional growth index in mathematics and reading on Measures of Academic Progress (MAP Growth) tests of students in single-grade third-grade classrooms to those of third-grade students in multigrade classrooms. The study looked at two groups of students. One group of participants was comprised of third-grade WELS elementary school students who were in multigrade classrooms. The other participant grouping were WELS elementary school third-grade students who were in single-grade classrooms.

Research Question(s)

This study sought to answer the following research questions:

1. What is the relationship between reading and mathematics achievement scores and third-grade class size in WELS schools?
2. What is the relationship between reading and mathematics achievement scores and the type of classroom (single-grade verses multigrade) for third-graders in WELS schools?

Research Design and Procedures

The Commission on Lutheran schools was contacted to obtain email addresses of the WELS elementary schools who participated in MAP Growth testing. In early

November the principals of WELS elementary schools were emailed asking them to participate in the study. The email provided a brief background of myself and stated the reason why the school was being contacted. It also included information about the survey, such as a deadline for the survey and a preview of the survey questions. A link to an electronic survey (Appendix A) was included in the email. Participation required principals to report each third-grade student's conditional growth index on the MAP Growth tests in mathematics and reading, the total number of third-grade students, the number of students in the classroom, and the different grades that made up the multigrade classroom which included the third-grade students. The conditional growth index compared growth between students using an equal scale. The conditional growth index ranks each student's growth among the levels of growth observed across all matching peers within the NWEA norms study (same grade, starting RIT score, and weeks of instruction before testing). Using the conditional growth index accounted for differences in growth rates of low-achieving students and high-achieving students so scores could be compared consistently (NWEA, 2018).

Population and Sample

The participants in this study were third-grade students in WELS elementary schools. The principals at the WELS elementary schools who use MAP Growth tests were contacted through an email sent on November 5, 2018 with assistance from the office of the Commission on Lutheran Schools. The email asked the principals to participate in the study by filling out a short survey. The email introduced the study, sample questions, and due date as well as a link to the Google Forms survey. A reminder/thank you email was sent one month later on December 7, 2018 to the

principals, thanking those who had participated and encouraged others to complete the survey. In hopes of getting a higher response rate, a reminder email was sent one week before the survey closing date on January 7, 2019. Responses were anonymous and categorized by multigrade classrooms and single-grade classrooms. 31 of the 170 principals emailed responded and 22 of the principals were able to participate in the survey. This is a participation rate of 12.94%. There were ten single grade classroom schools and twelve multigrade classroom schools who participated in the survey. This provided information from 273 third grade students. There were 199 students in single grade classrooms and 74 third grade students in the multigrade classroom.

Instrumentation

The survey was sent electronically to the principals. Reminder/thank you emails were sent in December and January to the principals who responded to the survey. The data was collected through a short survey created in Google Forms. The survey questions can be found in Appendix A. Survey responses were recorded and transferred into an Excel spreadsheet. The Excel spreadsheet was then used to analyze the data from the surveys.

Data Analysis Procedures

The study used a descriptive correlational design. The data were analyzed with correlation coefficients to determine whether there was a relationship between classroom type and achievement scores. Pearson's *r* was calculated to measure the strength of the relationship between the class of third-grade students size and achievement scores. Finally, a coefficient of determination was calculated into a percent. This indicates how

much variation (as a percent) in one variable can be explained by variation in the other variable. The coefficient was calculated for the following:

1. Size of third-grade class and mathematics growth achievement.
2. Size of third-grade class and reading growth achievement.
3. Grade configuration and mathematics growth achievement.
4. Grade configuration and reading growth achievement.

Limitations

The data for this study depended on the participation of the principals. This study was limited by a low participation rate of 12.94% of principals responding. The study also relied on school data that was ex-post facto. Five schools were unable to participate due to not testing during the specified time frame. Two other schools were unable to participate due to lack of third-grade students during the time frame. The survey also was not designed to collect specific data to determine whether the students have always been in a specific type of classroom organization. Students may have switched from a single-grade to a multigrade classroom or vice versa due to a variety of factors. The sample attrition was not able to be determined.

There were also several other factors that could have impacted the data collected from the survey. The schools' curricula and the teachers' characteristics could have influenced a third-grade student in mathematics and reading achievement.

Summary

This study compared the MAP Growth test conditional growth index in mathematics and reading achievement scores of multigrade students and single grade classroom students. The study looked for relationships between mathematics and reading

achievement and grade configurations. Relationships between reading and mathematics achievement and class size of third-grade students were also analyzed.

Chapter IV: Results

Introduction

Data was collected from twenty-two schools who responded to the Google Forms survey. A point biserial correlation was used to determine whether there was a relationship between third-grade student achievement in mathematics and reading and the classroom configuration. Pearson's *r* was also used to determine whether there was a relationship between class size and student achievement.

Data Analysis

The data collected from the survey was transferred to an Excel spreadsheet. Each school was given a school ID number. Table 1 shows the participants demographics of the schools who responded to the survey.

Table 1
Participant Data by School

School ID	*n*	Classroom type (M or S)
1	9	M
2	32	S
3	2	M
4	13	S
5	8	M
6	26	S
7	4	M
8	6	M
9	21	S
10	20	S
11	9	M
12	17	S
13	11	S
14	6	M
15	5	M
16	7	M
17	28	S

18	18	S
19	13	S
20	4	M
21	7	M
22	7	M

The data was then analyzed to find the means and standard deviation of the conditional growth index in mathematics and achievement all third graders. Table 2 shows the conditional growth index of mathematics for all of the third-grade students. The mean growth score on mathematics tests was -0.07 with a standard deviation of 1.13 (See Table 2). Table 2 also shows the conditional growth index of reading for the whole group of third-grade students. This shows the range of scores is slightly larger than the mathematics scores. Similar to the mathematics scores the average reading achievement score mean was -0.21 with the standard deviation is 1.06. This means that 68% of the scores are in the middle range.

The study was interested in the number of third-grade students in the classroom and grade achievement. The data was analyzed to determine the number of third-grade students in each classroom. The standard deviation was also large at 8.81 meaning more than half (68%) of the classes had from 9 to 27 students.

Table 2
Means and Standard Deviation of Key Measures

Measure	M	SD
Third graders	17.88	8.81
Math CGI	-0.07	1.06
Reading CGI	-0.21	1.13

Pearson's *r* correlation was computed to assess the relationship between the number of students in the classroom and the whole group mathematical growth scores.

Cohen's 1988 conventions were used to interpret the effect size and relationships ("Effect Size," n.d.). Table 3 shows that there is a medium negative correlation (r= -.326) between the number of third-grade students in the classroom and mathematical achievement. This means mathematical achievement scores decreased as more students were added to the classroom.

Table 3
Correlation of Mathematics and Reading Achievement and the Number of Third-Grade Students in the Room

	Math	*Reading*
# in classroom	-0.326	-0.148

The whole group's conditional growth index for reading achievement was then analyzed to see if it had a similar relationship as mathematics achievement. Pearson's *r* was again computed to determine the relationship. This time the data showed that there was only a weak negative correlation (r= -.148) between the number of students and reading achievement for the whole group as shown in Table 3.

The schools were then separated into multigrade classrooms and single grade classrooms on an Excel spreadsheet. The separated schools were coded a 0 for the multigrade classrooms or 1 for the single grade classrooms to describe the class configurations. There were ten single grade classroom schools and twelve multigrade classroom schools who participated in the survey. This provided information from 273 third grade students. There were 199 students in single grade classrooms and 74 third grade students in the multigrade classroom.

The data was then analyzed by using point biserial correlation to determine whether there was a relationship between classroom arrangement and achievement scores

in mathematics and reading. The data analysis showed there was a very weak positive correlation (r_{pb} = 0.156) between multigrade classrooms and mathematics achievement. Table 4 shows the mathematics conditional growth index goes down for students in single grade classrooms.

Table 4
Correlation between Mathematics Achievement Scores and Type of Classroom

	Mathematics
Multigrade	0.156
Single Grade	-0.156

There were similar results when the conditional growth index scores were analyzed. The single grade classroom had a weak negative correlation. In other words, being in a multigrade classroom positively affected the reading conditional growth index but very weakly (r_{pb} = 0.159). Table 5 shows the relationship between the reading conditional growth index and the classroom arrangement.

Table 5
Correlation between Reading Achievement Scores and Type of Classroom

	Reading
Multigrade	0.159
Single Grade	-0.159

Another way to interpret the relationship is through the coefficient of determination. This determines the extent to which type of classroom accounted for variations in conditional growth index for mathematics and reading. 2.56% of the variance in conditional growth index scores in mathematics can be explained by the type of classroom. Similarly, 2.52% of the variance for the reading scores can be explained by

the type of classroom. The coefficient of determination shows there are many other factors influencing student achievement scores.

Summary

This study was conducted to determine the relationship between achievement scores in mathematics and reading and classroom type of third-grade students in WELS elementary schools. The study also looked for a relationship between the third-grade size and the achievement scores. Of course, there could be several other factors that could influence the scores and it is important to remember this study only had a small sample size. Based on the results from the schools in the sample data, there was a negative relationship in achievement. Overall, schools with more students in the third-grade class had a lower conditional growth index in both mathematics and reading. The schools with students in a multigrade, third-grade classroom also had higher achievement scores in mathematics and reading when comparing multigrade and single grade classrooms.

Chapter V: Summary, Conclusions, and Recommendations

Introduction

This study sought to determine whether there was a relationship between achievement in mathematics and reading and the multigrade classroom. The specific research questions were:

1. What is the relationship between reading and mathematics achievement scores and third-grade class size in WELS schools?

2. What is the relationship between reading and mathematics achievement scores and the type of classroom (single-grade verses multigrade) for third-graders in WELS schools?

Principals in WELS elementary schools were sent Google Form survey to gather information from the MAP Growth test scores. The principals reported the conditional growth index for Mathematics and Reading of third-grade students. The principals also were asked to report the third-grade class size and grade arrangement in the classroom.

Summary of the Results

The Google Form survey was computed into an Excel spreadsheet to calculate the number of schools who participated, the number of students, the grade configurations, and the class size of third-grade students. There were only twelve multigrade classrooms and ten single grade classrooms that participated in the survey. This was only a 12.94% response rate. The multigrade classrooms provided information for 74 third grade students. The single grade classroom students were more than double the multigrade at 199 students. The variance in students also impacted the number of students in the

classroom. The single grade classrooms had more students in the rooms than the multigrade classrooms.

Pearson's *r* was calculated to determine if there is a relationship between achievement and third-grade class size. A weak negative relationship was found between mathematics and reading achievement and class of third-grade students size. Overall, schools with more students in the classroom had a lower conditional growth index in both mathematics and reading. Based on the data obtained, classrooms with more students present had a weak negative relationship with both mathematics and reading achievement.

Similar results were found when the point biserial correlation coefficient was analyzed. Again, a weak negative relationship was found between the two. The students in the multigrade classroom also had higher achievement conditional growth index scores in mathematics and reading when compared to the students in the single grade classrooms.

Conclusions

This study examined the relationship between third-grade class size, classroom type (multigrade versus single grade classrooms), and academic achievement in third-grade students. The participants in this study were 273 third grade students from 22 elementary schools in the Wisconsin Evangelical Lutheran Synod across the United States. The principals reported mathematics and reading conditional growth index scores from the MAP Growth scores along with information concerning the number of third-grade students in the classroom and the type of classroom. The data were analyzed using point biserial correlation. The correlation coefficient was also used to calculate the

coefficient of determination. There was a weak negative correlation between achievement in mathematics and reading and classroom type. However, there was a moderate negative relationship between the number of third-graders in the classroom and mathematics achievement but only a weak negative relationship between reading achievement scores and the number of third-grade students in a classroom. The findings of this study are what one would expect when comparing the multigrade to single grade classrooms and small classes to large classes of third graders. The study generated similar results between the two because single-grade classrooms usually have larger numbers of third graders in the room than a multigrade classroom.

The findings from this study were consistent with the literature reviewed regarding private schools around the world. The smaller multigrade classrooms had a higher growth rate in achievement than the single-grade classrooms. The findings from this study were not consistent with the literature review regarding public school studies stating that single grade classrooms performed better than the multigrade classrooms.

Recommendations

This study was limited by a low response rate. 170 schools were contacted to participate in the study and only 31 principals responded. However, only 22 of the schools could participate in the survey. This is a response rate of only 12.94%. The other eight had different situations which prevented them from participating, such as, no third-grade students, did not test in the time frame, or did not have time to fill out the survey. It would be beneficial to make another attempt at gathering information from our schools. Participation may have been higher if the principals were contacted during the summer rather than the middle of the school year.

The study found there was a weak negative relationship between achievement scores and grade arrangements. This relationship might have been different if there was a higher participation rate. The scores were skewed due to having double the number of scores for students in single-grade classrooms as for students in multigrade classrooms. However, the study did have similar results to several other studies done in private schools across the world. The results were different than information in the studies of public schools.

The results of this study were in line with studies of public and private school class size. This study also found a negative correlation between achievement scores and the number of third-grade students in the classroom. This study also found students' mathematics and reading scores were lower than students' scores in smaller third-grade class size.

Further research is recommended to give a clearer understanding of the relationship between multigrade classrooms and mathematics and reading achievement. There could be several other factors that could influence the relationships found in this study. Researchers could study the amount of time spent in the classroom teaching mathematics and reading. The teaching style and curriculum could also be factors when determining students' growth and achievement. Other factors could be the implementation of MAP Skills Navigator which is a program used to individualize instruction based on MAP Growth scores to improve future performances.

In conclusion, this study showed that a smaller number of third-grade students in the classroom and multigrade classrooms have a slightly more positive effect on students' conditional growth index scores than larger single-grade classrooms. Obtaining more data

from schools and doing further research could help paint a clearer picture in the relationship between achievement scores and multigrade classrooms in the WELS elementary schools.

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Appendix A: Survey Questions

1. What is the conditional growth index in mathematics on the spring MAP tests for each of the third-grade students in your school from the 2017-2018 school year?
2. What is the conditional growth index in reading on the spring MAP tests for each of the third-grade students in the school from 2017-2018 school year?
3. How many students were in the third grade at the time the tests were taken?
4. How many students were in the classroom at the time the tests were taken?
5. What was the grade arrangement in the classroom with the third-grade students?
    a. Third Grade Only
    b. First through Third Grade
    c. Second and Third Grade
    d. Third and Fourth Grade
    e. Second through Fourth Grade
    f. Third through Fifth Grade
    g. Other: _____