

RUNNING HEAD: Implementing Numbers and Math Curriculum

Implementing Numbers and Math Curriculum by Learning Without Tears

by

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Abstract

This study evaluated the Numbers and Math Curriculum published by Learning Without Tears in the setting of the combined 3K-4K classroom of St. Peter's Lutheran Tiny Treasures Preschool, Mishicot, Wisconsin. The purpose of this study was to determine the curriculum's compatibility with the Wisconsin Model Early Learning Standards, developmental appropriateness, and its effectiveness on student learning. Participants were six students in the combined 3K-4K classroom aged three-to-five-years-old during the study. The curriculum was taught the first eighteen weeks of school. Student learning was evaluated quantitatively using the assessment instrument included in the Numbers and Mathematics curriculum and the Brigance Inventory of Early Development III, Early Childhood Edition. Qualitative data was gathered through a parent survey to determine stakeholder satisfaction with the curriculum.

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I thank my loving God for calling me to share the Good News of His love with His little lambs. I thank Him for hearing my prayers, giving me all my abilities, and calming my doubts. I am humbled that He allows this jar of clay the precious privilege to serve Him and His precious lambs. I pray for His guidance so I may use all I have learned to give Him all glory. I can do nothing without Him.

To God be the glory!

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Chapter One: Introduction

The Purpose of the Project

Preschool children use math. Their statements and questions during the school day demonstrate their God-given ability to use math. They proudly state, “I’m four!” as they hold up four fingers. They ask, “When do we eat?” They compare snacks, saying, “She has more crackers than me.” However, they don’t always use math concepts correctly. They may grab a group of five objects, count them, and say, “There’s ten!” They seat three dolls at the table but set six plates and four glasses. They say, “I’m 48 tall,” but can’t understand what exactly that means. Their little minds are developing key number and math concepts they will use the rest of their earthly lives (Watts, Duncan, Clements & Sarama, 2018). A preschool math curriculum develops these God-given abilities through developmentally appropriate methods. This project introduced a math curriculum, Numbers and Math, whose effectiveness was evaluated.

Importance of the Project

St. Peter’s Lutheran Tiny Treasures Preschool became a stand-alone preschool on 2011 when the congregation closed its elementary school. Students were few. Budgets were small and tight. No math curriculum was in place, and funds did not exist to purchase one. Therefore, the teacher developed the math curriculum based upon the Wisconsin Model Early Learning Standards. This curriculum included basic math components: number skills, counting, grouping, classification, one-to-one correspondence, seriation, shapes, time, measurement, graphing, and patterns. The curriculum was evaluated yearly and adjusted as necessary. Most importantly, it adapted to individual student needs in the 3K-4K combined classroom. Additionally, it helped the

teacher in a school with flexible scheduling where parents could send their children two to five days per week.

However, several concerns surfaced which required implementing a published curriculum. The first concern was the need for a succession plan should the preschool change teachers. A second concern was a substitute teacher's ease in implementing a curriculum during a classroom teacher's extended absence. Implementing a published curriculum would address these concerns.

A third concern regarded the transition and education of students after they left Tiny Treasures. Students transfer to one of several area public or parochial schools after their time at Tiny Treasures. The overwhelming majority of these schools have adopted the Learning Without Tears curricular materials for handwriting and math. The handwriting curriculum has been used in Tiny Treasures for five years, and students experience great success during their preschool years and easily transition to their next school. Adopting the math curriculum would familiarize students with the curriculum overall goals and methods, easing their entrance into a new school setting.

A fourth concern regarded the stakeholders' understanding of the curriculum in their school. Parents, school board members, church council members, and congregation members have been very supportive of their preschool and the quality of education their school provides. This is supported by surveys, consultations, and discussions. However, individuals, especially parents looking for information prior to enrollment, have difficulty understanding the math curriculum without a lengthy explanation. Learning Without Tears has a web site where parents can find information about the program and suggestions for promoting math skills at home. This information could give parents more security in discovering specifically what their children are learning in preschool.

The Numbers and Math curriculum addresses these four concerns for St. Peter's Lutheran Tiny Treasures Preschool students. A study of the Numbers and Math curriculum could indicate appropriateness for implementation by other Lutheran preschools.

Project Goal

Implementing a curriculum simply because other schools use it or to make the teacher's job easier is not a good enough reason to risk financial resources or the impact on student learning. This curriculum project studied the effectiveness of the Numbers and Math curriculum (Olsen & Knapton, 2011) published by Learning Without Tears in the combined 3K-4K classroom at Tiny Treasures. The curriculum's effectiveness was determined by measuring student achievement during the semester. The evaluation of collected data determined if the curriculum follows Wisconsin Model Early Learning Standards (2013) and is developmentally appropriate for preschool students at St. Peter's Lutheran Tiny Treasures Preschool.

Chapter Two: Literature Review

Introduction

Math instruction in the preschool years has gained importance. Studies indicate that math knowledge gained during the preschool years is an indicator of overall achievement in the elementary years (Carbonneau & Marley, 2015; Moomaw, 2013). What constitutes effective preschool math instruction? What should a preschool math curriculum include? Literature provides answers as to the content and methodology which should be used to instruct God's little ones about the wonders of numbers and math. However, literature specific to the Learning Without Tears Numbers and Math curriculum is limited to that provided by the publisher. Therefore, an examination of learning theories, methods, and content of a preschool mathematics curriculum was compared with the Learning Without Tears curriculum materials.

Learning Theories

God gives each child individual gifts and abilities he or she brings into the preschool classroom. However, research demonstrates commonalities among young children which any curriculum must embrace and reflect in any learning strategies. An examination of prevalent learning theories gives insights into what a curriculum should use as the basis for optimum student achievement.

Piaget stated children pass through stages as they develop, and preschool children are in the preoperational stage of development (Copple & Bredekamp, 2009). Children in this stage are working on a concrete level, learn best when attending to one task at a time, and yet are beginning to understand basic abstract concepts of time, age, and space (Copple & Bredekamp, 2009). Brunner also defined a "course of intellectual development" that placed preschool children in the "enactive" level (Gallenstein, 2005).

This is also a concrete level of understanding where children use manipulatives as they learn. Bruner also believed in discovery learning, where children learn through self discovery (Follari, 2015). Vygotsky promoted teaching children concepts just above the child's full level of understanding with the instructor's guidance, called the "zone of proximal development" (Follari, 2015; Moomaw, 2013). Teachers build upon each child's knowledge and offer assistance to encourage student learning, a process called "scaffolding" (Brenneman, Stevenson-Boyd, & Frede, 2009; Follari, 2015).

Bronfenbrenner introduced the importance of a child's environment into learning, believing both the home and community influence development and learning (Follari, 2015).

A math curriculum for preschool children must respect and embrace learning theories in its development and presentation. Olsen and Knapton (2011) based the Numbers and Math curriculum on developmental stages, employing Piaget's and Brunner's concrete stage of learning. Manipulatives and "hands on materials" (Olsen & Knapton, 2011, p. 4) are part of every lesson. Opportunities for discovery learning as proposed by Brunner are included with methods and suggestions which allow children to explore and develop through extended learning experiences. Olsen and Knapton (2011) stated lessons are based on "developmental progression that builds on what children already know" (p.4). Lessons build on previous knowledge and offer suggestions instructors may use to scaffold student learning. Connections between home and school reflect Bronfenbrenner's theory of the child's total environment effect on learning. The Numbers and Math curriculum includes parents as an active participant in their child's learning (Olsen & Knapton, 2011). Students are encouraged to bring learning materials home to enjoy with parents, bring items from home to use in school activities, and share

family experiences. These examples demonstrate the Numbers and Math curriculum is based on and employs established learning theories of preschool child education.

Methods

The structure and methodology to teach preschool students are very different than in the elementary classroom. Any instruction in the classroom should be based on theories of child learning and development. The National Association for the Education of Young Children developed a position statement concerning what is termed “developmentally appropriate practice” (Copple & Bredekamp, 2009, p. 1). Critical elements in developmentally appropriate practice include “knowledge of how children learn and develop”, using “teaching practices appropriate to children’s age and developmental status, attuned to them as unique individuals, and responsive to the social and cultural contexts in which they live” (Copple & Bredekamp, 2009, p. xii). Lessons should include teacher-guided and student-guided instruction using play as the primary means for instruction (Copple & Bredekamp, 2009; Follari, 2015; Ginsburg, Lee & Boyd, 2008; Koralek, 2007, Whyte & Bull, 2008). Lessons must also meet individual student needs (Starkey & DeFlorio, 2013). The Numbers and Math curriculum uses a variety of methods including explicit instruction, student discovery, and play-based learning adapted to individual student needs (Olsen & Knapton, 2011).

Assessment is a necessary tool for the instructor to determine student knowledge and to plan effective instruction. Use of pencil and paper assessments similar to those used in elementary years is not developmentally appropriate in the preschool classroom. Assessments which are appropriate include developmental checklists, observations, student samples, student portfolios, anecdotal records, and student interviews (Follari, 2015; Gallenstein, 2005; Vanderheyden, Broussard, Fabre, Stanley, Legendre, &

Creppell, 2004). The Numbers and Math curriculum includes appropriate informal preschool assessments in the form of observations, review of student work, and records of student responses (Olsen & Knapton, 2011). The curriculum also includes a formal math assessment which can be administered in a ten minute timeframe and contains benchmarks for all content areas (Olsen & Knapton, 2011).

Content

The Wisconsin Model Early Learning Standards (2013) contain mathematics as part of the cognitive learning standards. The National Council of Teachers of Mathematics (2000) also includes standards for preschool students. Both include five content areas for the study of preschool mathematics: numbers and operations, algebra, geometry, measurement, and data representation and probability. Numbers and operations include one-to-one correspondence, stable order, number sense and counting, and cardinality. Charlesworth and Lind (2010) described one-to-one correspondence as the understanding that one group has the same number of objects as another group, serving as a precursor for counting objects. Number sense and counting include rote counting, understanding the number system, and using numerals to label group quantities (Brendefur, Strother, Thiede, Lane, & Surges-Prokop, 2013; Charlesworth & Lind, 2010; Frye, Baroody, Bruchinal, Carver, Jordan, & McDowell, 2013; Hinton, 2016; Moomaw, 2013). Moomaw (2013) described stable order as the understanding that counting begins with one and progresses in an established order. Cardinality refers to the understanding that the last number named in a group tells the total for the group (Charlesworth & Lind, 2010). The Numbers and Math curriculum demonstrates understanding and inclusion of this content area with use of manipulatives, realistic objects, and games to develop skills

and understanding (Olsen & Knapton, 2011). In addition, the Numbers and Math curriculum (Olsen & Knapton, 2011) incorporates higher level skills such as problem solving and reasoning as part of the lessons.

Algebra may not be a content area one associates with preschool student learning. However, preschool students can begin the thinking and reasoning process about relationships foundational to algebraic learning (Brenneman et al., 2009). Numbers and Math includes this content area whereby children identify and create patterns as well as sort objects according to specific characteristics and common attributes (Olsen & Knapton, 2011).

Geometry for the preschool child includes identifying basic shapes and spatial relationships. The understanding of shapes in a preschool geometry curriculum includes shape recognition, shape characteristics, and comparison (Frye et al., 2013). Knowledge in spatial relationships includes understanding position, direction and distance (Charlesworth & Lind, 2010; Frye et al., 2013). The Numbers and Math curriculum (Olsen & Knapton, 2011) develops student learning using shape manipulatives to explore basic shapes in God's world. Understanding of spatial relationships is promoted in the classroom with games, songs, and activities and further developed with applications in the child's indoor and outdoor environment (Olsen & Knapton, 2011).

Measurement for the preschool child includes comparisons of volume, weight, length, and temperature (Charlesworth & Lind, 2010; Henninger, 2009).

Developmentally appropriate activities require use of non-standard measurements such as blocks, index cards, and paper clips as initial measuring tools (Henninger, 2009).

Students can compare objects with descriptive words including heavier, taller, longer, and shorter (Brendefur, et al., 2013). Charlesworth and Lind (2010) describe three aspects to

instruction about time: “sequence”, “duration”, and “cultural time” (p. 270). Sequence relates to the order of events where duration concerns the length of an event. Cultural time refers to vocabulary understanding and using terms in the child’s environment and culture which measure time such as day, month, year, calendar, morning, today, tomorrow, early, and late (Charlesworth & Lind, 2010). Olsen and Knapton (2011) include measurement in the curriculum, defining measurement as “determining the size or amount of something” (p. 9). Children use non-standard units to measure and compare objects plus learn time vocabulary in terms of what is happening in their lives (Olsen and Knapton, 2011).

The final content area is data representation and probability. The preschool curriculum includes graphing in this content area where students use and construct simple graphs to represent data and promote discussion (Charlesworth & Lind, 2010). Pictures, blocks, stickers, and other items can be used by preschool students to visualize information they collected (Frye, et al., 2013; Charlesworth & Lind, 2010). The Numbers and Math curriculum include graphs as a means of data representation and for discussion (Olsen & Knapton, 2011). Objects and pictographs are used so students may answer questions about their world. Real-world events, such as predicting clothing to wear according to weather conditions, allow students to explore basic probability and prediction skills (Olsen & Knapton, 2011).

Suitability of Numbers and Math Curriculum

Specific studies of the Numbers and Math curriculum were not found for this literature review. However, several studies have been conducted regarding another curriculum developed by Olsen and Knapton, The Readiness and Writing curriculum (Olsen & Knapton, 2010). Research by LeBrun, McLaughlin, Derby and McKenzie

(2012) concluded that the Readiness and Writing curriculum (Olsen & Knapton, 2010) is effective in teaching students with varying academic abilities to write. Roberts, Derkach-Ferguson, Siever and Rose (2014) concluded the structured nature of the instruction including direct teacher instruction and interaction is effective in improving the quality of student printing skills.

The Numbers and Math curriculum includes Wisconsin Model Early Learning Standards math content and uses a multisensory approach for instruction. The Numbers and Math curriculum is a “natural extension” (Olsen & Knapton, 2011, p. 7) of the Readiness and Writing handwriting curriculum. The effectiveness of the handwriting curriculum plus the review of the methods and content of the Numbers and Math curriculum indicate it may be effective in increasing preschool student math achievement. However, the lack of literature regarding Learning Without Tears Numbers and Math curriculum required a curriculum study using evaluation processes.

Chapter Three: Implementation

Project Development

The Numbers and Math preschool curriculum published by Learning Without Tears (Olsen and Knapton, 2011) was used in the combined 3K-4K classroom at St. Peter's Lutheran Tiny Treasures Preschool. The instructor, who is also the researcher for this study, attended a one-day training session conducted by Learning Without Tears prior to curriculum implementation. The training session ensured the instructor was familiar with the curriculum methods, materials, and assessments. The instructor trained the classroom teacher aide so that she could oversee student activities as part of instruction.

The Numbers and Math curriculum was reviewed to ensure instruction meets Wisconsin Model Early Learning Standards (2013) for mathematics. Materials and manipulatives necessary for curriculum implementation and instruction were purchased prior to the beginning of the school year. Items purchased included I Know My Numbers booklets; 4 Squares More Squares; Tag Bags; Touch and Flip Cards; Sing, Sound, and Count with Me CD; and Mix and Make Shapes (Olsen and Knapton, 2011, p. 16). Existing classroom materials were included in instruction per the curriculum. These items included but are not limited to a math center area with tables and chairs, sand and water table, easel, number and shape posters, cups, bottle caps, buttons, shape puzzle pieces, scarves, animal counters, shoe boxes, and hoops. Teacher-made games and activities were created by the instructor and teacher aide per the curriculum.

Curriculum Implementation

The students attending St. Peter's Lutheran Tiny Treasures Preschool were the participants in the study per parental approval. The classroom is a combined 3K-4K room with six total students. The 3K class consisted of three children, two girls and one boy, in their first year of schooling. The students were three-years-old at the start of the school year, and celebrated their fourth birthday during the study. The 4K class consisted of three children, two girls and one boy, all of whom attended Tiny Treasures during their 3K year of school. All three 4K children were four-years-old at the beginning of the study, and two celebrated their fifth birthdays during the study. All participants were white English-speaking children who either lived in the village of Mishicot, Wisconsin, or the neighboring rural area. No participants were diagnosed with learning challenges before or during the study.

Parents have a vested interest in the education of their children not only in their God-given role as parents but also as stakeholders in Tiny Treasures. As such, they need an understanding of the curriculum and study before permitting their child to participate. Parents were educated about the new math curriculum during the registration meeting prior to the beginning of the new school year. Each parent signed a consent form permitting their child's participation and use of assessment scores (unless a court order forbids one parent from doing so). Individual child names are not revealed before, during or after this study. The school-home connections included in the curriculum were used to keep parents informed and encourage participation in their child's learning. Students were allowed to take games home per curriculum guidelines. Parents were given the website URL included in curricular materials to find information about the curriculum and to use suggestions at home. The curriculum and parent opinions were discussed

during first and second quarter parent-teacher consultations. Each parent completed a survey at the conclusion of the study.

The curriculum was implemented at the beginning of the school year and was conducted over eighteen weeks. Content areas included numbers and operations, geometry, algebra, data representation, and measurement. Lessons were scheduled and conducted as described in the manual. Students were divided into two groups according to grade for instruction. A lesson was taught each day for ten minutes per group using methods and materials prescribed in the manual. Students in each group were taught in individual, pairs, small groups, or whole groups per recommendations in each lesson. Materials and activities from each lesson were placed in the math center for center and free play time during the school day. Instructor observations of each student were used to determine student learning and lesson instruction per procedures in the manual.

Assessment Plan

Three separate quantitative and qualitative assessments were collected during the study to determine student learning and effectiveness of the curriculum. Quantitative data included a pretest given the first week of school using the Math Assessment as part of the Learning Without Tears math curriculum. This tool assessed the five concepts included in the curriculum. The pretest was administered by the classroom instructor for a period of ten minutes per child. Each pretest was scored by the classroom instructor and an instructor from a neighboring school using a rubric contained in the curriculum. This procedure was used to exclude researcher bias. The scores were averaged to compute a baseline score for each student. The same Math Assessment was administered and scored as a posttest during the eighteenth week of the study using the identical procedure as the pretest.

The Brigance Inventory of Early Development III, Early Childhood Edition was a second quantitative assessment administered during the eighteen weeks of the study. This standards-based assessment was administered per assessment instructions that use teacher observations during the eighteen weeks of the study. Each student was observed a minimum of once per week. This tool, which is independent from the Numbers and Math curriculum materials, provided additional quantitative data to verify curriculum effectiveness on student achievement.

Qualitative data consisted of a parent survey distributed week eighteen of the study. A Likert-type scale and open-ended questions were used to determine parental satisfaction with the curriculum and offer suggestions for improvement. Surveys were anonymous to encourage openness with answers.

Data Analysis

The math assessment data from each child's pretest and week eighteen assessment were analyzed to determine any significant increase in student knowledge during the study. A paired t-test was completed to determine statistically significant results. Results of the Brigance Inventory were analyzed in a similar fashion for each child. Results demonstrate any increased student achievement produced by the curriculum during the semester.

The parent survey was analyzed to discover opinions of stakeholders regarding the curriculum. A pivot table was used to analyze this data. Open-ended comments were read and themes that emerged were noted. Comments were organized by theme to get a sense of each theme's importance.

Limitations of the Design

The small sample size limited the design. Therefore, results may not generalize to other schools and classrooms. A small parent survey response also limited the effectiveness of the analysis. However, completing the study of the Numbers and Math curriculum allowed the instructor to make any necessary adjustments or enhancements to benefit the students of St. Peter's Lutheran Tiny Treasures Preschool.

Result

The Numbers and Math curriculum must first comply with Wisconsin Model Early Learning Standards (Wisconsin Department of Children and Families, 2013) in mathematics. A review of the lessons revealed a minimum of one standard is met in every lesson. Table 1 (page 22) lists examples from lessons and their correlation to specific standards.

Two quantitative assessments measured student learning during the eighteen weeks of curriculum implementation. The first quantitative assessment tool was the Numbers and Math Assessment Record included in the Numbers and Math Curriculum (Olsen and Knapton, 2013). A total of forty-four possible points in the areas of counting, number recognition, simple addition, position, ordinal numbers, measurement, and shape recognition were included in the assessment. The researcher conducted the assessment as a pretest the first week of the semester and as a posttest the eighteenth week of the semester per the implementation plan. Assessments were scored by the researcher and a teacher from a neighboring school to avoid researcher bias. The teacher uses the Numbers and Math Curriculum in her preschool classroom. The researcher's and teacher's scores

were in 98% agreement. Scores were averaged to obtain the percentage correct. Table 2 (page 23) lists the assessment results.

Table 1

Wisconsin Model Early Learning Standards and Numbers and Math Curriculum

Mathematics Standard	Curriculum Examples
B.EL.1 Demonstrates Understanding of numbers and counting	<ul style="list-style-type: none"> • Uses fingers to show age • sets table for dolls with one plate, cup, fork, and knife • counts a given set of manipulatives • makes set of manipulatives when shown a number card • traces numerals in number booklet counts by rote to 5, 10, or 20
B.EL.2 Understands number operations and relationships	<ul style="list-style-type: none"> • compares Tag Bag groups to find more and less • combines two sets of Tag Bags to tell how many in total • Uses more, less, greater, fewer when comparing groups of manipulatives
B.EL.3 Explores, recognizes, and describes shapes and spatial relationships	<ul style="list-style-type: none"> • Place classroom items through hole in box • Sort shapes by size, number of sides, curves • Matches large and small shapes • 4 Squares More Squares pieces used to compose larger squares and rectangles
B.EL.4 Uses the attributes of objects for comparison and patterning	<ul style="list-style-type: none"> • Sorts shapes by one or more attributes • Uses position words: top, bottom, below, over, under, beside, behind, in front • Completes and/or extends AB pattern • Creates original pattern • Identifies one object which does not belong in a group
B.EL.5 Understands the concept of measurement	<ul style="list-style-type: none"> • Orders objects by size • Compares towers by height and length • Uses balance to determine which objects are heavy or light • Uses index cards to measure table
B.EL.6 Collects, describes, and records information using all senses	<ul style="list-style-type: none"> • Uses and describes pictograph of favorite pets • Groups children according to similar attributes • Completes graph showing colored fish crackers

Student	Pretest Student Age (Years.Months)	Pretest Percentage correct	Posttest Student Age (Years.Months)	Posttest Percentage Correct	Percentage change
A	4.11	73	5.3	96	+31
B	4.10	75	5.2	91	+25
C	4.2	66	4.6	71	+7
D	3.11	57	4.3	71	+24
E	3.8	39	4.0	53	+36
F	3.9	50	4.1	87	+73

A paired sample T-test was used where $t(5)=6.531$, $p=0.001$ that demonstrated the average mean increase is significant. All students showed an increase in scores, and most had a substantial percentage increase. The researcher noted Student C stated she felt “sick” during the week eighteen assessment, which may have influenced that score. However, the assessment results demonstrate an increase in student learning using the Numbers and Math curriculum as prescribed in the curriculum’s teacher manual.

The Brigance Inventory of Early Development III, Early Childhood Edition was used to verify student achievement and to avoid potential bias when using an instrument created as part of a curriculum. The inventory consisted of evaluation in weeks one and eighteen plus observations a minimum of once a week during the semester. Students are assessed by completing tasks six months below age level and proceeding until a mistake occurs. An age equivalent is obtained according to the completed tasks. Table 3a and Table 3b (page 24) give the results of this assessment.

Table 3a				
<i>Brigance Inventory of Early Development III Age Equivalents (Week 1/Week 18)</i>				
Student	Student Age	Number Concepts	Counts by Rote	Compares Different Amounts
A	4.11/5.3	5.0/6.0	3.0/5.6	6.0/7.0
B	4.10/5.2	3.0/4.0	3.0/5.0	5.0/7.0
C	4.2/4.6	3.0/4.0	3.0/4.0	4.0/7.0
D	3.11/4.3	3.0/4.0	3.0/4.0	4.0/7.0
E	3.8/4.0	3.0/3.0	3.0/3.5	3.0/7.0
F	3.9/4.1	2.6/5.0	3.0/5.6	3.0/4.0

Table 3b				
<i>Brigance Inventory of Early Development III Age equivalents (Week 1/Week 18)</i>				
Student	Student Age	Identifies Shapes	Sorts Objects (Size, Color, Shape)	Recognizes Quantities
A	4.11/5.3	5.0/6.6	5.0/6.0	4.0/5.6
B	4.10/5.2	5.0/6.6	5.0/6.0	4.0/5.6
C	4.2/4.6	4.0/6.6	5.0/6.0	4.0/5.0
D	3.11/4.3	4.6/6.6	5.0/6.0	4.0/4.0
E	3.8/4.0	3.8/6.0	3.0/6.0	4.0/5.0
F	3.9/4.1	4.6/6.6	5.0/6.0	4.0/5.6

The data indicate that overall student achievement did increase over the eighteen week period. Three students' age equivalent scores in a minimum of three areas were above their actual age in the eighteenth week. The greatest areas of achievement were comparing amounts, identifying shapes and sorting objects. This tool did not assess every area of the curriculum; however it does validate the results of the Numbers and Mathematics assessment tool increase in student learning.

Qualitative data consisted of a survey distributed to each parent in the eighteenth week of the study. A total of 12 responses were gathered, a 100% return percentage. Respondents gave an answer ranging from strongly agree to strongly disagree for each of the first six questions. Responses were changed into numerical scores ranging from one

for strongly disagree to five for strongly agree. Question one received twelve strongly agree responses indicating all parents feel that math instruction is important for their preschool child. Questions two and three received twelve strongly agree responses which indicate the parents felt they were well informed by the teacher regarding both the curriculum and the participation of their child in the study. Question four received twelve strongly agree responses which indicated the parents felt their child enjoyed the activities and games which were used in the curriculum. Question five received ten strongly agree and two agree responses which indicate the parents felt the curriculum activities the teacher sent home to connect the home and school were helpful. Question six received eight strongly agree, two agree, and two neutral responses regarding the helpfulness of online materials provided by the curriculum. The two neutral responses noted that online sources were not used.

Questions seven and eight requested parents offer opinions regarding their preferences and suggestions for improvement in the Numbers and Math curriculum. Themes which emerged from these open-ended responses are included in Table 4 (page 26).

The comments reflect parental satisfaction with the age appropriateness of the curriculum, and especially the use of games and activities it uses to teach the concepts. This agrees with results of question four. The one area which the instructor will need to consider is the availability of online access and how to compensate. Overall, the parent survey indicated shareholder satisfaction with the Numbers and Math curriculum.

Table 4	
<i>Math Curriculum Parent Survey Open Ended Question Themes</i>	
7. Explain one or two items liked best about the Numbers and Math curriculum.	<p>A. Comments regarding games and activities in curriculum</p> <ul style="list-style-type: none"> - I liked all the games sent home. - Enjoyed playing the activities with my child. - My child liked sharing what he/she learned when we played the games. - Games are an excellent way for preschool children to learn. <p>B. Age appropriateness</p> <ul style="list-style-type: none"> - Appropriate to age and attention span of three-and-four-year-olds - Games and activities are an excellent way for preschool children to learn.
8. Suggest improvements or changes regarding the math curriculum.	<p>Pleased with curriculum</p> <ul style="list-style-type: none"> - No suggestions; like the program. - I have not noticed any changes that could be made. - I am extremely pleased with the program and my child's progress.

Chapter Four: Reflective Essay

Introduction

Finding an appropriate preschool math curriculum for St. Peter's Lutheran Tiny Treasures Preschool was the goal of this study. The selected curriculum must meet several criteria for Tiny Treasures. The curriculum must serve not only the current teacher but be in place should a new teacher be called to serve or should a substitute teacher serve during an extended absence by the current classroom teacher. Equipping students for their transition to kindergarten in a neighboring parochial or public school is another consideration. Stakeholders of Tiny Treasures, especially parents, must have confidence in the curriculum which guides their child's learning. However, these goals are secondary to the primary purpose of a math curriculum, namely improving student learning and achievement through developmentally appropriate methods. The Numbers and Math curriculum was selected to meet these needs and was evaluated according to these criteria.

Conclusions

The Numbers and Math curriculum was found to be appropriate for use at Tiny Treasures. Information from the leader of a curriculum workshop by the publisher recommended using a prescribed sequence of lessons that teaches each lesson over one or two days, but does not present material in topical order. For example, a week's lessons may include shapes, numerals, and graphing. The researcher found this procedure a challenge with the flexible scheduling used at Tiny Treasures. Planning lessons so that all students received instruction in all topics for the week required creative thinking and planning, but was possible, though not the researcher's preferred method.

Materials and manipulatives for lessons were available for purchase at reasonable cost. Additional teacher made materials, including games and manipulatives suggested in the lessons, supplemented the lesson plan. The use of purchased and teacher-constructed materials aided in preparation for lessons. A substitute teacher who taught during the study found the manual and materials very easy to use and understand, fulfilling another concern for establishing a curriculum.

Methods for presenting lessons were developmentally appropriate for three-and-four-year-old-children. Each lesson was taught within a ten minute time frame. Lessons are conducted in whole group, small group, pairs, or individual instruction. Discovery and direct instruction methods are used in lessons. Suggestions for assisting students are helpful and appropriate. Materials for lessons were placed in the classroom math learning center, where students selected activities during both center and free play times. However, the curriculum lacked instruction regarding the concept of zero. The classroom teacher will need to independently supplement instruction in this area.

The curriculum met concerns regarding stakeholders' understanding of a math curriculum in school. Online resources were helpful for parents to discover information about the curriculum in general and find activities to use at home. Parents particularly liked the games and activities, and that the students were able to bring them home to enjoy with their parents made an impression. The lack of comments suggesting improvements from the parent survey indicated satisfaction with the curriculum.

The primary concern in using a math curriculum was the improvement in student learning. The increase in student learning is apparent and striking in areas of numbers and counting. While all students improved, one student had a single digit percentage increase in the Numbers and Math assessment and two students tested below age level in areas of

the Brigance assessment. However, the instructor used the information to make these areas goals for each student. The instructor will use methods in addition to the curriculum materials to assist students in these areas.

Academic achievement was not the only measure of effectiveness noted by the researcher. Observations of students during center and free play noted students transferring their knowledge from the lessons to other activities. Students counted blocks as they built towers. Children found circles, squares, and rectangles in the classroom. They used one-to-one correspondence as they set the play table for a tea party. They noted positions as they placed chairs beside or behind another as they made their bus for a trip. They determined which cup holds more sand, and which bag of buttons weighs more. Children noted who was first, second, or sixth in line. Individuals sorted fruit snacks by color or shape and compared groups. Math instruction was not limited to class activities; they took God's gift of mathematics and applied it to their real-world experiences. They made math part of their lives.

Recommendations

Recommendation One: Participate in curriculum-sponsored training. This training allows instructors and administrators to obtain first hand information regarding the curriculum. Participants may ask questions specific to their students and school to gain insight into the curriculum's suitability. An added benefit is the availability of discounts toward purchase.

Recommendation Two: Present lessons as complete units. The researcher found the curriculum's prescribed method to present lessons of several topics during the

week to be challenging due to flexible scheduling. Presenting one topic per week may allow students to further improve learning with this different approach.

Recommendation Three: Supplement curriculum with additional resources.

Students requiring further instruction and practice may benefit from other methods and materials in addition to those included in the curriculum. Specifically, instruction on the numerical concept of zero should be a supplement.

Recommendation Four: Conduct study for a complete school year.

Every area of the curriculum was not fully taught during the eighteen week study. Assessment and analysis at the end of the school year, or thirty-six weeks, would give a complete picture of student achievement using this curriculum.

Recommendation Five: Conduct a study with a larger sample size.

This study used a very small sample size. Therefore, the results may not transfer to other school populations. Further research with a larger sample size would provide a more accurate evaluation of the curriculum's effectiveness.

This study helped the researcher gather information regarding the Numbers and Math curriculum. The materials are usable. The content is developmentally appropriate. The students enjoy using the materials. The stakeholders are pleased with student progress. And, student learning increased. This curriculum is an appropriate tool to teach students at St. Peter's Lutheran Tiny Treasures Preschool the wonder of God's gift of math and numbers. May He bless the teachers and students who use this curriculum.

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Appendix A:

St. Peter's Lutheran Tiny Treasures Preschool
325 Randolph Street
Mishicot, WI 54220
(920)-755-4555
ltinytreasures@yahoo.com

Curriculum Study Consent Form

I am informed that my child's instructor, Mrs. Lynn M. Jungen, is conducting a study of the Numbers and Math curriculum in my child's classroom at St. Peter's Lutheran Tiny Treasures Preschool. This study is part of her work in the Martin Luther College Master's of Administration program. The study will be conducted the first eighteen weeks of the school year, September 4, 2019 through January 17, 2020.

Samples of my child's work will be collected as a part of this study and used for curriculum analysis. These samples will include:

- Assessments as part of the Numbers and Math curriculum consisting of ten minute activities. Assessments will be completed during weeks one and eighteen of the study.
- Student work samples collected throughout the eighteen week study.

My child's name will not be used at any time in any study reports. Assessment scores and student work samples will only be used as part of the statistical analysis in this report. All confidentiality policies of St. Peter's Lutheran Tiny Treasures Preschool as outlined in the Policy Manual will be followed at all times during the study.

I may remove my child from this study by my written notice at any time.

I give my consent to my child participating in this study with my signature below.

Father's Signature

Date

Mother's Signature

Date

Mrs. Lynn M. Jungen, Director and Teacher

Date

Appendix B:

St. Peter’s Lutheran Tiny Treasures Preschool
325 Randolph Street
Mishicot, WI 54220
(920)-755-4555
litinytreasures@yahoo.com

Math Curriculum Parent Survey

Your child has been a participant in a study of the Numbers and Math curriculum at St. Peter’s Lutheran Tiny Treasures Preschool. As part of the study, you are asked to complete the following survey and return to the box in the school hallway.

Thank you for your cooperation and assistance!

Please read each statement and circle the word or phrase that best describes your opinion about the statement.

1. I think that math instruction is very important in preschool.

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
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2. I was well informed about the Numbers and Math curriculum at the registration meeting.

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
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3. I was well informed about my child’s participation in the curriculum study.

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
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4. My child enjoyed the activities and games used as part of the curriculum.

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
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5. The home-school connection activities were helpful.

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
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6. The online materials and suggestions were helpful.

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
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7. Please explain one or two items you liked the best about the Numbers and Math curriculum. (Use back if needed.)

8. Please suggest one or two improvements or changes you would like to see regarding the math curriculum.
 (Use back if needed.)