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Early Childhood Math Strategies

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Northwestern College

An Action Research Project Presented

in Partial Fulfillment of the Requirements

For the Degree of Master of Education

Abstract

This action research was led by the researcher's interest in improving early learners' academic

mathematics achievement, specifically in oral counting, number identification, and counting 1:1

correspondence up to twenty, for targeted students. The researcher is in her 14th year of teaching,

but 3rd year as an Early Childhood Special Education teacher, where her own students

participated in a trial group intervention study. The four-week intervention was performed where

students engaged in mathematics practice with implementation of five instructional practices and

providing interactive engaging math games that specifically focused on skills including oral

counting, number identification, and 1:1 correspondence.   Throughout the four weeks, student

progress was monitored weekly by the researcher on each of these skills in mathematics. The

findings of this research reveal that this type of intervention and classroom support increases

student achievement in specific math skills including 93% in oral counting, 60% in number

identification, and 91% in counting 1:1 correspondence. Further research in implementing

different types of math strategies for math instruction and application, including various

interactive engaging math apps, in an early childhood setting to help students increase their

performance in this developmental area would be recommended in the future.

Keywords: early math interventions and strategies, close the gap, kindergarten readiness, student achievement

Table of Contents

Implementing different types of math strategies for math instruction and application in an early childhood setting to help students increase their performance in this developmental area

When considering development of math skills in early childhood, there is a reason for concern. Clark (2020) shared "in 2018, just 66% of disadvantaged children achieved at the least expected level of development for number at the end of the Early Years Foundation Stage compared to 82% of their peers" (Rittle-Johnson, 2017). When early learners or students at the primary level start falling behind compared to students' peers, they start to develop a gap between their success and their peers' success. The larger the gap is, the harder it is for a student to catch up. Giving early learners the fundamental and foundational skills in math is critical to his/her success in the future.   McKnight and Mulligan (2010) have found that early learners are not having enough exposure in exploration of space and geometry (McKnight & Mulligan, 2010). The problem is, if early learners begin a large gap at the entry of kindergarten, the more the gap can grow as students transition to each grade level at the primary level.

The purpose of this action plan is to identify and implement different types of math strategies for math instruction and application in an early childhood setting to help students increase their performance in this developmental area. The intent of this project is to gain knowledge from research to help improve teaching and learning in mathematics early childhood.

These research studies through peer-reviewed journals are found in databases in DeWitt Library within the last 10 years. Article inclusion criteria will include research based off researched-based interventions, strategies, or applications that have been successfully identified to improve student achievement in math in early childhood setting.

      Early childhood educators should implement different types of research-based math strategies and interventions, not only to improve current academic performance, but to promote longevity in education. Specific research-based intervention strategies and or topics found include effective implementation and support of mathematics in early childhood, concerns about early childhood math, implementation strategies to support math, and providing resources for students that are interactive and engaging.

Review of the Literature

Early Childhood Math Concerns

As mentioned earlier, researcher Clark (2020), conducted a study with examining and identifying that math plays an essential role in an early learners' development to comprehend the world they live in with understanding differences in shapes of objects and quantities, circumstances, establish problem solving skills, time conception, sharing quantities with friends, and counting through play. Clark (2020) illuminates that it is essential for young learners to establish and strong foundation of these skills as it is highly linked with their later school performance. This research was conducted for learners ages three to seven years old and identifies 66% of disadvantaged learners performed at the least expected level in math as compared to 82% of peers. The data was collected internationally and accessed through consulting experts. Through this investigation, affidavit is based on meta-analysis of randomized controlled trial and qausi-experimental design to formulate actions for improving mathematics for early learners. Clark (2020) found mathematical recommendations to implement in an early learner setting based on best evidence synthesis of a wide range of study designs.

Researcher Rittle-Johnson (2017) conducted a study to determine if early learners' math comprehension were a strong predictor of upper-grade academic attainment of math. Five hundred and seventeen low economic students in the U.S. ranging from ages 4-11, were evaluated in this study. The intent of this study was to reveal certain early math comprehension that is a predictor of longevity in math success from students in low-income backgrounds. An evaluation was completed amongst these students from an Early Math Trajectory Model. The research identified that learners from low economic status continue to enter school with inadequate math comprehension. With this knowledge and growing area of concern, it seems to

identify that early math trajectories be identified and proposed to promote longevity for later academic success.

Researcher Miller (2017) identifies that there are currently only two publicly funded prekindergarten programs including targeted preschool and universal preschool. Within these programs, economic status enrollment can differ amongst each program and classrooms per program. During this study, student performance in upper-grade learners and the economic arrangement of contemporaries are being evaluated to identify the leverage of academics held within a preschool classroom. During this study, 2,966 students in 709 preschool classrooms were analyzed through data collection. Investigation took place to identify associations linked between classroom-economic arrangement and performance. Results have shown that higher economic status of students illustrated a positive trend line from fall to spring performance in learners. Lower economic status learners had a proportionate negative trend line in math, literacy, and language skills.   These results similarly agree with researcher Rittle-Johnson (2017), and Clark (2020), with low economic status learners continuing to enter kindergarten with inadequate math skills. However, results did indicate that integrated preschool classrooms, including lower income families, might be more advantageous with student achievement compared to a targeted preschool program.

Additionally, researcher Razza (2015), conducted a study to examine key domains of school readiness skills with academic trajectories. Specifically, this study investigates links between early learners approaches to learning performance and social competence for students ages 5 to 9 years old. Approaches to learning was tested while following a compensatory growth model.   Early learners (n=669) were picked from precarious families, predominately low economic status. The findings displayed those approaches to learning was linked with both

academic and social competency. Exclusively, early learners at the kindergarten level were

identified to have a significant predictor in reading and math performance across primary grades

which agrees with Clark (2020), Rittle-Johnson (2017), and Miller's (2017) young learners

academic predictor data.

Early Childhood Math Supports

Researcher Piasta (2015) conducted a research study to identify how to better support

preschool students academically, specifically in math and science. This research focusses on

investigating the influence and leverage of providing preschool teachers with quality

professional development in these developmental areas. Sixty-five early educators were selected

to participate in 64 hours or 10.5 days of professional development over a period of 18 months.

The study involved early educator's pre-test questionnaires, classroom observations, and twice a

month professional development training. Early educators' conditions of math and science were

examined along with student improvements in math and science from fall-to-spring. Teacher

hours were also compared with student data collection comparison from fall to spring. The

findings indicated that PD did not precisely influence student math or science comprehension,

but increased opportunities in both developmental areas was identified.

Researcher Brendefur (2012) also examined the impact of student academic achievement

based on teacher professional development and providing center-based mathematics activities.

This study identified the need to increase student understanding and skills in math to establish

foundational skills for future success. Random Head Start programs who taught four-year-old's

in the U.S. were selected as either a treatment or control group to examine the impact of

professional development and student achievement over a six month time period. The findings

of Brendefur's (2012) study indicated that the treatment group illustrated more fluency and

flexibility with number concepts including solving problems, completing measurement tasks, and spatial abilities as compared to the control group.

Similarly, to Piasta (2015), and Brendefur's (2012), Son (2013) also focused on identifying the impact of early educators' professional development on student achievement in academics. During this study, they track and investigate the influence of different types of professional development amongst different early childhood educators. School readiness skills are being monitored from low-income students in preschool. More specifically, early childhood educators staggering levels of professional development such as education level, degree(s), certification, teaching experiences, trainings, and support staff exposure are being compared to one another while being aligned with student achievement unlike Piasta (2015) who only compared educators who completed current professional development being offered and those who did not.

Sons (2013) conducted a study to examine if teachers multi-level analysis through various pathways of teaching background or experience are being observed and compared to classroom environments and kindergarten readiness skills. This study revealed that teachers with a higher degree providing stronger social-emotional support within the classrooms. The same classrooms with higher-quality social-emotional skills also performed better in math skills. Furthermore, teachers that provided higher-quality parent involvement performed higher in vocabulary skills. Therefore, early educators with higher education and higher-quality professional development along with providing enriched parent involvement activities can help best support school readiness. The findings of Piasta (2015), Brendefur (2012), and Sons (2013) all agree that providing early childhood educators with numerous opportunities of quality professional development can influence student achievement in academic areas such as mathematics.

In a different perspective of early childhood supports, McKevett (2019) digs deeper into student achievement in literacy and math based on the influence of teacher judgement. As this researcher describes, teacher judgements are a prime component to successfully design instruction and interventions. This study focusses on kindergarten and first grader educators of early learners' instructional level in mathematics and literacy skills while utilizing the pre-post quasi-experimental design to identify the degree to which the use of data changed educators' judgments. The findings suggest that when educators rated students at frustration level they were least accurate while overemphasizing students' skills. Utilizing data during this study did not help enhance accuracy in general, but few changes were in place at frustration and instructional teaching levels for instruction.   The results of this research indicate that teachers' judgements on low accuracy through overestimation, can result in learners who are in more of higher need of essential interventions.

In a comparison perspective of Piasta (2015), Brendefur (2012), Sons (2013), and McKevett (2019), researcher Jamil (2018), performed a study to examines the influence of teacher beliefs about STEM education and implementation and early educator professional development towards student achievement. The participants in this study included early childhood educators who attended a STEM professional development conference in the U.S. Surveys and interviews were given to educators before and after the conference to illustrate educators' knowledge, beliefs, and supports about STEM education. This study uses a mixed methods of research and design for implementation and analysis.

The findings indicated that majority of early educators see the value in the STEM approach, but when digging deeper at the essential elements of how or why to teach such as the purpose, practice, or supports provided, opinions varied considerably. Jamil (2018) additionally shares

that as our worlds economics and personnel requirements continually change, new early

educators' methodologies are needed for young learners to be successful and have up to date best

practices to support them.   Jamil (2018) identifies that early educators' beliefs, judgements, and

professional development can greatly guide innovation opportunities for young learners, while

new approaches and resources can also provide invaluable practices and essential up-to-date

skills learned in the early childhood classroom. Jamil's (2018) research agrees with McKevett

(2019), as teacher judgements and beliefs can impact student opportunities needed to be

successful. Additionally, this research likewise agrees with Piasta (2015), Brendefur (2012),

Sons (2013), as quality early educator professional development can directly impact student

success and achievement in developmental levels such as mathematics.

Researcher, Simoncici (2018) conducted a study to explore conceptualization of STEM,

teacher beliefs, and the impact it can have on student attainment.   The Early Childhood STEM

Habits of Mind Framework was the analytical perception towards data analysis. The research

took place in Australia in a professional development including 117 early educators who

completed a survey before the professional development. The surveys were open-ended,

qualitative questions. The current study emphasized early educators' conceptions about STEM,

beliefs about STEM in preschool, and how important early educators think STEM is in

connection to social emotional development. Data analysis was completed through organized

data analysis, read through data, coding, categories based on coding, themes presented, and

interpret data. Data showed that majority of early educators' beliefs of STEM illustrated of high

importance in education along with early learners social-emotional development which is

consistent with results from other studies including McKevett (2019), Piasta (2015), Brendefur

(2012), and Jamil (2018).

In another lens perspective, researcher Goff (2019) performed a study to investigate the importance of overall adult engagement of parents and educators for early learners when transitioning to an early education setting. This study was implemented in Australia during the start of a school year while focusing on mathematics, transitions and adult-child relationships, meeting of new adults, and collaborations. The specific intervention included providing optimum conditions for parents before school begins, the beginning of the school year, and throughout the school year. Two research teams at different locations were chosen for this project including new first year teachers, prior to school year teachers, and families that volunteered. The beginning of this study identified twofold problems including lack of theoretical view, process, and data with adult engagement and partnerships to increase student achievement and guidance available for educators to identify a process, key elements, or stages to develop relationships with families to help best support student learning. The findings identified that at different stages of the study, there was clear evidence between the differences of relationships and partnerships. The first two stages predominantly focused on relationship building which included understanding self and differences. The last stage was then able to focus on actions of a partnership and unambiguously focus on tasks needed. Through this lengthy learning process, the findings support those partnerships through quality steps of collaboration and relationship building are an essential component of student academic success.

Similarly, to Goff (2019), researcher Sparling (2019) conducted a study on early learner outcomes based on activities students received from early educators and the extent to which parents and students keenly engaged in the experiences for infants to young learners. The Abecedarian Approach was the international intervention used to implement teaching and learning strategies of individualized, planned, and unplanned adult-child interactions through

randomized control trial. Activities had to be created based on the understanding of parents and

or paraprofessionals to support each child. Findings included a strong positive link between

parental and student involvement, which agrees with Goff's (2019) findings, student attendance,

home visits, and parent meetings attended, with student achievement.   The evidence of this

study depicts that early learner's active role combined with parent quality of adult

implementation, response, and feedback. The findings also found that high-quality early

childhood programs enhanced student achievement outcomes.

Researcher DuPaul (2015) conducted a study to examine if early interventions for young

learners with ADHD could help increase behavioral and academic outcomes. During this study,

135 early learners, 105 boys and 30 girls, ages 4-5 years old, participated over a twenty-four-

month period in northeast U.S.   Each participant was diagnosed with a Mental Disorder and met

criteria for Attention Deficit Hyperactive Disorder (ADHD). Parents, children, and educators

participated in a randomized control trial of early intervention. Learners were provided the

multicomponent intervention (MCI) in behavior problems, academic readiness skills, and child

safety and or oppositional behavior. Students were assessed every 6 months including a

pretreatment and posttreatment, with a total of five data points. Parents were assessed through

measures of family functioning rating scale. Interventions included receipt medications, parental

attending in training sessions, and total hours of contact between educators and families. Home

visits and various ways of communication was included in contacts. Although the methodology

had several limitations, findings revealed that early interventions for young learners can provide

significant improvements in literacy and mathematics achievement for students at risk.

Additionally, findings indicated vast developments in oppositional defiant behaviors with milder

symptoms and greater cognitive capabilities. These findings also agree with research Goff

(2019) and sparling (2019) who also found evidence that early interventions and parent

engagement when transitioning to an early childhood setting can be an essential component of

student achievement.

Early Childhood Math Strategies

Researcher Clark (2020) organized a study to develop a solid understanding of how early

learners can develop strong math competency in the early years by being supported by best

practices. Clark (2020) identifies that early learner math skills and achievement is highly

associated with later school attainment and life outcomes. This study offers a guidance report

that offers five recommendations of the best mathematic practices for early educators through

references and guidance for meaningful and impactful outcomes for students ages three to seven

years. These mathematical practices include identifying how young students learn mathematics

best, dedicating time throughout the day to implement math concepts, utilizing manipulatives to

develop comprehension, build on what students already know, and use high quality support. This

study reviewed the best international research accessible while a team of consultative educational

professionals depicted evidence-based key principles for best practices in math. Data was

reviewed fundamentally based on meta-analysis of controlled trial and quasi-experimental design

in order to evaluate what evidence-based best practices could be identified for math instruction

for early learners.

Van de Weijer-Bergsma (2014) investigates a study to examine the significance of visual-

spatial and verbal working memory in the developmental area of math. Learners ($N=4337$) in

grades 2 through 6 were the participants of this study including 4,337 students and 32 primary

schools in the Netherlands. The intervention for this study included the impact of educator

professional development in differentiated math instruction and learner mathematics

achievement.   Each student was assessed using technology-based tasks. Assessments were conducted at the beginning, middle, and end of the year using timed math tests. Data revealed that as each grade level developed, visual-spatial working memory in mathematics declined while the verbal working memory improved. Therefore, this study found that visual-spatial memory in mathematics was found to not be a predictor for students as they progress through each primary grade level which disagrees with Clark (2020), who found that early learner math skills and achievement is highly associated with later school attainment.

Researcher Aleksic (2018) conducted a study in Serbia to examine the links between social-emotional skills, behavior, and mathematics and literacy achievement. Students (N=159) ages 5-8 years were evaluated by their educators on social-emotional skills and behavior. Learners' literacy and math skills were assessed at three different times through a 14-month period including two times in preschool and one time at the beginning of kindergarten. Educators were given training on how to rate students based on impulsiveness, inattention, and hyperactivity. Findings are reported through quantitative data to measure links in these developmental areas.   Aleksic (2018) hypothesis indicates that gender, mathematics, literacy, and social-emotional skills were a stronger predictor for controlling education from preschool entry to kindergarten entry. The strongest predictor was mathematics amongst these skills. This hypothesis also demonstrated social and cognitive skills were closely link to strong teacher student relationships.

Researcher Bavarian (2013) performed a study to evaluate the use of social-emotional and character development to improve academic achievement. One SECD program was used to measure educational effects amongst low-income, urban youth students in the U.S. More specifically, participants including a cohort of learners in grades 3 through 8 contributed for this

longitudinal study through a cluster-randomized controlled trial through educator ratings and

academic aptitude of standardized test performance. Findings indicated that Positive Action

(PA) considerably improved development in academic motivation and mitigated disaffection

with learning. Additionally, there was greater effects on reading outcomes for African American

boys in 7 and 8th grade and for mathematics for girls and low-income students which similarly

agree with Aleksic (2018) who found that gender, math, literacy, and social-emotional skills

were strong predictors for controlling education from preschool to kindergarten entry.

Researcher Gorard (2016) conducted a study to examine if student philosophy can

improve primary school attainment. This study examined the impact for when an educator

delivers explicit instruction in the areas of literacy and mathematics to improve reasoning and

problem solving, in terms of visible cognitive abilities and their fundamental skill through

randomized control trial. Educators were trained on how to provide specific explicit instruction

in these academics' areas prior to intervention. It was upon each school's decision on how often

or when the intervention would be conducted within the classrooms. An average of each school

delivered one explicit lesson in both academic areas once a week. The two groups of students

being compared between the intervention and control group were well balanced between terms

of sex, socioeconomic status, and special needs. Fidelity was assessed on educators and students

to rate impact and implementation of intervention. Participants included 48 volunteer schools,

involving students 3 to 6 years of age, with a total of 3,159 learners over a one-year period in

London. After a year of implementing this intervention, the trial group gained an average growth

of two months ahead of the control group in literacy and mathematics reasoning. However, this

research also concluded that educators need to be cognizant of their own biases and beliefs about

students and their learning as it can influence student involvement, learning process, and overall

achievement. Gorard (2016) identifies that if early learners do not develop trust and strong

relationship with their educators, they are less likely to share their views or voice to help enhance

their learning process and overall attainment.

Research Swanson (2019) performed a study to investigate an intervention to identify if

paraphrasing and problems-solving helps increase ELL students' math achievement. In

southwestern U.S., including California, a total 142 third grade monolingual or ELL students

from twelve classes in four public schools participated in this study over a one-year period. The

intervention tested was through an untreated control group or a treatment group including

paraphrasing on word problem-solving (WPS) accuracy and transfer. Three specific types of

interventions included problem translation of paraphrasing a question (restate), paraphrasing

relevant information (relevant), and paraphrasing all prepositions (complete). Educators were

trained on how to administer twenty scripted lessons for a four-hour block of practice and

delivery. For the treatment groups, educators were asked to read story problems aloud and

students in intervention group were asked to paraphrase the teachers' sentences based on one of

three paraphrasing interventions. Each of the three groups included in the paraphrasing

intervention were provided explicit and direct instruction related to the specific paraphrasing

strategy. A pretest and posttest were administered on word problem accuracy with increasing

difficulty. Findings included participants involved in the relevant and complete group illustrated

significant problem-solving improvements as compared to the control group and the intervention

group of restating. This data also agrees with Gorard (2016) who also provided an explicit

instruction intervention approach in problem-solving in mathematics and found over 2 months

further growth in the treatment group as compared to the control group.

Methods

Research Question

Will implementing different types of math strategies for math instruction and application in an early childhood setting help students increase their performance in this developmental area?

Variables

The independent variable will be the type of strategies used in math instruction and application. The specific strategies include implementing five instructional practices for early learners and providing engaging interactive math games. The dependent variable will be students' trend line of academic performance in the developmental area of mathematics. (Efron & David, 2020)

Setting

This current proposal plan will be conducted at Morningside STEM Elementary containing grades preschool through fifth grade. The school population is six-hundred and seventy-one students with 48.7% are male and 51.2% are female and is currently considered low-income. More specifically, 6.7 % of students are on an IEP and receive resource services, 1.7% are in the Talented and Gifted program (TAG), 14% of students are English Language Learners (ELL), and 57.9% of students receive free lunch. Student race includes 55% White or Caucasian, 23% Hispanic, 7% black or African American, 1% Asian, 7% two-or more races, and 2% Native-American.

Participants

In a preschool integrated classroom within the Sioux City Community School District, a teacher can have up to twenty early learners including both male and female students. These classrooms are set up to have fourteen general education students and six students on an IEP whose ages can range from three to five years old.   Students on an IEP in my classroom could receive specialized services from a variety of specialists including special education teacher, speech therapist, occupational therapist, and physical therapist. The current classroom of study has twelve students that are considered general education peers and two students who are on an IEP.   However, three general education students who are in the evaluation process. The plan to complete this research project will be amongst four students that are in between the at-risk level and proficient level in mathematics based on my Individual Developments and Growth Indicator (IDGI) math assessments as a performance measurement

Treatment or Intervention

The two mathematic strategies researched and chosen to utilize include implementing five instructional practices and providing engaging interactive technology games.

Five Instructional Practices will focus on teacher-directed implementation. The practices include identifying each students learning style in mathematics, integrating math concepts in the schedule throughout the school day, utilize manipulatives and other materials to develop and support comprehension, build new concepts off students' known knowledge and foundation skills. Through these different research-based strategies, a researcher will be able to make vigilant instructional decisions that are meaningful to a specific setting while also targeting best practices. (Clark, Henderson, & Gifford, 2020)

Engaging interactive technology games will include utilizing Khan Academy (2020) engaging interactive math games daily, while exploring math topics of number sense, completing assigned lesson, and completing assigned tasks. Within this app, skills being learned, taught, and explored will relate to oral counting, number identification, and counting 1:1 correspondence. Each student will be individualized based off of his/her baseline and or currently level of performance. Daily or weekly adjustments will be made based on student progress and or responses from interacting with these games.

Data Collection

Data needed to be collected for this research study includes GOLD, IDGI, oral counting, number identification, and 1:1 correspondence data. GOLD data is both qualitative and quantitative while providing reliability with validity. GOLD data through Teaching Strategies, (U.S. Department of Health and Human Services, 2021) allows an educator to collect observations in nine different developmental areas, including mathematics, and rate individual students based on their performances in each objective in the specified developmental areas. Specific GOLD objectives in mathematics this study will be focusing on include 20 a. counting, 20 b. quantifying, and 20 c. connecting numerals with their quantity.

IDGI data is qualitative while also providing reliability with validity. IDGI data through Renaissance Learning (2021), allows early educators to provide a screening predictor for students ages four to five years old, three times a year in fall, winter, and spring. The fall and winter IDGI's math assessments have already been conducted this year. Spring IDGI math assessments will be completed again at the end of April.   Specific math assessment for IDGI's include oral counting, quantifying, number identification, and counting 1:1 correspondence. IDGI data is considered a formal assessment. Students' scores are created based on how many

problems were answered correctly and then put into an equation to identify a number that is

considered in the at-risk (red color band), emerging (orange color band), or proficient (green

color band), level. Then, the district program identifies each student in an additional color band

category based on how many math assessments each student passes in the green. For example, a

student who passes one or less IDGI math assessments would be placed in the red color band. A

student passing two math assessments would be considered in the orange color band. Lastly, a

student who is passing three or more math assessments is considered proficient. The four

students picked for this research project will be picked from the orange color band or the in-

between category.

Oral, number identification, and 1:1 correspondence counting would also be considered

quantitative as it specifically identifies student skill and rate of acquisition throughout the

research study. These assessments will be completed on the four designated students for the

intervention and will be administered as a pretest, weekly on Fridays, and a posttest after the

intervention.

Data collection for the baseline of this research project took place during center time,

over a three-day period. Each of four students for this study was assessed in a one-on-one setting

with the researcher. Assessments, which were not timed, included oral counting, number

identification, 1:1 correspondence, and student survey. For the oral counting assessment, each

student was asked to start counting at 1 and counted as high as they could go. Counting 1:1 was

done similarly with students asked to start at 1 and touch each dot and count as high as they

could go up to 20. The baseline for these two assessments is considered the last number correct

before skipping a number. The number identification assessment included numbers 1-20, out of

order. The teacher pointed to each out of order numeral to student while recording if the student

identified it correctly or incorrectly. Then, the total number of correct responses for each of

these assessments was divided by the total amount of opportunities, which is 20 for each

assessment to identify the percentage correct.

The student survey included images of different topics at school such as math, art,

reading, recess, science, iPad, social studies, and music. Next to each of these topics, the student

pointed to one type of feelings face out of three total feelings of happy (3 pts.), medium (2pts.),

or sad (1pt.). The teacher would point to each topic image and then the student would point to

the smiley faces rating scale to identify how they feel per topic. After student is finished rating

each topic, the teacher would add up all the points to find the total number of points the students

identified out of twenty-four total possible points. The research will complete this student survey

again after interventions to see if student's feelings about these topics change, stay the same, or

increase.

Plan for Analyzing Data

This action research study will evaluate student success in the developmental area of

mathematics with using two specific types of strategies: implementing five mathematical

recommended best practices and providing engaging interactive math games. Each individual

student's success rate of performance over time, in chronological order, will be reported.

Through qualitative data, the researcher plans to divide predetermined categories of each

data collection of GOLD, IDGI's, and weekly data assessments up, in logical order to identify

further themes or trends. Then there will be reflection through summarization on how each

category correlates to one another. A bar graph will be used to transform the findings to

summarize different patterns and trends through coding.

Using quantitative data, the researcher will be implementing this theory and testing the

hypothesis of improving student success in math with using different strategies. Analyzing this

data in bar graph form will be categorized with dates of before, during, and after case study with

GOLD, IDGI's, and weekly assessment data representing the Y-axis and Dates representing the

X-axis. This study will also be analyzing and measuring each students testing data through

Dependent Samples T-tests. If students show an upward trend line, that will identify that the

interventions helped increase student achievement in math. Throughout implementing this

research study, data will help drive instruction and identify specific findings for a conclusion.

With these results, the researcher would also like to dig a little deeper from predetermined

categories, to find other trends or helpful information to present my findings of data analysis and

data interpretation results, conclusion, and implications.

IRB Information and Plan

The IRB application has been approved. The plan is to discuss with the parents, in

person, of the four students chosen to participate in this research project about the purpose of the

study and the steps taking to implement different research-based strategies to help increase

student achievement in math. The researcher will explain to parents the two types of

interventions being utilizing for five weeks each, student surveys of how they feel about learning

in different developmental areas, including math, before and after intervention, and how weekly

updates will be sent home of student progress. The researcher will explain that if a student

shows any risks of regression, adjustments will be made individually to promote future success.

The researcher will send the IRB consent form home in backpacks for parents to review, sign,

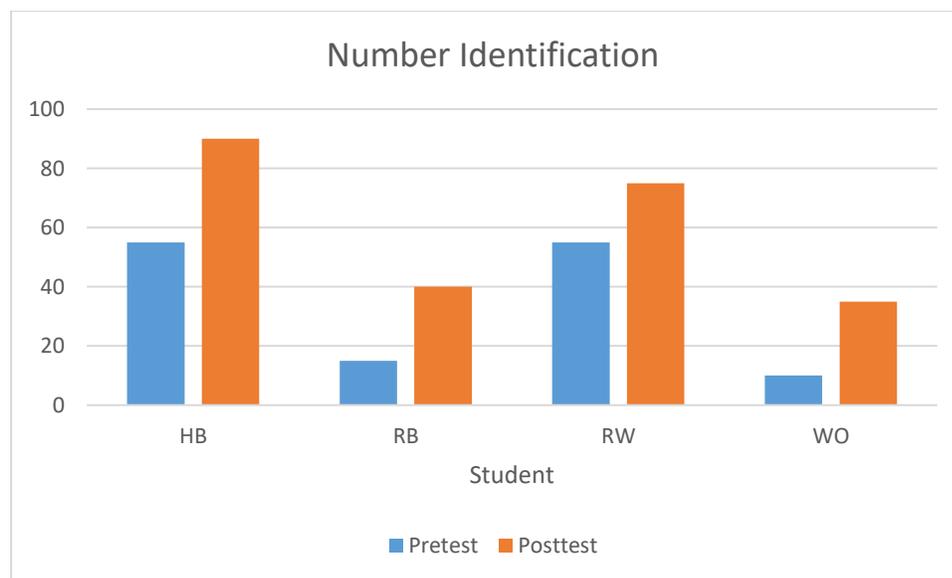and send back if they approve.

Findings

Data Analysis

Oral Counting

A dependent sample t-test was conducted to determine whether there was a significant change in students oral counting to twenty following the math interventions of math instruction and application. A baseline assessment revealed students were able to count to twenty with an average 62.5% or 100(M=62.5, SD=2.88) in an untimed one-on-one setting. Students participated in a four-week intervention where they engaged in mathematics practice with implementation of five instructional practices and providing interactive engaging math games that specifically focused on skills including oral counting, number identification, and 1:1 correspondence. Students were able to accurately oral count to twenty independently with an average of 93.75% of 100 (M=93.75, SD=12.5) in an untimed one-on-one setting. Results of the dependent sample of one-tailed t-test revealed a significant different between the baseline and final assessment, p=.0055. The intervention of math instruction and application increased student oral counting to twenty, independently.
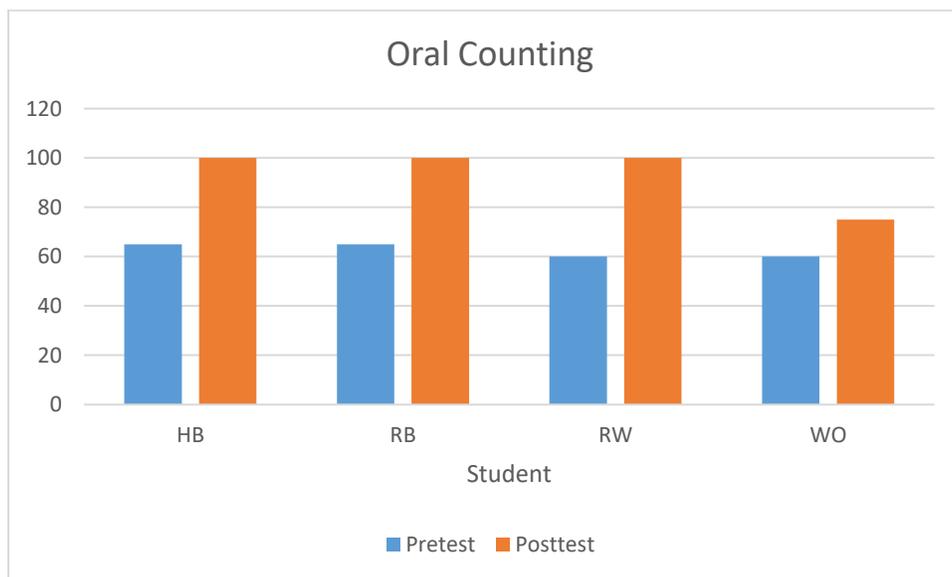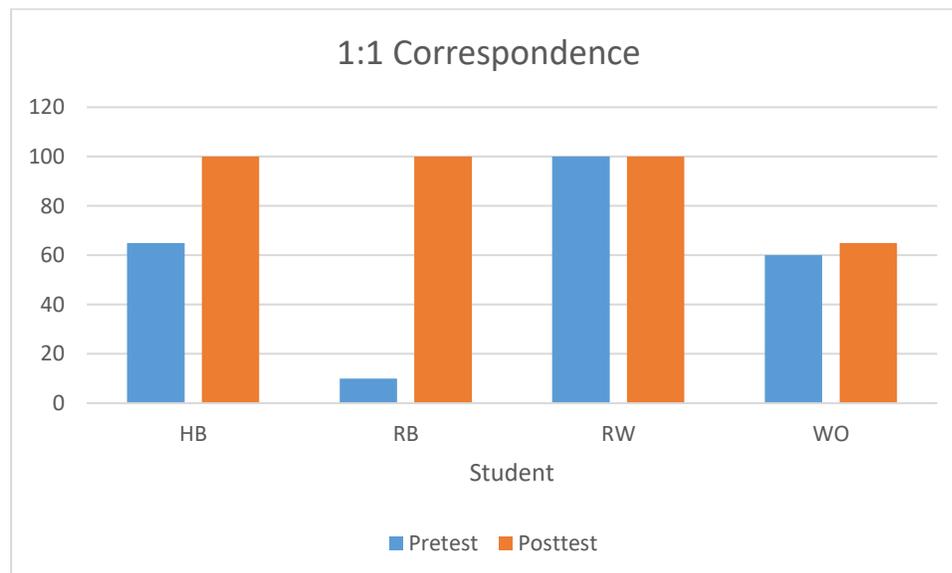
Number Identification

A dependent sample t-test was conducted to determine whether there was a significant change in students number identification to twenty following the math interventions of math instruction and application. A baseline assessment revealed students were able to identify numerals, out of order, with an average 33.75% or 100(M=33.75, SD=24.62) in an untimed one-on-one setting. Students participated in a four-week intervention where they engaged in mathematics practice with implementation of five instructional practices and providing interactive engaging math games that specifically focused on skills including oral counting, number identification, and 1:1 correspondence. Students were able to accurately identify numerals to twenty independently with an average of 60% of 100 (M=60, SD=26.77) in an untimed one-on-one setting. Results of the dependent sample of one-tailed t-test revealed a significant different between the baseline and final assessment, p=.001804. The intervention of math instruction and application increased student number identification to twenty, independently.

1:1 Correspondence

A dependent sample t-test was conducted to determine whether there was a significant change in students oral counting to twenty following the math interventions of math instruction and application. A baseline assessment revealed students were able to count 1:1 correspondence to twenty with an average 58% or 100 (M=58.75, SD=37.05) in an untimed one-on-one setting. Students participated in a four-week intervention where they engaged in mathematics practice with implementation of five instructional practices and providing interactive engaging math games that specifically focused on skills including oral counting, number identification, and 1:1 correspondence. Students were able to accurately oral count 1:1 correspondence to twenty independently with an average of 91.25% of 100 (M=91.25, SD=17.5) in an untimed one-on-one setting. Results of the dependent sample of one-tailed t-test revealed there was not a significant different between the baseline and final assessment, p=.106928. The intervention of math instruction and application did not increase student 1:1 correspondence to twenty, independently.

Student Survey

A dependent sample t-test was conducted to determine whether there was a significant change in students' interest in learning following the math interventions of math instruction and application. A baseline assessment revealed students survey results of how they feel about different areas of learning with an average 84% or 100 (M=84, SD=7.5718) in an untimed one-on-one setting. Students participated in a four-week intervention where they engaged in mathematics practice with implementation of five instructional practices and providing interactive engaging math games that specifically focused on skills including oral counting, number identification, and 1:1 correspondence. Student surveys included rating how they feel about topics including math, literacy, art, music, iPad, recess, lunch, science, and social studies. Students' surveys of interest in learning illustrated an average of 92.25% of 100 (M=92.25, SD=5.5) in an untimed one-on-one setting. Results of the dependent sample of one-tailed t-test revealed there is a significant different between the baseline and final assessment, p=.01607. The intervention of math instruction and application increased student in interests in learning different topics at school.
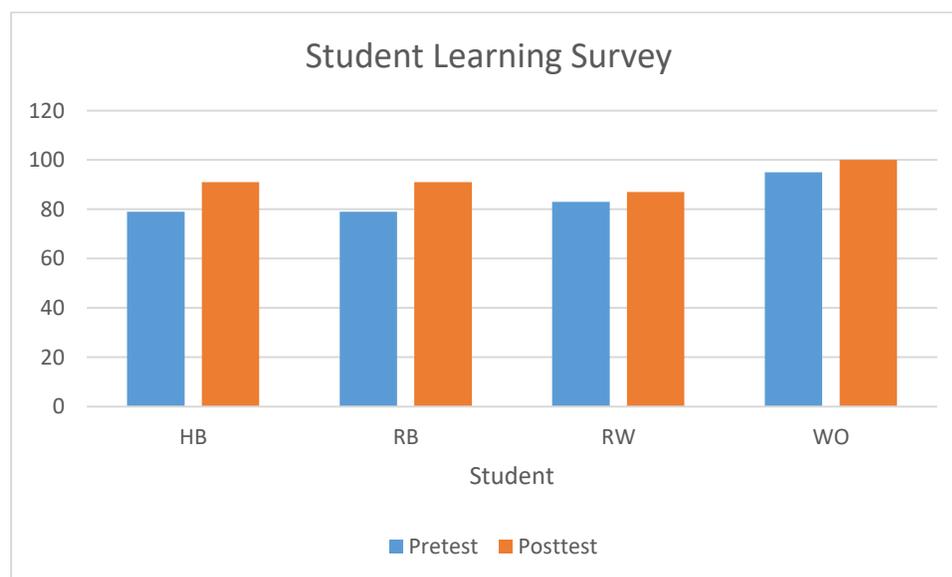
Discussion

Summary of Major Findings

The action study results allude to educators, researchers, and participants that implementing different types of math strategies for math instruction and application in an early childhood setting can help students increase their performance in this developmental area. This study indicates that all four early learner participants increased their performance by an average of 94% in oral counting and 60% in number identification. Additionally, the study also revealed these participants did not significantly increase an average performance in counting 1:1 correspondence due to the pretest and posttest standard deviation resulting in 17.5 and p=.1069. However, three out of four students did show growth in a positive trend line with this specific skill. The participant that did not show growth in 1:1 correspondence performed a perfect score of 100% on pretest and posttest which impacted the overall P value. The reasoning in the wake of these findings is that providing targeted, research-based best practices through explicitly structured math strategies and interventions can provide early educators a direction, purpose, and adaptability of support per student based on his/her continual performance.

Early learners were able to effectively complete the four-week intervention by participating in the methods with reliability, when presented. Through explicit teaching from the researcher, early learners were able to learn and exercise math skills of oral counting, number identification, and counting 1:1 correspondence at their independent level before interacting in the activities.   As the intervention started, and throughout the intervention, the educator was responsible for monitoring student progress, due to the dependency of the age group, keeping learners updated on independent level of each math skill, and provide immediate verbal feedback to encourage and motivate students throughout the process. Feedback consisted of student

instructional level and offering positive reinforcement for what the student is doing well on.

Redirection or additional individual strategies were given, as well, when needed. Additionally,

when using engaging interactive math games, students were able to practice these specific math

skills at their independent level. Math games varied from teacher picks to student picks on

different games at student independent level. Overall, implementing different types of math

strategies for math instruction and application is successful by providing meaningful and

purposeful research-based best practices, engaging interactive games, individual goal

monitoring, frequent feedback, and frequent adjustments made when appropriate to meet the

needs of students at their level.

Limitations of the Study

This study did present some limitations during the process that could have potentially

impacted the outcomes. Limited time, as the study took place over a four-week period, could

have altered more progress and student outcomes. The study took place during a sixty-minute

center time, where this part of the schedule is considered student lead. During many days of

center time, there was various high need behaviors that needed to be supported that took away

from devoted time from educator to implement and support intervention and activities with

participants. During center time, the number of staff in room may altar as breaks are taking

during this time of day. Lastly, another limitation was student dependency on independent

activities. When working on engaging interactive math games, students needed continual

direction such as how to get started, where to start, what to do next, what to do when done…etc.

Educator needed to be available frequently to monitor and direct students on math activities

throughout the whole process. Teacher may not have always been available promptly to help

support or direct students when needed.

Further Study

The next step will be to implement this action research with another group of students within the same researched classroom setting during this current year. Students will be presented with the same intervention of providing targeted, research-based best practices through explicitly structured math instruction and application. The specific strategies include implementing five instructional practices for early learners and providing engaging interactive math games. However, during the application and independent practice, the researcher would alter students' application of practicing engaging interactive games through assigned lessons and practice at independent level to exploring activities of student choice at independent level to increase student motivation and independence. After the four weeks of conducting this second intervention, the researcher can compare the growth from the first group to the second group to see if there is a significant difference when providing student lead activities.

Another future measure will be to continue to monitor the same four students from this intervention for another four weeks to analyze if more time could produce a stronger outcome for student achievement in math. The researcher will continue implementing the same five instructional practices for early learners and providing engaging interactive math games. At the end of the four weeks, the researcher will compare the students' baseline and posttest from the first intervention, and posttest from the second intervention. The results will be able to encourage a positive trendline in mathematics skills of oral counting, number identification, and counting 1:1 correspondence.

Furthermore, using targeted, research-based best practices through explicitly structured math instruction and application is the emphasis for the researcher for the remainder of this current year and the following school year. The objective will be to concentrate on early math

skills strategies and interventions that can be supported and aligned with Iowa Early Learning

Standards (IELS) and benchmarks to promote kindergarten readiness and longevity in education.

Conclusion

This research offers support by using a trial group with implementing different types of

math strategies for math instruction and application in an early childhood setting to help students

increase their performance in this developmental area. When early learners or students at the

primary level start falling behind compared to students' peers, they start to develop a gap

between their success and their peers' success. The larger the gap is, the harder it is for a student

to catch up. Giving early learners the fundamental and foundational skills in math is critical to

his/her success in future. The four early learners that participated in this action research profited

from being provided implementation of five instructional practices and providing engaging

interactive math games. The findings of this research reveal that this type of intervention and

classroom support increases student achievement in specific math skills including 93% in oral

counting, 60% in number identification, and 91% in counting 1:1 correspondence. Further

research in implementing different types of math strategies for math instruction and application,

including various interactive engaging math apps, in an early childhood setting to help students

increase their performance in this developmental area would be recommended in the future.

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