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Stimulating Children's Numerical Literacy: The Effectiveness of Singing Favorite Food Songs

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ABSTRACT: Numerical literacy is the ability needed to use number ideas and arithmetic skills in everyday situations as well as the ability to analyze quantitative data around children. This study aims to determine the effect of the intervention of singing favorite food songs on children's numerical literacy. Using a pretest-posttest experimental design with a control group, this study involved 20 children as research objects, consisting of 10 experimental class children and 10 control class children. The results of the study showed that singing activities with the theme of favorite food influenced the numerical literacy of kindergarten children. This singing activity attracts children's interest, thus showing a significant difference between the experimental class and the control class. Therefore, for further research, it is suggested that early childhood educators can always take advantage of artistic activities such as singing to attract children's interest in any learning.

Keywords: early childhood, numerical literacy, singing activities

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1 INTRODUCTION

Long before they enter formal schooling, early childhood begins their journey of learning to read, write, and count. Early literacy develops because of a developmental process that begins at birth and continues when children are involved in routine activities and are exposed to sounds, words, and printed concepts in their environment (Goldstein, 2011). Through this process, young children learn the early foundations of literacy, which are critical for successful reading and numeracy in later years (Dixon-Krauss et al., 2010).

Before starting school, children's arithmetic abilities vary greatly (Manolitsis et al., 2013). Given that early mathematics abilities are one of the most reliable indicators of later academic achievement (Duncan et al., 2007) it is imperative to comprehend why some students begin school better prepared to master mathematics than their peers. According to most studies (Lyons et al., 2014), mathematical proficiency is not a single thing but rather consists of a variety of separate mathematical talents. Magnitude comparison, number ordering, cardinal principle understanding, and digit recognition are examples of often-found early numeracy skills (Batchelor et al., 2015). We are unsure of how these skills relate to one another as people develop, though.

There is some evidence that a variety of factors, including cognitive abilities like working memory (Peng et al., 2016), language (Purpura et al., 2011), and sustained attention (Howse et al., 2003), influence the development of these numeracy skills. A substantial body of research has also shown that socioeconomic status and the home numeracy environment (Kleemans et al., 2012) have an extensive impact on children's mathematical and developmental results. However, research on the growth of numerical abilities in young children (i.e., those aged 3-5) frequently exhibits at least one or more of the following limitations. There are typically only one or two component numerical skills included (e.g., Purpura et al., 2011), Domain-general skills or non-cognitive factors are not considered, Cross-sectional methods are used (Batchelor et al., 2015), and analysis approaches that imply that all children develop along the same path are used. As a result, it is challenging to determine the developmental pathway of early numeracy skills or identify factors associated with disparities in growth from a person-centered approach due to the absence of comprehensive longitudinal data on numerical skill acquisition in this age group.

It has been discovered that math-related cognitive processes are correlated with musical training and general musical abilities (Haimson et al., 2011). These correlations show the potential for links between knowledge of music theory and mathematical thought processes (Harrison, 1996). Mathematical cognition and numerical aptitude may be used in musical cognitive processes, such as the recognition of musical and notational patterns. According to Pekrun (2006), math-related affective processes may also be a significant predictor of proficiency in music theory. The current study discusses the connections between the fundamental components of mathematics and music. First, proportions and numerical relations, integers, and logarithms are related to notes, intervals, scales, harmony (consonance and dissonance), tuning, and temperaments. In addition,

mathematical concepts can be found in melody and rhythm. For example, musical notation includes concepts of time (note length, bar lines, and time signatures), rhythm (beat and the grouping of notes in tempos), pitch (clefs, staff, and frequency of the sound), and dynamics (signs of graduation of intensity) all within the confines of the circle of musical space (musical geometry) (Santos-Luiz, 2007).

Based on the results of observations in the field, a problem can be formulated, how to make music develop the ability to recognize numbers in group B garden children. Based on facts in the field, children are less able to sort, children are less able to classify, and children are less able to solve problems. So, to fill the problem gap, this study aims to look at skills in number recognition using music media and singing activities in children aged 5-6 years.

2 THEORETICAL STUDY

2.1 *Early Numerical Literacy Skills*

A variety of fundamental mathematical skills are developed by children during the preschool years. The mapping between number symbols and quantities, order processing, cardinal principle understanding, and digit identification have all been highlighted as critical indications of a child's early mathematics learning and development. These four abilities capture key, distinctive aspects of early mathematical development. Children's knowledge of the size and order formation semantic grounds of number processing is assessed through the mapping and order processing activities. Children's counting knowledge is captured by the cardinal principle knowledge task, which is more significant than rote counting exercises.

Mathematical abilities in the preschool years and beyond are linked to the ability to map between number symbols and quantities (Mundy & Gilmore, 2009) with preschoolers, cross-notation comparison activities have been used to directly examine the mapping across magnitude representations (for example, dot arrays versus spoken number phrases). Recently, order processing has been viewed as an essential component in the growth of the numerical abilities (Lyons & Ansari, 2015). Understanding the relationships between numbers is known as order processing (i.e., symbol-symbol relations as opposed to symbol-quantity relations). Results from a cross-sectional study of students in Grades 1-6 revealed that ordinality is a vital skill for kids to have even from the very beginnings of their schooling when processing number symbols and reinforcing more difficult mathematical procedures.

Preschoolers' acquisition of cardinal principle knowledge is the subject of a sizable amount of literature. Children are instructed to produce sets of items in the Give-N tasks (Wynn, 1990). When counting a group of objects and expressing the number of items in the group with the last word correctly said and in the right order, a youngster exhibits mastery of the cardinal principle. As a result, to understand the meaning of number words, one must understand the cardinal principles of the knowledge (Sarnecka & Wright, 2013).

It has been established that cardinality is crucial for the development of preschool children's mathematical abilities because, according to some authors (Batchelor et al., 2015; Lyons et al., 2014), knowledge of cardinality indicates the beginning of children's symbolic representation of numbers.

These four fundamental numeracy abilities—namely, digit recognition, symbol-quantity mapping, awareness of the cardinal principle, and order processing—have been recognized as major markers of mathematical learning from childhood onwards. Most studies, however, are cross-sectional, which means that it is unclear whether the development of these four numeracy skills is related to one another. For instance, Wagner and Johnson, (2011) discovered a substantial association between cardinal number awareness and non-symbolic numerical discrimination in children ages 3-5. Cross-sectional data has also indicated relationships between these abilities. Slusser and Sarnecka (2011) found that children between the ages of 2.5 and 4 who understood cardinality also developed an understanding of the application of large number words to a variety of novel tasks (i.e., extend high-number words from one set to another based on their numerosity). To characterize the trajectories of skill development and identify patterns of change in these numeracy skills over time, longitudinal analyses will be employed in the current study to examine these four numeracy skills.

2.2 *Singing activities for Math Acquisition*

Over the past 20 years, there has been much discussion about the relationship between music and cognitive processes. The "Mozart effect," which showed that music listening improved young children's spatial reasoning abilities (Rauscher et al., 1997), prompted researchers to investigate links between other types of musical engagement, such as musical talent and training, and various cognitive abilities (Protzko, 2017). More recent research finds no causal relationship or small but significant effects of music on aspects of cognition including numerical discrimination, spatial-navigational ability, and intelligence, even though these studies were influential in providing some evidence for an effect of music training on cognitive skills (Mehr et al., 2013).

In addition to experimental research, there is evidence that certain cognitive factors, such as math skills, are correlated with music-related factors, such as music performance, music enrollment, and sight-singing (Haimson et al., 2011). For instance, studies show that taking music classes increases pupils' math achievement and standardized test scores (Helmrich, 2010). Most of the research reveals a moderate correlation between math skills and other forms of skills, enrolment, or achievement connected to the music (Haimson et al., 2011).

A similar, or maybe greater, link may exist between math skills and music theory skills specifically given that math skills have been proven to correspond to music training and the music skills (Rohwer, 2012). Both mathematical and musical theories are logical systems that employ symbolic representation (Singh, 2016). The same numerical and patterning features that both fields share theoretically suggest a connection between math

and music theory. A considerable relationship between arithmetic proficiency and music theory achievement has also been shown by empirical studies (Harrison, 1996).

According to research, math abilities uniquely predict music theory performance above and beyond SAT verbal scores, high school GPA, and piano ability ha, and they are associated with music theory performance both concurrently (Vaughn, 2000) and longitudinally (Jones & Bergee, 2008) as well. Importantly, different arithmetic ability tests may be able to explain disparities in music theory achievement between individuals better than standardized math examinations. As a result, we investigate whether other math indicators, such as math course experience and statistical numeracy skills, in addition to standardized math test scores, are significant for predicting performance in music theory. This can make it easier for us to distinguish between the general nature of the relationship between math and music theory achievement.

3 METHOD

This study is a quasi-experimental study with a non-equivalent pretest-posttest control group design. The research subjects were 20 children consisting of 10 experimental class children and 10 control class children. Collecting data using a scale assessment and observation. The instrument is tested through the quality of the measuring instrument and the content validity test by professional judgment. Data analysis to see reliability using SPSS 20.0 for window with Alpha Cronbach technique. Hypothesis testing uses statistical t-test techniques with the help of SPSS 20.0 for Windows which shows a significance level of 0.000.

In this intervention activity, the teacher and children sing in which there is a counting concept. The initial stage of counting in children is counting through memorization or counting. The teacher develops this ability by singing the banana compote (the theme of favorite food), which already has a number in the lyrics. Meanwhile, the control class received numerical literacy interventions through conventional methods such as using student worksheets. Research instruments include knowledge, skills, attitudes, and tendencies that are needed by someone to be able to use mathematics in various situations. Early numbering refers to the foundations of mathematical reasoning acquired from an early age. It is important to develop numeracy skills from an early age, such as guiding children to think mathematically, being required to be actively involved in the environment, providing a foothold for children to learn to reason, connecting ideas, and thinking logically, helping children observe, manage, and find meaning. The following is an assessment of children's numerical literacy skills, which can be seen in Table 1.

Table 1. Instrument

Content	Age 5 - 6 years
Algebra	Sorting, Grouping, Pattern Making, Solve the Problem
number	Compare, Order (First, second, and third), Dividing material among friends, Counting, One - one relationship
Geometry	Geometry is more than naming shapes. Geometry includes understanding spatial relationships, position, 2 dimensional and 3 dimensional objects

Measurements	Understand the attributes of objects - objects, Construct the concept of non-standard measurement, application of numbers to measure, serialize
Data Analysis	Collecting information, organizing information in simple terms, Asking, and answering questions regarding the information collected by the organization

4 RESULT AND DISCUSSION

4.1 *Result*

The results of research that have been done on the control group, after being given a pretest and then the control group did conventional learning 6 times meeting and given a posttest, can be seen from the results in Table 2.

Table 2 Paired Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	1.377	.256	12.038	18	.000	47.59500	3.95379	39.28839	55.90161
Equal variances not assumed			12.038	16.222	.000	47.59500	3.95379	39.22264	55.96736

Based on the results of the t-test, the results obtained were t = 12.038 with a level significance of 0.000. This shows that there is a significant difference between the experimental group and the control group.

The findings from observations in the experimental class were numerical literacy skills that stand out, namely indicators of problem-solving ability, such as: (1) Using the banana *kolak* song (the theme of favorite food) the ability to observe, observe and understand something, can be seen in the lyrics of the song, children can observe song lyrics, understand what information is in the lyrics (observations). (2) Ability to collect data and information (collecting). Children collect data on banana compote lyrics (the theme of their favorite food), such as the ingredients for making banana compote, and the amount of banana compote. (3) The ability to process information (communication), the child first processes any information related to the banana compote song. (4) Children's ability to convey information. The child begins to communicate what information is contained in the banana compote song and the child can ask and answer questions with the teacher.

4.2 *Discussion*

Based on the research findings, there were significant t-test results that indicated that there were differences in the observed values between the experimental class with the intervention of music and singing activities and the control class using conventional methods. This is supported by research on the effect of music or singing activities on numerical literacy skills such as Taylor and Leung's (2020) research which states that young children learn to read and count in a variety of ways. During language arts activities in preschool and kindergarten, written words are mixed with visual imagery, spoken

language, gestures, numbers, and other signals. When many forms of literacy are introduced in meaningful classroom contexts, all students, but especially those from multilingual/multicultural backgrounds, make use of the social, cultural, and emotional roles and structures they regularly observe and experience in their homes and communities.

According to Whitehurst and Lonigan (1998), developing code-based abilities and a focus on meaning is part of early numerical literacy. When children learn to understand written material and stories and narratives, systematic education based on codes and abilities that focus on meaning can potentially develop the skills a child needs to succeed in a world of literacy (Dixon-Krauss et al., 2010). Children's language development and acquisition depend on the support of adults who consistently provide feedback, foster an environment that encourages children's curiosity, and expand their exposure to the language (Mol & Neuman, 2014). Thus, the development of early numerical literacy skills is promoted in an environment that offers a variety of linguistic practices and exposes children to a variety of vocabulary and linguistic experiences (Neuman, et al., 2018).

Another important finding is the children's excitement when doing singing activities which can improve their numerical literacy skills without them knowing it. Especially when children are allowed to make their song lyrics according to their respective favorite foods, giving them new knowledge about types of food (objects) that can be counted and cannot be counted. The early growth of young children has been shown to require music. Family cultures, rituals, and relationships between early children and their social settings are strongly shaped through joint music-making, which serves as a regulator for children's behaviors and emotional states (Barrett, 2006). Taking part in music is a multifaceted activity that can operate as a scaffold to enhance children's engagement, self-expression, and the practice of academic abilities (Anvari et al., 2002). Children can co-construct their cultural milieu and learn new abilities about their experiences and environment through songs and musical activities (Lessard & Bolduc, 2011).

Additionally, music activities can provide a predictable framework, repetitious language, kinesthetic experiences, and a narrative that enhance all children's engagement and independent learning when they are incorporated into classroom routines. (Vaiouli & Friesen, 2016). In addition, music encourages engagement and collaboration in the educational context and gives students a sense of belonging in the classroom by singing, playing, listening, and responding to learn anything (Vaiouli & Ogle, 2015).

To gain better knowledge about the potential advantages of music in children's engagement and early numerical literacy skills, future research could examine the effects of music curricula in early childhood settings (combining quantitative and qualitative metrics). In addition, to improve professional development programs, it is important to research the needs of early childhood educators and the support available. Large cohort studies and long-term studies can be undertaken to further explore the possible contributions of music to the academic development and involvement of all young children in early childhood settings.

5 CONCLUSION

Using rhymes or songs is a fun way to learn numbers for children. The child will be able to count the number of ingredients to make banana compote (his favorite food) in the lyrics of the song. It requires a good understanding of the core and the relationships between numbers to be able to see the interrelationships between operations, through intervention with music and singing activities this will be resolved more easily. Problem-solving abilities can be stimulated by exchanging opinions, asking questions, or conversing with children, through the intervention of singing activities, this becomes an activity that stimulates numerical literacy skills by making children happier. Material can be in the form of imagination, real events that occur around children, or media games and songs.

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