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Modified Bottle Cap for Improving Children's Arithmetic Ability

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ABSTRACT: The preliminary study showed that the main problem, however, faced by kindergarten students are lack of mathematics skill, such arithmetic ability in kindergarten Galis. Therefore, the present study aims to investigate the effectiveness of a modified bottle cap as an educational game tool towards enhancement of arithmetic ability. Samples were prepared for the quasi-experiment research design involving 60 children, aged 4-5 years. A detailed comparison is made between the experimental condition, consisted of 30 students, received the educational game tool activities and the control condition which consisted of 30 students, received the instructional activities as usual. Before and after two weeks of the intervention with the game tool of a modified bottle cap, measures of arithmetic ability were administered to either experiment or control class. The results of the study indicated that in the experiment class, children's arithmetic ability increased significantly compared to children in the control class. The differences may have been due to the intervention. To conclude, the modified bottle cap as an educational game tool effective to improve children's mathematics skill, especially for arithmetic ability. However, the findings required the extended study on other research methods and the bigger size of the samples.

Keywords: Early Childhood, Modified bottle cap, Early Arithmetic Ability.

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1 INTRODUCTION

Early childhood develops a fundamental understanding of concepts during the early years of school. The development of concepts and skills from infancy to early childhood would become the basic and strategy for teachers needed in inquiry learning. The concepts which provided for early childhood must always pay attention to and prioritize about child development. Mistakes regarding the level of material concepts given to children are a barrier that must be avoided before giving the concepts to children.

Mathematics is one of the important materials that can improve concepts or skills, especially high order thinking skills such as logical thinking, critical thinking, creative thinking, analyzing and solving problems in everyday life. In this era, high order thinking skill is one of the important skills to be able to keep abreast rapidly of current development of science and technology. Education has the responsibility in fulfilling the ten main abilities needed to face the future. Children are not only equipped with knowledge but also must be equipped with ways of thinking. The way of thinking must be introduced and familiarized from children so that later they are accustomed to being able to think critically, analytically, and creatively. By having high order thinking skills, students are expected to find the right concept of knowledge based on activities.

The most recent results of the Program for International Student Assessment (PISA) 2015 (OECD, 2019) showed that Indonesia underperformed and was position in the bottom eight out of 70 participating counties for mathematics. Even though the PISA was conducted for 15 years old, the results can be assumed for the mathematics skill in the early childhood which means early math in kindergarten students assumed also underperformance because through identifying predictors of performance in the early grades will determine the performances in the later grades (Martin, Cirino, Sharp, & Barnes, 2014). The preliminary study on Kindergarten students showed that they lack arithmetic ability because of the inappropriateness teaching method such teachers used traditional methods that offer either a passive child acting or didn’t involve the element of playing.

Early childhood is still in a concrete operational stage. Ideal learning can be done through learning that provides direct experience with concrete objects, interesting media, or the use of certain techniques to arouse children's interest and motivation to get to know and understand mathematical concepts. Children master their cognitive skills through real interactions using various materials found in their environment. Play activities are valuable but direct for children. However, understanding the concept of play in the context of education remains unclear among educators and practitioners of early childhood education curriculum.

A stimulating environment to encourage learning while playing in preschool is very important. Therefore, to ensure the effectiveness of mathematics learning, teachers must recognize the different cultures and needs of various groups of children. Teachers must also realize that managing classrooms requires the ability to do many things at once, to make important decisions immediately every day and also to adapt and be flexible to sudden changes. Mathematics is an abstract and complex concept, so meaningful learning through play activities to nurture children's interests and attitudes towards mathematics must be the focus of the preschool curriculum. Teachers must avoid personal emotions during their interactions with young children because the field of education is quite challenging given the various play activities that will be held and achieved. In the end, teachers must always pay attention to the progress and development of their professionalism as a role model for children.

There are substantial benefits to be gained from a traditional game tool. However, this game tool has been declined these days due to an increasing number of digital game (Schacter & Jo, 2017) tools which is not accordingly with a rural area. Moreover, the traditional game tool could be gained through utilizing some kinds of stuff in around either a school or home (Suryadi, 2007) such as modified bottle cap.

Several recent kinds of research have shown that learning through games by intervention an object can develop mathematical competence proven effective (Rohmah & Waluyo, 2014); (Fitri & Syamsudin, 2019); (Vogt, Hauser, Stebler, & Rechsteiner, 2018) and more interesting as well as enjoyable (Ayuni & Setiawati, 2019); (Malapata & Wijayanigsih, 2019). This because play has an important part in children's life. However, in this study will modify a bottle cap as a counting tool. In line with this, one of the most suitable instructional activities in the kindergarten is learning while playing and combining some methods, media, and techniques which allow all senses to be used (Depdiknas, 2005). Therefore, the main aim of the present study is to investigate the effectiveness of the educational game tool of a modified bottle cap in enhancing the ability of kindergarten students' arithmetic in Galis. Additionally, this educational game tool can be an alternative approach in teaching mathematics skill for early childhood education.

2 THEORITICAL STUDY

2.1 *Educational Game Tool of a Modified Bottle Cap*

Generally, the educational game tool refers to as tools for a play that deliberately designed specifically for the instructional goal and the development of children (Guslinda; Kurnia, 2018). In line with (Aqib, Zainal, 2010); (Rahman, 2010); and (Depdiknas, 2007) the educational game tool is everything that could be used as a medium or tools to play and contain the educative value. From this definition, it could be concluded that educational game tools have some characteristics such as designed and developed for kindergarten students, to support the development of children, can be used with multiple ways and shapes, safety for the children, and relevance with the children's development and needs, as well as based on the instructional goal. Therefore, a modified bottle cap can be defined as an educational game tool to play and to count as an effort to improve the mathematics skills of the children.

2.2 *Why Educational Game Tool of a Modified Bottle Cap?*

Teaching mathematics in kindergarten students with educational game tools can support the development of mathematics skills because the children will learn best when they directly interact with an object, not just with the words (Khasanah, 2013). Therefore, the educational game tool of a modified bottle cap can be assumed effective in teaching the mathematic skill of kindergarten students. Even though a bottle cap from the kind of stuff which not used and as a non-digital game, (Zulkardi, 2011) proved that traditional game can be built mathematics skill of children. Thus, a bottle cap can be assumed effective to support the kindergarten students improving their mathematics skill. Therefore, those assumptions imply that to support mathematics skill teachers are encouraged to provide rich resources learning to facilitate instructional activities that can enhance the mathematics skill. The development of early mathematical skills, arithmetic ability, teachers should apply multiple methods and media which offer an active child and involve the element of play with an intervention either with an object or a process (Blevins-Knabe, 2016).

Therefore, teacher-student interactions are vital activities that build the kindergarten students' understanding of the arithmetic ability (Jacobi-Vessels, Todd Brown, Molfese, & Do, 2016).

In principle, to develop learning media in learning is through materials that are easily obtained and available in the surrounding environment. Creative teachers will be able to create, develop media at affordable costs, but provide optimal effects in learning. This media bottle cap was modified and developed with the aim of improving children's mathematical abilities. However, on the other hand this media can also be used to stimulate a child's sense of care for the environment. This is because the media used is made from recycled materials, which are used bottles. Children's creativity will also be stimulated because they are inspired by teachers who creatively create interesting media from these recycled materials. Additionally, the bottle cap is not only easy to modify but also easy to find around the home or schools as well as suitable for the rural area. In additional, educational game tools can be divided into the digital game and non-digital game ((Lai, Ang, Por, & Liew, 2018). They said that non-digital game may require physical contact and/or equipment which are not digital devices. However, this study defines educational game tools as utilization non-digital games in terms of the bottle cap as a tool to count for kindergarten students.

2.3 *Learning and Playing in Kindergarten Students*

Play and games are very important for children. Play is one way to help develop various aspects of early childhood. Playing according to Piaget (1951) is an activity carried out repeatedly for fun (Hurlock, Elisabeth, 1978). Additionally, Hurlock (1987) alsos saod that play is every activity carried out with pleasure without thinking about the final result. In its general definition, in psychological terms, is defined by Joan Freeman and Utami Munandar (1991) that play is an activity that helps children achieve complete development in terms of physical, moral, intellectual, social and emotional aspects (Ismail, 2006).

Mulyadi (2004) provides 5 definitions of play, namely: something that is fun and has intrinsic value in children; has no extrinsic purpose, the motivation is more intrinsic; spontaneous and voluntary, there is no element of compulsion and freely chosen by children; involves the active participation of children; have a special systematic relationship with something that is not playing, such as creativity, problem solving, language learning, social development and so on (Ismail, 2006).

Games according to KBBI are something that is used to play, goods or something to be played with ("Kamus Besar Bahasa Indonesia Online," 2019). There are some experts who explain theories about games. The game must be seen as an exercise of functions that are very important in later adult life. Meanwhile, the game provides respite after doing the task and at the same time has the nature of cleaning, he argues that the game is the opposite of work.

One of the most important principles of the brain is facilitated meaningful learning experiences through hands-on, immersed in real-life and meaningful learning (Rushton, 2011). It means that the best way of a child to learn is through hands-on learning experiences because when a child learns through this experience, they will use their senses so that the meaningful learning experience will take place. Therefore, a modified bottle cap as an educational game tool can support a child to learns and use their senses such as sound, sight, touch. Thus, learning with this educational game tool would create a meaningful learning experience.

Piaget, known as a cognitive theorist, consider playing to be a major tool for facilitating children's cognitive development. Simply, play is known as activities in which children are deeply involved (Grindheim, 2017). Additionally, Early childhood education has been based on a strong ideological commitment to a child-centered approach, which embraces learning through play, exploration, hands-on experiential activities (Elizabeth, 2011) because the play has a vital role for cognitive development. The study showed that children who play freely with designed non-digital play can stimulate cognitive development. (Lai et al., 2018). Additionally, to make children choose and practice over and over again, games and playful activities are the foundation of children's learning (Schwartz, 2005).

In the kindergarten, to facilitate children's learning and development should consider learning to play as an important pedagogical practice Barblett, Knaus, & Barratt-Pugh, (2016) because playing is vital for children as an attempt to understand and consolidate learning experience. Furthermore, Vygotsky's theory claims that the importance of young children learning is appropriating tools, it claimed that a direct impact on children's future abilities and learning experiences are learning using tools during early childhood (Johnson & Wu, 2019).

Therefore, (Barblett et al., 2016) proposed seventh characteristics of playing such as: pleasurable – is often repeated, because play makes a deep sense of joy; voluntary – event though the play is free to choose activities, it can be invited; symbolic – play, sometimes, has an "as if" activities; meaningful – play has meaning to the children; active – play with objects or ideas are requires active mental, verbal, or physical engagement; process-oriented – the most important of playing to the children is focused on the process, thus usually not about a predetermined outcome or product; intrinsically motivating – play is located in children itself. Based on the characteristic above, this study define play as a joyful activity with a physical engagement such a modified bottle cap as an educational game toll in order to make the kindergarten students deeply involved.

2.4 *Mathematics skills for kindergarten students aged 4-5 years*

The introduction of early mathematical concepts is very important because it is the basis for children in understanding higher mathematical concepts in the future (Bakar, 2017). Early mathematical knowledge gained through direct and meaningful experience in a pleasant environment helps in growing students' interest in learning mathematics (Ginsburg et al., 2008). Concepts such as pre-numbers, initial numbers, number operations, measurements, shapes, time and space must be learned after the student development stage and are important components in early mathematics learning in preschool.

Important mathematical developments among children begin with their experiences related to real objects or objects that have different quantities or qualities such as colors, sizes, and shapes when manipulating numbers around them. According to Piaget (1962), every normal child is able to understand mathematics well when the activities and methods used can interest them. Mathematics is an example of logical thinking that forms the concept of numbers among children who need experience, social interaction, time, language, and understanding of children's minds. Mastery of mathematical concepts does not come from workbooks or assignments or paper and pens. Children build their mathematical knowledge and develop mathematical skills through direct experience with real life activities. Children will use their mathematical thinking in solving actual problems in building mathematical abilities.

The term mathematic skill refers to basic concepts of counting, quantity, shapes, spatial relations, measurement, and pattern (Harris & Petersen, 2017). These basic concepts can be seen in table 1 as below:

Table 1. Development of early math skills for children.

Years	Basic Concepts
4-5 years old	Be able to add or subtract small quantities of objects

To define the mathematic skill, this study divides the mathematics skills into four center numerical skills for learning mathematics in children aged 4-5 years (Aunio, Pirjo; Tapola, Anna; Mononen; and Niemivirta, 2016). These are symbolic and non-symbolic number sense, understanding mathematical relations, counting skills, and basic skills in arithmetic (see table 2.)

Table 2. Core numerical skills for learning mathematics in children aged 4-5 years

Symbolic and non-symbolic number sense	**Counting skills**
	Number word sequence skills
	Knowledge of number symbols
	Enumeration skills
Understanding mathematical relation	**Basic skills in arithmetic**
Early mathematical-logical principles Operational symbols in mathematics	Simple addition and subtraction skills

Based on table 1 and 2, mathematic skills categorized into six and four core skills. However, this study concentrate on the basic skills in arithmetic refers to as simple addition and subtraction task with concrete materials in the limited number or small quantities, because the subjects of the study average in 4-5 years old. Thus, the adoption of bottle cap as an educational game tool the educational game tool called as concrete material. Therefore, mathematic skills can be defined as a simple addition and subtraction ability with the number less than 5.

Features of the learning environment an effective, supportive learning environment that ensures young children will be actively and successfully involved in learning mathematical content and processes includes the following features such: rich problem solving tasks, productive discourse opportunities, learning resources, differentiated learning experiences, observation of children's learning (Copley, 2016).

2.5 *Definition of Arithmetic*

Arithmetic (sometimes spelled incorrectly as arithmetic, derived from Greek αριθμός - arithmos = numbers) or formerly called arithmetic is a branch (or precursor) of mathematics that studies the basic operations of numbers. By ordinary people, the word "arithmetic" is often considered a synonym of number theory. Basic arithmetic operations are addition, subtraction, multiplication and division, although other more sophisticated operations (such as percentage, square root, removal, and logarithm) are sometimes also included in this category. Calculations in arithmetic are carried out according to a sequence of operations which determines which arithmetic operations are performed first.

Arithmetic, on the other hand, requires understanding fact numbers, counting, ordering serial numbers, mastery the sum of the number, reading and manipulation of symbols, and knowledge

of the rules governing the four basics addition, subtraction, multiplication, and division operations. In arithmetic, a number of discrete operations must be done in the right order. For example, additions involve the strict organization of numbers order. The symbol is used to indicate the nature of operations that must be performed, for example, the sign (+) is to add. In all these operations, unambiguous rules govern notation system spatial settings (Haskell, 2000).

3 METHODS

3.1 *Participants*

The study was conducted in kindergarten students in Galis, Madura with an average age of 4-5 years. This study involved two classroom that consisted of 60 students (30 for experimental class and 30 for control class).

3.2 *Research Design*

This study employed quasi-experimental design with two classes. These classes were divided into two conditions: experimental condition and control condition. In the control condition, the children received their learning activities as usual. Whereas, in the experimental condition, the children received learning activities used the educational game tool of modified bottle cap. Additionally, those classes received the same course in early math especially at the simple addition and subtraction.

3.3 *Mathematic Measures.*

This study defined the concept of the mathematic skill as the ability of arithmetic, in which the children can conduct a simple number of addition and subtraction. However, the simple number has been decided start from 1 number to 5 number. Moreover, these abilities are fit with the characteristic of the children age 4-5 years. (Harris & Petersen, 2017).

Measurement involved an assessment of the arithmetic ability, in which the children's skill level was measured by asking questions for arithmetic ability. To collect the children's responses a rubric using the 4-point scale for each task is employed (See table 3). The same mathematical measures were used in the pretest and posttest of two classes.

Table 3. Scoring Rubric for the Arithmetic Assessment.

Key Tasks Assessed	0 point	1 point	2 point	3 point	4 point
Addition	0 question answered	1 question correctly answered	2 question correctly answered	3 question correctly answered	4 question correctly answered
Subtraction	0 question answered	1 question answered	2 question correctly answered	3 question correctly answered	4 question correctly answered

3.4 *Procedure.*

The research of the study consisted of three steps, these are pretest (step 1), implementation (step 2), and posttest (step 3). In the pretest, a group of 60 students gathered in the classroom, three

teachers and two researchers would engage with each child for the assessment. During the assessment process for each child, the other children engaged in playful resources. Additionally, 60 students were divided into two schools where each school consisted of 30 students.

In the implementation step, there are two condition. These are: in the control condition the children participated in the learning activities led by a teacher and researcher. Whereas, in the experimental condition the children participated in the learning activities (educational game tool of a modified bottle cap) where the activities were given by the teacher and researcher. Additionally, this step was conducted in two weeks. The posttest step was conducted in the week after the implementation step was done with the same procedure to the pretest step.

3.5 *Data analysis*

Because of the absence ten of the 60 children who participate in the intervention study did not complete either in the pretest and posttest steps, thus only 50 children who completed all steps. Due to the distribution of data on the pretest and posttest did not fulfill the assumptions for normality and homogeneity of variance, this study reported the finding using nonparametric tests (i.e., Mann-Whitney *U* test) by SPSS.

4 RESULT AND DISCUSSION

4.1 *Result*

4.1.1 *Descriptive Statistic of the Scores Mean of arithmetic ability.*

Table 4 shows the mean item scores for the arithmetic ability for each class, control class and experimental class. These mean scores show that the scores on the arithmetic ability pretest did not differ between those class, it was proved by the control class obtained mean score 2.6 and the experimental class obtained mean score 2.8. In contrast, there was a significant difference on the arithmetic ability posttest between the control class and experimental class, it was proved by the control class that obtained mean score 3,4 and the experimental class obtained mean score 5,6.

Table 4. Descriptive Statistic for mean scores of arithmetic abilities in pretest and posttest,

Condition	Pretest (Mean)	Posttest (Mean)
Control class (n=25)	2.6	3.4
Experimental class (n 25)	2.8	5.6
Total (n=50)		

scored on 2 – 8 points scale, 8 is the highest score.

4.1.2 *Test of Mann-Whitney U for Pretest.*

4.1.2.1 Test of Normality Data.

Based on table 5 below, the Sig. value of Shapiro-Wilk test was obtained 0,00 < 0,05. Thus, it can be concluded that the data in the control class was not normal. In line with the experimental class the Sig. value of Shapiro-Wilk test was obtained 0,00 < 0,05. Thus, it can be concluded that the data in the experimental class was not normal.

Table 5. Shapiro-Wilk Test of Normality.

	Shapiro-Wilk		
	Statistic	d f	Sig.
Control Class	.785	25	.000
Experimental Class	.815	25	.000

4.1.2.2 Test of Homogeneity of variances.

Based on table 6 below, the value of Based on mean Sig. was obtained 0,607> 0,05. Thus, it can be concluded that the variance of data for the control class and experimental class was homogeny.

Table 6. Test of homogeneity of variances

	Levene Statistic	Sig.
Based on Mean	.269	.607

Even though the data was not normal but was homogeny. This study using nonparametric test to compare differences between the control class and experimental class. Based on the table 7 below, the asymptote. Sig. value of Mann-Whitney Test was obtained 0,556 > 0,05. Thus, it can be concluded that there was no statistically significant difference between control class and experimental class on arithmetic ability for pretest.

Table 7. Mann-Whitney Test for Pretest.

	Arithmetic Ability
Asymp. Sig. (2-tailed)	.556

4.1.3 *Test Statistic of Mann-Whitney U for Posttest.*

4.1.3.1 Test of Normality Data.

Based on table 8 below, the Sig. value of Shapiro-Wilk test was obtained 0,00 < 0,05. Thus, it can be concluded that the data in the control class was not normal. In line with the experimental class the Sig. value of Shapiro-Wilk test was obtained 0,00 < 0,05. Thus, it can be concluded that the data in the experimental class was not normal.

Table 8. Shapiro-Wilk Test of Normality.

	Shapiro-Wilk		
	Statistic	d f	Sig.
Control Class	.634	25	.000
Experimental Class	.732	25	.000

4.1.3.2 Test of Homogeneity of variances.

Based on table 9 below, the value of Based on mean Sig. was obtained was obtained 0,039 < 0,05. Thus, it can be concluded that the variance of data for the control class and experimental class was not homogeny.

Table 9. Test of homogeneity of variances

	Levene Statistic	Sig.
Based on Mean	4.489	.039

Due to the data was not normal and was not homogeny, the study using nonparametric test to compare differences between the control class and experimental class. Based on the table 10 below, the Asymp. Sig. value of Mann-Whitney Test was obtained 0,00 < 0,05. Thus, it can be concluded that there was statistically significant difference between control class and experimental class on arithmetic ability for posttest.

Table 10. Mann-Whitney Test for Posttest.

	Arithmetic Ability
Asymp. Sig. (2-tailed)	.000

4.2 *Discussion.*

The results of the study revealed the pretest scores showed that there were no differences in the mean arithmetic ability in the control class and experimental class. Whereas the posttest scores showed that there were differences in the mean arithmetic ability between the control class and experimental class. The differences may have been due to learning activities utilized the educational game tool of modified bottle cup so that this intervention had a significant effect on the children's arithmetic ability. Literature that investigates the factors underlying arithmetic problem-solving achievement extensively evaluates the cognitive components, such as working memory (WM) and processing speed, at the basis of this acquisition (Passolunghi, Cargnelutti, & Pellizzoni, 2019). The presence of learning media can affect the level of understanding and the level of memory of the brain to store material/knowledge compared to just listening to the material from the instructor or without learning media (Arsyad, 2017). This means that there is a difference in the level of understanding between learning by using media and learning without using media. Learning media provides psychological effects for students, namely giving their own interests, impressions and enthusiasm in obtaining a knowledge and learning atmosphere becomes more enjoyable so that the knowledge obtained lasts long in the brain of students (Smaldino, Russel, & Lowther, 2014; Wati, 2016).

In this context, the current research is consistent with other international research which indicate active involvement of children in the learning process as the most important factor in designing effective teaching interventions aiming at the development of children's mathematical ability. This result accords well with earlier literature showing that when the mathematical activities that take place in a school, are meaningful and help children approach the mathematical knowledge and discover mathematical concepts through various kinds of stimuli, can effectively help them develop their mathematical ability (Papadakis, Kalogiannakis, & Zaranis, 2017).

Whereas the children in the control class showed little improvement in the arithmetic ability. The role of the media in the development of education is very important. It has played an important role in influencing the underdeveloped and socioeconomic sections of society in recognizing the importance of education (Preeti, 2014). Various forms of media such as newspapers, television, radio, internet, etc. have contributed greatly to the spread of the perspective of the masses that they must focus on developing reading, writing and arithmetic skills, to make them live efficiently. In the development of education, media and technology are not only limited to classroom settings, but are also broad, make the provision of equal opportunities for learning, and are part of the real world that limits their use in the classroom. It is to limit the ability of students to compete in the world. The role of the media has been considered important not only in the development of education, but also in other fields such as, communication, motivation, social welfare, employment opportunities and understanding how to utilize technology effectively (Naz & Akbar, 2010).

The finding showed that the effect of the educational game of modified bottle cap activities on arithmetic ability were promising. Consistent with the previous studies, (Vogt, Hauser, Stebler, Rechsteiner, & Urech, 2018) said that the children gained higher learning outcome in early childhood mathematics through play-based approach, in which they used the object as an intervention. New strategies in basic mathematics education might be designed: strategies that make use of preexisting arithmetic intuition for children to drive acquisitions knowledge of symbolic numbers (Barth, La Mont, Lipton, & Spelke, 2005). Lai also claimed that non-digital games can stimulate the cognitive development of preschool age children. However, the kind of non-digital game in this study used a modified bottle cap as an educational game tool (Lai et al., 2018).

In addition, this research also showed from teachers' point of view who has the difference of knowledge and beliefs about mathematics. A teacher who has better knowledge and beliefs about mathematics leads to better teaching practice such as providing and applying adequate lesson plans. Whereas, a teacher who has bad knowledge and beliefs about mathematics lead to worse in teaching practice. This finding is in line with a prior study that knowledge and believe can predict teachers' perception skills and abilities in planning and applying adequate action (Dunekacke, Jenßen, Eilerts, & Blömeke, 2016). Teachers also need to improve knowledge and skills to enhance, improve and explore their teaching practices (Selvi, 2010).

In line with the findings, the presence of media that plays a role in creating an effective atmosphere in learning, the media also plays a vital role in increasing active participation and student ability. This is as stated by Manjale & Abel, (2017) in their research that learning media play a vital role for students and teachers to improve the learning process, increase active participation and a variety of student abilities and trainings on media for teachers are also important to improve teacher competence in developing learning media with the aim of improving the learning process. If this is done optimally, the learning process will have good quality.

This research consists of a small sample of children who involved in the assessment. Thus, it is recommended that for the future study on using the bigger sample sizes. A second methodological limitation in the research was conducted based on quantitative approach. Therefore, for the future research, it is recommended to utilize another research design.

5 CONCLUSION

To conclude, the research indicated that the utilization of educational game tool of modified bottle cap has a significant potential and may eventually lead to enhancing the arithmetic ability for kindergarten students, aged 4-5 years. Even though a play-based approach with an object to early mathematics certainly has a great potential to become an innovation, which will be adopted readily and widely by the practitioners in the early childhood education, future studies might consider utilizing educational game tool of modified bottle cap to another mathematics skills such problem-solving ability. In additional, a teacher has to have adequate knowledge and beliefs about mathematics in order to able to provide better teaching practice that leads to better planning and applying adequate action.

Media bottle cap was modified and developed with the aim of improving children's mathematical abilities. However, on the other hand this media can also be used to stimulate a child's sense of care for the environment. This is because the media used is made from recycled materials, which are used bottles. Children's creativity will also be stimulated because they are inspired by teachers who creatively create interesting media from these recycled materials. Additionally, the bottle cap is not only easy to modify but also easy to find around the home or schools as well as suitable for the rural area. As a teacher/practitioner of education, especially early childhood teachers, are required to have creativity to always present the media in each of their learning because early childhood is in the stage of thinking concretely to receive an understanding.

This bottle cap media can facilitate the teacher in learning so that children are easier to have knowledge and insight about arithmetic. The bottle cap media was developed and arranged with an attractive appearance so that children can slowly stimulate and unconsciously stimulate children's mathematical knowledge.

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