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Recognize Geometry Shapes through Computer Learning in Early Math Skills

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ABSTRACT: One form of early mathematical recognition is to introduce the concept of geometric shapes. Geometry is an important scientific discipline for present and future life by developing various ways that fit 21st century skills. This study aims to overcome the problem of early mathematical recognition of early childhood on geometry, especially how to recognize geometric forms based on computer learning. A total of 24 children aged 4-5 years in kindergarten has to carrying out 2 research cycles with a total of 5 meetings. Treatment activities in each learning cycle include mentioning, grouping and imitating geometric shapes. There were only 7 children who were able to recognize the geometric shapes in the pre-research cycle (29.2%). An increase in the number of children who are able to do activities well in each research cycle includes: 1) The activities mentioned in the first cycle and 75% in the second cycle; 2) Classifying activities in the first cycle were 37.5% and 75% in the second cycle; 3) Imitation activities in the first cycle 54.2% and 79.2% in the second cycle. The results of data acquisition show that computer learning application can improve the ability to recognize geometric shapes, this is because computer learning provides software that has activities to recognize geometric shapes with the animation and visuals displayed.

Keywords: *Early Childhood Computer Learning, Geometry Forms, Early Math Skills*

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1 INTRODUCTION

Children in their early childhood is in a fundamental or sensitive period. During this period, child's potentials emerged and stimulation from the environment is vital. Education is one of the ways to provide stimulation to children to optimize their development (Suryana, 2013). At this age, what children acquire will contribute to the development of skills and intelligence (Edwards, 2009; Trawick, 2007). At the age of 0-4 years the child's intellectual development will be as much as 50%, which then increases to 80% when they are at the age of 8 years (Gardner, 2011), thus the activity to develop children's intelligence is necessary. Visual-spatial intelligence defined as the ability to recognize space, shape and colour is one among types of intelligence that need stimulation since early childhood which can be done through playing activities as one of the alternatives.

Related to children intelligence, there are a number of research and survey results that describe the level of intelligence of Indonesian children. Program for International Study Assessment (PISA) under the auspices of the Economic Co-operation and Development (OECD) report their survey results in 2015 in which the mathematical value of the State of Indonesia placed 63rd out of 70 countries in the world (Gurría, 2016). In addition, The Trends in International Mathematics and Science Study (TIMSS) which is incorporated in the activities of the International Association for Evaluation of International Achievement (IEA) presents the results of a survey of Indonesia's achievements which ranked 36th out of 49 in the 2007 TIMSS with the acquisition of an average value of 405 from the predetermined standard value of 500, which then the average value achieved by Indonesia decreased to 386 (Martin, Mullis, Foy, & Stanco, 2011). Prior to the reports of mathematical ability and decrease of achievement above, there is a need to improve student mathematical ability especially to preschool children in kindergarten. Introducing and inculcating the ability to recognize mathematical shapes will build meaningful experiences and substantial knowledge which will contribute to their development in the future.

The introduction of mathematics to children stimulate their ability to think logically, analytically, systematically, critically and creatively as well as the ability to work together (Feliyanah, Norman, & Yulidesni, 2014). Early mathematical skills are related to human thinking abilities embodied in the thinking concept of Bloom's Taxonomy an empirical basis in cognitive development. This concept of thinking consists of 6 categories including; remembering, understanding, applying, analyzing, evaluating and creating Anderson, Krathwohl, and Bloom (2001) divided into Lower Order Thinking Skills (henceforth, LOTS) and Higher Order Thinking Skills (henceforth, HOTS) thinking stages. The ability in this stage will be well-optimized if children receive proper stimulation. Touching upon the research reports on mathematical achievement above, it is necessary to stimulate early math abilities to children which is categorized in Lower Order Thinking Skills. LOTS are stages of the initial ability to think at the stage of knowing / remembering, understanding, and applying. Considering that early childhood is in a period of concrete preoperational thinking, the ability to recognize or remember is of the researchers' concern as the focus of intervention to prevent and solve potential problems related to mathematical ability and children intelligence. The ability to recognize in early mathematics through computer learning based is expected to train children in improving early mathematics as scaffolding to higher thinking skills or HOTS.

One of the subjects that can be taught in the introduction of early mathematics is geometry. Geometry is an essential scientific discipline for the present life and the future (Inan & Dogan-Temur, 2010). However, there are some problems in the ability to recognize geometric shapes in children according to several studies that have been done, including 1) the institution, adults or teachers often ignore children limitated ability to recognize the geometry, 2) children have difficulty to classify geometric shapes such as circles, squares, triangles and squares and have limitations in recognizing the slope and size of geometric shapes at 3-6 years of age; and 3) heavy reliance to books and worksheets instead of other approach in helping children to recognize geometry in kindergarten (Conorldi, Mammarela, & Fine, 2016; Norton & Nurnberger-Haag, 2018; Sarama & Clements, 2006)). Therefore, enjoyable and interesting learning is important to attract children interest (Siswono, 2012). For this reason, creating interesting and relevant learning is

vital to build early thinking skills for children in early childhood education which later could be enhanced to higher thinking skills or HOTS.

Computer learning is one of alternatives to improve thinking skills, for instance, the ability to recognize geometric shapes. Some studies have found that computers are a central point in the formation of human resources (HR) to create independent and skilful individual (Novitasari, 2010). Computer learning has been shown to have a positive impact on children's lives such as in math skills, memory strength, problem solving skills, language, social interaction and problems on cognitive development in early childhood (Gulay, 2011b; Mohammad & Mohammad, 2012). Software available in computer learning is an alternative that can have a positive influence in the education system in Indonesia (Vitianingsih, 2016). The limitations in exploring the ability to recognize geometry forms can be overcome by the presence of technology such as the computers. Computers could be a powerful learning tool for children in helping to recognize geometric shapes in classroom. Thus, teacher skills, the availability of facilities and computer software which support the implementation of learning is paramount important to improve the ability to recognize geometry shapes in kindergarten.

2 THEORITICAL STUDY

2.1 *Early Childhood Computer Learning*

In several aspects of early childhood development (cognitive, social and emotional), computers are considered as one of the media that can help children in raising awareness, especially in the development of technology and communication (Clements & Samara, 2003; Trifunović, Čičević, Lazarević, Mitrović1, & Dragovi, 2018; Wang & Kinzie, 2010), which is also a determining factor in achieving the success that children will have in the future (Ameliola & Nugraha, 2013). The software provided in a computer unit is considered as a learning tool that can help stimulate creativity and foster children's enthusiasm. Enthusiasm that appears in children is influenced by the color composition, visual images that are displayed, games in this era have also shifted to animation and visual forms (Delima, Arianti, & Pramudyawardani, 2015; Suwarna, 2010). Therefore, computer learning can be an alternative in creating varied learning in kindergartens.

Computer learning is usually done so that children can develop the skills of imagination, critical thinking and help children express from them in learning activities (Weil, Calhoun, & Joyce, 2011) and become a means of evaluation in the learning process that has been implemented. The results that have been obtained will be used as a reference for the improvement of the upcoming chase. Computer-based learning will make students active individuals because it also contains enjoyable experience for them. Learning with the concept of active learning and student centered will make children easier to understand the concept of learning (Zare, Sarikhani, Salarii, & Mansouri, 2016). Computer learning helps children to learn and carry out activities more effectively so that the skills and knowledge they obtain are in accordance with the learning objectives, optimized and beneficial for their future education.

Computer learning in early childhood depends on the skills teachers have (Couse & Chen, 2010; Gimbert & Cristol, 2004; Sufa & Setiawan, 2017). Educators on computer learning become role models for children in guiding them in implementing learning activities (Chen & Chang, 2006; Gimbert & Cristol, 2004). In Indonesia, the use of software is used as one of the media to stimulate or provide stimulation for children to recognize numbers and geometric shapes (Alia & Irwansyah, 2018; Putra & Ishartiwi, 2015; Rochanah, 2016). Opportunities and freedom in thinking, imagining and increasing children's motivation or enthusiasm in recognizing geometric shapes are felt in computer learning, this has been proven that computer-based learning can attract children to participate in learning activities (Shilpa & Sunita, 2013) and improve their cognitive abilities (Suziedelyte, 2012).

In learning activities using computers, early childhood teachers must have skills such as; 1) to develop a basic understanding of using technology and the potential they have as a contribution to education; 2) to show some skills in using the right technology in learning in the classroom as

support as learning media; 3) to implement the technology in the objectives of learning and learning activities in kindergarten. In addition, computers in early childhood education are used and designed for individual activities. The program that can be done as a basic skill for teachers in early childhood learning activities is a program of graphical separation, observing, sorting, determining the number of objects, geometric shapes that determine, think, talk, memorize, etc. Various alternative choices and difficulties that occur in the implementation of learning can enable teachers to adapt the activities given to the characteristics and age of the child.

2.2 *Early Math Skills*

Children from low-income families in kindergarten are academically behind their friends with higher-income parents, especially in math skills (Duncan & Magnuson, 2011). Some predictors of academic achievement of early math skills (in kindergarten) are the strongest predictors of future academic achievement (Duncan et al., 2007). Children with lower math scores in kindergarten entry, on average, will continue to score lower than their peers who have higher scores throughout grade 8, a trend that disproportionately affects children low-income and minority children (Schoenfeld & Stipek, 2011). Thus, there is a call to place more emphasis on STEM education (science, technology, engineering and mathematics), especially in early childhood illustrating the need for young children to have strong basic math skills. Various studies have shown a relationship between self-regulation and math skills in early childhood. The results showed that the relationships of pre-schoolers with others - interacting effectively with peers and teachers in the classroom environment - positively predict math skills (Mackintosh & McCoy, 2019). The number and quality of parents' mathematical speech is related to initial numerical knowledge. The results of this study indicate that children who are exposed to numerical speech and more advanced mathematical conversations at home have better mathematical knowledge and skills (Susperreguy & Davis-Kean, 2016).

The natural curiosity and willingness of the child to engage in learning-learning activities is the basis for the application of mathematical concepts in kindergarten (Charlesworth & Lind, 2010). The ability that can be done in stimulating the ability to recognize mathematics is the ability to think critically, logically and analyze. The ability to recognize mathematics in kindergarten includes geometry, numbers, patterns, problem solving, and measurements that can be used as provisions for the life they will live in the future so that mathematics can be said as one of the important sciences for children who are in kindergarten. The ability to recognize mathematics in early childhood includes; 1) algebraic patterns, including the use of symbols; 2) numbers and number operations include counting, classifying or grouping, correspondence, relationships, comparisons, digging and writing numbers; 3) Geometry and spatial include tracking, analyzing the shape and structure; 4) analysis of probability data including collecting and organizing individuals and the environment; 5) measurements include recognizing and comparing length, height and weight; 6) problem solving includes communication, connection reasoning and representation (Jackman, Beaver, & Wyatt, 2014).

At an early age, children have early mathematical ability standards (Jackman et al., 2014) including; 1) numbers and number operations, which relate to a concept of the ability to think about something, then discuss these thoughts continuously; 2) the concept of arithmetic, the activity of matching names on the numbers from the count operations; 3) correspondence, the activity of pairing one object to another object or group of objects to the same other group; 4) classifying or grouping, sorting objects that include general characteristics such as size, shape, color; 5) patterns, sequencing activities or movements that occur repeatedly color, sound; 6) seriation / sequence, activities place things in sequence (small-large; short-tall); 7) geometry of activities which include shape, size, position space and direction of movement; 8) spatial comparison of activities fostering self-awareness and objects in space (exploration of beams and boxes); and 9) measurement, the activity of comparing object sizes, perceiving object characteristics. So, the introduction of early mathematics for early childhood is always adjusted to the characteristics and age of the child so that the initial mathematical activities carried out can be optimized properly and in accordance with their development.

At an early age cognitive abilities of children are related to the ability to remember, the ability to think, giving reasons about something that has happened, the language abilities they have (Sujiono, 2014). Activities that are appropriate to the age and stage of development of children are very important in supporting their growth and development (Papalia, Old, & Feldman, 2009). Jean Piaget (Santrock, 2016) revealed that in a child's cognitive development there are four stages which include sensorimotor stages (0-2 years), pre-operational stages (2-7 years), concrete operational stages (7-11 years), and stages formal operational (11-15 years). In this study, the focus of research subjects was children aged 4-5 years in kindergarten (concrete pre-operational stages). Concrete pre-operational stages can represent their world through imagination, images and words. At this stage the breadth of thinking using symbol-symbols is not based on the breadth of thought they have, but what they know by their logic. The stages in concrete preoperational include symbolic and intuitive stages. Symbolic means that abilities relate to objects invisible to the child such as words, images and numbers. There are two stages of ability that occur in this stage, namely first, the symbolic child reaches the ability to represent invisible objects (words, images, and numbers); second intuitively, children begin to practice their reasoning primitively and are curious about what concerns them.

The concept of Bloom's Taxonomy in the realm of cognitive development relates to the basis in categorizing the goals of an education, preparation of tests and curriculum related to thinking skills (Gunawan & Palupi, 2012). Lower Order Thinking Skills (LOTS) and Higher Order Thinking Skills (HOTS) are the stages contained in the Bloom Taxonomy concept. At the Lower Order Thinking Skills (LOTS) stage, it involves 3 stages, such as remembering, understanding, and applying. Whereas in the Higher order thinking skill (HOTS) stage, it includes analyzing (evaluating), evaluating (evaluating) and creating (Anderson et al., 2001). The stages in the ability to think occur sequentially and structure between one another. The ability categories contained in each stage, including;

Table 1. Concepts of stages of Bloom Taxonomic thinking

Stages of Thinking	Information
C1 Remember	mentioning, pairing, differentiating, sorting, showing, identifying, imitating, finding, recording, memorizing, declare writing, numerating and giving code
C2 Understand	explaining, categorizing, estimating, changing, calculating, associating, characterizing, comparing, description, contrasting, discussing, exemplifying, exploring, simulating, solving, doing and tabulating
C3 Apply	assigning, determining, applying, classifying, assimilating, preventing, describing, submitting, questioning, producing, process, relating, compiling, predicting, performing, stimulating, relating, solving, and synthesizing;
C4 Analyze	auditing, analyzing, confirming, detecting, diagnosing, diagraming, correlating, testing, exploring, maximizing, ordering, measuring, choosing, training and transferring
C5 Evaluation	comparing, evaluating, concluding, directing, criticizing, deciding, separating, clarifying, defending, emphasizing, measuring, choosing, summarizing, supporting, proving, testing detailing, interpreting and directing
C6 Create	collecting, composing, connecting, designing, dictating, clarifying, enhancing, combining, formulating, facilitating, repairing, displaying, producing, preparing, creating, creating, combining, compiling, animating, and correcting.

Based on the explanation that has been described regarding early mathematical abilities in early childhood, the research subjects were 4-5-year children who were at a concrete preoperational stage. In the early mathematical abilities, they are in the Lower Order Thinking skills which must be well stimulated. The ability to recognize (remember) becomes a goal that will be improved especially in overcoming problems that occur in the introduction of early mathematics especially in the ability to recognize geometric shapes based on computer learning in kindergarten. Activities undertaken by children in learning in this study include the activities of mentioning, grouping and

imitating geometric shapes in each cycle of research conducted. The ability to recognize geometric shapes can familiarize children in the activities of classifying objects in their environment either through activities using computers in the presence of animation or audio that is displayed on software in a computer unit

2.3 *Ability to Recognize Geometry Shapes*

One of the mathematical abilities related to shape and spatial (two dimensions and three dimensions) is called geometry (National Research Council, 2009; Rich, B., & Thomas, 2009) which indirectly introduces children to shapes of different objects. in their environment (Ben-Yehoshua, Yaski, & Eilam, 2011). The aspects contained in this ability such as the introduction of forms, the appearance of these shapes, the science of topology and movements and the symmetry of geometric shapes (Asiye, Ahmet, & Abdullah, 2018). In this study, activities related to the topology aspects, which are aspects of geometry without prioritizing the calculation of numbers (quantitative) or measurements in the implementation of the introduction of geometric shapes in kindergartens. The ability to recognize geometry forms is only an introduction to the shape and nature of geometry (Aslan & Yasare, 2007).

Stages of the ability to recognize geometric shapes in each individual according to Van Hiele (Tatang, 2012) including; 1) recognition, relating to the recognition of shapes (squares, triangles, circles) but they have not been concerned with the introduction of the properties of these geometric shapes; 2) analysis, the activity of recognizing and then understanding the nature of the geometric shape being observed; 3) sorting, sorting traits which are then concluded in an informal manner; 4) education, children's ability to understand and draw conclusions; 5) accuracy, the ability of children to realize the accuracy of basic principles in a proof relating to high levels of thinking, complex and complex. The concept of familiar skills related to Bloom's Taxonomy such as the activity of mentioning, grouping and imitating various geometric shapes (triangles, squares and circles) through learning using computers in the software provided in the unit.

The National Council of Teachers of Mathematics (NCTM) believes that all preschoolers up to the second grade of primary schools should be able to recognize, name build, imitate, draw, classify and distinguish between two and three dimensions (Kennedy, Tipps, & Johnson, 2008). The ability of the child number and arithmetic math concepts unwittingly are also studied by children indirectly in the process of recognizing geometric shapes (Dooley, Dunphy, & Shiel, 2014; Sarama & Clements, 2006). There are various kinds of geometric shapes such as building spaces and flat shapes. There are also various geometric shapes including flat shapes (circles, ellipses, triangles, parallelograms, squares, squares and rhombus), triangles (arbitrary third, equilateral triangle, isosceles triangle, right triangle, taper and blunt), squares, squares, rows, rhombus, kites, trapezium, beams, tubes and balls (Djadir, Minggi, Ja'faruddin., Zaki, & Sidjara, 2017; Suharjana, 2008; Tarigan, 2006). Geometry is a branch of mathematics that is taught in every level of education (Mirawati, 2017), therefore it is a good idea to instill these abilities early on in children so that they can facilitate them in facing further education.

There are several geometric shapes that can be introduced to children such as circles, triangles and squares (Depdiknas, 2007). This is also supported by a number of opinions that such as circular, triangular, and rectangular forms which are forms of early geometrical recognition which are included in flat and outer shapes (Runtukahu & Kandou, 2014; Sarama & Clements, 2006; Sudaryanti, 2006). The geometrical forms introduced through computer learning in this study to improve the ability to recognize geometric shapes are circle, triangle and square.

3 METHOD

3.1 *Participant*

The subjects of this study were children aged 4-5 years who were in group A with a total of 24 children in one kindergarten *in Yogyakarta*. The teacher in this study acted as a learning activity implementer and the researcher as an observer who assessed the achievement of the ability to

recognize geometric shapes in computer learning. In addition, the teacher and observer designed the activities together to be carried out in improving the ability to recognize geometry in computer learning through software on computer units.

3.2 *Procedure*

The action research approach is used in the research implementation of this study to solve problems in learning geometry identifiers of children aged 4-5 years in kindergarten. Action research design is 'a small-scale intervention in the functioning of the real world and a close examination of the effects of such an intervention (Cohen & Manion, 1994, p. 186). Action research approach is chosen due to its rigour as a process for practitioners to examine problems scientifically for evaluation, improvement and changing for decision and practice (Corey, 1953). In this study, there are 2 research cycles with 3 meetings in the first cycle supplemented with the activities of watching videos and question and answer session. The second cycle is carried out through 2 meetings, at each of these meetings the participants carry out the activities individually by using computer software. In each cycle researchers measured the average value of test score of each cycle after giving the intervention.

3.3 *Instruments*

This study defines cognitive development in the concept of Bloom's Taxonomy in mathematical skills towards the ability to recognize geometric shapes. During the implementation, the children perform activities that based on the stages of Bloom's Taxonomy thinking such as the preparation or remembering which is included in the Lower Order Thinking Skills (LOTS) through the activities of mentioning, grouping and drawing geometric shapes in the form of triangles, squares and circles. The assessment of the ability to recognize geometric shapes in computer learning employed a 3-point scale assessment on each of the indicator. These indicators are as the reference of interpreting the ability to recognize geometric shapes (see table 1) for each cycle. In addition, each cycle only differs in terms of the activities for to ease the teacher and the observer in assessing the children ability.

Table 2. Indicators of Ability to Recognize Bloom's Taxonomy Geometry

Variable	Indicators	Assessment
Ability to recognize geometric shapes	• Mentioning geometric shapes (square, circle and triangle)	1. Children are able to mention geometric shapes 2. Children are less able to mention geometric shapes 3. Children have not been able to mention geometric shapes
	• Grouping geometric shapes (square, circle and triangle)	1. Children are able to group geometric shapes 2. Children are less able to group geometric shapes 3. Children have not been able to group geometric shapes
	• Imitating geometrical shapes (square, circle and triangle	1. Children are able to mimic geometric shapes without help 2. Children are less able to imitate geometric shapes 3. Children have not been able to imitate geometric shapes

3.4 *Data Analysis*

In analysing the data, the researchers employed descriptive statistics such as percentage and mean score. To ease the calculation a computer software of SPPS version 22 was utilized in calculating the scores in pre-cycle, cycle I and cycle II. The data of recognising geometric shapes

were obtained from observation and documentation during the implementation of computer learning. Then, the results of the ability to recognize the geometry will be assessed by indicators of three scale which in turn will be interpreted based on interval data representing the level of this ability. The criteria for assessing the achievement based on interval data is taken from Arikunto (2010) which include; 1) very good, if the average ability score is between 81-100%; 2) good, if the average ability is between 61-80%; 3) sufficient, if the child's average ability is between 41-60%; 4) Less, if the average value of a child is 21-40%; and 5) Very lacking, if the average is between 1-20% (Arikunto, 2010). The interval percentage will be deployed in interpreting the ability to recognize geometric shapes via computer learning in kindergartens.

4 RESULT AND DISCUSSION

4.1 *Result*

The results (figure 1) showed a significant improvement of the ability in recognizing geometric shape through computer learning. The improvement of this ability includes; (1) the ability to mention geometric shapes (triangle, square and circle) shown by seven pre-schoolers who performed well with interval data of 29,2%. After watching videos and question-and-answer session in the cycle one, the ability increased to 45,8% (11 children) and significantly went up to 75% (18 children) in cycle two after they followed individual activity by using computer software. (2) in the pre-cylce, 29,2% of the pre-schoolers or 7 children who did well which then increased to 25,7% (9 children) in cycle I then finally went up to 78% (18 children) in cycle II. (3) in pre-cycle of the ability to imitate geometric shape, seven children (29,2%) performed well, then became 13 children or 54,2% in cycle I and risen up to 79,2% (19 children) in the cycle II.

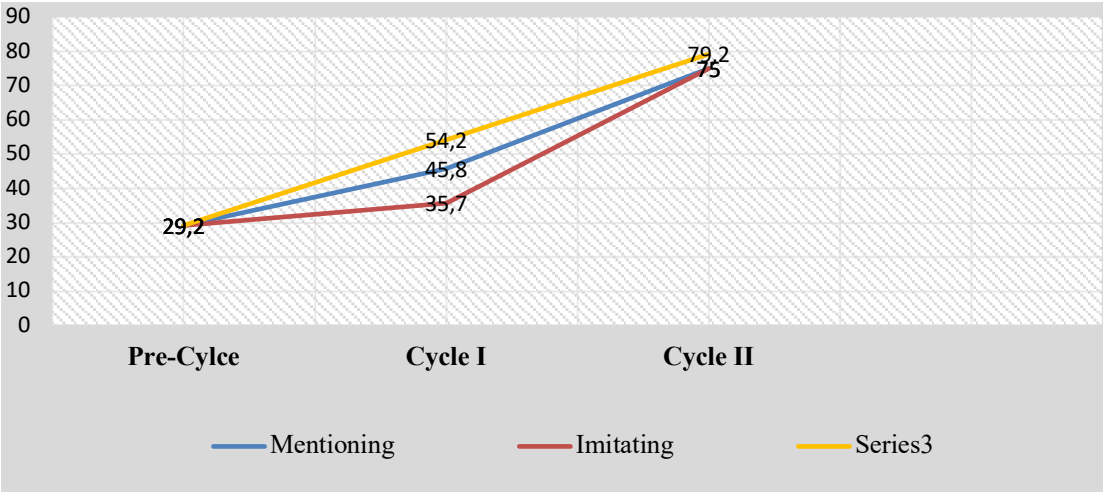

Figure 1. Graph of the ability to recognize geometric shapes in computer learning

The assessment in pre-cycle is performed by interpreting the learning conducting by the teacher. The activities of introducing geometric shapes were conducted using pictures of picture media or used magazine and draw the same shapes on the board by the students in group A in turn. The assessment in the observation suggested that there are some mistakes by the teacher where the explanation of the shapes was too brief without question and answer session. The following the result of computed learning in improving the ability to recognize geometric shapes in kindergarten:

Table 3 Percentage (%) of ability to recognize geometry shapes in pre-cycle

Variables	Assessment		
	Able	Less Able	Not

			Capa-ble
Mentioning geometric shapes	29,2	70,8	
Grouping geometric shapes	29,2	45,8	25
Imitating geometric shapes	29,2	70,8	

Seven children are able to mention and draw geometric shapes while 17 children performed below average. Six students were not able to classify geometric shapes, 11 children perform above average and only seven children do well. In pre-cycle, the activities are too centered on teacher which might accounted as major cause to the results above. The availability of school facilities in the kindergarten such as computers are not utilized optimally by the teachers to create communicative and enjoyable activities to improve this recognizing ability. Also, the picture used as examples on the board and pictures for media are not similar which drive students confused. Moreover, monotonous learning dominated by teacher discourages student participation and only usual active students who participated duplicating the geometric shape. Thus, the result of in the pre-cycle is 27,8% average of the range between 21-4`% which is still less than enough.

The planning stage becomes the main stage carried out in cycle I, at this stage the activities include the preparation of the Daily Activity Plan (RKH), managing the learning environment, and equating perceptions between researchers and teachers regarding learning activities). The implementation of the actions in the first cycle carried out 3 times. The activity carried out in the form of showing a video about geometric shapes to children such as squares, triangles and circles on a computer screen on each unit for each child. After showing the video, the teacher questions and answers the child about the geometric shape. Based on the results of the observational assessment (Table 4), it was concluded that; 1) there are 11 capable children and 13 children who are still unable to mention the three geometric shapes; 2) 9 children are categorized as able, 13 underprivileged children and 2 children who have not been able to classify geometric shapes; and 3) 13 able children and 11 underprivileged children in imitating ge-ometry forms. The meeting which was held 3 times this time the teacher only displayed a video and question and answer about geometric shapes in order to deepen the child's knowledge of geometric shapes. The grouping activities are done by the teacher by giving examples of drawings from the computer, while the imitating activities are done by drawing geometry using Microsoft Word applications with examples of drawings as a child's help in remembering the shape of this activity takes about 20 minutes. From the results that have been described, the average value obtained in the first clusters was 47.2%. This shows that in the first cycle there has been an increase and the criteria for the ability to recognize geometric shapes of children in computer learning are in sufficient criteria, with an average value in the range of 41-60%.

Table 4 Percentage (%) ability to recognize geometric shapes in Cycle I

Variables	Assessment		
	Able	Less Able	Not Capable
Mentioning geometric shapes	45,8	54,2	
Grouping geometric shapes	35,7	54,2	8,2
Imitating geometric shapes	54,2	45,2	

In cycle II, the improvements made include providing opportunities for each child to be active in the introduction of geometric shapes. The introduction of geometrical features becomes the focus of the cycle in order to optimize children's understanding of geometric shapes through computer learning. The meeting was held 2 times in this cycle, the first meeting the teacher still showed a video about the shape of the geometry and then explained its characteristics by using computers. At the second meeting after the teacher shows the video, the teacher gives a concrete example of objects around the child that characterizes geometric shapes using a computer. The two meetings in this cycle require children to conduct question and answer activities, which are

then followed by activities grouping and imitating geometric shapes through applications (software) learning on computers that are carried out by children independently.

Table 5 Percentage (%) of ability to recognize geometric shapes in Cycle II

Variable	Assessment		
	Able	Less Able	Not Capable
Mentioning geometric shapes	75	25	
Grouping geometric shapes	75	25	
Imitating geometric shapes	79,2	20,8	

From the observations (table 5), there was an increase which included 18 capable children and 6 children who were less able to mention or classify geometric shapes. In the ability to imitate geometric shapes, there are 19 capable children and 5 children who are less capable of imitating geometric shapes using a computer on the software provided. These results indicate that the acquisition of the average percentage value of children obtained in this cycle 76.4% where the value is adapted to either criteria with a range of values of 61-80%. Obtaining these results states that there is a significant increase in class II of the ability to recognize geometric shapes in computer learning

4.2 *Discussion*

The increased ability to recognize geometry in this study shows that computer learning can be used as an alternative in improving the ability to recognize geometric shapes and overcome problems related to these abilities in learning. In the implementation of the second cycle, children use software related to activities on geometric shapes. In the activities of operating a computer, children have been given instructions on geometric shapes then moving onto activities using computer. They start by moving the mouse, turning on and off the computer, typing letters on the keyboard, etc. This illustrates that the ability of teachers to understand the potential in learning by using computers help children to utilize computer as learning media to develop their skills and knowledge (Paquette, Fello, & Jalongo, 2007). Teacher's ability to determine when and how to integrate and utilize computers in early childhood education make learning-learning activities interesting for children which build their experiences, creativity and skills to explore their lives in the future (Mohammad & Mohammad, 2012). The more children receive or carry out varied learning activities, the more knowledge and information they obtain. The results of this study indicate the importance of developing the ability to recognize geometry in kindergarten to stimulate early mathematical abilities as part of cognitive development that improves children's thinking abilities (Anderson et al., 2001). Thinking abilities in this sense refer to LOTS which later on could help children to level up their thinking abilities to HOTS.

The implementation of pre-cycle activities on the ability to recognize geometric shapes is still inadequate. Activities to improve this capability are carried out by carrying out computer-assisted learning. The first cycle of this research showed that there was an increase of ability after the treatment of showing a geometric shape videos on a computer and conducting question and answer within two meetings. In the second research cycle, children begin their activities by operating computer in carrying out applications on the introduction of geometric shapes. The result of this research is in line with Rochanah (2016) on improving mathematical abilities through computer media. Computers can be used as learning media, in which the ability of memorizing and understanding is proven to be better with the variation of learning using learning media compared to the traditional learning (Arsyad, Rahman, & Ahmar, 2017). The results of this research also demonstrated the emergence of children interest and enthusiasm in carrying out activities using computer media (Gulay, 2011a) The experience gained from activities that children do directly reinforces their knowledge lasts longer in a child's brain memory (Smaldino, Russel, & Lowther, 2014). In activities that support children's mathematical abilities, the implementation of learning should be meaningful for them through the activities that stimulate their mathematical abilities (Papadakis, Kalogiannakis, & Zaranis, 2017). In computer learning, the availability of software

that contains activities to recognize geometric shapes stimulates creativity and enthusiasm for children through animation and visuals that are available in a computer display (Delima et al., 2015).

The activities carried out by children in this research are associated with learning theories proposed by prominent educational figures, including; 1) Jean Piaget, on children's computer learning through research cycles that have been designed. This shows that the increase in ability occurs due to information processing carried out by children such as assimilation, accommodation and equilibration (Santrock, 2016; Sujiono, 2014). The process of assimilation refers to the process of new information which enters into one's cognitive structure. Secondly, the accommodation process is the process of adjusting new information with information that previously has been obtained. Third, the equilibration process is the adjustment of information from the assimilation and accommodation processes. The formation of this knowledge is achieved by constructing knowledge that children have through their experiences, as well as their activity in finding and obtaining information which means an action that supports the formation of knowledge with the activities they carry out in their daily lives; 2) Lev Vygotsky, computer learning is done with the help and direction of the teacher in operating the computer or direction in the implementation of the research cycle can improve cognitive abilities that children have cognitive abilities that children have. The Zone of Proximal Development (ZPD) illustrates this, whereby children's abilities can develop better if there are interactions with people who are more mature or more understanding (Santrock, 2016). The assistance provided is on the same level as children ability, then the assistance will gradually be released if the child has been considered capable of solving the problem independently (Zack, 2014, p. 3). John Dewey, the ability to recognize geometric shapes in children through computer learning as it has been explained that the activities in this study in the first and second cycles of children were more actively involved compared to activities in the pre-research cycle. Early childhood learning must be child-centered, where children do the learning process in obtaining information or knowledge (Santrock, 2016).

Based on the explanation above, there is a significant improvement in ability to recognize geometric shapes in children of ages 4-5 years in kindergartens. This improvement is the result of computer learning which involves children directly to recognize geometric shapes which also contribute to their engagement during the implementation of the activities. Thinking skills as described in Bloom’s Taxonomy in Lower Order Thinking Skills (LOTS) which are embodied in the activities are parts of effort to level up their thinking ability to higher level which is Higher Order Thinking Skills (HOTS).

5 CONCLUSION

This study aims to solve the problems in the introduction of early mathematics, especially on the ability to recognize the geometrical shapes via computer learning. Computer learning and the involvement of children become proven to positively influence the improvement of their ability. Computer learning with animation attracts children participation during the implementation. A significant improvement has been demonstrated in pre-cycle activities with an average value of 27.8%, cycle I with an average of 47.2% and cycle II an average value of 76.4%. The ability to recognize geometric shapes is part of the mathematical ability in the cognitive domain of Bloom's Taxonomy with the assistance and active involvement of children in conducting learning activities as an effort to improve the ability to recognize geometric shapes in computer learning. The stages in Bloom's Taxonomy will help children to achieve the Higher Order Thinking Skills (HOTS) skills. Higher Order Thinking Skills are important for the child's thinking ability to solve and deal with problems in their lives which should be done gradually through different stages. Thus, the results of this research suggested that computer learning could improve thinking skills on the level of Lower Order Thinking Skills (LOTS) in recognizing ability to children aged 4-5 years in kindergarten.

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