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Content of Early Numeracy in the Malaysian Preschools

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Abstract

Malaysian curriculum has seen a dramatic increase in attention to the numeracy ability among primary school students. Through LINUS (Literacy and Numeracy Screening) program, curriculum aims that every Malaysian students should acquire basic numeracy skills at the end of 3 years of primary education. In line with global concern that numeracy are basic skills needed to prepare students for the next level of education. But, literatures prove that numeracy skills among primary school students depends on the early numeracy skills that carried from their preschool life. Therefore, the contents of early numeracy skills grasped during preschool should be taken seriously in order to make sure development of numeracy skills among children well constructed. This concept paper will discuss the contents of early numeracy for the preschool children aged five to six years in Malaysia. The early numeracy content from several international bodies and researchers will be discussed too. Knowledge of the content involved in the formation of early numeracy will help educators and parents plan and apply appropriate, challenging mathematics activities that will intentionally build numeracy skills in children.

Keyword: Early Numeracy, Malaysia

Numeracy

Numeracy has been defined in variety ways depending on individual, organization or country based on their own opinion and understanding. British Columbia Association of Mathematics Teachers (1998) quoted by British Columbia Association of Mathematics Teachers (BCAMT) (n.d.), defines numeracy as a combination of mathematical knowledge, problem solving and communication skills that needed by everyone to interact with others. Numeracy includes the ability to apply various aspects of mathematics to understand, predict, and control routines in human life (British Columbia Association of Mathematics Teachers, n.d.). National Research Council (NRC) (2001), as quoted by (Walker-glenn & Reynolds, 2007), added affective domain to the definition given by British Columbia Association of Mathematics Teachers. It states

that people should have confidences in applying aspects of mathematics in life daily life. The Southern Regional Education Board (SREB)(2006), defined numeracy as a combination of mathematics' skills and attitudes towards mathematics. Numeracy was expressed as the ability to understand and interpret the number symbol and the relationship between them, communicating and representing mathematical concepts through a variety of ways, developing the culture of mathematics. Numeracy also refers to ability of looking the world through the eyes of mathematics as well as appreciating the aesthetics value, history or mathematical applications (SREB, 2006).

Besides organization such BCAMT, NRC, SREB, researchers also played a significant role in mathematics education by giving variety definition of numeracy. Numeracy is associated with the ability to process, communicate and interpret numerical information in many different contexts (Askew, Brown, Johnson, Rhodes, & Wiliam, 1997). Although different terms are used such as quantitative literacy or statistics literacy, many researchers defined numeracy as the ability to associate and use mathematics in a different aspects of life (Asiahwati, 2015; Gal et al., 2003; Kemp, 2003; Watson, 2002). As the term mathematics used in defining numeracy, shows that numeracy and mathematics are inseparable. Although the boundaries and overlapping between numeracy and mathematics is often discussed among researchers, but they are not deny that numeracy and mathematics are interrelated (Dunphy, Dooley, & Shiel, 2014).

In Malaysia, the terms of numeracy was first mentioned in mathematics education in 2010 through a national program called LINUS (Literacy and Numeracy Screening). The program aims to assess the numerical levels of Year 1 to Year 3 school children. Through LINUS, numeracy is defined as the "ability to perform basic mathematical operations and understand the simple mathematical ideas and applying knowledge and skills of mathematics in daily life" (Kementerian Pelajaran Malaysia, 2010). Even though the term numeracy is a newly stated in l in 2010, numeracy element has been inculcated in the mathematics curriculum since the outset.

Early Numeracy

Focusing on development of numeracy starting from early stage is a new global agenda, including a world body, Evaluation of Educational Achievement (IEA), which operates the leading mathematics assessment, Trends in International Mathematics and Science Study (TIMSS). TIMSS 2011 suggests that early numeracy experiences that gained during preschool are critical for developing numeracy. In particular, early numeracy lay a good foundation for future numeracy skills (Atweh, Arindam, Graven, Jayasree, & Venkat, 2014; Mullis, Martin, Foy, & Arora, 2012). Many researchers agreed that focusing on early numeracy development (numeracy before school) is the key to ensure the future ability of numeracy (Anders et al., 2012; Anderson, 1997; Clements & Sarama, 2007; Munirah, Ayminsyadora, & Abdul Razak, 2013). Hence, providing appropriate content is crucial in developing numeracy skills among children as this is foundation for their future numeracy skills (Clements & Sarama, 2011; Deflorio, 2011).

Contents of Early Numeracy

To know the appropriate content for student's level is the key point to help them developing their numeracy skills (Clements & Sarama, 2011). Hence, this paper will discuss the content of early numeracy skills by focusing on early numeracy knowledge and skills to be mastered by children before their age of seven (preschooler). Since the definition of numeracy has to do with knowledge and skills related to mathematics (as discussed above), the analysis content of early numeracy will cover skills and knowledge of mathematics besides the

content of numeracy as suggested by scholars. As Dunphy et al., (2014) and many other researchers define numeracy related to mathematics, the content of it also should be interrelated.

National Council of Teachers of Mathematics (NCTM) as an international organization associated with mathematics education suggested the principles and standards for mathematics education for preschooler in 2000. This is an improvement to the previous standard, known as curriculum focal points which is updated in 2006. Based on the Curriculum focal points outlined by NCTM (2006), there are five content indicates for preschooler :numbers and number operations, algebra, geometry, measurement, and data analysis. Clements and other scholars further discussed and illustrate the relationship between these content as shown in the figure 1. Clements concluded that the topic of number and number operation is the most important of all for the for early school ages children (Clements &Sarama, 2011).

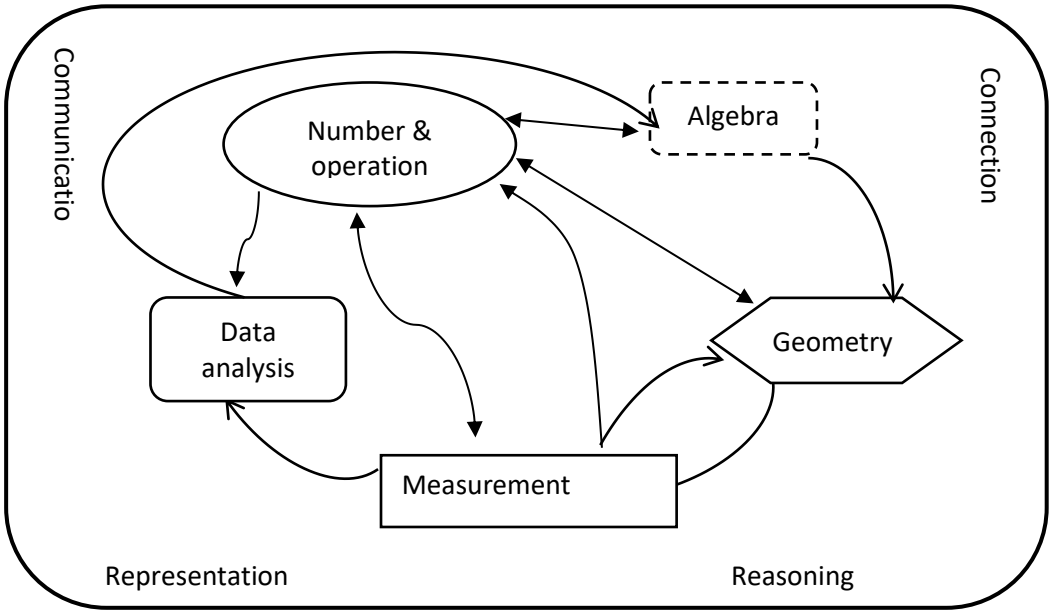

Figure 1: The contents of mathematics (Clements &Sarama, 2011)

The content of early numeracy always refers to the knowledge and skills that related to numbers, number operations and geometry. Among the organizations that in line of this are Evaluation of Educational Achievement (IEA), which controls the evaluation in Trends in International Mathematics and Science Study (TIMSS), the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), the Department of Education, German Federal Ministry for Economic Cooperation and Development (BMZ) (Mullis, Martin, Foy, and Arora, 2012; Zusammenarbeit, 2012). In 2014, Education agency of the Washington State Office, Superintendent of Public Instruction (OPSI), released the contents of early numeracy. Besides the concept of number, number operations and geometry, OPSI also listed measurement, data analysis and mathematical applications as content that suitable for children aged up to 8 years (OPSI, 2014). In conclusions, literatures show that, early numeracy content includes the concept of number, number operations, measurement, geometry and data analysis (Clements, 2001; Kleemans, Peeters, Segers, &Verhoeven, 2012; Lefevre, Polyzoi, Skwarchuk, & Fast, 2010; LeFevre et al., 2009; Starkey & Klein, 2008; Stiles, 2010)

Content of Early Numeracy in Malaysia

Malaysian curriculum in line with international curriculum that increases the focus on the early education. Ministry of Education Malaysia with the study showed long-term investment for children at their early stages contribute positively to the government and society. Hence, in 1996, the preschool has been incorporated into the national education system and in 2003 the first National Preschool Curriculum was implemented (Kementerian Pelajaran Malaysia, 2010). After five years of implementation, the National Preschool Curriculum 2003 has been revised and finally the National Preschool Curriculum Standard (KSPK) was developed and implemented from 2010 in all government and non-government school.

This section will discuss the content of early numeracy in Malaysia based on KSPK which implemented since 2010. To facilitate these discussions, we categorizes the preschool children into two groups. The five years old (children aged over four years on the first of January on the current school year), and six years old (children aged over five years on the first of January of the current school year) children.

KSPK aims to provide early mathematics experiences to preschoolers (KPM, 2010). The experiences include prenumber, numbers, basic number operation, value of money, time, shape and space. All these contents will be discussed in details starting from content of prenumber. KSPK indicates that at age five years old, preschooler should be capable to matching, comparing and seriating the objects according to its criteria. They need to become familiar with the term equal, unequal, more than, less than, as many as, longest, shortest, smallest, biggest etc.. Besides that, five years children also will exploring patterns by recognizing the pattern and copying the pattern. For six years children, they need to expand their skill by recognizing the pattern, finding the next one, extending a pattern and making their own pattern by using the materials provided. Prenumber experience will provide a very importance basis for building early number concept.

The second content is the number concept. Number concept covers content standards of understand number 1 to 50, knowing zero, and skip counting. For five years children, they will be introduced to number concept starting from rote counting which children may say the number names but don't know the quantity represented by it. Later, they will be introduced to rational numbers and at this stage they can give correct number names as the objects counted. They also should be able to write the number symbol at this age. KSPK indicates that at five years, number concept will covers number 1 to 10 only. When children become six years old, they will explore more advance skills related number concept such as counting on, counting back, and skip counting. KSPK aims that children understand number within the range 10 to 20. This means that, six years children can say the numbers, write the numbers, and make connection between symbol, numbers and objects/manipulative which prove that they understand concept of numbers. Skip counting also will be thought at this year which covers counting by tens. The counting on, counting back and skip counting skills provide readiness among children to learn number operation.

The next early numeracy content listed in KSPK is number operation, which only introduced to children at the age of six years old. Addition and subtraction in the range of 10 are the number operation that aims to be explored by them. The skills of counting that children acquired before, will be used to state the sum of two numbers. So, they have to apply counting all and counting on strategy to get the sum. KSPK also aims that children can see the element of numeracy in real life. Hence, beside solving the simple arithmetic problems such as 4 + 2 = 6, they need to solve mathematics problem which related addition in real life too. They are encouraged to talk using their own language and make sentences involving addition.

Children will be exposed to subtraction in the same method. Firstly, they will be introduced the concept subtraction as taking away or removing. After that, the subtraction in real life will be exposed to them.

The value of money also included as a content for preschooler in KSPK. They should be able to recognize value of money, sorting the money according to its value and also find the amount of money when the teacher demonstrate the purchasing situation. Value of money is only listed for six years old children. KSPK also indicates that children should be exposed to the content measurement of time. Both five years and six years children are planned to learn about time. Five years children need to sort the event according to time stated and state the time (morning, afternoon, night) according to the event given. Content of time explored more when they reach six years old. At this stage, they will learn about time in a day such as 7 a.m., 11.00 a.m. etc.. Besides that, they also will be able to state the day such as Sunday, Monday etc. and state the month January, February etc.. To build up confidence among them, they will be guided to story about their life schedule which is strengthen their view about numeracy element in life.

According to KSPK, shape and space considered as part of early numeracy content that should be acquired by preschooler. KSPK aims that this content exposed to children since they are five years old. They start to explore shape and space by recognizing the position of the object shown. As they understand the position in space, they will be able to use the term such as in front, back, top, bottom, outside, inside etc.. For the content of shape, the five years children should be taught to recognize the shape, differentiate the shapes. In order to let them aware about numeracy, they also have to recognize the shapes in the world around them. The knowledge and skills further expanded at the age of six years old. They need to be able to recognize part of left and right body, place the object at the space according to the direction given. Curriculum indicates that six years children should be able to build the shape as requested using the solid given by their teacher.

Basically, the contents of early numeracy in Malaysia almost similar to the contents of other countries as we discussed before. It can be conclude that, compulsory content for preschooler are number concept and number operation. But, the range covered might be different by countries. KSPK targets that preschooler to understand the number concept up to 20 and also solve number operations in the range of 10. On the other hand, NCTM showed a higher aims. At the age of six, children should master the concepts of numbers up to 100, and they are also expected to perform number operations involving two digit numbers (NCTM, 2006). NCTM goals seem much higher compared to local.

NCTM state that data analysis is part of the content that should be acquired by preschooler but not listed in KSPK. However, according to the guidelines by the NCTM, the contents of data analysis are actually incorporated with other topic such as measurement and shape and space. Thus, this integration allows children to learn new contents of data analysis as well as strengthen the understanding of previous related content such as space and measurement. KSPK also did not list the content of measurement as part of preschooler curriculum. Instead, measurement is listed for preschool children in foreign countries (Clements et al., 2001; NCTM, 2006; OPSI, 2014; Starkey & Client 2008; Stiles, 2010). Preschoolers should be capable of doing direct measurement as well as indirect measurement. Measuring length and weight is specifically dictated as an examples of attribute that needed to be mastered by children (Clements et al., 2001; NCTM, 2006; OPSI, 2014). However, on further analyzing the contents by KSPK, measuring element is embedded implicitly in the content of "create seriation by a characteristic". In seriating, the children

sort objects according to the criteria such as small to large, short to long, low to high and thin to thick. To conclude, measurement is covered in the curriculum of early numeracy in Malaysia although it is not listed as a specific topic. In fact, early numeracy in Malaysia includes the concept of time, where children are required to understand the concept of time in daily life. This content also applies the measurement concept.

Apart from measurement, algebra also do not appear in the KSPK. NCTM (2006) and OPSI (2014) associates algebra with the ability to recognize, copy and extend the given pattern. Children should also be able to see that addition is the inverse operation of subtraction. This proves that the algebraic concepts has been applied. In Malaysia, KSPK aims the six years preschooler learn to identify, copy and extend the patterns shown and thus confirming that algebraic reasoning has taken place. (Gan, 2007; NCTM, 2006; OPSI, 2014).

Conclusion

Based on the discussions above, early mathematics outlined by the KSPK has covered most of the contents of early numeracy practiced by other countries. Basic skills related to prenumber, number concept, number operations, value of money, time Concept, shape and spaces are the contents indicates for Malaysian preschooler. Even though some of the terms may not be listed as other countries and scholars, but its contents are incorporated into other topics which similar knowledge and skills applied. The contents of numeracy which coincided with the development of preschool children should be given attention in order to support their development of numeracy (Clements & Sarama, 2011). Hence, this paper may contribute to the knowledge development especially in the scope of Malaysian early numeracy skills. The early numeracy content that have been discussed may be used as a guidelines to explore more knowledge related Malaysian early numeracy such as the practices, achievement, expectation etc.

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