The Meaning of "A Half" from the Perceptions of 3-5-Year-Old Children

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Abstract

In everyday life young children experience "half" such as sharing a half of candies with a friend. As a half is a fraction value, which considered as one of the difficult concepts for primary school students, we were then interested on how children interpret "half." Totrace 3-5-year-old-children's perception of "half," we developed the activities "Sharing a half" and "Taking a half." There were 6 children participated in the activities. The method of summative content analysis was applied for analyzing the data collected from children's responses while they participated the activities. The results showed that some of the children perceived the meaning of a half as one part of two equal parts. We also found that the understanding of cardinality did not affect children's concept of a half. Our findings evidenced that children who either understood cardinality or do not understand cardinality percept "a half" correctly. Some children (mostly 3 years old) had no concept of "a half."

Keyword: numeracy concept development, fraction concept, children's numeracy perception

Introduction

There are a number of the studies revealing that numeracy skills of young children developed at pre-school levels influenced achievement of mathematics in higher levels (Malofeeva, Day, Saco, Young, & Ciancio, 2004; Purpura& Napoli, 2015). The numeracy skills mostly referred to "number sense." "Number sense" was explained as the flexible use of numbers to compare, recognize patterns, and solve problems (Gersten & Chard, 1999). From this meaning, number sense includes the sense of understanding the meaning of numbers, the relationship of numbers (greater than, less than, equal to). The child who has developed "number sense" would be able to understand symbolic representations, and can also use numbers in everyday life. For preschool levels, children develop the numeracy skills in two aspects, cardinality and ordinal relations. Development of the concept of cardinality helps young children to be able to understand numerical magnitude which supports the children to explain the number

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of the objects in a set. On the other hand, ordinal the concept of relation helps young children compare the quantity using the words "less than" or "greater than." (Brannon & Van de Walle, 2001).For developing children's numerical skills in preschool levels, we (both parents and teachers) always have our children count.

Counting is a rote activity for preschoolers. We know that counting provides a strong foundation for developing more complex mathematical skills including cardinality. A study by Gelman & Gallistel (1978) suggested 5 principles for counting to develop children's number sense and mathematical skills. Those 5 principles were 1) One-to-one (one-to-one relation between objects and counting words), 2) Stable order (counting words must be recited in a consistent, reproducible order), 3) Cardinality (the last number counted is the number of objects), 4) Abstraction (many kinds of objects can be collected together for purposes of a count), and 5) Order irrelevance (objects can be counted in any sequence without altering the outcome)

Although counting supports development of some mathematical concepts, children developed ordinal relation skill before they were able to count. For instance, infants were able to distinguish the differences between the cardinal values of sets of entities. The studies of Xu et.al revealed that six-month old infants were able to discriminate arrays of 1:2 ratio, but fail to discriminate 2:3 ratio (Xu, 2003; Xu & Spelke, 2000; Xu, Spelke, & Goddard, 2005) The study of Brannon & Van de Walle (2001) revealed evidence that two-year-old children were able to identify the larger of two sets of objects, although they were not able to count yet.

Although, preschoolers use cardinal value concepts for explaining the quantity of objects, comparing and ordering the numbers, the concepts of rational numbers have not developed yet. This is because children develop cardinal concept through the process of counting. As preschoolers develop numerical concepts in only whole-numbers, counting numbers including zero, this knowledge does not map directly onto developing understanding rational numbers, fractions (Gelman, 2002). Since the concept of fraction is widely accepted as one of the difficult topics in primary mathematics (e.g., Empson & Levi, 2011; Moss & Case, 1999; Armstrong and Larson, 1995; Kamii and Clark, 1995), preparing children at very young ages on the concept of fractions would be help children understand fractions when they learn fractions at primary school levels.

For developing concept of fraction value for preschoolers, the teachers have to provide the activities of teaching and learning for enhancing the concept differently from developing whole number concepts, counting. There are activities suggested for teaching preschool levels for children to master numeracy concepts of fraction. The book *"Early Childhood Literacy and Numeracy: Building Good Practice"* (Fleer & Raban, 2007, p.6) provides the idea: *"Children hear words like 'half' or 'quarter' every day. Having lots of experiences with splitting things into equal amounts helps children understand fractions later."* "Half" or "quarter" for young children are purely numeracy

value concepts. This is the same way as children understand the quantity of objects in a set without using number symbols. As reviewed earlier that children develop concept of quantity without knowing numbers words such as “one”, “two”, or “three” and if we considered “half” or “quarter” as a quantity of objects without using any symbol, we are able to imply that some children at ages of 3-5 understand the meaning of a half or a quarter.

Considering the quantity of a “half”, we might agree that a “half” was the first numerical value of fraction for young children. As children have experienced sharing, the situation of sharing with equal parts can be considered as children’s experience of numerical values of fractions. Although some studies revealed that children are able to recognize the equivalence of 2 sets of objects without understanding cardinality (Brannon & Van de Walle, 2001), we still do not know if these children understand that a “half” means “one part of two equal parts.” Moreover there was inadequate evidence for explaining that the numerical skills of children who understood a “half” differed from ones who did not. To understand this situation, we then conducted this study on how our Thai children interpreted a “half” when they heard it from their parents or teachers. More specifically, the purpose of this study was to investigate how Thai children at the ages of 3-5 perceived on the quantity of “a half.”

Methods

We conducted this research as a small research project. The children who were our participants were the children of our friends and relatives. These parents and the researchers had discussed how they used “a half” to their children in daily life. They then agreed to work with us to assist their children while the children participated in this study. We collected the data from 6 children and applied a qualitative method for analyzing the data. This would be a small scale evidence filling some information for Thai early childhood education.

Participants

The children participating in this study were 3, 4 and 5 year old children. There are 2 children in each age group. All of the children were sons or daughters of the researchers’ friends or relatives. The parents of these children work with the authors as assistants while the children participated in the activity.

Procedure, data collection and analysis

To trace the perception of “a half” from our children, we set the activities for the children then observed the children’s verbal and non-verbal responses. There were 3 parts in the activity. The questions in Part 1 were designed for determining the children’s concept of counting and cardinality. Part 2 is “Sharing a Half” and Part 3 is “Taking a Half.” Figure 1 shows the detail of the activity.

Activity for tracing children's perception of "a half"

Part 1. Counting and Cardinality Skill

The teacher places a number of candies on the table (4, 5 or 6) and ask; "Can you count this candies?"

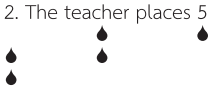
The teacher has each child count then ask "How many are there?"

Part 2. Sharing a half.

1. The teacher places 4 candies by arranging them into 2 columns.

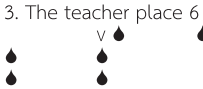
Then asks both children to share a half of candies.

2. The teacher places 5 candies by arranging them in 2 columns.



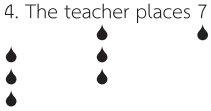
Then asks both children to share a half of candies.

3. The teacher place 6 candies by arranging in 2 columns.



Then ask the both children to share a half of candies.

4. The teacher places 7 candies by arranging them in 2 columns.



Then asks the each kid to share a half of candies.

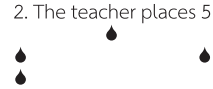
5. Repeat 1 – 4 but place candies randomly.

Part 3. Taking a half.

1. The teacher places 4 candies by arranging them in 2 columns.

Then asks one of them to take a half of the candies.

2. The teacher places 5 candies by arranging in 2 columns.



Then asks one of them to take a half of the candies.

3. The teachers place 6 candies by arranging in 2 columns.

Then asks one of them to take a half of the candies.

4. The teacher places 7 candies by arranging in 2 columns.

Then asks one of them to take a half of the candies.

5. Repeat 1 – 4 but place candies randomly.

Picture 1: The activity for tracing children's perception of a half

For the activities "Sharing a half" and "Taking a half," which were to trace children's perception of "a half," we designed the way to place the candies into 2 forms, arrays and piles. The purpose of placing the candies into arrays was for detecting the children who did not understand cardinality. As the evidence supported that these children may be able to identify the equivalent sets (Reid, 2016) by providing these children the arrays of the candies, and if the children understood the meaning of a half, the children would perform sharing a half correctly without using counting skills.

As one of the authors used to be a kindergarten school teacher, this author worked with the children and took the role as the teacher while the children did the activity. The other author and the parents observed. The parents sometimes clarified the questions to their children. Two children with the same age participated in the activity at a time.

The children's responses to the tasks in the activity were recorded using filed notes and video clips. The method of summative content analysis was applied for analyzing the data. The researchers analyzed the children's actions and verbal communication with the other child or the teacher. At first, both researchers analyzed the data individually, then compared the findings. Any discrepancies between the authors were negotiated until a consensus was reached.

Result

The activity in the process of data collection consisted of 3 part. The first part was designed to examine children's cardinality. We found that our children who were 3 and 4 years old did not understand cardinality while the 5-year-old children had the concept of cardinality.

Children's conception of a half

Part 2 and 3 of the activity were designed for tracing children's concept of a half. We then reported the perception of a "half" of the children of the activity in Part 2, Sharing a half and part 3, Taking a half.

1. Children's conception of a half from "Sharing a half"

1.1 Sharing a half is just a share.

When asked to share a half of the candies, some children shared some of the candies without considering the meaning of "a half." The children exhibited evidence when the teacher placed 4 candies or 5 candies and asked these children to share a half of the candies, they just took some form the table for him/herself without considering the number of the candies. Sometimes they leaved some candies on the table. The children performed the same way when the author placed candies into 2 columns, these children picked some candies without determining a half of the candies. The children who performed "sharing a half is just a share" were the ones, all 3 years old, who do not understand cardinality.

1.2 Sharing a half performed correctly if there were 4 and 6 but not 5 and 7.

The evidence showed that some children were not consistent in performing "sharing a half." For 4 candies, they were able to share the candies into a half. These children shared a half of candies using one-to-one dealing. (Muldoon, Lewis, & Towse, 2005). When 2 children asked to share 4 candies, they would take one for herself and give another one to the other until they both had 2 candies. Form this, we were able to conclude that they considered the word "a half" in their sharing. When the teacher placed the candies into 2 equal columns, these children took all of the candies from one column to him/herself and the other column to the other. This response revealed that the children understood that sharing a half meant sharing equally.

For 5or 7 candies, we found that the meaning of a half is ignored these children. In the situation that the teacher placed 5 candies and asked 2 children to share a half of candies, one of them gave 2 to the other and grabbed 3 candies for himself. When they were asked "Did you get a half of candies?" They both said "yes". When the teacher asked "Did you both have candies equally?", the answer was a no. That meant they did not consider the meaning of "a half." The children who exhibited this evidence were 3 and 4 years old and they did not understand cardinality.

1.3 Sharing a half means sharing equally.

All of 5 year old children who were the participants understood cardinality. The concept of sharing a half was performed correctly by these children. After the teacher placed 4 or 6candies in front of 2 children, both of them took the number of candies equally. When the teacher placed 5 or 7candies they said they could not share a half. One of them even said "we cannot do this because it is odd."

For the situation that the teacher placed the candies into 2 columns, if both columns contained the candies equally, the children shared the candies by taking the whole column for him/herself. On the other hand if the number of the candies were not identical, one of them would say "We cannot do this because they (numbers of candies in each column) are not equal."

2. Children's conception of a half from "Taking a half."

2.1 Take some not all.

For the children who were 3 years old and did not understand the concept of cardinality, they would take some of the candies when asked to take a half of candies. The word "a half" was ignored.

When the teacher placed candies in front of these children and asked them to take a half of the candies, the child sometimes takes 2 candies or 1 candy without considering the meaning of a half. The children performed the same way when the teacher placed the candies into 2 columns.

2.2 Take and leave equally.

For children who exhibited that they understood the concept of cardinality, when the teacher place 4 or 6 candies, they began to observe the number of the candies. They, then, mentally examine the number of candies and then took half of the candies for him/herself. For 5 and 7 candies, the children said that they could not have a half of candies because they could not divide them into 2 equal groups. This exhibition revealed that these children understood "taking a half" correctly. These children consistently performed "taking a half" with the same concept in the case that the teacher placed the candies into 2 columns. In this situation, the children picked the candies from 1 column. On the other hand, when the teacher placed the candies into 2 unequal columns, these children refused to take half of the candies. They said "the numbers of candies in each group are not the same."

Discussion and Conclusion

The purpose of this study was to investigate young children's perception of the numerical magnitude of a half. This finding revealed that some children understood the meaning of a half. These children exhibited that they were able to perform both "equal share" and

"taking a half." Although we did not present the meaning of a half directly at school, the children had developed concept of a half from the activity they participated in everyday life. This is an example of informal numeracy concepts that children developed before being taught in school (Song & Ginsburg, 1987; Sophian, Harley & Manos Martin, 1995).

Our finding also revealed that not only the children who understood cardinality and were very strong at number concepts had the concept of "a half" but also some children who did not understand cardinality. These children (who understand "a half," but cannot use the number to present the numerical magnitude) were able to recognize two equivalent sets of objects. Considering the meaning of a half --one part out of two equal parts, children's ability of comparing two equal sets supported children's development of the concept of "a half." There are numbers of studies agreeing that children at very young of ages are able to compare, share, order and estimate quantities without understanding cardinality (Wynn, 1996; Xu, Spelke & Goddard, 2005). This evidence revealed that abilities to understand the concept of a half is grounded by the concept of equivalence.

In this study, we did not focus on how the children understood the concept of a half in which this concept has not been discussed in preschool levels. As we know that the activities the children participated at school or their houses develop children's numerical skills, these children may have the experience of sharing a half or taking a half before. A part of our findings showed that the 3-4 year old children exhibited the failure of sharing and taking "a half." We did try to explain the meaning of a half to them and then had they performed sharing a half again. With the 2 columns task, the children exhibited that they understood, but they had the difficulty of sharing a half when we placed the candies as a pile. This evidence confirmed us that if the children had experience with a half, they would be able to understand the meaning of it.

To understand the quantity of objects, we always think whole numbers, counting number including zero. Although the process of counting develops higher mathematical concepts especially cardinality (Gelman & Gallistel, 1978), fractions are numerical values that also explain magnitude values. The concept of fractions is different from counting numbers and does not develop directly from counting. Fractions such as "a half" or "a quarter" involve children's everyday life. As we know that the ability of mathematics in primary school levels or higher levels is grounded by the ability of preschool abilities of numbers. Fractions in primary school levels is one of the most difficult topics. Understanding of simple fraction values such as a half or a quarter in very young of ages may help our children develop the concept of fractions better in higher levels. To develop activities for enhancing children in primary school levels, concept of fraction value is still an interesting areas of early childhood education.

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