

Parental Perspective on Teaching Number Sense to Young Children (One to Five Years Old)

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Abstract

The first author is a former mainstream school mathematics teacher and the second author is his wife, a homemaker. Together they have three daughters, Oli¹ (five years old), Ven² (three years old) and Ely³ (one year old). Their first two daughters, Oli and Ven, currently attend a pre-school enrichment class in the day for about three hours. At home, the parents teach them numeracy and literacy skills for around 30 to 45 minutes a day. The two authors have explored various ways to engage, enrich and enlighten their children in learning mathematics. They acknowledge that every child is unique and learns differently at every stage of their development. As such, the authors have employed a repertoire of mathematics teaching strategies to cater to their children's learning needs, especially in making sense of numbers. One of the key challenges the authors have encountered is finding a meaningful way to make mathematics learning fun and relevant. In this paper, they have chosen to share, from their parental perspective, how to teach number sense to young children.

Keywords: Mathematics Learning, Numeracy, Number Sense, Teaching Methods

Introduction

In today's competitive and fast paced economy, the ability to solve problems through mathematics is considered critical. This is especially true in Singapore's fast paced workforce where one who possesses such skills is often seen as valuable to any organization. Major corporations believe that such a quality may translate to higher productivity and efficiency to the company or society. Hence, one with good mathematical ability is often deemed as an asset in any organization to solve problems. As the employment rat race continues to remain competitive in Singapore's context, one should start from young and enrich their children with mathematical experiences so as to enhance their mathematical abilities (Ritchie & Bates, 2013; Watts, Duncan, Siegler, & Davis-Kean, 2014).

Anecdotal evidence suggests that it becomes increasingly difficult for children to bridge their mathematical abilities later in their school life if little or no intervention was provided to help them at a young age (Aunola et. al., 2004; Bodovski & Farkas, 2007). The lack of mathematical ability may persist because many children have underdeveloped mathematical skills and knowledge, and as a result, have low confidence in achieving mathematical success (Gervasoni & Perry, 2017). In addition, further research suggests that there is a direct correlation between a child's inability to make sense of numbers in their early years and poor mathematics learning in their elementary years (Gersten, Jordan, & Flojo, 2005; National Research Council, 2009). These conclusive research results indicate that a strong mathematical foundation and attention to early math education and instruction is vital to enhancing a child's mathematical achievements at a later stage.

All children are natural mathematicians and parents are their children's first teachers. One highly important tool parents can utilize to help maximize their children's strengths is play. Play has been shown to be a highly effective technique that can help parents expose their children to the world of mathematics. A parent can help their child realize their potential earlier by helping them uncover and unpack their strengths through play. Play is a very powerful enabler to help expose a child to a mathematical world. When play is meaningful and fun, the child can gain a deeper understanding of number, quantity, size, patterning, and data management (Grossman 2012).

¹ Not the first child's real name; a pseudonym has been used.

² Not the second child's real name; a pseudonym has been used.

³ Not the third child's real name; a pseudonym has been used.

There are 3 operating principles the writer builds on when teaching number sense. Firstly, to seek every possible opportunity to learn and communicate math in a fun and simple way. In such a manner, the child's curiosity would be aroused and learning can take place constantly. Integrating mathematical language in everyday communication could further contribute to learning mathematics. This could come in the form of using terms such as 'addition' or 'subtraction' when referring to an event where items are added or removed. Communicating in mathematical language such as adding the number of cookies or taking away/ hiding the number of toys could also contribute to learning math. Secondly, create a safe and positive environment to learn. The home numeracy environment (Rathé et al., 2020) is a good place for children to start learning math and making mistakes in their pursuit of learning math. Studies have shown that a child's home numeracy environment plays an important role in a child's number sense acquisition (LeFevre et al., 2009; Skwarchuk et al., 2014) as the home presents a safe place for trial and error. Lastly, celebrate every possible success no matter how big or small. Everyone, including adults, want some form of affirmation and encouragement when executing their tasks. It is no different for any other child as it would empower their learning and build a stronger parent-child bond.

Teaching Ely (one-year-old) number sense

A key developmental milestone is that at one-year old, children develop an explorative attitude towards everyday objects and how they function. Ely, being the youngest of the authors' three daughters, likes to meddle with objects and may explore objects largely through her senses of taste, touch, smell and sight. The child displays keen touch actions such as pushing the door, opening the cupboard drawers and taking out toys. In this trial-and-error exploration stage, it is an opportune time to facilitate their number sense by introducing the following:

- (1) *Count whenever possible.* Parents should seize every opportunity to count objects or everyday items with the toddler. For instance, counting the number of cookies in a bowl, counting big and small goldfish in a tank or counting different shapes and sizes of toys. The parent should explicitly point to the object or guide the child's finger to point as the parent counts. This will enable and enhance the child's numeracy awareness. Progressively, the child would associate counting numbers to the number of objects, a useful method known as one-to-one correspondence.



Picture 1: Ely taking out soft balls as parents count 1,2,3

- (2) *Sing counting songs out loud.* Numerous counting songs can be found on Youtube as videos or in the form of nursery rhymes. Some examples include, ‘1 little 2 little 3 little monkeys’ or “Six little ducks went out one day...”. Parents can sing the songs during play time or nap time and, if possible, have a toy for each number present in the song so that the child can relate to it. Encourage the child to sing along and eventually, he/she will learn how to sing it him/herself. This allows a rhythmic counting impression to be formed in the young mind.



Picture 2: Ely clapping her hands to a song with counting rhythm

- (3) *Read with the child.* Reading counting picture books can form new numeracy domains on the child. Consistent reading of counting books to children would allow them to learn how to connect numbers to the objects in the book. Some recommended books include the following: baby’s first 123, Dr. Seuss’s 123 and 10 little you’s.
- (4) *Playing with toys.* Using cause and effect ‘toys’ such as a squeaky duck to play with the child can help to make learning mathematics fun. The parent may start counting as she/he presses the duck, thus helping the child associate the number of squeaks with the number spoken by the parent. Also, parents need to allow the child to press the duck and count the number of squeaks. When keeping the toys, parents could also count the toys as they place them back into a basket. This may inherently cultivate a good habit and discipline of ensuring the correct number of toys taken out is placed back.
- (5) *Use of pictorial number flash cards.* Using flashcards, a form of drill and practice, has its advantages as they are easy to create and they can be used individually or in groups (Reynolds, 2010). The use of flash cards aids in reinforcing numbers at an early stage. For instance, a flash card with one dot represents the number one, two dots represents two and so on. The parent may use flash cards with one to three dots at the start of the exercise, once a day for three weeks. One of the teaching strategies found to be useful is repetitive teaching. It allows the child to concretize his/her impressions of numbers both visually and verbally. As the existing schema is strengthened, the child may inherently recognize that one dot is the number one. For older children who are advanced learners, their parents may show and question which is one dot and which is two dots, allowing the older child to point to the correct card. Furthermore, one could make learning more fun and interesting by using flash cards with the respective number of animals in place of dots.

Teaching Ven (three-year old) number sense

As a three-year old, Ven displays an absorbent and curious mind. This is evident in her speech and action. For instance, the child may ask many 'why' questions. They may also try out many other things and appear to be mischievous as it is the child's natural way of discovering things around them. As long as safety is not compromised, the parent should encourage the child's freedom to learn and play. The following are methods enacted to integrate play with teaching number sense:

- (1) *Playing math prediction games.* Children love any sort of games their parents play with them. To arouse their interest in number sense, parents may play a game of prediction with their child. For example, encouraging the child to predict the number of steps at the staircase, predicting the number of oranges in the basket at the supermarket or predicting how many people are wearing black in a restaurant. After the prediction, parents may reveal the actual number by counting the aforementioned items to the child. They may even ask their child to count along with them!
- (2) *Playing memory games.* This may come in the form of showing pictorial number flash cards. Patterns may also be introduced to enhance the difficulty of the game. A recommendation is to start with three cards first to trigger the child's interest and gain his/her confidence. Then, increase the number to five, moving gradually to ten depending on how fast the learner is. The numbers can be repeated from one to ten and objects can change. There is no need to rush and one may repeat with three cards until the child is familiar before proceeding with an increased number of cards.
- (3) *Use of Montessori Mathematics Manipulatives.* Montessori Mathematics manipulatives are fundamental representations of mathematical tools that do not resemble real objects or possess irrelevant perceptual features. One example of a good set of teaching manipulatives is the Cylinder blocks (see Annex A, picture 3). It can be used to enhance a child's sensory awareness, and also to introduce the mathematical idea of size and proportion to the child as she/he will eventually be led to the concept of comparison of size. The activity can be conducted to allow the child to feel the depth and shape of the cylinder to make sense of which one to use. The Number Rod is another useful tool to introduce numbers to the child. Parents may form a rod stair, i.e., using one, two and three rods (each with a different length), and ask the child to follow in forming the pattern shown. Parents can count aloud the number of rods being used to form the stairs. Young children do not understand or easily interpret the meaning of symbols or tools used in helping them in problem solving (DeLoache, 2004). Hence, it is recommended that parents use these teaching manipulatives over a period of time in their mathematics teaching so that children can become more familiar and can better associate the teaching tools with the mathematical concepts they are acquiring.



Picture 3: Ven exploring the cylinder blocks



Picture 4: Using small blocks to make sense of number 1 to 5

- (4) *Learning to write numbers one to ten.* Identifying numbers one to ten is a crucial milestone for early mathematics learners. With this number sense, the child can better understand the basics of counting as this form of meaningful exercise allows a child to draw connection between written numbers and objects. When writing, the parent should guide the child's hand in writing the proper form and encourage the child to count out loud when writing. Writing on tracing numbers could be a useful guide for the early learners as it guides the penmanship of the child.
- (5) *Learning math through nature.* When time permits, bringing the child to nature and introducing real life mathematical concepts to them can help to contextualize their learning. For instance, counting the number of trees along a stretch of road, or counting the number of petals found on a flower. Parents should encourage the child to also count back the objects found in nature back to their parents and self-discover the connection between numbers and nature.

Teaching Oli (five-year-old) number sense

Oli avoids numeracy tasks such as her school mathematics homework and home-based worksheets. Rote learning through the use of worksheets would often bore her very quickly and her natural attitude towards math is not positive. However, we believe all children can learn and can cultivate a habit of learning and liking math. Hence, it was necessary to engage her with fun and interesting lessons, otherwise she would lose interest, impeding her mathematical learning. When children are not engaged during mathematics instruction, it can affect the child's learning (Hanich, 2011). Therefore, the following methods were used to make lessons relevant, meaningful and entertaining for Oli:

- (1) *Counting and write up to twenty.* After having learnt the counting and writing of one to ten, the child should proceed to learn to count and write to twenty. There are many manipulatives available and one them is a teen board, where small blocks can be used to formalize the numbers from 10 to 20. The child will be guided to count the small blocks and put them beside the number they see on the board. Tracing numbers is another good strategy which can be used to guide the child in writing number. It may come in the form of a puzzle maze game, where one correct trace leads to another path in the maze. Seeking opportunities to count in our everyday life such as counting the number of lift buttons from one to twenty could also reinforce the idea of counting. One may play a game of counting backwards to further reinforce the number

sequence order. An example of this could be by using a rocket toy to count down successfully before showing the rocket lift off. For advanced learners, the parent may also ask children to identify the numbers of a car number plate and ask if they can make 2 digit numbers, between 10 and 20, from the numbers they see on the number plate. This activity may excite the child and enhance their understanding of basic number combinations.



Picture 5: Oli preparing for her math task



Picture 6: Oli using teen board to learn numbers 11 to 15

- (2) *Addition and subtraction.* Pre-schoolers can attempt to solve easy problems through the addition and subtraction of objects. For instance, at a supermarket, you may ask your child to help you to pick up four oranges, three apples and two pears. Then, introduce the term ‘addition’ as the child counts the fruits together. The final number can be validated by asking her to count. Another example is that if parents have a fish tank at home, they may encourage their children to actively count the number of fish food pellets before feeding the fish. Take 10 pellets and feed 4 pellets to the goldfish in a tank. After feeding 4 pellets, the child can then count the remaining 6 pellets. Parents can then reinforce the idea of subtraction by saying “Subtracting 4 from 10 leaves us 6 pellets/ $10 \text{ minus } 4 \text{ is } 6$ ”.
- (3) *Comparing numbers.* The idea of bigger or smaller and more or less is an integral part of understanding the number system. There are many activities parents can engage in with their children to teach the concept of comparison. For example, one can put five balls of the same colour in front of a child and ask them to sort them out into groups of 2 and 3. After which, ask them which group has more and which has less. If the child is unable to compare, parents can explain the concept by showing them how to count and telling them which group has more and which has less. Also, parents can help to emphasize comparisons by using the terms ‘more’ or ‘less’. For advanced learners, parents may introduce more colored balls (up to the number the child is familiar with) and ask the child to group by colours and compare. When given more chances to explore and compare, children are able to utilise 2 or more mathematical concepts easily. (Gick & Holyoak, 1983; Son, Smith, & Goldstone, 2011).
- (4) *Learn Number Sense using time.* Understanding the concept of time is one of the more important skills a preschooler should learn. A parent may introduce the basic idea of time by telling them, ‘It is the morning and the sun rises at 7am. The sun sets at 7pm and there are 12 hours of day time.’ or ‘How long did you sleep during your afternoon nap?’ The use of a teaching clock is useful in illustrating key concepts necessary to tell time. The first key concept is in recognizing that a clock has numbers 1 to 12. The second is that the movement of a clock’s hands is from left to right (clockwise direction). Finally, it helps to explain that when the clock strikes 12, the hour hand moves to the next number. By allowing the child to feel the numbers and spin the hands in a clockwise direction, they are able to kinesthetically and visually explore these key concepts of telling time. For advanced learners, parents may show a specific time and ask their child to set the clock to the same time after resetting it. To incorporate an element of fun and enjoyment in learning concepts of time, you may gamify the activity by using a timer.

Conclusion

Teaching number sense to young children or any pre-schoolers is no mean feat. However, it does bring along a sense of joy and with a calibrated approach, it fosters a strong parent child relationship. The above list of suggestions on how to teach is based purely on experience and the list is non exhaustive. There is no one-size-fits-all method, and we should always explore ways to widen the child's perspective of numbers. One may refer to teaching books, watch math pedagogical videos for early learners and read articles to gain more knowledge on teaching methods. Real life experiences and a hands on approach via trial and error appear to be the most efficient and effective way to hone the teaching skills.

In this journey of educating our children, both parents (i.e., father and mother) must learn to complement and support each other. This is an essential factor because parenting burnout can result in detrimental effects, both in the wellbeing of the parents, and the wellbeing and learning of the child. One suggestion is to divide the labour and designate roles for each parent. For example, the father could tend to the children during play while the mother performs a greater role in direct teaching or vice versa. It is recommended that parents should distinguish their respective parental roles so that the child is not confused and is easily able to associate the role of each parent when it comes to different types of learning. As the saying goes "it takes a whole village, to raise a child". Hence, every family member should make a concerted effort in the upbringing and teaching of young children in order to maximize their potential.

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