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Awakening Early Learners' Mathematical Competencies

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Abstract

The early childhood stage is an exciting time for young learners. At this age, they are avidly curious about the world around them prompting them to ask a million and one questions to their parents, teachers and other significant adults in their lives. Apart from learning about letters, the concept of numbers also surrounds them and such symbols do not fail to catch their attention. This is especially true if they see their parents work with letters as they read news papers or books and computes with numbers as they prepare the budget, solve math problems, etc. The interest of this action research paper is how young learners learn about basic math concepts deemed to be more complicated as they grow older. It is a fact that many people find math difficult and become alienated to the subject because they cannot understand mathematical language. What strategies are employed for young children to effectively learn basic math concepts? To satisfy these research questions, a review of literature is done to give the researcher a background of what previous scholars have found out about early learning in Math concepts. Then, the researcher tries out various activities with a four-year old girl to help her learn basic math concepts such as recognition of numbers, knowledge of quantity and one-to-one correspondence.

Review of Literature

Young learners in the preschool stage learn very fast. In their math curriculum, they are exposed to basic such as numeracy and quantities, measurements, mathematical reasoning for patterns, sequences and relationships, time and days of the week, simple money concepts, shapes, positions and handling data [1].

The goals of including Mathematics in the curriculum include the development of students' mathematical thinking, their understanding, competence and confidence in applying math concepts and skills, as well as their creativity, enjoyment and appreciation of Math as they take on their journey in lifelong learning. Higher order thinking processes such as questioning, reflecting, reasoning and proof are involved in the study of math. Children gain a powerful skill in solving problems both in Math and even beyond it [2,3].

The National Council of Teachers of Mathematics (2000) identified high quality mathematics programs for early childhood as having the following characteristics [4]:

- "They build upon and extend children's intuitive and informal mathematics knowledge"
- "They are grounded in knowledge of child development"
- "They provide environments that encourage children to be active learners, eager for new challenges
- "They develop a strong conceptual framework that provides the foundation for skills acquisition"
- They nurture and develop children's inclination to solve problems."

Apart from the skills developed from the study of Math, values and attitudes are likewise emphasized. Learners accept that math is essentially a part of their everyday life. They develop the confidence necessary in applying the mathematical knowledge they have learned and the basic skills and understanding of usual problems they encounter and the solutions they come up for them [5]. Math also encourages the development of persistence and perseverance in facing mathematical challenges. Students recognize that mathematics has been developed in many cultures in response to human needs [2].

Theoretical Foundations

Believed that children's intellectual development is influenced more by social context than by

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individual experiences [6]. His theory places a great deal of emphasis on effective social interaction. He came up with the concept of the Zone of Proximal Development (ZPD). It is the gap between what a child can do independently and what he can do with a little help from others [7]. Cautioned us, however, that a ZPD is formed not just within an individual learner, but in the interaction between the learner, co participants, and available tools during involvement in a common activity. ZPDs, therefore, depend on the quality of the total interactive context as well as individual learner capabilities [8]. Children usually find it more challenging to learn a slightly more difficult concept to test their mettle in the skills they have gained. "Such cognitive apprenticeships are, of course, inherently reliant on a mentor or guide who effectively uses "scaffolded instruction [3]." As the term implies, scaffolds are temporary supports in the process of learning which are gradually taken away when the student is already capable of learning without them. As an example, the teacher helping the children to do mathematical operations first give them more concrete materials such as paper shapes or beads and as they master the concept, the materials or "scaffolds" are slowly eased away until they can do the operations mentally. This is also done because students may be at a stage when attention span could be short and supports become necessary to hold the children's attention long enough for the teacher to introduce mathematical concepts.

It is essential to strike a balance between giving the pupils sufficient challenge and taking care not to push them into a level they are not yet capable of. Research shows that when children are trained to learn mathematics above their reasoning level, there may be positive results at first but they are "rarely retained unless the child is already in transition from one level to another". The teacher should be discerning enough to know when to apply ZPD with her students and know the proper scaffolds to use [9].

Children in the preschool stage belong to the pre-operational period (two to seven years) of Piaget's Stages of Cognitive Development. This period marks the time when a child becomes able to represent objects and knowledge through imitation, symbolic plays, drawing, mental images and spoken language. Lack of conservation skills is also characteristic of this stage. "Conservation is defined as the knowledge that the number, mass, area, length, weight, and volume of objects are not changed by physically rearranging the objects." That is why it is important to always give concrete materials to young children when teaching a math concept since that is how they understand things better [4]. They need to be able to see things concretely first before they can be translated to abstract thinking.

According to the behaviorist view, an individual is reinforced (positively or negatively) for responses to various stimuli; hence, the external environment plays a great part in the formation of behaviors. By administering positive reinforcement such as praising or smiling when a desired behavior occurs and administering negative reinforcement such as scolding or correcting when an undesired behavior occurs, one is assumed to encourage the desired behavior and make it more likely that that behavior will recur [10]. Positive reinforcement works well in bringing out the best in pupils.

More important than the lessons taught in the sessions are the interests of the children themselves. This is especially true with very young children whose minds are always brimming with ideas. The learning environment must be supportive of children's ideas and feelings. Being very young, the children must be allowed to express themselves freely. The teacher must allow the children to share their experiences that seem to be all-important to them and the message that comes across is that she is interested in them and their lives. Trafton suggests that individualization must include "acceptance of each child as an individual worthy of adult respect," and that to this should be added "an acceptance of the child's ideas, a provision of opportunities for pupil input in developing and selecting learning experiences, a concern for the quality of the child's intellectual development, and a willingness to take time to know the child as an individual" [11].

Mathematics is a hierarchical discipline where concepts build on previous concepts and more often than not, need full understanding before proceeding to the next, more complicated concept [12]. One cannot just jump and teach multiplication without the student understanding the concept of addition. However, in the foundation stage, the most basic mathematical concepts are taught, leaving out technical numeracy skills such as mathematical operations of addition, subtraction, multiplication and division. Only the basics of addition and subtraction are informally introduced when children are given story problems and more practical activities that may involve mathematical understanding of math concepts they shall take up when they are older [13]. This is possible with the teaching of number songs that have stories of addition or subtraction (ex. Five Green Speckled Frogs; There Were 10 in the Bed and the Little One Said. Roll Over). Children also learn the concepts with more concrete activities that involve counting.

Action Research Methodology

This research engaged the researcher to conduct one-on-one sessions with a four-year old girl who is in the early stages of learning about numbers. The concepts of recognition of numbers, knowledge of quantity and one-to-one correspondence was taught by the researcher to the young girl with different activities and materials. In each concept, a simple background of the baseline skills of the girl is given along with the specific activity implemented by the researcher.

The researcher has previously observed the girl in her home and has interviewed her mother about her mathematical skills. The observations written here are summaries of what the researcher has observed.

Name of Child: Lena

Age: 4 years old

Math Concept: Number recognition.

Expected level of skill for age: Differentiating shapes from other shapes; Visual discrimination of numbers (at least 1 to 3).

Observation: Lena would proudly count from 1 to 10 by rote. However, she does not seem to associate the numbers she recites with the symbols that represent the numbers. Her mother has previously assessed that she knew her shapes, namely: circle, square, triangle, rectangle, oval and heart. This shows that she can visually discriminate one object from another. Lena cannot do the same with numbers. She cannot even recognize which are numbers and which are letters. For her they just look like squiggles and strange marks.

Activities: For the one and a half hour the researcher spent with Lena in this session she was exposed to visual appearance of each number, the quantity it represents and even the strokes used when writing it down. The researcher showed her flashcards of numbers to imbed the appearance of the number to the child's mind while its

name is repeatedly said. Lena was taught counting songs and when the number is mentioned, up comes the flashcard of that number. Children love singing and movement and incorporating these in their learning a concept becomes interesting and fun for them. Then, the researcher told Lena a story that focuses on a particular number (ex: 2 friends found 2 birds eating 2 apples). After the story, the researcher gave Lena a coloring sheet with a big print of the specific number discussed (Number 2). The variety of activities address the needs of the visual (flashcards and story pictures), auditory (songs and story), kinesthetic (movements to songs) and tactile (coloring sheet) learners.

Resources/Materials used: number flashcards; CD's of number songs (Five Little Monkeys; Five Green Speckled Frogs; There were 10 in the Bed. etc.); number storybooks; number coloring sheet focusing on 1 number at a time, box of crayons.

Math Concept: Determining quantities of numbers.

Expected level of skill for age: Number identification up to 10; knowledge of quantities Up to 10; matching numbers to quantities.

Observations: Lena can visually compare sets with more objects or fewer objects if the quantities are obvious (like comparing a set of 2 buttons with a set of 10 buttons). Now, she needs to learn to match numbers with their quantities.

Activities: In another session with Lena, the researcher provided concrete materials for Lena to count such as buttons, candies and blocks. Number cards were available at hand so when Lena learned to count the concrete object and knew the last number counted is the quantity of the set and then she looked for the correct number card to match the set to. The researcher gave her 2 options of numbers at a time, and as Lena gained more skills in quantities and then she also increased the number of options of number cards to choose from.

Resources/Materials used: concrete objects for counting; number cards.

Math concept: one-to-one correspondence of objects.

Expected level of skill for age: number identification up to 10; knowledge of quantities up to 10; matching numbers to quantities.

Observations: Lena can rote-count objects and identifies numbers, but lack understanding of one-to-one correspondence when matching objects from different sets. She needs to learn that for a corresponding object, there is another object to match it. For instance, for one hand, there should be one glove.

Activities: For the third session, the researcher gave Lena lots of practice in matching corresponding pairs of things. The researcher asked her to match a set of bottles with its bottle caps, so she learns that one bottle needs one bottle cap and not two. The learning she derived from this concrete activity was translated to the activity sheet task which required her to match objects from one set with those of another set by pairing up matches with a line. When the task is completed, she would determine if the sets are equal or if one set has more or less objects than the other set.

Resources/Materials: set of 5 bottles and 5 bottle caps; activity sheet of matching objects from one set to objects from another set by aligning each object with a line; crayon.

Results of the Action Research

The researcher was able to successfully establish rapport with the child, Lena in just a short span of time. This was because they immediately got busy with the activities the researcher prepared for her and she was excited to do them. With just a few examples demonstrated by the researcher, Lena easily caught on and learned the concept fast. It may be due to the fact that she had the full attention of an adult "teacher" to supervise and guide her and access to concrete materials to support the learning of the concepts. The researcher was also generous with praises whenever Lena successfully gave correct responses and completed his tasks.

The researcher especially noted that Lena showed a sense of fulfillment with her bright smile whenever she was able to get things correctly. Initially, it was apparent that she had difficulty in learning the concepts (ex. identifying numbers or matching them with their quantities). This showed that the activities provided her were within her zone of proximal development. When she was able to learn the concepts, it made her feel good and encouraged to work some more. The researcher thinks that if she had been given very easy tasks even when she has learned the concepts, she will not be challenged enough, that is why it is important to also adjust the degree of difficulty in the activities as she progressed in the learning of the concepts.

Since the attention span of four-year olds is short, the researcher gave Lena several breaks in their session. Lena happily played with the materials or stood up to go outside the room to play. There were also breaks for her to take his snacks. Whenever they resumed the sessions, Lena was cooperative and happy to oblige, sharing a lot of stories with the researcher which were either related or not to number concepts.

The varied activities presented to Lena were found to be effective in capturing his interest in the "lessons" given during each session. The researcher found it easy working with Lena as she showed full concentration on the tasks given him.

Conclusion

Mathematics is part of everyday life. Children see it in numbers, counting, in telling time, in measurements, in ordering of sequences, etc. Very young children will benefit greatly if both the home and their school settings will support their mathematical explorations. Teachers and parents may share simple tips or activities with the children to encourage mathematical learning. Parents may learn play-like approaches to assigning home chores to children such as letting them count place settings and set the table according to the number of people who will have dinner. They may also involve children in cooking or baking and letting them follow the recipe and add the correct measurement of ingredients, exposing them to units such as 1 cup, ½ cup, ¾ tablespoon, etc. In doing practical and fun activities like these, the children get to view mathematics in a more positive light that they become more open to learning more about it.

It is heartening to note that "the ultimate reason for mathematics is, after all, not just to solve problems as presented in a text or worksheet but to solve problems that present themselves in many phases of life. The complexity of life today is many times greater than that in earlier centuries, and we are discovering that young children are capable of mathematical thinking that is much deeper and broader than we had ever before realized [15,16]."

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