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Enhancing ESN Children's Understanding of Addition

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Addition is essentially a basic computation skill necessary in learning numbers. Studies have shown that there is a general pattern of addition strategies emerging amongst children.

According to Carpenter and Moser (1984), the earliest strategy is the "count-all" method which requires the child to count the first addend and the second addend before subsequently counting them altogether e.g. in 5 + 2, the child first counts the first addend 5 . . . 1, 2, 3, 4, 5, and then counts the second addend 2 . . 1, 2,; subsequently the child counts them altogether i.e. 1, 2, 3, 4, 5, 6, 7 and discovers the answer as 7.

Gradually, the child advances to the "count-on" strategy (Houlihan and Ginsburg, 1981) where the child first identifies the first addend before counting on to the second addend e.g. in 5 + 2, the child first identifies the first addend 5 and then counts on 2 more i.e. 6 (5 + 1), 7 (6 + 1) and discovers the answer as 7. Eventually the child advances further when he realises that it is preferable to identify the larger of the two addends before counting forward to obtain the answer.

Lastly, the child either memorises addition facts or develops more proficient fact strategies using visual assistance called "doubles" whereby the child tries to recall numbers through pictures e.g. wheels of the car to represent 2 + 2 = 4.

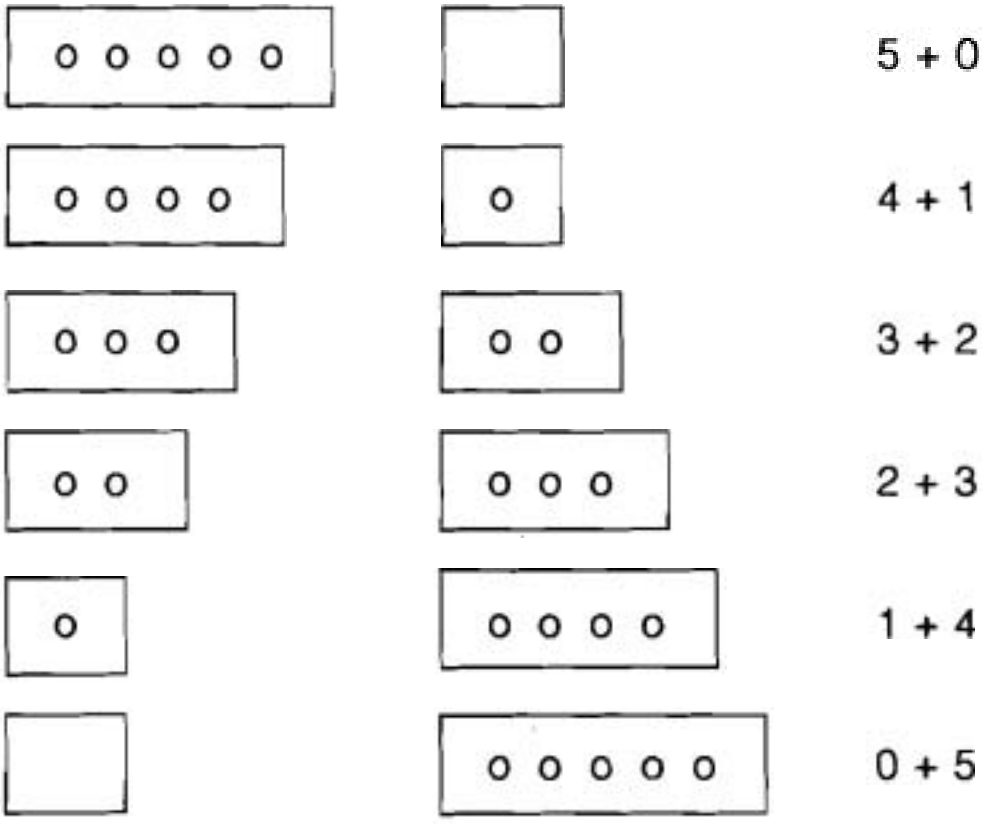
According to Hanrahan (1991), the role of the teacher in the development of these strategies is unclear. Some studies (e.g. Cobb, 1984, Kamii, 1985) found that children tend to invent addition strategies with minimum teacher input. While other studies (e.g. Houlihan and Ginsburg, 1981) have found that teachers did play a part through their instruction. This paper hopes to demonstrate that special education teachers indeed have a role to play in enhancing their children's understanding and development of a more efficient addition strategy, the "count-on" strategy.

A recent Singapore study that looked at the addition and subtraction strategies of Educationally Sub-Normal (ESN) children (Ee, 1991) found that these intellectually disabled children with an intelligence quotient (IQ) range of approximately 50 – 70 (American Association on Mental Deficiency; Grossman, 1978) require the assistance of their special education teachers if they are to use more efficient strategies. Some of these children will eventually use the above three main addition strategies that have been identified with their intellectually abled peers if teachers realise the need to minimise their process of learning during developmental programming so as to reduce redundant, unnecessary steps. Also, as special education teachers, they must constantly search for effective instructional materials and strategies which are appropriate to their children's developmental level.

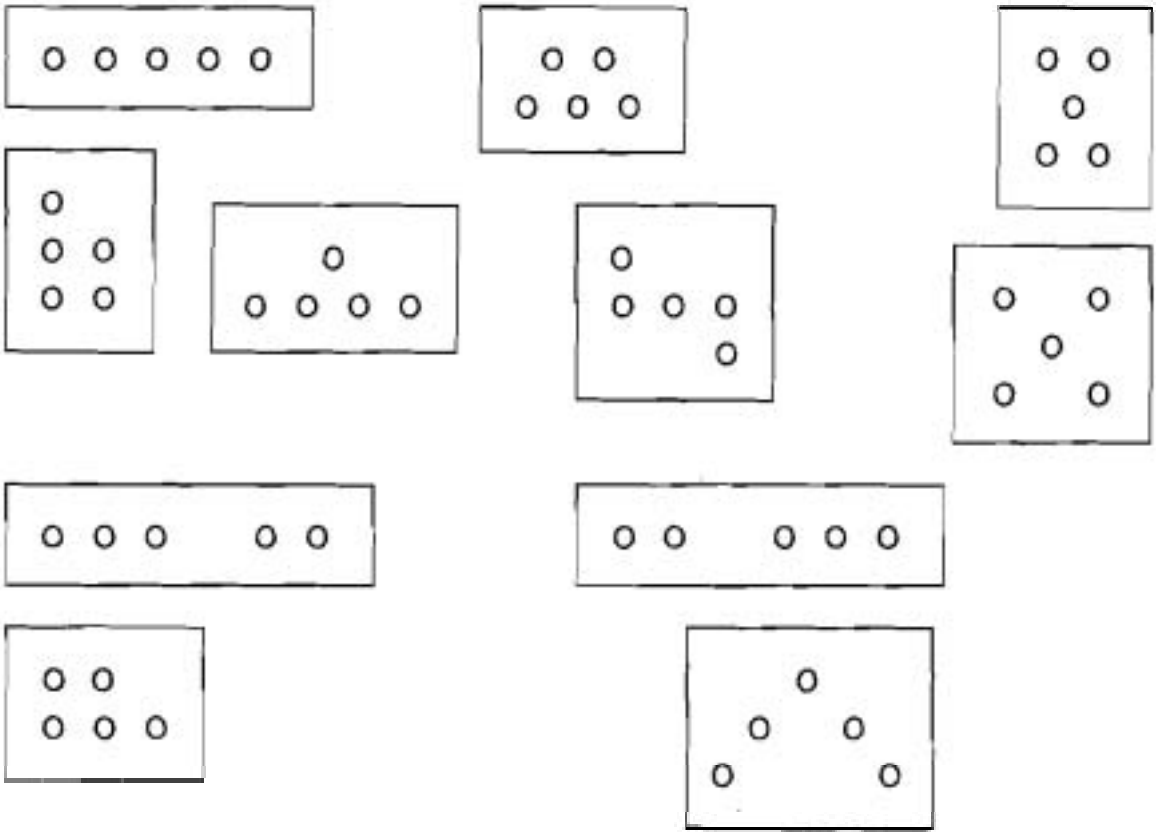
Ee (1991) found that these ESN children were using mainly tedious, elaborate procedures such as the "count-all" strategy in computating their addition sums and would resort to use the same strategy with sums even like 0 + 15 = _____ and 4 + 1 = _____. Also, in the process of counting, these children would develop lots of unnecessary procedural errors. As researches like Baroody (1986a, 1986b) recommended the use of more efficient, short-cut procedures to reduce unnecessary labour in learning and enhancing recall, the "count-all" strategy was used in her study to see if ESN children were able to use more efficient strategies like their intellectually abled peers. The "count-on" strategy was found not only less confusing but that the forward counting is a natural process which reduces errors in the process of counting. Time taken to work out the sums was also found to be shortened and interference with other computation procedures was reduced. This strategy was further found not only to provide a good addition foundation for these ESN children but assisted them in their subtraction computation strategy in the later part of the study.

Based on Ee's study (1991), what can special education teachers do to enhance their intellectually disabled children's learning of addition? You may wish to consider some of these procedures which teachers can do in enhancing a comprehensive understanding of addition in their children.

Concrete presentations which are sequentially and logically structured must be introduced to highlight relationships. This can further be reinforced through concrete activities. Children must be able to perceive that the sum of 3 + 2 as 5, at the same time be able to recognize that 2 plus 3 also gives the same equivalent. This conceptualization of addition will assist them in their understanding of subtraction at a later stage. Activities such as encouraging direct manipulation of concrete materials for children to "experience" that a number set does not change its elements can be done through manipulative activities e.g.



Opportunities to recognise patterns of objects and pictures in a set without counting should be encouraged to prepare children towards self-reliance activities once mastery of addition is achieved. This can be done through dice and card games.



3. Initial learning of addition requires children's good understanding of the meaning of the symbol " + " as "plus" or "altogether" or "add" or "more" or "putting sets together". Likewise, " = " may mean "is equal to" or "is the same number as" or "is as many as" or "makes".

4. Teachers must search for effective strategies to enhance children's learning e.g. from the review of the different strategies for addition, the "count-on" strategy tends to be the most efficient strategy used and hence should be encouraged.

5. Prerequisites for the strategy chosen must be thought through and presented effectively e.g. the teaching of "what number comes after _____?" and "what comes before _____" should be taught so that children's forward counting from a given number will not be hindered.

6. The zero set being an empty set should also be introduced simultaneously so that unnecessary counting will not be enforced when children identifies a sum with zero e.g. 5 + 0.

7. Children must also be given the opportunity to verbalise the procedural steps leading to the answer. This is not only to provide children immediate feedback to eradicate any misconceptions in the procedure but also to enhance their recall of the procedures used. Teachers can also understand the child's level of understanding as well as the effectiveness of her teaching procedures from the children's verbalisation. Initially, questions to cue the steps may include probing e.g. in a sum 2 + 5 = _____

   "What kind of sum is this?"

   "How do you know?"

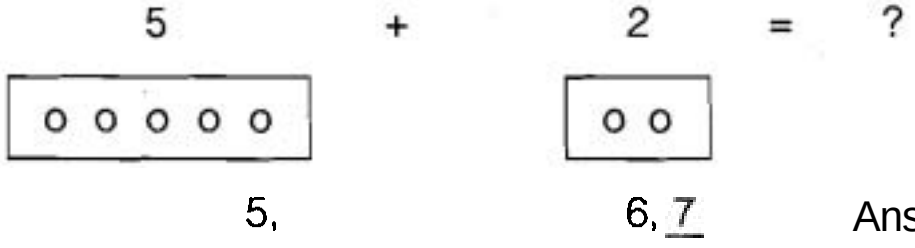
   The child is required to answer whether it is an addition sum and the reason for that decision e.g. "I can tell by the " + " (plus) sign".

   Further probing by the teacher may be required e.g.

   "Now, what do you do?"

   The child may be required to reply:

   "Find the larger number and count-on", and from his finger patterns and verbalisations continue to count after identifying with the larger number.



Answer = 7

8. Drills and practice such as games, worksheets, self-instructional activities, mental sums, quiz to assist recall and consolidation of learning is necessary.

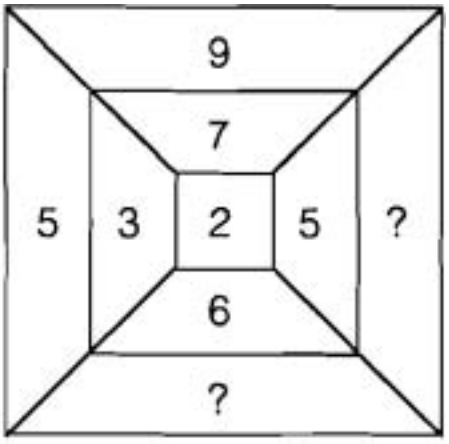
9. In enhancing transfer of learning, teachers must consider various means of introducing the same problem in various situations and in various formats e.g. displaying computation sums in a vertical as well as horizontal formats and other creative ways to ensure that children's cognitive skills are enhanced besides assisting automatic recall.

a) 5 + 2 = _____

b)
$$\begin{array}{r} 5 \\ +\ 2 \\ \hline \\ \hline \end{array}$$

c) If Jane has 5 sweets and John gave her 2 more, how many sweets has she altogether?

d)



(Children to infer from the pattern the need to add the two inner numbers to obtain the answers.)

Also, story sums which are related to children's daily lives should be included to allow for application and generalization.

10. Lastly, early continual assessment for diagnosis and corrective feedback to eradicate any lack of understanding or misconceptions in procedural errors must be maintained.

In conclusion, although these suggestions are necessary, special education teachers need to use their own discretions to adapt it to their children's individual differences in the classroom. However, it is imperative that teachers are always searching for effective instructional materials and strategies which are appropriate to their children's developmental level so as to optimise their children's mathematical understanding as well as to equip them with more effective strategies for problem-solving.

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