Multidisciplinary International Journal http://www.mijournal.in

(MIJ) 2015, Vol. No. 1, Jan-Dec **e-ISSN: 2454-924X; p-ISSN: 2454-8103**

ROLE OF THE CONCEPTUAL METAPHOR IN CHILDREN'S: COMPARISON AND CONTRAST OF EMBODIED LEARNING PERSPECTIVES

Mr. Anoop Kumar Yadav
Assistant Professor
Mata Jiyo Devi College of Education, Hissar

ABSTRACT

The purpose of this paper is to propose that the notion of the conceptual metaphor, as defined in the theoretical framework of embodied learning, can have a role in the construction of children's arithmetic and, in particular, in their invention of calculation strategies. In doing so it acknowledges the role of the sensory perceptual world in the development of children's arithmetic. A Piagetian framework makes a distinction between an embodied world of learning and the operational world of arithmetic. The two theoretical frameworks are compared in relation to children's realisation of the equality of commuted pairs in addition. The proposal is that the conceptual metaphor can be seen as an additional cognitive tool to explore children's analogous reasoning in abstractions from the results of operations. The potential of the conceptual metaphor in this role would be to provide a theoretical framework to explore children's development of arithmetic in terms of their everyday, perceptual experiences. In doing so it supports the notion of analogy as a key part in the creative process of arithmetic.

INTRODUCTION

There is much evidence that young children invent their own procedures in arithmetic and that these are based on flexible strategies such as „splitting‟ or „complete‟ number methods. It has been suggested that more able mathematicians recognise the economy of these flexible strategies whereas lower attaining children rely on inefficient procedural counting strategies. Research within the Piagetian framework has proposed that children‟s invented arithmetic procedures are evidence of operative schemes that involve mental operations or „interiorized action‟, abstracted through layers of reflective abstraction. The model proposed that the move from the physical act of counting to the use of number in arithmetic is achieved through „compression‟ of the process of counting. In this way the word three is not just a counting word, it is also „compressed‟ into the concept of three as an „economical unit‟ that can be held both as a focus of attention and as an access to the process of counting. This view of numbers as both a process and a concept is termed „proceptual‟. Gray and Tall have suggested that the diverging ability in calculations can be explained by a „proceptual divide‟. The more successful child will be „in tune‟ with the flexible notion of „procept‟ whereas the less successful child will rely on the process of counting.

In a similar way had theorised on the dual nature of process and object. She proposed that mathematical ability was explained as being capable of „seeing‟ „invisible objects‟. Such mathematical notions were not only referred to structurally as objects but also as operational concepts arrived at through processes. In this way "the ability of seeing a function or a number both as a process and as an object is indispensable for a deep understanding of mathematics…".Reification describes the ability to see a process as a „fully-fledged" object which allows the user to manipulate the object as a whole.

Within the embodied learning framework, metaphorical projection is presented as a mechanism to work up from sensory experiences to abstract concepts, to bring abstract concepts into being. In the embodied learning perspective the term metaphor is not just seen as a linguistic device to communicate an idea. Metaphors are seen as conceptual, as mental constructions that play a constitutive role in structuring our experience and shaping imagination and reasonin. Such conceptual metaphors can play a part in representing a piece of knowledge in our mind used the abstract concept „love" as an example and how we may refer to perceptual experiences, such as „warming our hearts", to provide a more direct, immediate understanding of the abstract concept of „love". In the same way the conceptual metaphor can be used to map an abstract mathematical idea onto a more concrete representation. Based on collages of pre-mathematical frames such as „in", „next", „together" the conceptual metaphor becomes a "powerful tool for knowing something". We can employ a common repertoire of pre-mathematical frames based on sensory experiences such as motion, sharing, giving and receiving to develop sophisticated mathematical ideas.

From an embodied learning perspective Davis has suggested that the good mathematicians have synthesised abstract mathematical ideas from the pre-linguistic schemas that are common to all of us. The child who can make the analogous link and see the resemblance with other everyday experiences may be more likely to use arithmetic in an inventive way.

This paper proposes that the conceptual metaphor may also be seen as a cognitive tool in the development of children"s flexible use of arithmetic and invented strategies. In order to explore this phenomenon we will first need to consider how children may come to use invented strategies that rely on intuitive knowledge of arithmetic principles such as commutativity and associativity. In order to make a case for the role of the conceptual metaphor we will also need to compare and contrast the two theoretical frameworks in relation to children"s intuitive knowledge of the arithmetic principles.

LEARNING AND ARITHMETIC

Learning, on the other hand, provides a framework that acknowledges the role of the figurative or perceptual in the building of abstract ideas in arithmetic. Within this framework the conceptual metaphor is seen as a cognitive tool through which all mathematical ideas are developed. Conceptual metaphors are seen as mental constructions that play a constitutive role in structuring our experience and shaping imagination and reasoning. Conceptual metaphors inform analogical mappings from the concrete or physical concepts of source domains to more abstract target domains such as the world of number. In mapping from the source domain to the target domain the source provides the conceptual domain from which

MIJ

we draw the metaphor and the target is the domain that we are trying to understand. In this way conceptual metaphors are more closely related to physical and neural development and interaction with the body within the world.

It analysis of mathematical ideas suggests an elaboration of simple ideas such as containment though the projection of metaphors into the abstract world of number and arithmetic. Everyday commonplace metaphors such as object collection and object construction are projected onto the number world. Grounding metaphors such as „Arithmetic is Object Collection" and „Arithmetic is Object Construction" map the metaphors of the physical world onto the number world.

CONCLUSION

The recognition of the elaboration of abstract ideas in arithmetic from sensory experiences may provide a theoretical framework for examining the connections between children"s informal knowledge and the formal world of number. The issue of divergence in children"s use of arithmetic remains a concern for educationalists. Some children may stay with counting procedures, unable to use the more flexible and economical invented procedures successfully. At this stage we cannot claim that the analogous nature of metaphorical projection explains the divergence in abilities but as many children find it difficult to work with number in a flexible way it seems worth investigating. As yet little is known how metaphors are processed but the conceptual metaphor may provide a lens to investigate children"s abstraction in arithmetic and give insight into the role of children"s everyday pre-mathematical ideas.

Analogy has been recognised as a cognitive mechanism involved in creative thinking. It has been seen as a mental mechanism for combining and recombining ideas in novel ways. Metaphorical projections have been claimed as providing insights and „mental leaps" in building scientific theories. One of the most common examples is that of Kekule in the field of biochemistry who proposed a new theory of the molecular structure of benzene following a dream that contained the mental image of a snake biting its own tail.

REFERENCES

- Carpenter, T. & Moser, J. (1984) „The acquisition of addition and subtraction concepts in grades one to three", Journal for Research in Mathematics Education, **15** (3), 179-202.
- Davis, R. (1984) Learning Mathematics: The Cognitive Science Approach to Mathematics Education, London: Routledge.
- Dubinsky, E. (1991) „Reflective Abstraction in Advanced Mathematical Thinking", in Tall D. (ed) Advanced Mathematical Thinking, 95-126, London, Kluwer Academic Publications
- Gray, E. (1991) „An Analysis of Diverging Approaches to Simple Arithmetic: Preference and its Consequences", Educational Studies in Mathematics, **22**, 551-574

- Gray, E., Pinto, M., Pitta, D. & Tall, D. (1999) „Knowledge and Construction and Diverging Thinking in Elementary and Advanced Mathematics", Educational Studies in Mathematics, **38,** 111-133
- Johnson, M. (1987) The Body in the Mind, Chicago, The University of Chicago Press. Kamii, C., Lewis, A. and Jones Livingston, S. (1993) „Primary arithmetic: children inventing their own procedures", Arithmetic Teacher, **41**(4), 200-203.
- Lakoff, G. (1980) Metaphors we live by, Chicago, The University of Chicago Press.
- Piaget, J. (2001) Studies in Reflecting Abstraction, edited and translated by Campbell R., Hove, Psychology Press.
- Pitta, D. (1998) In the Mind: Internal Representations and Elementary Arithmetic, Unpublished Doctoral Thesis, Mathematics Education Research Centre, University of Warwick.
- Polya, G. (1973) Induction and Analogy in Mathematics, New Jersey, Princeton University Press.
- Resnick, L. (1983) „A Developmental Theory of Number Understanding", in Ginsburg H. (ed.), The Development of Mathematical Thinking, New York: Academic Press.
- Steinberg, R. (1985) „Instruction on derived facts strategies in addition and subtraction", Journal for Research in Mathematics Education, **16** (5), 337-355
- Tall, D. (2004) „Thinking Through Three Worlds of Mathematics", in Gates P. (ed.) Proceedings of the Annual Meeting of the International Group for the Psychology of Mathematics Education, 28th, Bergen, Norway, **4**, 281-288.