

The Role of Manipulatives in Enhancing Pupils' Understanding on Fraction Concepts

Jamilah Yusof
Sultan Hassanal Bolkiah Institute of Education
Universiti Brunei Darussalam

Sarimah Lusin
Ministry of Education

Abstract

Zoltán Dienes and Josef Perner's work [24] convinced many researchers that the use of various representations of a concept, or 'multiple embodiments,' were needed to support pupils' understanding. Piaget [4] suggested that young children do not have the mental maturity to grasp abstract mathematical concepts presented in words or symbols alone and they need many experiences with concrete materials and drawings for learning to occur. Bruner [1,2] suggested that children demonstrate their understandings in three stages of representation: enactive (the role of physical objects), iconic and symbolic. Skemp's theories [22] supported the belief that pupils' early experiences and interactions with physical objects formed the basis for later learning at the abstract level. Based on theories of cognition and the social construction of knowledge [23], more recent research by Cobb [3] discusses cultural tools like hundreds boards, showing the complicated relationship between manipulatives and sociocultural perspectives. Current research in mathematics education views pupils as active participants who construct knowledge by reorganizing their current ways of knowing and extracting coherence and meaning from their experiences [8], [9], [17], [19]. The impact of theories and research connecting pupils' actions on physical objects with mathematical learning has had an important influence on the emergence and use of manipulative in primary school classrooms.

This paper reports on a study which examined how much manipulatives have been used in the teaching of fractions for Year 5 pupils in Brunei Darussalam. The purpose was to determine whether using manipulatives to teach fractions could promote active learning and enhance the achievement among those pupils. This small scale study used both qualitative and quantitative data obtained from the pre and post tests, interviews and classroom observation to determine the effectiveness of using

manipulatives as implemented in the teacher-designed intervention lessons. The paper concludes with some recommendations on how different types of manipulatives can be used in their effective ways to promote pupils' understanding of fraction concepts.

1. Introduction

Fractions teaching have embraced attention of mathematics teachers and educators worldwide due to the fact that many learners seem to have problems in understanding the concept of fractions [5], [13], [14], [16]. Pupils need to be actively involved in their learning and manipulate objects in their surrounding so that they can generate better understanding of mathematical concepts. Thus, in the teaching and learning of fractions, ideally, pupils should be given opportunities to explore the fractions concept through hands-on experiences, share their ideas among themselves and more importantly to learn fraction concepts with the help of appropriate manipulatives.

Heddens [11] defined manipulative materials as concrete models that involve mathematical concepts, appeal to several senses including the socio-cultural needs that can be touched and moved around by the learners [6].

Mathematics educators around the world have found that mathematics is better learned, and therefore should be taught, by students experiencing it through manipulatives [20]. According to them, the two main reasons for teachers not using manipulatives in their mathematics classrooms were that teachers were uncertain of how to use the manipulatives, and they felt that manipulative instruction was inappropriate for students above the fourth grade. Sherman and Richardson [18] reported these reasons for teachers not using manipulatives: being unfamiliar and uncomfortable with the materials themselves, concerns about time constraints, possible discipline problems, availability of manipulatives and their cost.