

A Longitudinal Study on Young Children's Development of the Representation of Written Number Symbols

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Abstract

Young children's representation of written number symbols was examined at 4 time points during two years (mean age = 55, 64, 70 & 76 months). Measurements were Number Symbol Representation Task; Cardinal Concept Task; Written Addition and Subtraction Task and Written Arithmetic Formula Representation Task. The results indicated children's rapid development in the ability to represent written number symbols. Scores on Written Number Symbolic Tasks, Cardinal Concept and Written Addition and Subtraction Task were significantly correlated. Performance of children in university affiliated childcare center surpassed that of the center serving working families at Time 1, but the advantage of the center faded at Time 3 and Time 4. A multiple regression analysis identified 2 significant predictors for children's representation of written number symbols at the end of kindergarten: written number symbol representation score at Time 1 and the type of kindergarten.

[Key Words] number concept, number development, written number symbols, cognitive development, longitudinal, young children

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INTRODUCTION

Studies have indicated that it takes several years and much experience for young children to learn to use oral number symbols such as counting words (Fuson, 1988; Fuson & Hall, 1983). It is certainly for children to take even longer time to learn written number symbols. Written number symbols here are defined as Arabic number symbols and other symbols that contain special mathematical meanings such as "+", "-", "=". The written number system is getting more and more efficient and abstract in the process of historical development. Sometimes one symbol or one simple mathematical formula presents many complicated meanings. "An expert's model of number will contain ready-made metaphoric links among the different levels of representation and between the different meanings that number words and symbols can take" (Mann, 1998, p.53). It is a great challenge for young children to learn these complicated connections and it is important for educators to understand these connections. We have had much research information on children's acquisition of oral number system (Fuson, 1988), but the information on children's development of written number symbols is still limited.

Studies found very similar results in U. K. and U. S. children's difficulty in the representation of written number symbols in using paper and pencil (Hughes, 1998; Kamii, 1985). Children had problems in doing translations between different representations of written numbers or arithmetical concepts—either from concrete to written or from written to concrete, such ability directly related to children's performance in school mathematics (Kamii, 1985; Stallard, 1982). Counting system in Chinese language is more regular than that of in English. It forms a clear base-ten system while the English number names do not. For example, 10-1, 10-2, 10-3 is used for eleven, twelve and thirteen. It may be easier for children to understand the meaning of these number symbols. Given their linguistic advantage, Asian children (e.g. Chinese and Korean speaking children) develop counting skills earlier than American children, also develop understandings about base ten organization and place value notation earlier (Fuson & Kwon, 1992; Miller & Parede, 1996). With such evidence, we were wondering whether Chinese children have similar advantages or problems in using written number symbols to represent the quantity and the operation of addition and subtraction. There