



Children's formation and representations of money-related thinking in graphical complexes: Compound relation operations and creative high-order thinking



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ABSTRACT

Money has been explored frequently from adults' diversified perspectives. The study investigated qualitatively children's formation and representations of money-related thinking and concepts with the aid of drawing and languages. The subjects included 135 girls and 165 boys of ages from four to eight, recruited from the City of Tainan, Taiwan. The children were found to understand money from the perspective of physical exchange media and undertook creative relation operations on the graphical monetary and nonmonetary objects produced in their drawings in forming and representing thinking in graphical complexes. The relation operations included attribute representation, grouping, ordering, counting, partitioning/complementing, measurement-unit self-defining, object extending, value correspondence, purchasing power storage, and play-objects manipulating. Relation operations may be undertaken by children sequentially in the form of a compound relation operation and pave the way for children's formation of higher-order thinking and linguistic productions. The data suggested that the children's strategic formation of compound relation operations and creative high-order thinking may be characterized by the three sequential relation operation strategies of undertaking attribute representation as the initial relation operation, undertaking numeric relation operations on monetary complexes, and undertaking goal-oriented relation operations to link monetary complexes to nonmonetary complexes. An extensive form of thinking formation by sequential relation operations was proposed in the study to illustrate how children's formation of higher-order thinking and linguistic productions may be enhanced through sequential relation operations in the form of a compound relation in drawing activities.

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1. Introduction

Money, with a variety of functions, may influence individuals and a nation as a whole in diverse ways. While economists viewed money from various perspectives and asserted that money has a number of important functions, including a medium of exchange, a unit of account, and a store of value (Froyen, 2002), the perspectives they have taken to understand the role money would play in human societies have been subjective to successive refinements. Copeland (1994) stated that money may be merely a synonym for wealth or even for income for adults without a professional knowledge of money. As indicated

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by the diversified perspectives which adults, particularly economists with an expertise in monetary economics, have taken to understand money and its influential role within human societies, more research effort should be directed toward the investigation of human experiences with money, in particular those which children would acquire in daily lives within a social context. While a large number of studies have reported on the influence money would have on economic performance (e.g., Barro, 1977; Dornbush & Fischer, 1980; Rocheteau & Wright, 2005; Sargent & Surico, 2011), evidence regarding children's understanding of money and thinking related to their experiences with money is less well-developed. To examine children's perceptions of money and formation of complex thinking and concepts associated with money, the present study is to answer the following research questions with the aid of children's graphical representations: (1) How would young children use drawing and languages to interpret and represent their experiences with money? (2) What strategies would children use in drawing to form and represent thinking and concepts associated with money?

As mentioned by Jeffrey and Craft (2004) with regard to the definition of teaching for creativity presented in the 1999 report of the National Advisory Committee on Creative and Cultural Education, teaching for creativity takes forms of teaching which would help young people to develop their own thinking or behavior. Zachopoulou and Makri (2005) mentioned that the existed definitions for creativity comprise some basic elements, such as the creative product, the creative person, and other factors which are related to the creative performance. As asserted by Runco and Garret (2012), while originality is essential to creativity, for original products to be creative they must possess the attribute of effectiveness, which may take such a form as usefulness, fit, or appropriateness. With regard to drawing as a developmentally appropriate means of self-expression for children, Vygotsky (1978) asserted that sign operations would extend the human operation of memory beyond the biological dimensions of the nervous system and drawing is graphic speech which originates from verbal speech. Children can use drawing to communicate what they think and develop a better and deeper sense of their world and to sort out relations and experiment with concepts (Helm & Katz, 2001; Oken-Wright, 1998). Children's drawing was found to be a creative activity and a significant contributor to children's emergent writing through their formation of thinking in graphical complexes (Chen & Zhou, 2010; Wu, 2009, 2013).

Children's graphical representation of their experiences acquired within a social context may be understood from the perspective of concept formation and mapping. Vygotsky (1986) asserted that one of major phases in children's concept formation comprises many variations of thinking in complexes, including complex thinking of association, collection, chain, diffusion, and bridge, and the individual objects in a complex are united in the child's mind not only by his subjective impressions but also by the relations existing between these objects. Novak (1990) mentioned that propositions are formed by two or more concepts linked together with words and a person represents the meaning of any concept by all of the propositional linkage. Concepts maps, as he stated, are a representation of meaningful or ideational frameworks which are specific to a domain of knowledge. With the technique of concept mapping, researchers have presented research results regarding the application of the concept mapping technique to enhance learners' learning performance in various fields (e.g., Kinchin, De-Leij, & Hay, 2005; Novak, Goodwin, & Johansen, 1983; Novak, 1990; Novak & Musonda, 1991).

Among a rare number of studies concerning children's experiences with money, Saul (1997) presented activities to integrate money concepts and in turn mathematical concepts with other curriculum areas in an early childhood classroom. Brenner (1998) used interviews and observations to determine what activities Hawaiian children from preschool through second grade did with money at home, while shopping, and during classroom lessons. Children's values about money were conceptualized as to what is important to the individual about money, including the goals of particular practices. Lau (1998) investigated the meaning of money to children and adults, and indicated that money was not an unfamiliar or uninteresting concept to young children. Grunberg and Anthony (1980) investigated children's interest of money by a recall task in which the subjects viewed from the same orientation 16 items, including a dollar bill, a quarter, a penny, and other non-money items, in a box and were asked to tell what they saw in the box, with the order of recall recorded by the experimenter. To examine their understanding of money, the subjects each were requested to identify among the 16 items the item they liked best and to make a choice between a one dollar bill and a plastic bowl containing 100 pennies and provide an explanation for the choice.

2. Method

2.1. Subjects

The subjects of the study included 135 girls and 165 boys of ages from four to eight, recruited from two elementary schools and their affiliated preschools located in the City of Tainan, Taiwan. Among these subjects, 51 girls and 66 boys were preschoolers, while 84 girls and 99 boys were elementary school students of grades from one to two. They spoke Mandarin Chinese at schools. The elementary school students were provided at schools with opportunities to write in the Chinese phonetic symbols termed *Zhuyin Fuhao* and traditional Chinese characters. The two female directors of the affiliated preschools, who were also teachers of the preschoolers, were interviewed to obtain information regarding the children's learning about money in preschool.

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