TRAINING PROPORTIONALITY THROUGH PEER INTERACTION

RICHARD CLOUTIER  
Université Laval, Québec, Canada

MARCEL L. GOLDSCHMID  
Swiss Federal Institute of Technology, Lausanne, Switzerland

ABSTRACT

The study aimed at determining the effects of training based on peer interaction over practical problems of proportion with normal subjects aged from 8 to 12 years. Two experimental groups were assigned to two treatment conditions: (a) training in solving problems of proportionality with social interaction (T1), and (b) training in solving the same problems without social interaction (T2).

Training groups included either 5 or 10 subjects who were heterogeneous with regard to their initial level of mastery of the concept of proportion. The results indicated that in group T1 the scores on proportionality improved significantly while group T2 and a control group did not. Thus, practice alone produced no change. The improvement on proportionality in T1 proved durable over a period of two months and generalized to a structurally related concept (probability). The variation in group size did not affect the extent of improvement. The number and duration of interactions within the group discussion over problems were not directly related to the amount of improvement. A detailed analysis of the pre- and post-test difference revealed that only 50% of the Ss in T1 improved substantially, and, in line with the Genevan view, improvement from training was found to follow the same sequence as normal development.

Introduction

In Piaget’s view, cognitive conflict, the subject’s activity and social interaction are three crucial determinants of cognitive evolution (Piaget, 1970). By progressing from one stage to the next and by experiencing “conflicts” along the way, the child finally acquires the operational structure that corresponds to an equilibrium state. The role of conflict in conceptual development has been theoretically and empirically supported by Ranzi and Tamperei (1966), Langer (1969), Berlyne (1970), Lefebvre and Pinard (1972), and Inhelder et al., (1974).

The subject’s activity, be it with respect to physical objects or social interaction, is a necessary condition for development since the essence of the equilibration process, at each developmental level, are real actions performed
by the subject (Flavell, 1963; Amy et al., 1964; Milton and Raph, 1973). “Cooperation and discussion with other children can often help the child more than the adult can to move out of his egocentricity toward the awareness of new points of view” (Kamii, 1973).

The significant influence of social interaction, as an agent of conceptual development, has been demonstrated by Brison (1966) and Murray (1972) for conservation, and by Schirmerhorn et al. (1975) for probability.

The development of the concept of proportion and related probability involving the capacity to perceive and compare ratios, has been described by Piaget and Inhelder (1951) as characterized by a marked progression between the age of 9 and 11 with increased mastery up to 14–15 years, an age range which corresponds to the formal operational period. These findings were supported in a number of studies (e.g. Lovell, 1961; Lunzer, 1965; Noelting et al., 1973; Noelting, 1975; Brainerd, 1971), although some individual and age differences have been reported (Davies, 1965; Yost, Siegel and Andrews, 1962; Goldberg, 1966; Fishbein, Pampu and Manzát, 1970; Cloutier and Goldschmid, 1976).

Piaget’s description of the development of the concept of probability and proportion generated several other studies on formal reasoning (for reviews, see Flavell, 1963; 1970). Among the studies replicating and extending Piaget’s work on proportionality, Noelting et al. (1973) have constructed a seven-point developmental scale based on a scalogram analysis of a 28-item group test for a sample of 339 Ss varying in age from 6 to 16 years; the authors have described seven stages of development and defined as many types of problems. Their testing procedure was adopted in this study.

During the last fifteen years, several researchers have tried to experimentally induce various Piagetian concepts: while the first attempts were relatively unsuccessful (Flavell, 1963), a second phase of research (involving more than sixty studies) has produced improved results (Goldschmid, 1968; 1971; Flavell, 1970). The majority of these training studies was concerned with the transition from the pre-operational to the concrete level of thought; few experimenters have attempted to train formal concepts. Among the latter figure Brainerd and Allen’s (1971) investigation of conservation of density, Tomlinson-Keasey’s (1972) experiments on pendulum, balance and flexibility, and Fishbein et al.’s (1970) study on ratios and the chance concept. These researchers have generally been successful in training formal reasoning.

Evaluating the modalities of learning cognitive structures, Inhelder and Sinclair (1969) and Inhelder et al (1974) have summarized the Geneva School’s point of view by arguing that improvement resulting from training is subordinate to development and consequently follows the same sequence as normal development. It follows that subjects who are initially closer to completing the acquisition of a new cognitive structure will be more influ-