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This Week's Citation Classic®

Sigel I E, Roeper A & Hooper F H. A training procedure for acquisition of Piaget's conservation of quantity: a pilot study and its replication.
Brit. J. Educ. Psychol. 36:301-11, 1966.
[Merrill-Palmer Inst.; City and Country Sch.; and Center for the Study of Cognitive Processes, Wayne State Univ., Detroit, MI]

The study represents an initial investigation of the relationship between logical operations deemed prerequisite to the development of conservation and acquisition of conservation The hypothesis guiding the study was that special training on the acquisition of the logical operations described by Piaget[1] is a necessary condition for children's ability to solve conservation of quantity problems Two groups of preschool children between the ages of 4 3 and 5 with IQ scores over 130 were involved One group served as controls Training procedures focused on logical operations Changes in conservation of quantity, weight, and volume were found for the experimental group only The study was replicated with similar results [The *Social Sciences Citation Index*® (*SSCI*®) indicates that this paper has been cited in over 50 publications, making it the most-cited paper ever published in this journal]

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This study came about as a fluke. I noticed that the gifted children at the City and Country School in Bloomfield Hills, Michigan, did no better on conservation tasks than nongifted children. This was surprising since they were so bright.

Conservation is a principle which holds that an attribute retains its identity in spite of transformation. An example of conservation is the oft-quoted riddle, "What weighs more, a pound of feathers or a pound of lead?" Individuals who are conservers realize the amount is constant even though the material is different. Understanding this principle is vital for logical thinking, and hence, helping young children to understand this concept helps them in their development of logical reasoning.

Most training studies reported at the time indicated that children could not achieve the concept of conservation by any of the usual didactic training procedures and concluded that conservation acquisition was not amenable to training. My argument was that these studies failed because they did not train the children on the prerequisites. I contended that the children had to learn the prerequisites first, and, if they did, they could solve conservation of mass, weight, and volume without further ado. In general, one can only learn a new thing if the prerequisites are in place.

Annemarie Roeper, the head of the preschool program at the school, concurred, so we set up an experiment that trained one group in the prerequisites first; the control group played. The results worked out just as we predicted; the experimental group did acquire conservation of mass and weight, and in some cases, volume. Since the groups were selected on the basis of having failed the conservation tasks prior to the experiment, we felt certain their acquisition had something to do with the training.

No one before that time who did training studies followed the same logic that we did. Our logic was from the perspective of developmental theory, which holds that development of cognitive functions follows an invariant stage progression and that these cognitive functions cannot emerge unless preceded by the necessary prerequisites.

We did not train our children for each of these processes separately to determine which of them was more or less important than any other. It is this issue that our fellow investigators felt limited the usefulness of the study, but this is a misinterpretation. We *deliberately* were not examining how each specific operation influences the outcome. We were interested in determining how the collection of operations introduced in developmental sequence described by Piaget would affect the children, but our critics were on another wavelength. I believe this is the reason that people read the study. Citations could have been made for different and almost contradictory reasons: to show that training in conservation is possible, or to show that because of the so-called poor methodology, a spurious result occurred that did not allow anything definitive to be said as to why the phenomenon appeared. I disagree. Since the children in the study failed all the conservation tasks we gave them as pretests, and since the training group did significantly better in the post-tasks, the logic of our position is justified. This study was a direct demonstration of Piaget's theory.

A review of the field[2] provides information on trends since 1966. More recently, I have done work on distancing strategies.[3]

1. **Piaget J.** *The child's conception of number* London: Routledge and Paul, 1952 248 p.
2. **Sigel I E.** Child developmental research in learning and cognition in the 1980s continuities and discontinuities from the 1970s. *Merrill-Palmer Quart —J Devel* 23:347-71, 1981.
3. ----------. A constructivist perspective for teaching thinking· a distancing strategy *Educ Leadership* 42 18-21, 1984

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