

This Week's Citation Classic[®]

Gelman R. Conservation acquisition: a problem of learning to attend to relevant attributes. *J. Exp. Child Psychol.* 7:167-87, 1969.
[Brown University, Providence, RI]

Five-year-old children who failed standard Piagetian tasks of conservation were trained, with a modified learning-set procedure, to focus their attention on relevant quantity dimensions in a three-item set. Experimental subjects quickly came to respond correctly and applied what they learned on "immediate" and "six-month delayed" post-tests of their ability to conserve. [The *Social Sciences Citation Index*[®] (SSCI[®]) indicates that this paper has been cited in over 150 publications.]

Rochel Gelman
Department of Psychology
University of Pennsylvania
Philadelphia, PA 19104

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This *Citation Classic* was based on my dissertation. How I came to do one of the first studies showing it is possible to train children who fail Piaget's conservation tasks is less than a noble tale. I was gearing up to do a multidimensional scaling study of how adults respond to music. It would not have been an easy study to do, and I wasn't sure I would learn anything musicians did not already know. I began to get cold feet and allowed myself to get talked into a brief skiing trip to Mammoth, California, but I took a bit of work along—a copy of Flavell's *The Developmental Psychology of Jean Piaget*.¹

The choice of book may seem odd. I had resisted the fact that developmental topics interested me most because I did not like being told that women fared better in this area. So throughout graduate school I did two lines of work in parallel, one in what is now called cognitive psychology, one in developmental psychology. The two lines came together while I was lying in a hospital bed with a broken leg and with nothing else to read but Flavell's book. As I read and reread it, the work I was doing on the role of attention in learning kept coming to mind. Its juxtaposition alongside my thoughts of Piaget led me to the idea that I might succeed in teaching children to conserve quantity if I adopted the methods of those who treated learning as a function of the ability to attend to relevant attributes or dimensions in a display.²

The translation of the attention argument into a Piagetian training study involved thinking of the stan-

dard conservation stimuli as two complexes of relevant and irrelevant dimensions. The relevant dimension was the quantity, e.g., the liquid in two identical containers; the irrelevant dimensions were the height, width, size, color, etc., of the containers. Given that the irrelevant and relevant dimensions are redundant to start, probability favors attention to one or more irrelevant dimensions. Since Harlow could teach monkeys to ignore irrelevant dimensions and respond to the odd stimulus of three,³ I thought it reasonable to try to adapt his learning-set method to teaching five-year-olds.

I could not rush out and work with children. I had a cast on, and they attended more to the fact I had no shoe on my left foot than to my questions about same or different number or length—my trinket reinforcers notwithstanding. With time to think, I realized that children needed to see how different transformations varied the relevant and irrelevant dimensions—even though Harlow did not let monkeys watch him set up the within-problem trials.

The young children in my experimental group responded quickly to the training; they also applied what they learned on follow-up tests of conservation. More importantly, they could justify their answers and, when given a post-test six months later, continued to conserve. I had at least met some of the Piagetian transfer criteria.⁴

My effort to publish the work introduced me to the world of conflicting reviews. The journal editor would accept the manuscript if I could deal with the "enclosed reviews." One reviewer as much as said I could not have done what I said I had and would know this had I cited comparable studies. Worse yet, I could not have read any Piaget, either in the original or as presented in Flavell's book on Piaget. The other encouraged publication and asked me to try to explain the robustness of the transfer effects, especially the explanation data. It was signed by John Flavell! I shipped the reviews off to Tom Trabasso and Wendell Jeffrey, the cochairmen of my dissertation, who explained that the article had not been rejected—quite the contrary.

It wasn't until 1982 that I published another conservation training study.⁵ I reasoned that the children in the first one caught on too quickly if they really lacked underlying structures to interpret the environment I was presenting them; they had to have known more about quantity. I turned my efforts to studying what preschool children do know about quantity—and to other domains.^{6,7}

1. Flavell J. *The developmental psychology of Jean Piaget*. Princeton, NJ: Van Nostrand, 1963. 472 p.
2. Trabasso T & Bower H G. *Attention in learning: theory and research*. New York: Wiley, 1968. 253 p.
(See also: Citation Classic. *Current Contents/Social & Behavioral Sciences* 13(49):16. 7 December 1981.)
3. Harlow H F. Learning set and error factor theory. (Koch S, ed.) *Psychology: a study of science. Study 1. Volume 2. General systematic formulations, learning and special processes*. New York: McGraw-Hill, 1959. p. 492-537.
4. Inhelder B & Sinclair H. Learning cognitive structures. (Mussen P H, Langer J & Covington M, eds.) *Trends and issues in developmental psychology*. New York: Holt, Rinehart & Winston, 1969. p. 2-21.
5. Gelman R. Accessing one-to-one correspondence: still another paper about conservation. *Brit. J. Psychol.* 73:209-20, 1982.
6. Gelman R & Brown A L. Changing views of cognitive competence in the young. (Smelser N J & Gerstein D R, eds.) *Behavioral and social science: fifty years of discovery*. Washington, DC: National Academy Press, 1986. p. 175-207.
7. Gelman R & Gallistel C R. *The child's understanding of number*. Cambridge, MA: Harvard University Press, 1978. 260 p.