DOCUMENT RESUME

ED 171 430 PS 010 663

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TITLE Comparison of Children's Performance on the Torrance Tests of Creative Thinking and Selected Piagetian Tasks.
PUB DATE Feb 79
NOTE 13p.; Paper presented at the Annual International Interdisciplinary UAP Conference on Piagetian Theory and Its Implications for the Helping-Professions (9th, Los Angeles, California, February 2-3, 1979)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Concept Formation; *Conservation (Concept); Creative Ability; *Creativity Tests; Divergent Thinking; *Elementary School Students; Individual Differences; *Kindergarten Children; *Performance; *Research
IDENTIFIERS Torrance Tests Of Creative Thinking

ABSTRACT

The purpose of this study was to examine the relationships of children's performance on the Torrance Tests of Creative Thinking (TTCT) and on selected Piagetian tasks of conservation. Study subjects, 133 kindergarten and first grade multi-racial boys and girls, were administered the TTCT-Figural Form A and selected Piagetian tasks of conservation of number, of discontinuous quantity, of mass and of time measurement. Two assumptions were tested: (1) that characteristics of creative thinking, such as flexibility of thought and resistance to premature closure, in particular, also underly ability to conserve, and (2) that those children who attained an above average creativity index on the TTCT would be early conservers. Analysis of variance yielded significant correlations at the .001 level that indicated that conservers were more resistant to premature closure and their thinking was more flexible than non-conservers. A multiple regression of the creativity variables that were significant as a result of canonical correlation was done to identify those useful in predicting readiness for conversation. Piaget's notion of reversibility of thought is brought into question. Conservation is interpreted as reconciling simultaneous opposites or "Janusian thought" taken from the creativity literature. (Author/MP)

Comparison of Children's Performance on the Torrance Tests of Creative Thinking and Selected Piagetian Tasks

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The purpose of this investigation was to analyze relationships of children's performance on the Torrance Tests of Creative Thinking (TTCT) and on selected Piagetian tasks of conservation. Two assumptions were tested. First, that characteristics of creative thinking such as flexibility of thought and resistance to premature closure, in particular, also underly ability to conserve. Second, that those children who attained an above average creativity index on the TTCT would be early conservers.

Reisman and Torrance administered the TTCT - Figural Form A and selected Piagetian tasks of conservation of number, of discontinuous quantity, of mass, and of time measurement to 133 kindergarten and first grade multi-racial boys and girls ranging in age from 5 years, 5 months to 8 years, 1 month. Conservation depends upon a child's ability to maintain an invariant under various transformations. That is, to be aware that quantity remains the same even though transformations of spatial arrangement or shape occur. In order to conserve a child must be able to consider more than one aspect of a situation at a time. For example, s/he must notice that the cardinal number property of a set remains the same regardless of how the objects that comprise the set are moved about in space, or that a ball of clay will contain the same amount of clay across certain transformations such as rolling the ball out into an elongated shape, flattening it into a pancake, or breaking the ball of clay into individual smaller balls of clay. A more difficult task deals

with conservation of time where the invariant is a duration of time and the transformations are changes in speed and distance (Reisman, 1978). Thus the child must reconcile simultaneous opposites. The Piagetian conservation tasks, administered are on the examiner's record form shown in Figure 1.

(Insert Figure 1 here)

The figural Battery of the Torrance Tests of Creative Thinking comprise three activities; Picture Construction where the examinee is directed to make a picture by adding to a jelly bean or tear drop shape which serves as the stimulus object, Figure Completion consisting of ten incomplete figures which the examinee must use to form a picture, and the Repeated Parallel Lines Activity where the direction is to see how many objects or pictures the testee can make in ten minutes. The Torrance Tests of Creative Thinking focus on divergent thinking expressed in several constructs underlying creative thinking abilities. Fluency of thought is assessed by counting the number of different relevant responses to Activities two and three. Originality scores depend upon the uniqueness of response, with focus on the statistical infrequency and unusualness of the response. Elaboration is defined as the amount of embellishment of a picture in comparison to responses of the appropriate norm group. Two assumptions underlie elaboration. First, the primary response to the stimulus is a single meaningful response and second, that "imagination and exposition of detail is a function of creative ability" (Torrance and Ball, 1978, p. 9). Resistance to quick closure is scored by observing whether or not the examinee immediately closes incomplete figures by "straight or curved lines, cutting off chances of more powerful, original images" (Torrance and Ball, 1978, p. 10). Abstract Titles is a measure of one's ability to synthesize and to abstract beyond the picture representation of an idea.

Name _____ Grade ____ Date of Birth _____

Task I: Question - Is there the same number of raisins in both rows?

A. Step 1:

Y___ N___

Step 2:

Y___ N___

B. Step 1:

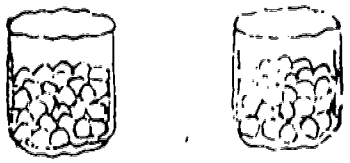
Y___ N___

Step 2:

Y___ N___

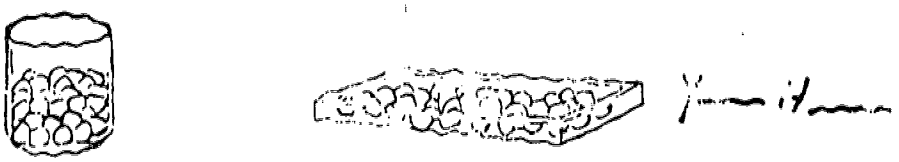
Task II: Question - Is there the same number of marbles in both containers?

Step 1:



Y___ N___

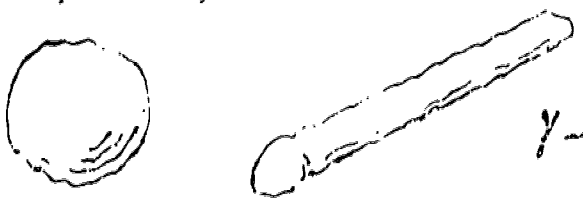
Step 2



Y___ N___

Task III: Question - Is there the same amount of clay in the ball as in the other shape of clay?

A.



Y___ N___

B.

Y___ N___

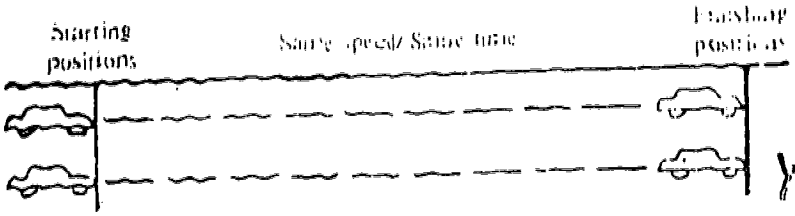
Figure 1. Conservation Tasks Administered to Grades Kindergarten and One

Task IV: Question - Is there the same amount of clay in the ball as in the pieces of clay that were made from the ball?

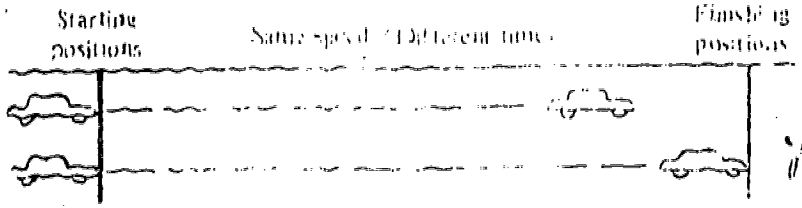
A.  Y___ N___

B.  Y___ N___

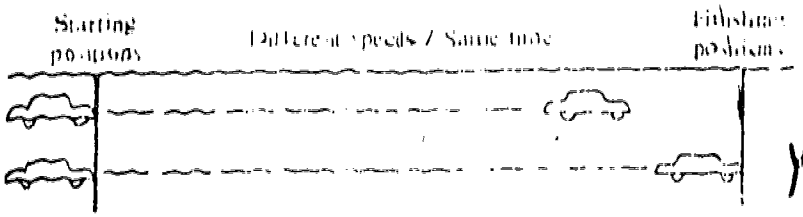
Task V: Question - Do both cars stop at the same time?

A. 

Y___ N___

B. 

Y___ N___

C. 

Y___ N___

Interviewer's comments on child: Right Hand ___ Left Hand ___ Boy __ Girl __

Of the total group, 7.5 percent were conservers (C) defined as having gotten all five of the conservation tasks correct, and fourteen percent Near-Conservers (NC) with four out of five conservation tasks correct. Overall comparisons of scores on the TTCT for Conservers, Near-Conservers, and Non-Conservers (Non-C) using analysis of variance showed several significant differences at the .001 level for Resistance to Premature Closure, Articulateness in Telling a Story, Movement and Action, Synthesis, Unusual Visual Perspective, Internal Visualization, Richness of Imagery, Colorfulness of Imagery, Originality, and at the .003 level for Flexibility, using standard scoring for the latter two indices. Table 1 presents coefficients of correlation for the Conservation Scores run with each of the Creativity Variables.

(Insert Table 1 here)

The Duncan Multiple Range Test was applied and this analysis showed no differentiation between C and NC; C only differed from Non-C for Abstract Titles; both C and NC differed from Non-C for Elaboration, Resistance to Premature Closure, and for total Creativity Index. The Kruskal-Wallis One-Way Analysis of Variance was applied to the checklist of Creative Strengths data and the following results were obtained: Unusual Visual Perspective, Internal Visual Perspective, and Richness of Imagery differentiated the C and NC from the Non-C and also C from NC. Articulateness in Telling a Story, Movement, Synthesis (Combining circles in Activity Two), and Colorfulness of Imagery differentiated C and NC from Non-C. Expression of Emotions and Feelings, and Humor differentiated C and Non-C only. Expressiveness of Titles and Quickness of Warmup did not differentiate any of the groups. The results showed that Conservers and Near-Conservers were more resistant to premature closure and their thinking was more flexible than the Non-Conservers.

Table 1

Product-Moment Coefficients of Correlation Between Conservation Scores and Figural Measures of Creative Thinking Ability (TTCT)

Creativity Measure	N	r	p
Fluency (Streamlined)	127	.10	.130
Originality (Streamlined)	127	.19	.017
Abstractness of Titles	127	-.06	.264
Elaboration (Streamlined)	127	.00	.494
Resistance to Premature Closure	127	.32	.001
Emotional Expressiveness	127	.19	.016
Articulateness in Telling Story	127	.33	.001
Movement, Action	127	.35	.001
Expressiveness of Titles	127	.22	.007
Syntheses	127	.27	.001
Unusual Visual Perspective	127	.44	.001
Internal Visualization	127	.33	.001
Humor	127	.21	.008
Richness of Imagery	127	.49	.001
Colorfulness of Imagery	127	.28	.001
Quickness of Warmup	127	-.07	.220
Creativity Index	127	.15	.047
Flexibility (Standard Scoring)	127	.24	.003
Originality (Standard Scoring)	127	.27	.001
Elaboration (Standard Scoring)	127	.21	.010

A canonical correlation was run to combine the most promising creativity predictors of early conservers. A multiple regression of the ten creativity variables significant at the .001 level showed that the following were most useful in predicting readiness for conservation: Richness of Imagery, Unusual Visual Perspective, Articulateness in Telling a Story, Resistance of Premature Closure, Synthesis, Colorful Imagery, Originality, Internal Visual Perspective, Flexibility, and Movement. These correlations are shown in Table 2.

(Insert Table 2 here)

Of the Near-Conserving group, 14 examinees showed four or more of these creativity indicators while this occurred for seven of the children in the Non-Conserving group. A follow-up study during October showed that a significant number of those children displaying readiness for conservation on the TTCT the previous Spring, but who were either Near-Conservers or Non-Conservers, maintained or achieved at least NC status. Of the original NC group five displayed four creativity indicators, three displayed five, four displayed six, one displayed seven, and one child displayed eight creative strengths.

Torrance provides a Checklist of Creative Strengths in addition to the Fluency, Originality, Titles, Elaboration, and Resistance to Quick Closure scores. Whereas these are norm referenced measures, the Checklist provides a criterion referenced measure. The Checklist of Creative Strengths consists of: Expression of Feelings and Emotions communicated either through titles or drawings, Articulateness in Telling a Story showing ability to communicate clearly and powerfully, Movement and Action which has long been an indicator of imagination and creative functioning (Klopfer and Davidson, 1962) and is displayed in the titles or in the speech and/or bodily postures of figures in the drawings, Expressiveness of Titles that communicate a feeling, emotion,

Table 2

Canonical Correlation of Creativity Predictors of Conservation

Variable Entered/Removed	Multiple R	Number Variables included
Richness Imagery	.49	1
Unusual Visual Perspective	.55	2
Articulate in Telling a Story	.57	3
Resistance to Premature Closure	.58	4
Synthesis	.58	5
Colorful Imagery	.59	6
Originality	.59	7
Internal Visual Perspective	.60	8
Flexibility	.60	9
Movement	.60	10

or other synthesized abstraction that is not immediately apparent from the drawing itself, Combination of Two or More Incomplete Figures showing ability to synthesize and "to see relationships among rather diverse and otherwise unrelated elements" (Torrance and Ball, 1978, p. 15) as in "reconciling simultaneous opposites" (Reisman, unpublished manuscript, p. 5), Synthesis or Combination of Two or More Sets of Lines which represents a departure from the ordinary response, Unusual Visual Perspective which involves perceiving the common place in different and unusual ways, Internal Visualization or ability to "visualize beyond exteriors and pay attention to the internal, dynamic workings of things (Torrance and Ball, 1978, p. 20), Humor in Titles, Captions, and Drawings that involves unusual combinations and surprise, and Richness in Imagery consisting of responses that show "variety, vividness, liveliness, and intensity" (Torrance and Ball, 1978, p. 20).

Conservation of number is said to be dependent upon one's ability to reverse their thought. This notion permeates American translations of Piaget's writings as well as voluminous writings of his American and English devotees. However, this is not logical - thought is not reversible. In fact, Piaget writes, "A physical or mental movement is never wholly reversible since it occurs in time, and time is not reversible..." (Piaget, 1965, p. 201). Indeed to state that thinking is reversible ignores the fact that "thought is a future directed flow in time" (Reisman, unpublished manuscript, p. 2). One can reverse a mental image, for example to picture an object and then its mirror image, or one can retrace a process - but all of this occurs ahead in time. Reisman (ibid, p. 2) describes a child performing a conservation task as follows, "When a child ... states, 'If I put it back the way it was, then the * (quantity in terms of number, weight, volume, etc.,...) would be the same,'

s/he is employing an 'if ... then' condition -- a future directed phenbmenon -- not reversibility of thought." Reisman and Kauffman (in press) make the distinction between the French words "donc" meaning "therefore" and "alors" translated as "and then" indicating succession in time and not the relationship of consequence. Another quality of conservation is the ability to decenter, that is, to consider more than one aspect of a situation at a time such as noticing the elongation of the ball of clay while simultaneuously noticing the fact that the shape is becoming more slender. Mathematically, we are dealing with two axioms - the inverse idea and the additive identity. The additive inverse ($n + \bar{}n = 0$) underlies the conservation of number tasks, the multiplicative inverse referred to as the reciprocal idea ($n \times \frac{1}{n} = 1$) underlies the conservation of mass (clay) task, and the additive identity underlies all conservation since it implies that the invariant remains because nothing was added or taken away (Reisman, 1977, Chapter Three). In light of the results of this investigation it appears that the same constructs underly both conservation and creativity. Perhaps an interpretation of conservation as "Janusian thought" taken from the creativity literature will provide insight into using both creative strength and the ability to conserve in learning mathematics and in creative problem solving. The Roman god Janus has been exemplified in terms of his ability to engage in simultaneous decentering, "... the god of gates and transitions, looks with one face into the past and with the other into the future" (Meerloo, 1966, pp. 248 - 249). Rothenberg (1976, pp. 312 - 313) related the god Janus to the capacity to conceive and utilize two or more opposite or contradictory ideas, concepts, or images simultaneously, labeling this "Janusian" thinking:

> ... when the creative person is engaged in creating... it involves simultaneity of opposition... I have substituted the term 'Janusian' for 'oppositional' (thinking) because it more accurately conveys the simultaneity of

opposition and because as a metaphor, it embodies the process it denotes. Janus, of course, was the Roman god with two faces, the god who looked and apprehended in two directions simultaneously.

Reisman and Torrance found significant relationships of children's performance on selected Piagetian tasks of conservation and on the Torrance Tests of Creative Thinking (1974). Ability to engage in imagery, flexibility of thought and resistance to premature closure, in particular, appear to underly both creative thinking and conserving. The results of this study suggest alternative theoretical explanation for conservation in relationship to research in creative thinking.

References

Klopfer, B. and Davidson, H. H. The Rorschach Technique: An Introductory Manual. New York: Harcourt, Brace and Jovanovich, 1962.

Meerloo, Joost M. M. "The Time Sense in Psychiatry," in The Voices of Time. J. F. Fraser, Editor. New York: Braziller, 1966.

Piaget, Jean. The Child's Conception of Number. New York: W. W. Norton, 1965.

Reisman, Fredricka K. "Reversibility - from Group Theory Thru Piagetian Theory to Conservation - Applied to Mathematics Instruction," unpublished manuscript.

Reisman, Fredricka K. Diagnostic Teaching of Elementary School Mathematics: Methods and Content. Skokie, Illinois, Rand McNally Company, 1977.

Reisman, Fredricka K. A Guide to the Diagnostic Teaching of Arithmetic. Second Edition. Columbus, Ohio: Charles E. Merrill Publisher, 1978.

Reisman, Fredricka K. and Kauffman, Samuel H. Teaching Mathematics to Children with Special Educational Needs. Columbus, Ohio: Charles E. Merrill Publisher, in press.

Rothenberg, Albert. "The Process of Janusian Thinking in Creativity" in The Creativity Question edited by Albert Rothenberg and Carl R. Hausman, Durham, North Carolina: Duke University Press, 1976.

Torrance, E. Paul. Torrance Tests of Creative Thinking. Lexington, Ma.: Ginn and Company, 1974.

Torrance, E. Paul and Ball, Orlow E. Streamlined Scoring and Interpretation Guide and Norms for Figural Form A, TTCT, Athens, Georgia: Georgia Studies of Creative Behavior, January, 1978.