

Conservation of Number Task with Small and Large Quantities on Male and Female Preschool Children

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1. Summary and Introduction

Revolutionary psychologist Jean Piaget reasoned that early development occurred in a specific stage-like manner. Through extensive research and experimentation Piaget concluded that development occurs in stages, with a qualitative shift in the organization and intricacy of cognition at each specific stage. Piaget categorized the steps of children's early development in to four specific stages: sensorimotor, preoperational, concrete operational and formal operational. As he presented his theories Piaget carefully emphasized that children are not less knowledgeable or slower than adults, they understand the world in a distinct way. Through the categorization of children in to distinct stages Piaget began to understand what tasks children were capable of performing at a given stage. At the preoperational level (roughly ages 2-7) children possess symbolic thought, can apply logical principles to symbols (not objects) and can perform reversibility, identity and compensation tasks. However, many children during Piaget's preoperational stage are not cognitively developed enough to succeed at conservation tasks. Piaget came to the conclusion that children fail at conservation tasks due to the fact that their thinking is not governed by principles of reversibility, compensation and identity just yet. As with any study, this particular research paper contains five important features which outline the idea being addressed and hypotheses that will be tested. The central phenomenon in this study is the phenomenon that young children have the ability to conserve with numbers at a preschool level. The linking hypothesis addressed in this study is that young children will have the ability to actively conserve using numbers grouped in small amounts at the preschool level.

Susan A. Rose and Marion Blank (1974) conducted a classic study which investigated the effects of certain types of question on children and the responses children produced. The central phenomenon of the Rose and Blank study was the manner of questioning the children in typical conservation tasks and the child's subsequent response. Rose and Blank's considered two specific linking hypotheses in their study. The first hypothesis stated that when the child has just declared the rows equal (or unequal) he interprets the request for a second judgment as a signal to change his response. When the subject is not in this predicament (having to judge the arrays once), he is more likely to respond to the correct central demand (the evaluation of number). Rose and Blank's second hypothesis implicitly states that children would have an easier time successfully completing the one judgment task because there would be no pressure for the subject to gauge the researchers intentions or intended response from the subject. Alternately, children will perform the same on all tasks regardless of contextual cues given by the researcher. The independent variables or variables

that were manipulated, in Rose and Blank's study are age, gender and assigned condition (to a standard conservation test, a one judgment task, or a fixed-array task). For a standard conservation test objects were lined up in a 1:1 ratio, the children were asked if the rows were equal then one row was expanded or contracted and then children were asked again whether or not the rows were equal. In the one judgment task the children watched the experimenters manipulate the objects and were subsequently asked if the two rows were equal. Finally, the fixed-array task consisted of not giving an initial set of chips with a 1:1 ratio and solely asking the children if two manipulated rows were equal. Ultimately the dependent variable, or what the researchers are measuring, is the ability to conserve number in a standard conservation test in comparison to a task where the manner in which the children are questioned is altered (e.g. initial questioning is omitted).

A similar study conducted by Gerald A. Winer (1974) investigated the occurrence that young children can, in fact, conserve number when tested with small quantities. Winer's findings suggest that the child's understanding of small quantities might possibly play a role in the development of conservation of larger numbers. The central phenomenon Winer's study explores is whether children will have a higher ability to conserve number in an experiment when tested with small quantities rather than large quantities. Winer's linking hypothesis stated that younger children are tested with small quantities will have a higher ability to conserve number than those who are tested with large quantity sets. Alternately, despite the evidence of conservation found, it may be that young children cannot perform or be tested on ability to conserve. The independent variables Winer controlled for are age, gender and condition order (i.e. small then large quantity or large then small quantity). The small quantity contained approximately 3-4 chips while the large quantity condition contained 5-6 chips. The dependent variable measured in Winer's study was the child's ability to conserve number in each condition (small or large).

Many previous studies have tested the extent to which children of different ages can conserve. Relatively all evidence gathered from these studies suggest that young children cannot conserve on standard tests (e.g., Beilin, 1968; Piaget, 1968; Rothenberg & Courtney, 1986).

2. Methods

A similar study to Winer's was conducted on March 21, 2006 at Vanderbilt University Child Care Center in the Stallworth Building on Vanderbilt University Campus in Nashville, Tennessee. Subjects included 3-year-old and 5-year-old male and female children attending the preschool. The preschool included indoor and outdoor play and learning facilities. The conservation study was conducted at a small classroom table in one of the classrooms. More specifically, tests were administered to an energetic and intelligent Caucasian 3-year-old girl and an outgoing and rambunctious Caucasian 5-year-old boy. Upon arrival to the child care center I explained my project to the supervising teacher and asked to administer my test to two of the children (a 3-year-old girl and a 5-year-old boy). Once the teacher had selected two willing students, I played and conversed with the each child to familiarize myself with the child. After becoming familiar with the child I led them in to the classroom to "play a game with numbers" and subsequently conducted our conservation experiment on each child.

To test ability to conserve using small and large quantities I assigned each child to a specific condition. No pretest, posttest or training was administered prior to the experiment. I utilized two different conditions which dealt with the order of varying chip quantities. The condition that the girl received included giving the girl a small quantity and then a large quantity. The boy was given the same task but in reverse order (large quantity and then small quantity). I then gave each four different trials for both the small quantity and the large quantity conditions. The four trials administered were the following: (1.) The child was shown two equal rows (a 1:1 ratio), a chip was added or subtracted from one of the rows and the child was asked 'Do you have more or do I have more, or do we both have the same number of chips?' (2.) The child was shown two equal rows (in a 1:1 ratio), one row was either expanded or contracted with a chip added to the shorter row or taken away from the longer row. The child is then asked the original question. (3.) The child is shown two equal rows (in a 1:1 ratio), the experimenter expands or contracts a row, a chip is either added or subtracted from each row, the experimenter then asks the subject the original question. (4.) The child is shown two equal rows (in a 1:1 ratio), one row is either expanded or contracted, and the child is asked the original question. If the child gives a yes or no response or uses a headshake to answer and gives no reason for his or her answer, the experimenter inquires of the child, "Why do you think that is the answer" or "How do you know this?" While conducting the experiment on the child, I recorded the child's answers on to a results sheet. Once the data was thoroughly collected it was organized in to a data spreadsheet (attached).

The experiment focused on the ability to perform number conservation with small and large quantities of chips. In recording and measuring responses for each condition (the 1:1 ratio condition and the conservation task condition) a child was given a score of 0 if her or she did not respond correctly (i.e. responding correctly to whether or not groups of chips were equal). A correct response is defined as an answer of 'yes' to the question 'are these rows equal?' in the 1:1 ratio condition and the number conservation condition when rows contain equal chips.

3. Results and Discussion

My observations included many findings of particular interest (Figure 1). Since I conducted an array of trials we found more variation in the individual trial results. My first trial was especially different than the fourth conservation trial. I found that in a 1:1 ratio children were able to gauge number, as they provided the correct answer to my investigative query. But, when a chip was either added or subtracted, the same child was not able to gauge the conservation operation. In this first trial the ratio was a 1:1 ratio and then added or subtracted a chip. When a chip was added or subtracted while the rows are still in a 1:1 ratio I found that children were able to recognize the change and deliver the correct response (that the rows were equal). The results of this task illustrate that the children had some concept of the numbers and the change occurring to the numbers although the children were too young to even count.

Another particularly interesting finding was that the 5-year-old boy tested focused on the properties of the individual chips uttering phrases such as, "this row is bigger because those chips are bigger." This boy focused on the chips as individual objects and not as a long row. When asked 'is the row bigger?' the boy would respond with an answer specific to the specific chips and not the overall row of chips.

Table 1
Experimental Results

Age	Order	Correct Response?	
		1:1 Correspondence	Stretch
3	1	0	0
3	2	0	0
3	1	1	0
5	2	0	0
5	1	1	1
5	2	1	0
Order			
1 = small to large			
2 = large to small			
Response			
0 = no			
1 = yes			

In addition, it was also quite noteworthy that towards the end of the experiment conducted on the 3-year-old girl, the girl started to organize the chips in different ways, contracting and expanding them, proving that she was starting to understand the operations I was performing. The girl showed that she cognitively understood the operations being performed on the chips by independently organizing the chips at the termination of my experiment. One could see the physical expression of confusion on the girl's face as she manipulated the chips trying to organize them in contracted and expanded rows.

In regard to the total observations researched, results gathered from this experiment are consistent with the alternative hypotheses of Winer's current study but not Rose and Blank's classical study. Although both the classic and current studies focus on conservation in children, context of questioning (the attention of Rose and Blank's study) was not taken into account in this study. My results fit with the alternate hypotheses of the current study due to the observation that only one child out of the six tested was able to successfully conserve the number of chips and report the correct answer. However, my study does not fit with Winer's linking hypothesis because Winer suggests that young children will be more successful in number conservation when given small numbers. This was not the case in my study, as only one child was able to conserve number. Even children given a small quantity of chips were not able to conserve, contradicting the linking hypothesis proposed in Winer's article. I found that the quantity order in which the child was assigned to did not make a difference in whether or not the child was able to conserve. This finding may suggest that children ages 3 and 5 do not have the ability to conserve number in any manner.

References

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