

# The effects of gender on a child's ability to conserve



## **The Effects of Gender and Number of Questions on a Child's Ability to Conserve**

### **Abstract**

Piaget did not differentiate between genders in his developmental theory. Since girls and boys develop differently biologically, do they also develop differently cognitively? Six-year-old participants (N= 2) were engaged in a conservation tasks experiment to investigate the role of gender in the ability to conserve. One of the criticisms of Piaget's conservation tasks concerns children being confused when asked the same question repeatedly. A one-question-conservation-tasks experiment was then conducted to investigate how the number of questions affected a child ability to conserve. While there is inconclusive evidence of gender affecting the ability of child to conserve, it was shown that a child is more likely to correctly conserve one-question-conservation-tasks compared to the traditional version. Individual differences as well as the need to move away from a one-size-fits-all model of education are briefly discussed.

### **Introduction**

Educational theory and practice has been strongly influenced by Piaget's theory of development, especially in terms of the notion of developmentally appropriate education. Does developmentally appropriate have different meanings for boys and girls of the same age, especially with increased reports of girls outperforming boys from primary to secondary to even tertiary education levels? Piaget's conservation tasks are is not without its criticisms; is there any basis to claims that the tasks create confusion among young children?

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## **Literature Review**

### **Piaget's Theory**

Piaget (1954) suggested that the ability to reason about conservation problems is the major hallmark of the concrete operational stage of his stages of cognitive development. Conservation involves the understanding that an entity remains the same despite superficial changes in its physical appearance. Five-year-olds, still in the preoperational stage where they are supposed to be struggling with logic and taking the point of view of other people, cannot conserve as the appearance of the items in the task changed during the transformation (Piaget, 1952). Most seven-year-olds, having entered the concrete operational stage, are able to conserve. Pratoomraj and Johnson (1966) showed that while a child may be able to correctly conserve some physical quantities, he/she may not be able to correctly conserve others; the older the child, the more conservation tasks he/she should be able to complete correctly.

### **Gender Differences**

Notably, Piaget (1954) did not distinguish between boys and girls in his theory. Research in gender differences in conservation tasks has yielded mixed results; while it has been shown that boys and girls utilise different parts of the brain when solving conservation tasks (Affleck & Joyce, 1979) and that gender differences exist in boys' and girls' spatial abilities (Voyer, Voyer, & Bryden, 1995), many other studies over the years found no gender difference in ability to correctly solve conservation tasks (Braine, 1959; Dodwell, 1960; Murray, 1983; Pratoomraj & Johnson, 1966), even in male-dominated education systems (Onyehalu, 1984).

**One-Question Conservation Task**

Being asked the same question twice triggers feelings of insecurity in children; many would interpret the request for a second answer as a signal that his/her first answer was wrong (Agger, 2007). Rose and Blank (1974), and then J. Samuel and P. E. Bryant (1984) showed that children fail the traditional task thinking they needed to give an alternative answer, not because they cannot conserve.

**Purpose/Objectives**

The purpose of this study was to investigate gender and the number of questions affect a child's ability to conserve. The following research questions guided the study:

1. What differences, if any, are there in the ability of six-year-old boys and girls to conserve?
2. Does the number of questions asked during the conversation task affect a child's ability to conserve?

The objective of the conservation tasks was to test a child's ability to see that some properties are invariant after an object undergoes physical transformations.

**Method****Participants**

Participants were two Kindergarten Two (K2) children, a boy and a girl, attending a full-day childcare run by the Singapore Muslim Women's Association (PPIS). The boy was six-years-eight-months old while the girl was six-years-seven-months old at the point of testing. Both children have been

attending the PPIS childcare since January 2010. Both children were volunteers.

#### **Experiment 1**

Experiment 1 was conducted on both participants to investigate gender differences in the conservation tasks.

**Measures.** Participants were put through three conservation tasks involving number, volume and mass.

**Materials.** Twelve twenty-cent coins were used in number conservation task. Two identical short and broad glasses, one taller and slimmer glass, and Ribena juice were used in the volume conservation task. A packet of three Oreo cookies was used for the mass conservation task.

**Procedure.** For each task, a similar general procedure was followed. An original presentation was shown to the participant, followed by a question. The transformation was then presented to the participant, followed by another question. Participants were also asked to give reasons for their answers. Appendix A provides the diagram representations and questions asked for each of the conservation task.

#### **Experiment 2**

In Experiment 2, conducted two weeks after Experiment 1, the same girl was put through the one-question conservation task for the same physical quantities. This is to investigate the effect of number of questions in the conservation tasks.

Measures. The girl was put through the three one-question conservation tasks involving number, volume and mass.

Materials. Similar to Experiment 1.

Procedure. For each task, a similar general procedure was followed.

Participant was asked to closely observe what the interviewer shows as the question will only be asked at the end. An original presentation was shown to the participant, followed by the transformation. Only then was the question asked. Participant was also asked to give reasons for her answers. The original and transformation presentations used are similar to Experiment 1. Appendix B provides the diagram representations and question asked for each of the conservation task.

All three interviews were video- and audio-recorded for ease of subsequent transcribing. The complete transcripts for the two experiments can be found in Appendices C to E.

## **Results**

Table 1 below shows the summary for the three interviews.

Table 1

*Summary  
for the  
three  
interviews*

	Experiment 1	Experiment 1	Experiment 2
Conservation task	Boy	Girl	Girl
			Yes
			(Both lines have
			the same number of coins, but one is closer and the other further apart)
Number	No (All the coins are 20-cents)	No (One line is longer, the other shorter)	No (One line is longer, the other shorter)
Volume	No (One is bigger, the other is smaller)	No (One is shorter, the other is taller)	No (One is shorter, the other is taller)
Mass	No	No	Yes

	(Both	(You
(Both	have two	broke my
have two	cookies	one
cookies	each)	piece
each)		into
		two!)

*Note* : The reasons given by the children are in brackets.

The boy's ability to conserve number is doubtful; his reason given shows either a misunderstanding of the question or a lacking of ability to conserve. This is in line with the findings of Lourenço and Machado (1996) who remarked that a judgments-only (without providing reasons) conservation task will likely mistake preoperational competencies for concrete operational competencies.

In Experiment 1, neither boy nor girl was able to correctly conserve mass. In both Experiments 1 and 2, neither boy nor girl was able to correctly answer the volume conservation task.

Interestingly, while the girl was unable to correctly conserve in any of the tasks in Experiment 1, she was able to correctly conserve number and mass in Experiment 2, giving acceptable reasons in doing so.



## **Discussion**

### **Gender Differences**

Experiment 1 shows both boy and girl unable to correctly conserve in any of the three tasks, leading to the belief that both have equal ability. Both children focused on the physical appearance of the presentations: the longer versus shorter line, and the taller versus shorter cups. The reasons given by both boy and girl confirms Piaget (1952)'s theory that children who cannot conserve tends to focus on the appearance of things instead of the actual unchanging physical property. This is further evidenced by the lack of conservation for mass; the appearance of "two" cookies led both boy and girl to believe that they both have the same number of cookies as the interviewer did (two), and thus the same amount of cookies. Both children are evidently still at the preoperational stage of development.

Just as Piaget (1954) had not distinguish between boys and girls in his theory, the results from Experiment 1 also leads to conclude that gender difference has no difference in the ability to conserve, supporting the many studies that showed no gender difference in ability to conserve (Braine, 1959; Dodwell, 1960; Murray, 1983; Onyehalu, 1984; Pratoomraj & Johnson, 1966).

### **One-Question Conservation Task**

Experiment 2 was particularly eye-opening; the girl's response to the mass conservation task especially gave solid evidence that she was able to conserve mass. Comparing the results from Experiments 1 and 2, it can be concluded that one-question task was better able to allow a child to show his/her ability to conserve. The number of questions asked in a conservation task thus affected the child's ability to correctly conserve, confirming

previous findings (Rose & Blank, 1974; J. Samuel & P. Bryant, 1984) that a child is more likely to correctly conserve when he/she is not in a dilemma of trying to interpret if his/her first answer was wrong.

Experiment 2 also confirmed Pratoomraj and Johnson (1966)'s findings that the ability to conserve in some physical quantities does not imply a child's ability to conserve in all physical quantities.

#### **Limitations and Possible Future Studies**

Rehearsal effect may have influenced the results of Experiment 2, given that Experiment 2 was conducted two weeks after Experiment 1. A longer period between Experiments 1 and 2 should lead to a more reliable result.

Sample size of only one boy and one girl is definitely not enough to conclusively conclude on gender differences for conservation ability.

However, Experiments 1 and 2 have provided interesting insights to the cognitive thinking abilities of boys and girls, especially in terms of embracing individual differences of students within a given age group (Goldschmid, 1967) and to provide alternative forms of teaching, learning and assessments to cater to the needs of these differences.

#### **Conclusion**

In conclusion, while there is inconclusive evidence of gender affecting the ability of child to conserve, it was shown that a child's ability to conserve in some physical quantities does not imply an ability to conserve in all physical quantities. Also, children's ability to conserve may be masked by feelings of insecurity; it is thus important to provide opportunities for children to display abilities through multiple modes. There is thus a strong need to cater to

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individual differences in students; more needs to be done to move away from a one-size-fits-all model of education.

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