

## Early Adolescent's Conservation of Internal Volume

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**P**IAGET AND HIS collaborators had used conservation of volume to judge Genevan children's level of cognitive development. Their studies have demonstrated that conservation of volume is attained in three sequential phases of 8-years (internal volume); 9-years (liquid volume) and 11/12-years (occupied/displaced volume). Piagetians had fixed 75% level of performance as an index of conservation attainment by the target group. Researches conducted on early adolescents' (11/12-year) occupied/ displaced volume tasks show 25 to 48% level of performances (Beard; Elkind; Lovell; Uzgiris; Vernon; Vinh-Bang and Inhelder, all cited in Fogelman, 1970). Conservation of internal volume has been spurtly studied here as well as abroad. These facts had tempted, the author to investigate 'early adolescent's conservation of internal volume'. Specifically, the following hypothesis was examined through this study:

Sampled early adolescent's (i.e., 12/13-year) would be conserving internal volume to the extent of 75% of Piagetian criterion.

*Sample:* 80 Ss participated in this study. 20 Ss of either gender were randomly

selected from 2 boys/2 girls schools of Bhopal township. All of them were studying in Class VII and were between 12 and 13 years.

*Data collection:* Data were collected in small groups of 10Ss by the experimenter. Two towers made out of match-boxes of a brand were shown to the Ss ( $2 \times 2 \times 6$ ). They were told that these towers were indetical in all respects and match boxes represented living spaces in them. The following three questions were then asked.

*Identity phase:* Do both the towers have equal spaces to live in them?

*Judgement phase:* One of the towers was changed into a  $2 \times 3 \times 4$  configuration and the Ss had to judge, whether the two towers still had equal spaces to live in them. The Ss had to answer in yes or no.

*Explanation phase:* The Ss were requested to justify why they said yes or no to the judgement question.

*Scoring:* A non-conserver failed on all the three questions. A partial-conserver succeeded on anyone of the three questions only, while the conserver passed all the three questions.

*Results:*

### Conservation of internal volume

	Conserver	Partial-conserver	Non-conserver
Boys	57.50	37.50	5.00
Girls	52.50	37.50	10.00

57.50% boys and 52.50% girls conserved this internal volume task. 37.50% of either gender category Ss were

partial conservers. 5% boys and 10% girls were non-conservers as well.

For a sample size of 80, at 5% level of confidence limit, the needed value of the Omega statistic ( $w$ ) (percentage difference) is 0.22. Proposed hypothesis ascertained whether the sampled early adolescents' (12/13-year-olds) conserved internal volume to the extent of 75% level of performance or not. The attained level of performance had been 55% (boys/girls). 20% difference exceeds the tolerance limit of 17% in our case. Hence, the sampled Ss had performed significantly poorly against the 75% Piagetian criterion on the internal volume task. A delay of 2/3 year's, therefore, exists for these 12/13-year-old boys/girls of VII class on this task. It was also revealed by the data that gender difference was silent on this task like the earlier studies on different conservation tasks.

**Discussion:** It is difficult to understand, why/how 7.50% of the boys/girls denied/missed in variance of internal living spaces between the two identical towers ( $2 \times 2 \times 6$ ) that were perceptually similar during the identity phase. In judgement phase, one of the towers was transformed into a  $2 \times 3 \times 4$  configuration. In order to negotiate this created spatio-perceptual conflict, the respondent either equilibrated it through decentration of thought process or a non-decenter relied on the perceptually created information. All the partial-conservers were non-decenters of thought. For them perceptually transformed tower had changed in internal living spaces. This towed line of thinking duped them on

both the judgement/why (explanation) questions. The rest of the Ss (55%) were decenters of thought process and, therefore, succeeded in attaining conservation status. According to Piaget's theory of cognitive development, resolution of cognitive conflict on a conservation task is a process of reflective abstraction. It begins by operating on the stimulus materials and then interiorising the executed action of the experimenter. Creation of a logical link is necessary between the transformed and unchanged stimulus during the explanation phase.

**Educational implications:** According to Brunerian perspective on conservation of quantities, had the non-conservers and partial-conservers (45%) simply verbalised that the towers were identical and/or remained the same towers even then they would have been conservers. However, this creates two problems: How reliable is our faith that telling of imparted information is attended to properly and it is appropriately stored for future apt/quick retrieval? And, does conceptual/rational thinking come by listening to transmitted informations and/or by attending to empirico-inductive or perceptually produced information? Conservatism studies conducted on children, adolescents/adults across cultures support the view that rational thinking does not develop by listening to, reading about and remembering of scientific facts, etc. *Sciencing strategies* that bank on logico-mathematical schemes (concrete thinking) and hypothetico-deductive reasonings (formal thinking) form

necessary pre-requisites in the development of rational thinking of the individual. *Therefore, allow children to engage in exploratory activities that are related with change in configuration of things.* Let them also design measurement procedures to establish their invariant properties. Classroom discussion shall be useful in the creation/construction of logical linkages between the changed and unchanged things for why of their invariant properties. One shot exploration is a very poor pedagogic principle. Therefore, extend it to multiple contexts with a

variety of things available in the immediate environment of the learners. Existing lab facilities should be exploited maximally. This should be helpful in generating context-specific situations for ascertaining invariances of the quantities. On the learnt concepts, higher-order forms of invariances can be tried by the bright students either through hypothetico-deductive reasonings/mathematical interventions or by actually performing controlled experiments. All this, it is opined, should improve rational thinking process of the early adolescents.

#### REFERENCES

- FOGELMAN, K.R. 1970. *Piagetian tests for the primary school*. NFER. London.  
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