

Attainment of Volume Conservative Ability in Primary School Children (A Study of Khyber Pakhtunkhwa Pakistan)

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Abstract

The purpose of this study was to investigate the volume conservation ability among children of different grades at primary level in Pakistan. The study focused on Piaget's concept of Volume Conservation and investigated whether the children have the ability to understand the concept or not. Analysis of the responses to the tasks on conservation shows the description of cognitive functioning of children's mind. If the child is the central character of educational process, this description plays important role in developing early education for the child in primary schools. There was also sufficient ground to conclude that present findings does not indicate that cognitive abilities of KPK (Khyber Pakhtun Khwa) children are in anyway inferior to children anywhere else. The only thing, which KPK (Khyber Pakhtun Khwa) children are lacking, is educational activities suitable to *their level of cognitive development*.

Keywords: Introduction; literature review; Tables; Discussion; conclusion; Recommendation.

1. Introduction

Educational psychology is important rather essential for the teachers' for the very objective of the understanding of the human nature, values and potentialities with home interact daily. Nowadays the knowledge and understanding of psychological facts and principles are the effective and essential tools for the good teaching [1].

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Knowledge in educational psychology provides understanding to human nature, its behavior, the nature of learning process, the factors stimulating and inhibiting the learning, the inherited and environmental factors influencing learning variety of individual differences and teachers own mental and emotional setup, affecting his own and of students adjustment in school and classroom. The researchers and experiments bring advancements in the field of educational psychology and its application inside the classroom. Educational psychology also provides us understanding to the responses of the students as a result of the teaching learning process, in which the major areas are related to their behavior that they show to different means like their facial expression, their gestures, and body languages [2]. We can also say that educational psychology helps teachers to communicate with the students on the basis of their behavior. In teaching learning situation, the learning process is more active, dynamic, living, flexible and reflective when teachers understand and apply suitable learning principles [3]. The main objective of the learning process is the "child" who is treated as a human being, accepted and respected as person and an individual. His abilities are encouraged and his or her limitations are appreciated.

For a healthy and stable personality, the growth and development of a child must take place in the suitable environment i.e. s/he must be given proper attention and guidance. Child growth in this case can be defined as all those structural and psychological change that take place within individual during the process of maturation; where maturation is the adaptation of an individual towards his environment [4]. On the other hand, development is the name of all those psychological changes that take place in the functions and activities of different organs of an individual. Growth is external and development is internal in nature. Growth is taken to be quantitative whereas development is qualitative in nature [5].

The study aims to investigate the volume conservation of the students studying at the primary level. In psychology, Piaget provides a comprehensive framework to the process of intellectual development. Therefore selection of Cognitive Development Theory of Jean Piaget was perceived a better choice to understand how children in Pakistan respond to activity about the concept of Volume Conservation. Piagetian theory is based on solid scientific grounds but at the same time it is not entrapped in a narrow and mechanical interpretation of science.

2. Literature review

Paget's theory of cognitive development is most comprehensive theory in which an organized pattern of thoughts or action constructs to interpret some aspects of one's experience. Being a biologist, Piaget was considering that how an organism gets and used to its environment; Piaget described as "intelligence". Behavior or adaptation to the environment is handled through mental organizations called techniques that the person uses to represent the world and designate action. This adaptation which is describes in Paget's is driven by a biological drive and it obtain balance between environment [6]. Some other researcher [7, 8] described that, during the preschool period a specific form of thinking is applied to theory of mind and a set of problems that do not require the knowledge of mental states.

Other scholars [9] found out that Cognitive process involves changes in the child's thinking, intelligence, and language. Cognitive developmental processes enable a growing child to memorize a poem, imagine to solve the

problems, or to speak out some concern sentences. In the light of Cognitive Complexity and Control Theory Based on the growth of reflection between 3 and 5 years of age group revealed increases in demand over thought and action by allowing children to integrate incompatible pairs of rules into a solitary rule system [10].

Nevertheless in human beings as the newborn uses these reflexes to adapt to the environment, these reflexes are quickly replaced with constructed schemes. Literature [11, 12] shows that Piaget defined two processes which are used by the individual which attempt to adapt: accommodation and assimilation. Both processes can be used throughout life as the individual increasingly gets used to the environmental surroundings in a more complex manner.

There are many terms and concepts that scholars use related to the study of educational psychology and child development. For instance, assimilation is the mental process that occurs when a child incorporates new knowledge into existing knowledge so the children simulate the environment into a schema. Accommodation is the mental process that occurs when a child adjusts to new information so the children adjust their schema to the environment [13]. The above two process are being used simultaneously and alternately throughout life. A good example of accommodation would be when the child needs to improve a sucking schema developed by sucking on a pacifier to the one which would be successful for slurping on a bottle. A great example of assimilation would be when a newborn baby utilizes a sucking schema that was originated by sucking on a tiny bottle when making an attempt to suck on a larger bottle. Seeing that schemes become increasingly more complex i.e., responsible more complex behaviors; they termed as structures. While one's structures become more complex, they are structured in a hierarchical manner i.e. from basic to specific.

Scholars [14, 15] tried to explain how cognitive development happens by skill structures called "levels," together with transformation rules relating these levels to each other. The transformation rules specify the developmental steps by which a skill moves gradually from one level of complexity to the next. At every step in these developmental sequences, the individual controls a particular skill. The theory suggests a common framework for integrating developmental analyses of cognitive, social, language, and perceptual-motor skills and certain behavioral changes in learning and problem solving. In a similar view, another scholar [16] described with various external variables which may have plagued earlier studies and explores the linkage between naturalness or restrictiveness of the house environment and the intellectual functioning of low-income children's. Both before and after relocation, objective procedures of naturalness are applied along with a standardized instrument measuring the kids cognitive functioning.

2.1 *Stages of Cognitive Development*

Piaget formulated the stages of cognitive development which seem to be related to the major brain growth development. The brain of the human is not fully developed until late teenage years or in the circumstances of male sometimes early on adulthood. It is very important that parents really know what they expect from their child as they develop to be sure that their expectations about their child in that age are really realistic.

Piaget's theory identifies "four" stages and these are as follows [17, 18]:

2.2 Sensorimotor

(birth to 2 years)

1. The sensorimotor stage, is the first of the four stages in intellectual development which contains
2. Intelligence demonstrated through motor activity with no use of symbols.
3. Knowledge of the world is limited (but developing) because it's established on physical interactions/ experience. Children acquire object resolution about 7 months of age.
4. Physical development (mobility) allows the children to commence development new intelligent abilities.
5. Some symbolic (language) capabilities are developed at the end on this stage.

2.3 Preoperational stage

(2 to 7 years)

The second stage of Piaget's theory of development coincides the preschool year.

Children begin to use symbols such as language to represent things. For instance, the child understands the "apple" although a real apple is not seen. The preoperational child is also uninformed of another person's perspective.

2.4 Concrete operational stage

(7 to 11 years)

Concrete operations stage is normally represents the fundamental grade year. The concrete operation child starts to think logically. Operation is associated with personal experience. Operations are in concrete situation, however, not in hypothetical manipulation [19]. This study focused on this Concrete Operational stage of development among the early primary schooling of Pakistan children.

2.5 Formal Operational Stage

Formal operational stage (11 years of age through adulthood) After roughly 11 years of age students have the ability to consider many possibilities for a given condition. They are able to deal with the propositions that clarify concrete facts. They have the ability to use planning to think forward. Child is capable of formulating hypotheses and then testing them against actuality. Thinking is abstracts that are a child/adolescent can formulate all the possible outcomes before beginning the problems. Also, they are capable of deductive reasoning.

2.6 Problem Statement

Many studies about child conservation abilities have been done but mostly with different focuses. Some studies

show that conservation abilities are different from country to country while others show no significant differences [20, 21]. What we did not know was how children in the sampled place in Pakistan achieve conservation levels and how that could help in understanding issues of child development in Pakistan and the world.

2.7 Purpose of the Study

- The purpose of this study was to find out the levels of volume conservation of primary school pupils in Pakistan.

2.8 Specific Objectives

- a. To find out the achievement levels of conservative ability among the grade 2-5 primary school children in Pakistan
- b. To measure the appropriate age of volume conservation ability among the above pupils
- c. To compare the volume conservation ability among the different pupils by grades

3. Research methodology

This study basically used the quantitative research methodology. The study used eight tasks that were performed so as to measure children's conservation abilities. Task one was about water poured into two identical glasses and the child was asked to agree or disagree that the glasses contained the same amount of water. In the second task, one of the glasses from the first task was poured into the thinner glass and a child was asked to answer whether one glass contained more water now or not. In the third activity, the same water was poured into two wider bickers and the child was asked to judge whether the amount of water was the same or not now. In the fourth activity, water from one wider bicker was poured into a long beaker and a child was asked to judge if there was a difference now. In the fifth activity, a child was given the same amount of plastic balls and was asked whether they were of the same weight or not. In the sixth activity, one of the two balls was pressed to have a different shape and the child was asked if the weight was different or the same now. In the seventh activity, two rubber bands of the same length and width were presented to the child and the child was asked if the width was the same or not. In the eight activities, one rubber strips was rolled and the child was asked if the width was had changed now not. After checking the responses, data were recorded manually and later analyzed using Descriptive Statistics from SPSS. The resulting data of the analysis were used for the discussion and interpretation of the findings for the study.

4. Results and discussion

The main purpose of the study was to assess the attainment of the conservative ability in primary school children in (KPK Pakistan) based on Piaget's Cognitive Development Theory. To do this, eight different types of tasks were conducted to get data on the conservational ability of the pupils. Hence the nature of study was quantitatively descriptive in type. This section presents findings and discussions about the research results in order to assess the children's conservation abilities.

Table 4.1: Percentage of Volume Conservers in Each Grade (N=24)

GRADE	2 nd	3 rd	4 th	5 th
Percentage	12.5%	20.83%	41.6%	58.3%

Table 4.1 shows, the percentage of volume conservers at grade 2nd, 3rd, 4th, 5th are 12.5%, 20.83%, 41.6%, 58.3% respectively.

Table 4.2: Percentage frequency of volume conservers, non-conserver and transitional from Grade 2nd - 5th.

Categories	2 nd Grade	3 rd Grade	4 th Grade	5 th Grade
Conservers	12.5%	20.83%	41.6%	58.3%
N-Conservers	8.33%	4.17%	0%	0%
Transitions	79.17%	75%	58.33%	41.67%

Table 4.2 indicates that the numbers of volume conservers is increasing with the increasing grades of the children as they move from one to another grade and the number of non-conservers decreases. There is also great number of students at each age level and grade who are in the stage of transitional between non-conservers and conservers.

Table 4.3: Mean and Standard Deviation of the Volume Conservation Scores of the Grade 2 to Grade 5 children (N=96)

Statistics	Grade 2	Grade 3	Grade 4	Grade 5
X	5.25	6.16	6.96	7.5
SD	1.506	1.43	0.952	0.645

The above table indicates that the mean and volume conservation scores of children of different grades are 5.25, 6.16, 6.96 and 7.5 respectively out of the maximum score of 8 at the grade 2, 3, 4 and 5 respectively.

Table 4.4: Significance of the Differences between Mean Volume Conservation Scores of the Grade 2 and Grade 3.

Grade	N	X	SD	t	SE	P
2	24	5.25	1.506	2.056	1.3	N.S
3	24	6.16	1.43	same	same	Same

**Non-significant DF=47, t-at 0.05=1.684

The table 4.4 depicts that the obtained t value 2.056 is greater than the critical t value (1.684). Therefore, there is no significant difference between the mean volume conservation scores obtained by the grade 2 and grade 3. Thus the null hypothesis is accepted that there is no conservation ability development which occurs at the level of grade 2 and grade 3 children.

Table 4.5: Significance of difference between mean volume conservation scores of Grade 3 and Grade 4:

Grade	N	X	SD	t	SE	P
2	24	6.16	1.43	1.4809	1.3	S
3	24	6.96	0.952	same	same	S

*Significance DF=47 t-at 0.05=1.684

The table 4.5 depicts that the obtain t value 1.4809 is less than the critical t value (1.684). Therefore, there is significant difference between the mean volume conservation score obtained by the grade 3 and grade 4. Thus the null hypothesis is rejected so that there is conservation ability development occurs at the level of grade 3 and grade 4 children.

Table 4.6: Significance of difference between mean volume of conservation score of grade 4 and grade 5:

Grade	N	X	SD	t	SE	P
2	24	6.96	0.952	0.9306	1.15	S
3	24	7.5	0.645	same	Same	Same

*Significant DF=47, t-at .05=1.684

The table 4.6 depicts that the obtained t value of 0.9306 is less than the critical t value (1.684). Therefore, there is significant difference between the mean volume conservation scores obtained by the grade 4 and grade 5. Thus the null hypothesis is rejected so that there is conservation ability development that occurs at the level of grade 4 and grade 5 children.

4.1 Summary of discussion

This study was designed to assess the achievement of conservative ability among grade 2-5 primary school children in KPK Pakistan. The study focused on Piaget concept of volume conservation and investigated if the children had the ability to understand this concept or not. According to this study, the volume conservation is found to be a function of growing age because this ability tended to increase with growing age time. Children attained the volume conservation ability approximately at the same level. The result of the current study, therefore, supports Piaget's and a follow-up study by scholars [22] who found that the proportion of the solid mass conservers progressed at different levels. The result of our study needs further verification not only taking larger sample but also by including other educationally important variables which were not taken into consideration in present study.

Analysis of the responses to the task on conservation showed the description of cognitive functioning of children's mind. If the child is the central character of educational process, this description can play important role in developing primary education for the child in primary schools. While looking at stage curves of all the two classes, it strike out that class 4 seems to follow normal distribution, distribution in class 5 is respectively skewed. As the sample in all the two classes were randomly selected, this cannot be ascribed to any apparent sampling error. The only plausible explanation is that those children of relatively lower cognitive abilities who were there in class 4 are just not there in class 5. Majority is still at middle to mature level of concrete operation. There was strong association between conservation of these tasks and understanding of the structural complexity of the measurement tasks, leading to correct calculation of these tasks for all conservers.

There is sufficient ground to say that the present findings do not indicate that cognitive abilities of KPK (Pakistan) are in anyway inferior to children anywhere else. The only thing which KPK (Pakistan) children are lacking is educational activities suitable to their level of cognitive development.

5. Conclusion

This study sought to assess the volume conservation ability of pupils of grades 2 to 5 in KPK Pakistan using Piaget's Cognitive Development Theory under Concrete operational stage: (7 to 11 years). Methodologically, the study used descriptive statistics to measure how the children responded to eight tasks that checked on their conservation ability. The results indicate that the performance of their conservation ability falls in a normal curve implying that the conservation ability of the children increase with increasing grade/age and the children failing conservation decreases with each grade upwards. The study has agreed with Piaget's basic theory of volume conservation among the children at concrete operational stage. The paper therefore recommends that teachers should bear this in mind when designing instructions for children under this age range.

5.1 Recommendations

Based on the findings of this study, it can be recommended as follows:

1. All students in class are not necessarily operating at the same level. It is important for teachers to understand the level at which students are functioning so that they adjust their teaching accordingly.
2. Teachers should be encouraging pupils to be self-checking, approximating, reflecting and reasoning while they do activities at concrete operational stage
3. Comparison of intellectual ability of Khyber Pakhtun Khwa (KPK) children with children of elsewhere requires a detailed and updated survey of recent research in this field.
4. A large number of mathematics and daily life activities be used this way to present students with problems of conservation and should be permitted to solve problems in a variety of ways and contexts. This provides students and possibility to progressively abstracts the principle of resource efficiency from the concrete exemplarity would seem to be that this would bring about student proficiency with this aspect of cognition.

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