ATTAINMENT OF CONSERVATION ABILITY AMONG PRIMARY SCHOOL CHILDREN IN THE LIGHT OF PIAGET’S COGNITIVE THEORY

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ABSTRACT: Education brings positive changes in an individual according to the concerned society. In education Piaget’s cognitive theory has a vital role. Piaget’s discoveries have had an impact upon curriculum, instruction and assessment in schooling, particularly for mathematics. The aim of this study was to determine Piaget’s notion of cognitive development particularly his concept of attainment of conservation. The design of the study was descriptive and cross sectional. Population of the study included all the Primary Schools in District Kohat, North-West of Pakistan. Sample comprised four schools, two each from urban and rural areas and a total 160 students including 80 each from rural and urban (Both genders) were selected through simple random sampling. Moreover the sample consisted of grades IV and V with equal proportion of both genders. Seven tasks were developed to attain the objectives of this particular study. Data was collected through performance of children and further tabulated, analyzed and interpreted by using SPSS 17. Results revealed that rural school children showed slightly better performance as compared to urban students, it might be due to late enrolments in the schools and female performance is slightly better as compared to male students.

Keywords: Conservation, Cognition, Gender

Introduction If teachers are familiar about Intellectual stages of their students they can handle students in a better way and can provide them learning materials, and adopt learning methodology according to their mental level. If teachers are aware of the level of their students they will never be angry if something is not clear to their students, it may be possible that their students still not reach to that particular level where they can understand those things.

In Cognition mental performed some processes to obtain knowledge and grasping of that knowledge; those processes comprises on some sort of knowing, thinking, remembering, perceiving, and problem solving. The development of cognition is primarily distributed into three stages: sensory-motor, concrete operational and formal operational. {1}. 
Piaget's concept of cognitive development stages is an integral part of his theory. Conservation is the most famous of all logical operations associated with the stage of concrete operations level of Piaget's theory of intellectual development. Conservation means, if we change the place of physical object, it will not affected its length, quantity or number of that particular items. Different types of conservation can be observed: Conservation of Number, length, area, amount of substance, weight, quantity and liquid volume etc.

Present study is based on the concept of conservation of concrete operation stage of Piaget's theory of cognition. It brings into limelight the importance of cognitive development and its understanding in teaching profession. Teachers will be able to teach and mold their teaching strategies according to the cognitive levels of the students with special focus at concrete operational stage of Piaget's cognitive theory.

**Literature Review**

The scientific study of psychology in education refers to the educational psychology [2]. There are so many learning theories which contributed in educational psychology e.g. John Locke tabula rasa theory, Jean Jacques Rousseau natural theory, Charles Darwin maturational theory, Sigmund Freud’s theory of psychosexual development, gestalt learning theory presented by Heinz Werner, behaviorist theory presented by Pavlov and Skinner and Piaget's theory of cognitive development. This theory of cognitive development is the most powerful contributions to psychology in the past century.

During the human life period the progression of modification and stability which occurs is called development [3]. To attain one specific point in a developmental stage contains so many months. Although children are usually grouped by their physical age, but when children pass through each stage their development levels may vary significantly [4].

According to one other psychologist there are so many factors which affected this difference of developmental stages like culture, experience maturity, and the ability of the child. [5].

But according to Piaget experiences of each developmental stage only provide foundations for the next stage and children develop gradually and progressively during the different stages. [6].

The following four key concepts were cited in [7], which Piaget found so useful in describing what he observed:

1. **Schema**: As structures, schemata (the plural of schema) are the mental counterparts of biological means of adapting. Schemata can also be simplistically thought of as concepts or categories and used to process and identify incoming stimuli.
2. **Assimilation**: This is the intellectual process in which a person assimilates new things into existing perceptions of things.
3. **Accommodation**: It is the formation of new perception as respective to the existing one.
4. **Equilibration**: It is the balance between assimilation and accommodation.

Piaget described four stages of cognitive development:

1. **Sensory-motor stage**: This stage starts from birth and continue up to two years. Different children possess at different rate of development. This stage is called sensory-motor stage because children uses their five senses and through these senses they experiences their outer world. Children perceiving their world with their own perception.
2. **Pre-operational stage**: this stage marked from two to seven years. In this stage children performed some small logical problems, learn language and to do some small operations.
3. **Concrete operational stage**: this stage starts from seven years and goes to eleven years. This is the stage where children starts thinking independently and logically, they uses different aspects of the things or matters.
4. **Formal operational stage**: this age is counted from the age of eleven and continues to sixteen years. Here logical thinking is more profound and abstract. Cited in [8, 9, and 10].

There is a lot of research literature, where researchers try to understand the cognitive theory with their different aspects. To check the Conservation of volume researcher used two balls of clay identical in size, shape and weight. He asked the subjects’ predications, judgment and explanation questions. The sample consisted of 175 children of 5 to 11 years. Out of them 56 children were conservers of volume. [11]

One other researcher used two similar cylinders differing in weight and two glasses of water. The subjects from age 8 to 12 (N = 27) were asked why two cylinders were raising the water levels equally. Percentage of conservers was 48 at 12 years, which were the highest among all the age groups of the study. [12]

To check the conservation researcher, tested 332 school children on plastic-ball tasks. He uses in his study children of minimum 7 years 8 months to a maximum 10 years 8 months. Each child was asked a judgment and an explanation
questions. 85% were conservers among children whose mean age was 10 years 8 months. Study revealed that the percentage of conservers grew with age. [13]

Researcher conducted his study on a sample of 139 of 8 to 14 years old Tanzanians children. Plastic ball test was employed. The subjects showed conservation of substance at 8 to 9 years age. The researcher used 75% criterion for determines the attainment age. The conservation has also been studied on adults also. [14]

One of the Psychologist concluded that nobody can skip any developmental stage, everybody pass through these stages, each stage provide foundations for the next stage. [15]

Significance of the Study

The focus of study is on determining Piaget's notion of cognitive development, particularly his concepts of the attainment of conservation ability among primary school students of District Kohat and to compare the conservation ability of the male and female students in rural and urban areas. Study is highly significant because cognition play a vital role in teaching learning process and conservation ability is one of the clue towards true education of children.

Research Methodology

The study is descriptive in nature, because it describes the present situation of the scenario. Researchers try to collect the original record of children age from the schools age records registers and selected the sample only of the age of seven to eleven years old children, because this is the age where Piaget says that children starts thinking logically and he named this stage as a concrete operational stage.

Population & Sample

Population of the study comprised all Primary Schools in District Kohat, North-West of Pakistan. Sample comprised four schools, two each from urban and rural areas and a total 160 students including 80 each from rural and urban (Both genders) were selected through simple random sampling but researchers selected the sample only of the age of seven to eleven years old children. Moreover the sample consisted of grades 4th and 5th with equal proportion of both genders.

Research Instruments

The researchers prepared the following seven tasks to check the attainment of conservative ability among primary school children in District Kohat.

1. Conservation of Length: In length conservation, a child is presented with two eight inch long strips of plastic pieces are laid parallel to each other that is their edges are exactly same with one another. The child asked if these sticks have the same length, when child is satisfied that they were of the same length. Than one of them move a little and asked the students that which one is longer. Conserver child were say that both sticks having same length.

2. Conservation of Weight: Two balls of same amount of plastic given to the students and asked for judging their weight, that either they are of the same weight. Than press one of them. And asked again which one is heavier? Conserver child will respond that both balls of the same weight.

3. Conservation of Area: Take four blocks of equal size of plastic and arranged them in the center of a paper and asked the students that see the area these blocks take than arranged them in the corners of a paper and asked the students that either they take the same area or not. Conserver child will respond that on the change of the position of blocks there is no effect on the area covered by blocks.

4. Conservation of Amount of Substance: Take two rubber bands have the same length & width and show them to the child and asked them that either they take same rubber. They will say yes then one of them is rolled and again repeats the question, which one having more rubber? Conserver child will say that both rubber bands are of the same length.

5. Conservation of Quantity of Items: Two shapes of equal blocks of plastic is arranged with 6 x 2 and 4 x 3 different size one will be high and other one will be flat. And asked the students which shape contains more blocks. Conserver child will responded that both shape carry equal blocks.

6. Conservation of Liquid Volume: Two identical glasses A, and B, contain the same amount of water. The child is asked, “Is there the same amount of water in these two glasses?” The child responds that they are the same. Than the water in glass B is poured into a tall thin glass and the child compares glass A and C. the same question is repeated. Conserver child will responded again that both glasses contain same amount of water.
7. Conservation in Situations Supported by Logical Reason: On a paper two figures are printed one of them is 24+42=66 then asked the students that what would be the answer of 42+24=? If students stats to count them it means they have not conserved it and if they judge their reversibility it means they have conserved it.

Data Collection and Interpretation Researchers personally visited and administered the conservative ability tasks (CAT) from the student. To achieve the objectives of the study seven tasks were developed, including Conservation of Number, length, area, amount of substance, weight, quantity, liquid volume and conservation in situations supported by logical reason. Those who responded on all the seven tasks were classified as conservers. Those who partially responded got one mark as per task conserve. Data was collected, tabulated, analyzed and interpreted by using percentage and graphics methods.

RESULTS AND DISCUSSION

Following table show the performance of the respondents collected through these seven tasks.

Class 4th and Class 5th

Table 1

<table>
<thead>
<tr>
<th>Class</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female/Male 4th</td>
<td>8</td>
<td>38.50</td>
<td>15.14</td>
<td>5.35</td>
</tr>
<tr>
<td>Female/Male 5th</td>
<td>8</td>
<td>48.87</td>
<td>5.40</td>
<td>1.91</td>
</tr>
</tbody>
</table>

Table 1a

<table>
<thead>
<tr>
<th></th>
<th>Levene's Test for Equality of Variances</th>
<th>t-test for Equality of Means</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>Sig.</td>
<td>t</td>
</tr>
<tr>
<td>Female/Male</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equal variances</td>
<td>4.29</td>
<td>.057</td>
<td>-.38</td>
</tr>
<tr>
<td>not assumed</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

An independent sample t-test was conducted to compare class 4th and 5th Male and Female students. The analysis of data in table 1 and 1a indicates the comparative result of Performance of the class 4th and 5th male and female students on the conservative ability task. There was a significant difference found in the scores for class 4th (M=38.50 SD=15.14) and class 5th (M=58.87 SD=5.40)
Conditions; \( t (14) = -3.587 \ p = 0.003 \). The result revealed that there was significant difference found between class 4th and 5th conservative ability task score as well as mean difference shows that class 5th performed better as compared to the class 4th.

**URBAN VS RURAL**

Table 2

**Group Statistics**

<table>
<thead>
<tr>
<th>Area</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female/Male</td>
<td>8</td>
<td>48.12</td>
<td>16.21</td>
<td>5.73</td>
</tr>
<tr>
<td>Urban</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>8</td>
<td>49.25</td>
<td>15.23</td>
<td>5.38</td>
</tr>
</tbody>
</table>

Table 2a

**Independent Samples Test**

<table>
<thead>
<tr>
<th></th>
<th>Levene's Test for Equality of Variances</th>
<th>t-test for Equality of Means</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>Sig.</td>
<td>t (2-tailed)</td>
</tr>
<tr>
<td>Female/Male</td>
<td>.050</td>
<td>.826</td>
<td>14.888</td>
</tr>
<tr>
<td>Equal variances</td>
<td>not assumed</td>
<td></td>
<td>13.94 888</td>
</tr>
</tbody>
</table>

An independent sample t-test was conducted to compare class Urban and Rural Male and Female students. The analysis of data in table 2 and 2a indicates the comparative result of Performance of the Urban and Rural male and female students on the conservative ability task. There was a non-significant difference found in the scores for Urban (M=48.12 SD=16.21) and Rural (M=49.25 SD=15.23)

Conditions; \( t (14) = -1.143 \ p = .888 \). The result revealed that although there was non-significant difference found between Urban and rural conservative ability task score but their mean difference shows that Rural performed slightly better as compared to the urban.
An independent sample t-test was conducted to compare Male and Female students. The analysis of data in table 3 and 3a indicates the comparative result of Performance of the male and female students on the conservative ability task. There was a non-significant difference found in the scores for Male (M=45.12 SD=19.21) and Female (M=52.25 SD=9.88). The result revealed that there was non-significant difference found between Male and Female conservative ability task score but their mean difference shows that Female student performed better as compared to the Male Student.

Findings

1. It was found that teachers were not familiar about the Piaget’s cognitive theory of learning and his concept of developmental stages and their influence on children.
2. Analysis of the responses to the task on conservation showed the description of cognitive functioning of children’s mind. It showed that children of relatively lower conservative abilities who were there in class IV as compared to those who were in class V. Majority of the students in class V was still at middle to mature level of concrete operations.
3. Additionally Primary school children of district Kohat having the same conservation ability as elsewhere. Rural school children having slightly more conservative ability as compared to urban school children due to late enrolment in the schools.
4. Performance of female children was slightly better than male children.
5. These differences between boys and girls and urban and rural children in primary school supports Piaget’s theory which emphasis that such advancement in intellectual development as
conservation abilities are mainly results of hereditary factors such as age and maturation, rather than environmental factors.

6. During research it was observed that practical implication of Piaget’s cognitive theory and his concept of Conservative ability are not given proper attention in the teaching aims of primary level subjects in Pakistan.

Recommendations
1. Teachers may understand the cognitive levels of their students and adjust their teaching accordingly to the mental level of their students.
2. The curriculum planners need to give suitable place to this subject both as a topic for study and as a tool for the development of student’s conservative ability.

List of Conservative Ability Tasks

To check the conservative ability seven tasks were conducted as shown in Figure 1

Figure 1

These were the tools which were used to check the conservative ability of primary school children.

1. **Conservative Task of Length**
   Two eight inch long strips of plastic pieces laid parallel to each other

Figure 2
Than one of them move a little.

**Figure 3**

And asked the students that which one is longer. Conserver child will say both were the same.

2. **Conservation of Weight**

Two balls of same amount of plastic given to the students and asked for judging their weight,

**Figure 4**

**Figure 5**

Than press one of them and asked again which one is heavier?

3. **Conservation of Area**

Take four blocks of equal size of plastic and arranged them in the center of a paper and asked the students that see the area these blocks take

**Figure 6**

**Figure 7**

And asked the students that either they take the same area or not.
3. **Conservation of Amount of Substance**

Take two rubber bands of the same length & width and show them to the child and asked them that either they take same rubber. they will say yes. Then one of them is rolled

![Figure 9]

And again repeats the question, which one having more rubber

5. **Conservation of Quantity of Items**

Two shapes of equal blocks of plastic is arranged with 6x2 and 4x3 different size one will be high and other one will be flat. And asked the students which shape contains more blocks. Conserver child will responded that both shape carry equal blocks.

![Figure 10]

And asked the students which shape contains more blocks.

6. **Conservation of Volume**

Two identical glasses A, and B, contain the same amount of water.
Figure 11

The child is asked, Is there the same amount of water in these two glasses? The child responds that they are the same. Then the water in glass B is poured into a tall thin glass C.

Figure 12

And the child compares glass A and C. The same question is repeated. Child having the conservative ability give the correct answer.

7. Conservation in Situations Supported By Logical Reason

On a paper two figures are printed one of them is $24+42=66$ then asked the students that what will be the answer of $42+24=?$

Figure 13

If students stats to count them it means they are not conserve it and if they judge their reversibility it means they conserve it.

REFERENCES


