ISSN: 2278-4012, Volume:3, Issue:2, April 2014

Recognition of Cognitive Development Stages in Students with Reference to Pagetian Cognitive Stages

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ABSTRACT: *Present study sets out to investigate into the cognitive developmental stages of students of class VIII in Pakistan. Out of sixty students of section C of class VIII, odd baring thirty students were systematically selected as subjects of study. Five Piaget tasks i.e. conservation of mass, conservation of volume, conservation of continuous quantity, conservation of number, conservation of volume displacement and three inquiry activities i.e. control of variables, combinatorial reasoning and proportional reasoning were brought into practice. Piaget tasks were used to measure the concrete operational stage while the inquiry activities were administered in order to determine the formal operational stage of class VIII students. These tasks and activities were administered to the subjects one by one and students' performance was evaluated.*

While evaluating students' performance, the characteristics of concrete operational stage were identified in most of the students. Almost 75% students performed the Piagetian tasks correctly while only 25% students were unable to perform certain tasks showing the presence of characteristics of concrete operational stage in class VIII students. While administering the inquiry activities, it was observed that through some of the characteristics of formal operational stage were present in few students, yet most of the students were unable to solve these activities accurately. Only 11% students solved these activities correctly while 89% students could not perform them.

It was concluded that class VIII students were in concrete operational stage while some features of formal operational stage like control of variables and proportional reasoning were also demonstrated by a few students. But on the whole, class VIII students were found in concrete operational stage.

INTRODUCTION

Development is a progressive change occurring in a progression with passage of time in human beings. Its speed or pace differs in different age groups. The human beings go through physical, social, emotional and cognitive development in their life span. All these developments have their own significance but, here, our focus of attention is cognitive development of students in the same school class and almost the same age group. According to Driscoll (1994) the change from child's incapability of differentiating cognitive abilities to acquire competence in getting concepts and problem solving ability is actually termed as cognitive development.

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Jean Piaget (1952), the educationist and biologist, later turned into a psychologist, has given a comprehensive theory of cognitive development. According to Jean Piaget, cognitive developmental stages are physical and mental actions that can be seen in different stages of a development from child into adult. He considered the difference between humans and animals that animals do not possess reasoning while human have this quality to think and act logically. Moreover, children act and behave differently in different age from adults as they answer in a different way. After observing his and his friends' children of different ages, he concluded that children go under a process known as process of cognitive development. He was interested in determining how children adopt the surroundings and the way to learn new information (behavior and schemata); and organize balance systematically between environment and schemes that is the equilibration. He believed that children possess reflexes called schema by birth and make understanding with environment by them and then constructed schemata are developed. He introduces assimilation and accommodation that means that individual adapts more complex way to cope with environment. He came to a conclusion by observing developing stages of various age group children for many years that all children went to four stages of development in the same sequence all over the world. The first stage starts from birth to two years when children show motor reflexes. This stage is called as sensori motor stage. In the age of seven months the children start to get about object permanency and with the realization about control of their movements they learn to get new intellectual abilities. They also start to discern that what are the appropriate actions and how to produce sounds and then words to convey message. They see and try to copy their parents and care-givers what they do and say. The second stage is termed as pre-operational stage that starts at about two to six or seven years old. During these years, children recognize the use of language and about mental imagery. They are egocentric and concentrate on one view rent about things happening around. At this stage they are not able to assume logically. The third stage is concrete operational that starts at the age of six or seven and ends at eleven or twelve. Here, children are no more egocentric and they are able to take point of views of other people. Although they can do reasoning with concrete knowledge, yet they are not capable of seeing abstract factors of things. They can understand and perform these seven kinds area, conservation of weight, conservation of length and conservation of number. The last and final stage is formal operational that starts at the age of eleven and twelve and lasts through adulthood. Children at this stage are logical and can do reasoning and their thinking involves abstract side things. As children are self-motivators, therefore they need to revise things for getting knowledge and finding new ideas. It is worth noting that Piaget is of the view that every individual is not necessarily required to be at the same stage.

In Pakistani school system, the knowledge of the cognitive developmental stages is not taken into consideration. Teachers do not pay attention to the cognitive level of students and result is that they adopt the activities to teach them which do not match the characteristics of that particular stage in which young learners are expected to be. Consequently, when students reach the next grade, they find it difficult to understand the new concepts they are taught. During

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school years, it is often seen that even those students are promoted to the next grades whose thinking may not have fully developed to cope with coming stage. The cognitive developmental stages of learners have not been given the significance as they should have been. The cognitive level of the students at every step should be kept in view. According to Piaget, children have the capability to exhibit and display the characteristics of that particular stage to which they belong. And they can perform the activities that teacher assigns to them. Everything matching with the mental capabilities of students is appropriate, avoiding asking them to do those tasks that are not matching their existing mental and cognitive level. A teacher with this knowledge in hand, i.e. of cognitive development, actively involves students and presents challenges before them.

Cognitive development is immensely important, related to the abilities and efforts of children to perform according to their age. If mental capabilities of the children are well understood by the teachers, according to their age, children can attain all the characteristics of their specific age and subsequently can perform all the activities they are expected to do.

In school years, it is often observed that students are considered as passive recipients of instruction. This happens when teachers have no practical consideration for cognitive developmental stages of children. Curriculum factor is another facade of this picture that shows the incompatibility of children towards the cognitive developmental stages. The concepts of curriculum do not have the capability to cope with mental level of students. Teacher should also keep in mind the practical considerations of cognitive developmental stages of students. This knowledge helps students in forming the accurate concepts of what they are taught. So, in order to bring forth the characteristics of that particular stage of students, the knowledge of cognitive developmental stages is found helpful for a teacher.

There is a support from western cultures, in many cross sectional studies of children that they pass from these stages of cognitive development stated by Piaget (Renner, Stafford, Lawson, McKinnon, Friot & Kellogg, 1976). Piaget, when discusses assimilation and accommodation, he concentrates on relation between environment and organism responsible for both (Piaget, 1952).The children start to raise object permanency and the realization about control of their movements. They learn to get new intellectual abilities. It is through trial and error that they understand object handling and the world around them in sensori motor stage. The initial show of intelligence is started at this stage (Anderson, M. 2003). Piaget worked on students of pre-school and elementary in the early stages of moral reasoning (Bee, 1989). The children in pre-operational stage, have limited thinking that needs to be widened (Ginsburg, Herbert & Sylvia). Piaget's formal operational stage where individual can do logical reasoning is a stage that cannot be attained by all children because different settings need different needs (Berk, 2000).The children are not having the same stage in performing characteristics of Piaget's stages of cognitive development theory. The performance of children may vary due to some reasons (Berk, L.E. 2000). It is observed that in common class room, students are kept according to their age, since their level may significantly differ (Weinert & Helmke, 1998). Data that obtained in many similar cross- sectional researches showed that it is not necessary to enter in the next stage

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automatically with biological maturation (Jordan & Brownlee, 1981). Data that was collected from adult individuals rendered the results that 30-35% of the high school seniors were there in formal operational stage because to get this stage needs a specific environment for individuals (Kuhn, Langer, Kohlberg & Haan, 1977).

The children's minds have the ability to grow naturally well if their capabilities are planted in fertile soil (Brainerd 1978). The basis of mental functions is schemas that are central to the cognitive development theory (Gruber and Voneche, 1977). There is a support from western cultures, in many cross sectional studies of children that they pass from these stages of cognitive development told by piaget (Renner, Stafford, Lawson, McKinnon, Friot & Kellogg, 1976). Piaget, while arguing about assimilation and accommodation, concentrates on relation between environment and organism responsible for both (Piaget, 1952). The children start to get about object permanency and the realization about control of their movements. They learn to get new intellectual abilities. It is through trial and error that they understand object handling and the world around them in sensori motor stage. The initial show of intelligence is started at this stage. (Anderson, M. 2003). Piaget worked on students of pre-school and elementary in the early stages of moral reasoning. The children in pre-operational stage have limited thinking that needs to be widened (Bee, 1989). Piaget's formal operational stage where individual can do logical reasoning is a stage that cannot be attained by all children because different settings need different needs (Ginsburg, Herbert & Sylvia). Berk (2000) believes that children are not having the same stage in performing characteristics of Piaget's stages of cognitive development theory. The performance of children may vary due to some reasons (Berk, 2000). It is spotted that in common class room students are kept according to their age, since their level may significantly different. (Weinert & Helmke, 1998). Data that was obtained in many similar cross- sectional researches showed that it is not necessary to enter in the next stage automatically with biological maturation (Jordan & Brownlee, 1981). Data that was collected from adult individuals rendered the results that 30-35% of the high school seniors were there in formal operational stage because to get this stage needs a specific environment for individuals (Kuhn, Langer, Kohlberg & Haan, 1977). Saettler (1990, p. 77) identifies the importance of Piaget's theory in teaching as it gives teachers a new approach of dealing children while teaching. If the teacher is a good facilitator, then he can make the minds of students can be made to those of the experts (Zahorik, 1997).

OBJECTIVES

The main objective of this study was to find the cognitive developmental stages of class VIII students with reference to Jean Paget cognitive stages.

METHODS AND PROCEDURES OF RESEARCH

SAMPLE SELECTION

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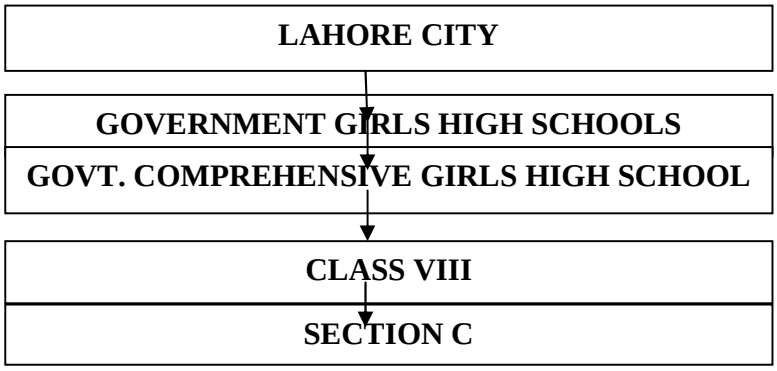
Government Comprehensive Girls High School Wahdat Road was selected for the research purpose. There were six sections of class VIII and total strength of that section was 497. The section C of class VIII was selected by balloting. There were sixty students in section C. From all the sixty students of that section, odd baring roll no. students were systematically selected as sample in order to collect data for research.

SAMPLE DESIGN



INSTRUMENT OF RESEARCH

Five Piaget tasks and three Inquiry activities were used to measure the cognitive developmental stages of class VIII students. Five Piaget tasks were used to measure the Concrete Operational Stage and three inquiry activities were used to measure the Formal Operational stage of class VIII students.

Task 1 was related to conservation of mass.

Task 2 was related to conservation of volume.

Task 3 was related to conservation of continuous quantity.

Task 4 was related to conservation of number.

Task 5 was related to conservation of volume displacement.

1st inquiry activity was related to control of variables

2nd activity was related to combinational reasoning.

3rd activity was related to proportional reasoning.

PROCEDURE

The study was designed to find out the cognitive development stages of class VIII students of Govt. Comprehensive High School Lahore. Five Piagetian tasks of concrete operational stage were performed by the subjects one by one. The Piagetian tasks were asked in their mother tongue Urdu.

TASK1

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CONSERVATION OF MASS

After showing two equal balls A and B,

A B

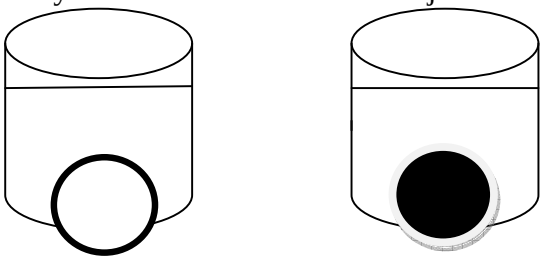
The subject was asked, "Which is bigger A or B?" after receiving response from the subject, clay ball B was rolled out.

A B

TASK 2

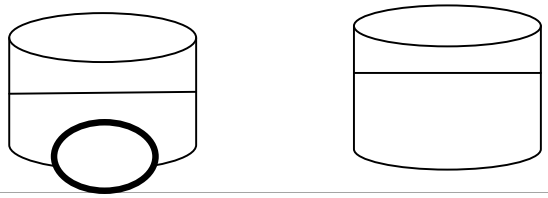
CONSERVATION OF VOLUME

At first, two cylinders having equaled level of water and with two clay balls immersed in the cylinder were shown to the subject.



A B

And the question was put up, "Is the level of water equal in both cylinders?" after receiving the response from the subject, the balls were taken out from the cylinders and rolled out into a sausage. Before putting rolled clay ball B into the water cylinder, the subject was asked, "In which cylinder will the level of water be higher?" the response of the subject was noted.



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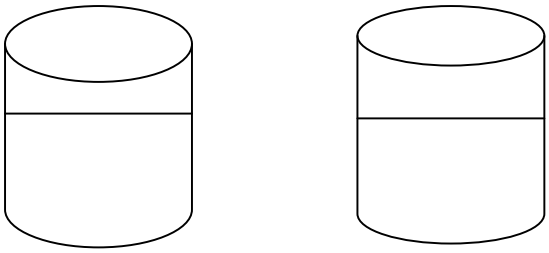
A

A B

TASK 3

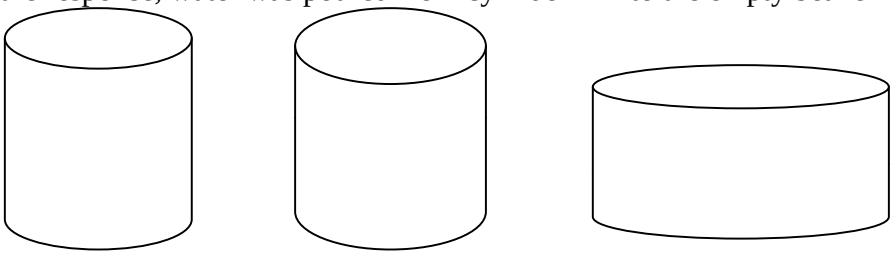
CONSERVATION OF CONTINUOUS QUANTITY

At first, two cylinders having equal level of water in them were shown to the subjects.



A B

The subject was asked, "Is the level of water equal in both cylinder A and B?". After receiving the response, water was poured from cylinder A into the empty beaker C.



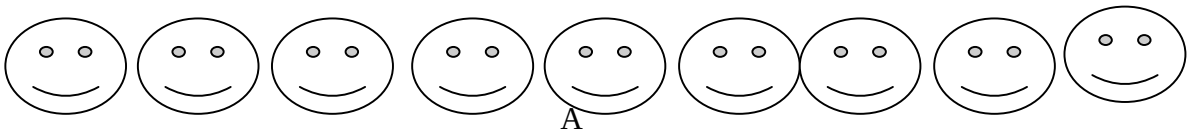
A B C

Then the subject was asked, "Is the level of water equal in cylinder B and beaker C?" the response of the subject was noted.

TASK4

CONSERVATION OF NUMBER

Two bars A and B having the equal number of buttons were shown to the subject.



A

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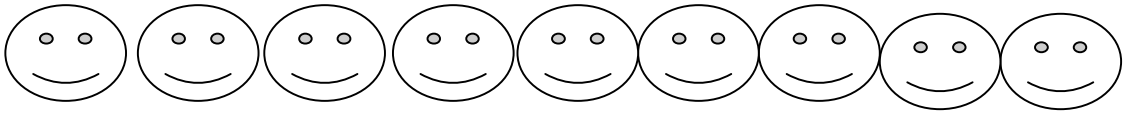
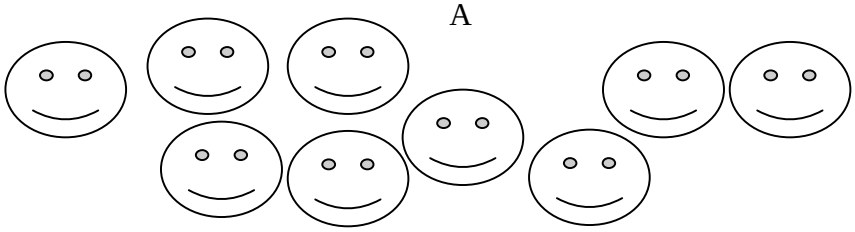
B

Then the question was asked to the subject, “Is the number of buttons equal in both bars A and B?” the response of the subject was noted. Then the buttons on bar B are dispersed.



A



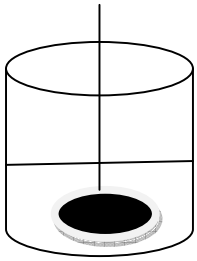
B

Then the question was asked, “Which bar has more buttons A or B?” and the response of the student was noted.

TASK 5

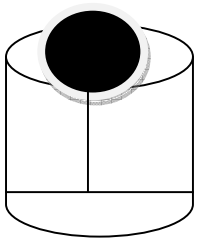
CONSERVATION OF VOLUME DSPLACEMENT

A cylinder having some water and a hanging bob in it was shown to eh subject.



A

The subject was asked, “What is the water level in cylinder?” after receiving response of the subject, bob was taken out of the water.



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B

Then the subject was asked, "What is the volume of the metallic bob?" the response of the student was noted.

The criterion that was used for evaluating the subjects' performance is as follows:

Each task was given two marks, one for the correct response and one for the correct justification. The subjects who gave the right response and correct justification were given two marks and they were assumed to be in concrete operational stage. The subjects who gave the correct response but wrong justification were given one mark and they were considered in transitional stage while the subjects who produced wrong response and wrong justification were given zero mark and they were assumed to be in pre-operational stage.

INQUIRY ACTIVITIES

After the completion of the piaget tasks, three inquiry activities of formal operational stage in written form were given to the subjects to solve.

ACTIVITY 1

CONTROL OF VARIABLES

The activity that was administered was in written form and was in sudents' mother tongue (Urdu).

Activity was as follows:

Five cows are brought to the cattle show. Their colour, race, weight, age and scores are given in the following table. Select two appropriate cows showing that the age of cows has influenced the judge's decision.

SERIAL NO	RACE	AGE(years)	WEIGHT (kg)	COLOUR	SCORE
1	Native	3	400	Black	85
2	Australian	4	380	Brown	75
3	Native	4	400	Black	95
4	Australian	3	420	Brown	60
5	Native	4	380	White	75

Write the number of cows _____ and _____ that you find the best.

Elaborate your answer.

This activity was given to each subject to solve in 10 minutes.

ACTIVITY 2

COMBINATORIAL REASONING

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This activity was about combinatorial reasoning. The activity that was administered to the subjects was as follows:

I have four kinds of food (A, B, C, D). How many kinds of meals you can make from them.

(i) Write down the alphabets of these food ingredients.
(ii) If we combine at least two food ingredients in each meal, how many kinds of meal can be made.

A B C D

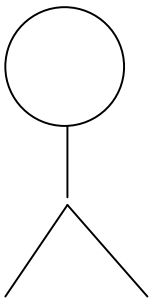
This activity was administered to each subject to be solved in 10 minutes.

ACTIVITY 3

PROPORTIONAL REASONING

The activity about proportional reasoning was as follows:

This drawing is of Mr. Small. For given purpose we used paper clips that were kept side by side to measure the height of Mr. Small. The measurement of the height of Mr. Small was made by placing paper clips from the floor between his feet to his head. His height was found to be four paper clips. After that a new figure of Mr. Long was introduced. In this case, measurement was taken in the same manner again with those same paper clips.



While measuring the height Mr. Long using those paper clips, the task was to perform measurement by keeping paper clips in a chain.

The height of Mr. Long is _____.

Explain your answer.

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The criterion that was used for evaluating subjects' performance is as follows:

Each task was given two marks, one for the correct response and one for the correct justification. The subjects who gave the right response and correct justification were given two marks and they were in assumed to be in formal operational stage. The subjects who gave correct response but wrong justification were given one marks and they were considered in transitional stage while the subjects who gave wrong response and wrong justification were given zero mark and they were put in concrete operational stage.

FINDINGS

PIAGETIAN TASKS

TASKS	STUDENTS IN PRE-OPERATIONAL STAGE	PERCENT-AGE	STUDENTS IN CONCRETE OPERATIONAL STAGE	PERCENTAGE
Conservation of Mass	2	6.67%	28	93.3%
Conservation of Volume	6	20%	24	80%
Conservation of Continuous Quantity	9	30%	21	70%
Conservation of Number	3	10%	27	90%
Conservation of Volume Displacement	17	56.67%	13	43.34%

INQUIRY ACTIVITIES

ACTIVITY	STUDENTS IN CONCRETE OPERATIONAL STAGE	PERCENT-AGE	STUDENTS IN FORMAL OPERATIONAL STAGE	PERCENTAGE
Control of Variables	23	76.67%	7	23.33%
Combinatorial	27	90%	3	10%

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Reasoning				
Proportional Reasoning	30	100%	0	0%

CONCLUSIONS

It was concluded:

1. In 1st Piagetian task "Conservation of Mass", 93.3% students were in concrete operational stage while 6.67% students were in pre-operational stage.
2. In 2nd Piagetian task "Conservation of Volume", 80% students were in concrete operational stage while 20% students were in pre-operational stage.
3. In 3rd Piagetian task "Conservation of Continuous Quantity", 70% students were in concrete operational stage while 30% students were in pre-operational stage.
4. In 4th Piagetian task "Conservation of Number", 90% students were in concrete operational stage while 10% students were in pre-operational stage.
5. In 5th Piagetian task "Conservation of Volume Displacement", 43.34% students were in concrete operational stage while 56.87% students were in pre-operational stage.
6. In 1st Inquiry activity "Control of Variables", 76.67% students were in concrete operational stage.The students in formal operational stage were 23.33%.
7. In 2nd Inquiry activity "Combinatorial Reasoning", 90% students were in concrete operational stage.The students in formal operational stage were 10%.
8. In 3rd Inquiry activity "Proportional Reasoning", 100% students were in concrete operational stage.There was not any student in formal operational stage.

It was concluded that class VIII students were in concrete operational stage and there were some characteristics of formal operational stage like control of variables and proportional reasoning were present in few students. But on the whole, class VIII students were in concrete operational stage.

RECOMMENDATIONS

It is recommended:

1. Educationists must devise a plan that enhances logical as well as growth related to conceptual learning and it must ensures developmentally appropriate curriculum responsible to achieve the set goals.
2. Teacher should adopt the activities according to the characteristics of the cognitive developmental stages of the students in which they are expected to be because children do not provide the same explanations of same events at different stages of cognitive development.
3. Teachers should keep in mind the practical consideration of the subject they are teaching, because this will help the students in forming concepts correctly.
4. Individual differences all the students should be the first priority of the teachers because all the students do not belong to the same cognitive level.

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5. Learning aids and activities that are provided to the different grade students should have the appropriate motor or mental operations for them according to their age.
6. Teachers should avoid asking students those actions that do not match their current cognitive capabilities.

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