

Analysis of cognitive development of learners at concrete operational stage in Pakistan

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Abstract

Concrete Operational Stage is the third stage of Piaget's Theory of Cognitive Development. It ranges between 7 to 11 years of age. At this age the child develops the level of operational thinking. Children are capable to classify, understand cause-and-effect relationships and become proficient at mathematics and science. The data have been collected through purposive sampling from a sample of 120 male and female students ranging between 7 to 11 years age. A tailor-made test and inventory instrument was developed and analyzed qualitatively and quantitatively. It was found that there is a significant difference in the cognitive development of children at concrete operational stage in the rural and urban areas. Gender difference does not affect the cognitive development in any way. Cognitive level of students in the same areas also differs. The scholarly suggestions are given at the end of the paper.

Keywords: *Cognitive development, gender difference, concrete operational stage*

Introduction

Pakistan is an agricultural country with seventy percentage population living in rural areas. Equity and access to quality education is an issue in Pakistan. It is common in Pakistan that city born and bred children enjoy better exposure in terms of opportunity and quality schooling, while children from rural community are marginalized or deprived from these benefits. They do not get chances to optimize their talents and thus they are not in a position to contribute positively towards society and their self. The researcher tries to explore the phenomenon of cognitive development at concrete operational stage. Piaget's theory of cognitive development provides support to the study. This study attempts to explore the phenomenon of cognitive development among rural and urban children and among girls and boys children at concrete operational stage with reference to Piaget's theory of cognitive development.

In history, the cognitive development of children has been studied in different ways. Many psychologists, such as Lewis Terman, John Watson, B.F. Skinner, John Dewey, Jean Piaget, Lev Vygotsky, and Jerome Bruner, provide the theoretical support to understand the cognitive development of learners and the understanding of effective teaching learning process. Fisher (1995) believes that "children are exposed to a variety of stimuli in their environment" (p. 2). He further elaborates that "children need to understand the world and a natural curiosity about the stimuli in the environment" (Fisher, 1995, p. 2). Similarly Sprinthall N., Sprinthall R. and Oja (1994) express that "cognition is the term to name the constant process of going back and forth between the person and the environment" (p. 103).

The word 'Cognition' has been derived from the Latin word *cognosco* (to know) and refers to all those psychological activities involved in the acquisition, processing, organization and use of knowledge (<http://en.wikipedia.org/wiki/Cognition>). Lutz and Huitt (2004) illustrate that "several major assumptions of the information processing approach to

cognition are incomplete” (p. 33). On the other hand, Greeno (1989) proposes that thinking is an outcome of interaction between the individual and the environment.

There are two classical theories of cognitive development. In this study the researcher has focused on Piaget’s theory of cognitive development. According to his theory Piaget hypothesized that learning is a physical, biological function of dealing successfully with the environment.

The main focus of the present study is to test the theory in different areas i.e. rural and urban male and female children’s cognitive development at concrete operational stage and the variables that hinder or foster cognitive development.

Objectives of the study

The following objectives are developed to structure the study.

1. To know the difference in the cognitive development of children at concrete operational stage in the rural and urban areas.
2. To differentiate among male and female children’s cognitive development at concrete operational stage.
3. To identify the variables that affect cognitive development.

Research questions

1. What is the difference in the cognitive development of children at concrete operational stage in the rural and urban areas?
2. What is the difference between male and female children’s cognitive development at concrete operational stage?
3. What are the variables that affect cognitive development?

Hypothesis

Ho#1. There is a significant difference in the cognitive development of children at concrete operational stage in the rural and urban areas.

Ho#2. There is no significant difference in the cognitive level of boys and girls.

Review of literature

Cognition refers to the sensitivity of information (you read the question), it deals with understanding (you comprehended the question), it deals with thought (you asked yourself whether you knew the answer) and it deals with the formulation and production of an answer. Acredolo (1976) states that cognition touches all parts of the perceptual, memory and thinking processes and is prominent characteristic of all people. An information-processing model assumes that cognition can be analyzed into a series of stages. At each stage certain unique operation are performed on information. Each stage gets information from former stages and then performs its exclusive function. Since all components of the information-processing model are in some way related to each other, it is difficult to identify an initial stage, but for convenience one can think of the sequence as starting with incoming stimuli.

The cognitive development of children has been studied in a variety of ways. The oldest way is through intelligence tests, such as the widely used Stanford Binet Intelligence Quotient, or IQ, test first adopted for use in the United States by psychologist Lewis Terman (1877-1956) in 1916. According to this test, scoring of IQ bases on the concept of "mental age" in which the scores of a child of average intelligence equivalent his or her age, as a gifted child's performance is equivalent to that of an older child, and a slow learner's scores are comparable to those of a younger child. IQ tests are usually used in the United States, but they have come into view below rising criticism for significant intelligence too closely and for being prejudiced with view to race and gender. In contrast to the emphasis sited on a child's native abilities by intelligence testing, learning theory developed out of work by behaviorist researchers such as John Watson and B.F. Skinner (1904-1990), who argued that children are absolutely easily influenced. Learning theory emphasizes on the role of

environmental factors in shaping the intelligence of children, particularly on a child's ability to learn by having certain behaviors rewarded and others discouraged (Fischer, 1980, p. 20).

Eggen (1999) looking at Piaget's theory of cognitive development in more detail found that Piaget based it on two biological tendencies. The two tendencies are organization, and adaption. The author of the article defined that "organization as Piaget saw it said that humans are designed to organize their observations and experiences into coherent sets of meanings" (p. 34). In addition, the author advocates that this organization of observation makes the thinking process more efficient. If a person can put the things he observes in some sort of order the easier it is to remember and apply his observations. He further elaborates that "if we do not organize our observations and experiences we would have little bits of information floating around in our brains with no connection between them" (p. 56). Adaption according to Piaget's theory is the tendency to adjust to the environment. Piaget hypothesized that children learn, in different ways based upon their level of development. According to Piaget's theory, individuals are placed one of four stages: sensory motor, preoperational, concrete and formal operations (Muuss, 1996, p. 44).

In Piaget's theory of Cognitive development the Concrete Operational Stage is the third stage of cognitive development in children. According to this stage, the children at concrete operational stage are characterized by the appropriate use of logic. Important processes during this stage are:

- **Seriation** refers to the ability to sort objects in an order according to size, shape, or other characteristic. For example, if we give different-shaded objects to the children, they may make a color gradient.
- **Classification** is the ability of children at concrete operational stage is to name and identify sets of objects according to appearance, size or other characteristic, including the idea that one set of objects can include another.

- **Decentering** refers to where the child takes into account multiple aspects of a problem to solve it. For example, the child will understand that wide but short cup contains water less than a normally wide, taller cup.
- **Reversibility** is the ability, where the child understands that numbers or objects can be changed, and then returned to their original state. For example a child will be able to rapidly determine that if $3+3$ equals 6, $6-3$ will equal 3, the original quantity.
- **Conservation** is an ability of concrete operational child to understand that quantity; length or number of items is unrelated to the arrangement and appearance of the object.
- **Elimination of Egocentrism** refers to the ability to view things from another's perspective (even if they think incorrectly). According to C. George Boeree (1998), Children in this stage can, however, only solve problems that apply to concrete objects or events, and not abstract concepts or hypothetical tasks.

Research Methodology

Strategy

The study adopted mixed research design with both quantitative and qualitative paradigms. A survey regarding the concrete operational stage of child's development of public schools of District Hyderabad was made. Quantitative data has been generated through tailor- made especially adapted and designed tests for the purpose of measuring cognitive development of children at concrete operational stage living in rural and urban area. Qualitative data has been generated through an inventory, especially designed to describe students experiences related to environment and their impact on cognitive development.

Method and tools

Survey method was used for the collection of data, in which Tailor- made Tests and inventory tools were used.

Collection of data

The data used in this research were collected through primary and secondary resources. Primary data were collected from students through Tailor- made Tests and inventory tools. While the secondary data were collected from books, journals, magazines, newspapers, education commission reports, education policies and education plans etc.

Population

The population of this study was all children of Pakistan, while the access population was the male and female students of Hyderabad district ranging between 7 to 11 years age.

Sampling

The method of sampling was purposive sampling. As the phenomena of cognitive development studied with reference to Piaget’s concrete operational stage, the students ranging in 7-11 age groups had been sampled. For this study a sample of 120 students of class III from 24 schools of 52 union councils of Hyderabad had been selected as the target sample.

Table 1: Sample of students by gender and area n=120

Hyderabad n=120			
Urban n=60		Rural n=60	
Male	Female	Male	Female
30	30	30	30

Figure 1: Sample size n=120

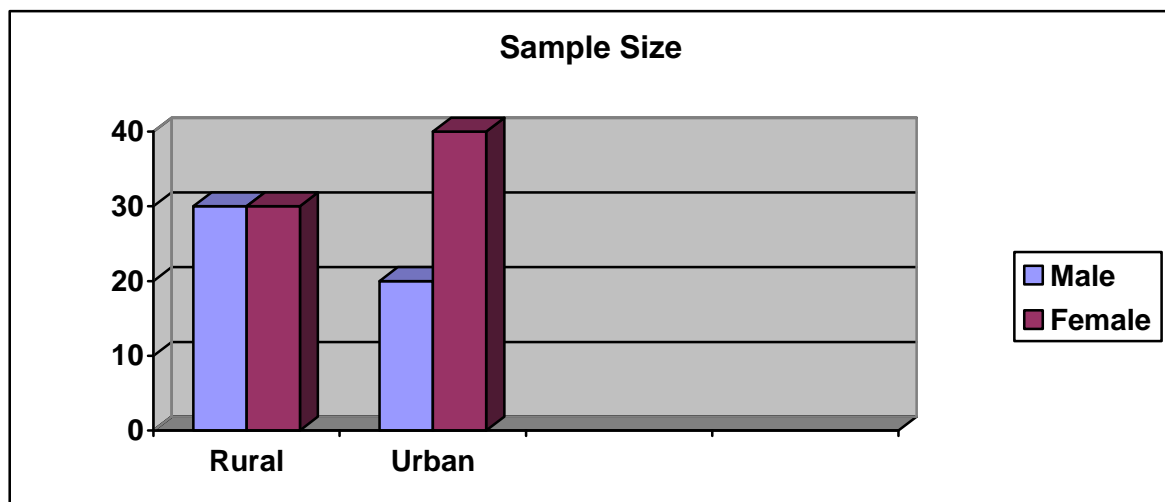


Table 2: Sample by institution

District Hyderabad		
Taluka	Sample of schools	Sample of students
Latifabad	6	30
City	6	30
Qasimabad	6	30
Taluka Hyderabad	6	30
Total	24	120

Instrumentation

In order to fulfil the need of required data, the tailor made tests and inventory for students of public schools had been designed. In addition to above tools the observation diary and interview protocol had also been devised for the collection of data.

Data analysis plan

The data were analyzed through quantitative analytical technique. Two types of analytical techniques were used. First, qualitative analysis of the inventory was made and the results were described through percentages and in narrative form. The second type of technique used for the analysis of the tests was quantitative, which involved descriptive and inferential statistical procedures. Z-test had been used to test the major hypotheses.

Findings and discussion

1. Finding One

Hypothesis one: There is a significant difference in the cognitive development of children at concrete operational stage in the rural and urban areas.

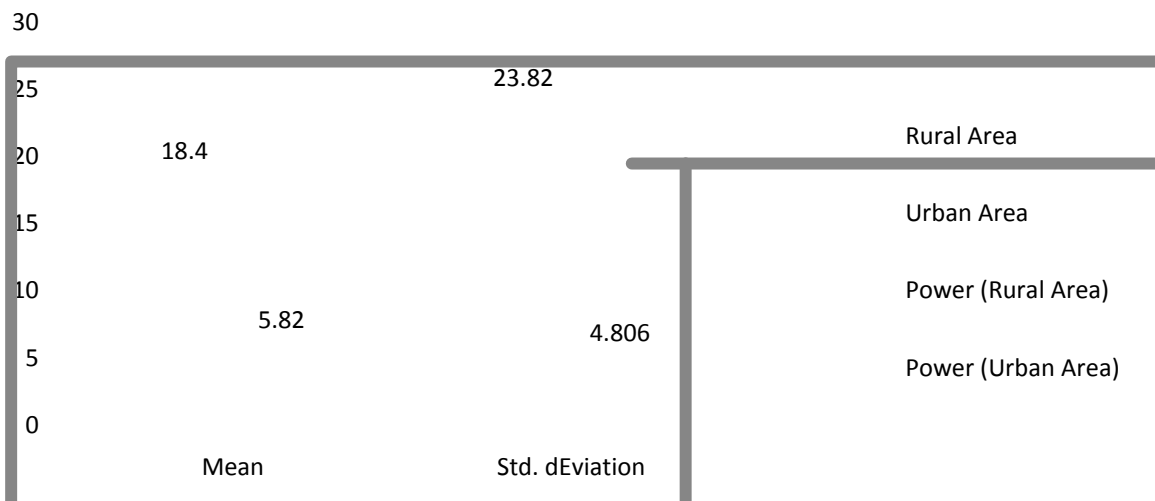
Table 3: Rural data (descriptive statistics)

Rural Area	N	Minimum	Maximum	Mean	Std. Deviation
TOTAL SCORE	60	8	28	18.40	5.820
Valid N (list wise)	60				

Table 4: Urban data (descriptive statistics)

Rural Area	N	Minimum	Maximum	Mean	Std. Deviation
TOTAL SCORE	60	9	28	23.82	4.806
Valid N (list wise)	60				

Figure 2: Mean and Std. Deviation of Urban and Rural Area



Analysis and discussion

The results indicate that there is a significant difference in the cognitive development of children at concrete operational stage in the rural and urban areas. Students belonging to rural areas could not perform independently in the five areas of reversibility, conservation,

classification, seriation, and transitive inference, while a sizeable majority from urban areas could do it independently. All children from rural and urban areas were sample from public sector schools, so all of them have exposed to the same curricula, yet the difference was in the below- mental areas:

Children from urban areas have exposed to:

- Rich environment
- Literate parents
- Higher Socio Economic status
- Professional parents
- Rich culture
- Socially literate peer group
- Gadgetry like mobiles, computer, electronic toys and video games
- Social organizations like, Markets, schools, colleges, parks and hospitals
- Electronic and print media

Children from rural areas have exposure to:

- Natural environment
- Strong family structure
- Traditional values
- Strong customs
- Large number of family
- Limited access to media like, T.V, newspaper

2. Finding Two

Hypothesis two: There is no significant difference in the cognitive level of boys and girls in the same environment.

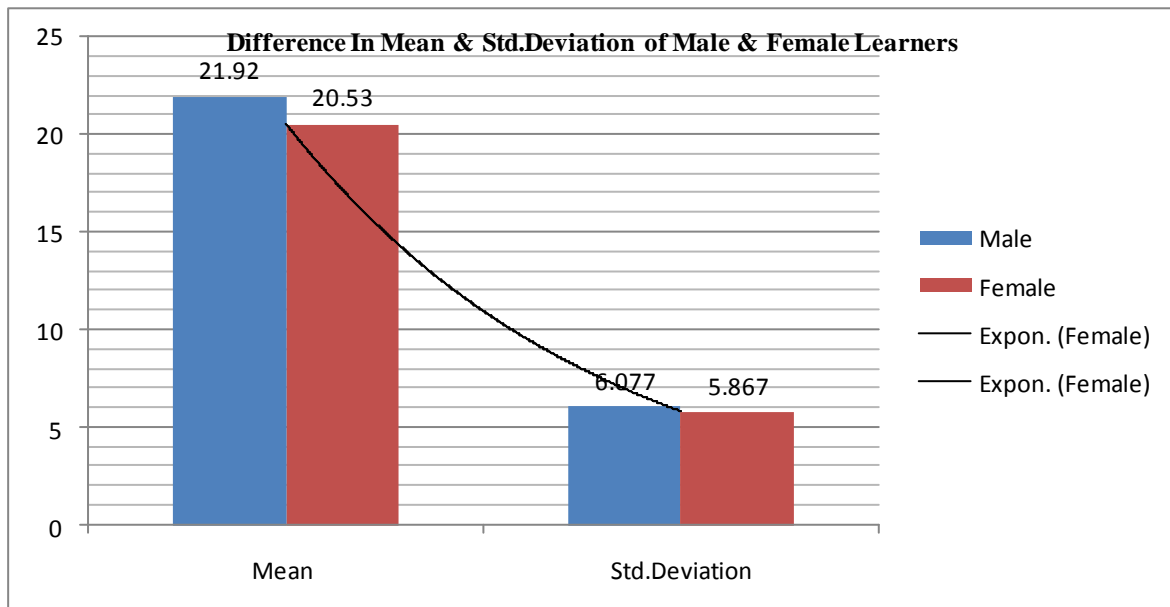
Table 5: Female data (descriptive statistics)

Rural Area	N	Minimum	Maximum	Mean	Std. Deviation
TOTAL SCORE	70	9	28	20.53	5.867
Valid N (list wise)	70				

Table 6: Male data (descriptive statistics)

Rural Area	N	Minimum	Maximum	Mean	Std. Deviation
TOTAL SCORE	50	8	28	21.92	6.077
Valid N (list wise)	50				

Figure 3: Difference in Mean and Std. Deviation of Male and Female Children



Analysis and discussion

The result further indicates that there is no significant difference in the cognitive level of boys and girls in the same environment. The findings, suggest that gender does not affect the cognitive development in any way. This is quite surprising as the usually the girls in rural environment are submissive and withdrawn. They are neither encouraged at home, nor are they exposed to external environment. The results pertaining to girls indicate that in rural and urban areas both girls have equally scored the tests as compared to boys.

3. Finding three (Piagetian test)

Table 7: Test of Reversibility

Test of Reversibility	Rural						Urban					
	Male			Female			Male			Female		
Questions	C.D.I	C.D.H	C.N.D	C.D.I	C.D.H	C.N.D	C.D.I	C.D.H	C.N.D	C.D.I	C.D.H	C.N.D
1 Which one is larger than other?	10% 3	20% 6	70% 21	10% 3	17% 5	73% 22	75% 15	15% 3	10% 2	45% 18	18% 7	37% 15
2 Which space is bigger than other space?	10% 3	33.3% 10	87.7% 17	10% 3	33.3% 10	87% 17	80% 16	10% 2	10% 2	70% 28	13% 5	17% 7
3 Which one is heavier than other? (by weight)	100% 30	0% 0	0% 0	53% 16	43.3% 13	3.4% 1	100% 20	0% 0	0% 0	100% 40	0% 0	0% 0
4 What change occurs when 2 is added to 3 and when 2 is subtracted from 5?	10% 3	20% 6	70% 21	10% 3	17% 5	73% 22	43% 13	15% 3	42% 4	40% 16	10% 4	50% 20%

C.D.I (can do it independently), C.D.H (can do it with help), C.N.D (cannot do it).

Analysis and discussion

The results further indicate that the rural cohort achieved remarkably low in the area of reversibility, and transitive inference as compared to their counterparts in the urban areas. The rural cohort have achieved highest in conversion test. There is no significant difference found in the achievement of boys and girls in the same environment. Discussion showed that the children who could do the tests with or without help belonged to rich environment and had literate parents, higher socio economic status, professional parents, rich culture, socially literate peer group, gadgetry like mobiles, computer, electronic toys and video games, markets, schools, colleges, parks and hospitals, electronic and print media

4. Finding four

Table 8: Test of conservation

Test of Reversibility	Rural						Urban					
	Male			Female			Male			Female		
Questions	C.D.I	C.D.H	C.N.D	C.D.I	C.D.H	C.N.D	C.D.I	C.D.H	C.N.D	C.D.I	C.D.H	C.N.D
1 Which are more?	37%	30%	33%	40%	47%	13%	70%	25%	5%	65%	30%	5%
	11	9	10	12	14	4	14	5	1	26	12	2
2 Which is longer than other?	47%	33%	20%	50%	40%	10%	75%	10%	15%	55%	33%	12%
	14	10	6	15	12	3	15	2	3	22	13	5
3 Which amount of water is more?	76%	24%	0%	74%	16%	10%	100%	0%	0%	85%	10%	5%
	23	7	0	22	5	3	20	0	0	34	4	2
4 Do you have more blocks or do we have same blocks?	94%	6%	0%	100%	0%	0%	95%	0%	5%	100%	0%	0%
	28	2	0	30	0	0	19	0	1	40	0	0

C.D.I (can do it independently), C.D.H (can do it with help), C.N.D (cannot do it).

Analysis and discussion

The result reveals that a wide majority of children from rural areas could not do the tests as compared to their counterparts in urban areas. In question one and two the students from rural areas had difficulty; they exhibited insufficient understanding of these questions. But the children from urban areas showed the sufficient understanding of all the questions and majority of students could do the tests. The data shows that the rural cohort was exposed to mostly illiterate parents, parents working in limited profound areas, low socio economic status, socially backward peer group, mother tongue only, absence of electronic and print media, absence of social centers like; markets, hospitals, roads, colleges, and parks.

5. Finding five

Table 9: Test of Classification

Test of Reversibility	Rural						Urban					
	Male			Female			Male			Female		
Questions	C.D.I	C.D.H	C.N.D	C.D.I	C.D.H	C.N.D	C.D.I	C.D.H	C.N.D	C.D.I	C.D.H	C.N.D
1 Weather there is more red buttons or more plastic buttons?	40% 12	27% 8	33% 10	40% 12	47% 14	13% 4	80% 16	15% 3	5% 1	70% 28	25% 10	5% 2
2 Do these groups belong to same group?	50% 15	27% 8	23% 7	50% 15	40% 12	10% 3	90% 18	10% 2	0% 0	77% 27	20% 8	13% 5
3 What is the number of item presents in each group?	77% 23	23% 7	0% 0	74% 22	16% 5	10% 3	95% 19	5% 1	0% 0	85% 34	10% 4	5% 2
4 Put things that are alike together?	100% 30	0% 0	0% 0	100% 30	0% 0	0% 0	100% 20	0% 0	0% 0	100% 0	0% 0	0% 0

C.D.I (can do it independently), C.D.H (can do it with help), C.N.D (cannot do it).

Analysis and discussion

The result indicates that a wide range of students from rural areas could not answer the first two questions but majority of students answered the last two questions. Students from urban area exhibited the great understanding in all questions of the test. Urban students were able to show a connection between ideas that show how they reach to conclusion but minor error in presentation. It is alarming to note that the students from rural areas had insufficient understanding of logical problems and had shown error to include the results. The test covered variety of subject areas, such as number, space and logical operations. By gauging children's responses to these tests and by questioning the children about how they reached these answer. Another significant result is that there is no difference in cognitive

development on the base of gender. The performance of girls students were not lesser then boys students in the same environment.

6. Finding Six

Table 10: Test of Seriation

Test of Reversibility	Rural						Urban					
	Male			Female			Male			Female		
Questions	C.D.I	C.D.H	C.N.D	C.D.I	C.D.H	C.N.D	C.D.I	C.D.H	C.N.D	C.D.I	C.D.H	C.N.D
1 Can u put these sticks in order?	43%	33.3%	23.7%	27%	20%	53%	95%	5%	0%	77%	18%	5%
	13	10	7	8	6	16	19	1	0	31	7	2

C.D.I (can do it independently), C.D.H (can do it with help), C.N.D (cannot do it).

Analysis and discussion

The result indicates that the all male students from urban area scored high in seriation test and 95% girls could do the test with or without help. On the other hand, 76% boys from rural areas could do test with or without help. 47% girls from rural areas could do test with or without the help. Students from rural areas were able to pursue the sub goal but failed to arrive at the main goal of the question. It is further noted that 27% male students from rural area did not reach the solution of the problem and 53% girl students from rural areas were also not able to solve the problem. In contrast, the percentage of the students from urban areas, who could not solve the problem, is very low. It is very serious concern that majority of student from rural areas could not develop one of the important logical operation that, an individual is expected to develop. The forgoing discussion only explains that as an individual goes through the four successive stages of cognitive development, logical operations also develop progressively. This also implies that an individuals with higher level of cognitive performance exhibit that they have rich environment and have exposure of all modern and social organizations, while those with lower level of cognitive performance can solve limited types of problem only.

6. Finding seven

Table 11: Test of Transitive Inference

Test of Reversibility	Rural						Urban					
	Male			Female			Male			Female		
Questions	C.D.I	C.D.H	C.N.D	C.D.I	C.D.H	C.N.D	C.D.I	C.D.H	C.N.D	C.D.I	C.D.H	C.N.D
1 If A is bigger than b, and B is bigger than C, than which is bigger than candle, A or C?	30%	30%	40%	27%	20%	53%	95%	0%	5%	77%	18%	5%
	9	9	12	8	6	16	19	0	1	31	7	2

C.D.I (can do it independently), C.D.H (can do it with help), C.N.D (cannot do it).

Analysis and discussion

The result indicates that 80% male students from rural area could do the item while, 47% female students from rural area could answer the item of the test. The result of urban students is again higher than students from rural area. Children from rural area had no access to the major environmental factors, which affect cognitive development of the children. There is a significant association between the cognitive development and rich environment. Neighborhood, socio economic status of parents, parents literacy, access to media, access to modern social organizations, such as, hospitals, markets, colleges and parks have the significant association with the cognitive development of children

Suggestions

- Cognitive development is fostered through the school and environment. It is therefore, recommended that schools be prepared to play a conducive role in nurturing the following measures:
- Curricula may be reviewed and sequenced in order to bring up at par with the cognitive level of the child. This includes the review of books and the organization of experiences.
- Teachers should be trained to assess the level and the type of thinking of each child, and to arrange social situations to permit social interaction, so that children can learn from

one another. They should also be taught to plan learning experiences taking into account the level of thinking attained by the child. Encouraging children to classify things on the basis of classifying things into single attributes before exposing them to problems that involve relationships among two or more attributes before exposing students to problems that multiple relationships. Teacher must remember that learning through activity and direct experiences is essential.

- Community participation should be enhanced to develop caring, nurturing environment. Scientific evidence and research findings reveal that parents education and socio economic status, neighborhood and peer group associations, exposure to modern gadgetry, like T.V, computer, internet, electronic toys (play station, video games, etc), and books, greatly impact cognitive development. The present study recommends that NGO and community based clubs and associations should play a positive role especially in the rural areas in the form of establishment of libraries with rich literature both in books and in electronic media. Schools in the rural areas should be equipped with computers. Print rich environment should also be created in the community and schools to help facilitate cognitive development.
- Adult literacy programs should be arranged to literate the parents of the rural children. These should be arranged programs for skill development to develop skills so that the people get more chance of livelihood in rural areas, this can be decrease the rate of poverty and increase the living standard of rural people.

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