Journal of Education and Practice
ISSN 2222-1735 (Paper) ISSN 2222-288X (Online)
Vol 3, No 15, 2012

Intelligence And Teacher's Rating Of Creativity Among Grade V Children: A Study Of Gender Differences

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Abstract

The study was designed to examine the relationship between Teacher's rating of creativity and WISC-R performance of Grade V children. The sample consisted of 40 subjects between 8 to 10 years of age, 20 each from boys and girls. The subjects were randomly selected from five different schools. The subjects were categorized into six groups of boys and girls as high, moderate, and low in IQ. The means and Standard Deviations for all the six groups of subjects revealed that creative potential is directly related to the IQ of the subjects. Creativity is prominently observed among the children of high IQ than among moderate and low IQ children. Boys tended to show more creative potential than girls. High IQ boys and girls respectively show 0.81 and 0.55 correlation coefficient with their creativity score. Those correlations for moderate IQ children are 0.57 and 0.38, while that of low IQ children are 0.26 and 0.24 respectively for boys and girls. Hence, they are rated as higher in creativity than girls. The present study highlights a smooth positive relationship between creativity and intelligence.

Keywords: Intelligence, Creativity, Teacher's rating, WISC-R

1. Introduction

Intelligence refers to the activities involved in thinking, reasoning, decision-making, memory, problem solving, and all other forms of higher mental processes. It is the brightness and sharpness of an individual, and his ability to understand things, figure things out quickly, and learn from experience. It explains why some students learn readily, while others in the same class with the same books, and teachers have great difficulty in learning. In the literature, discussion about definition and measurement of intelligence go hand in hand. In fact, definitions of intelligence evolved through the development of ways to measure it. Although no complete consensus has yet been reached about the meaning of intelligence, psychologists from all factions overwhelmingly agree on three characteristics of intelligence (Rothman, 1987). The ability to deal with abstractions like ideas, symbols, relationships, concepts and principles more than with concrete things like mechanical tools, and physical objects. The ability to solve problems to deal with new situations, and not simply to make well-practiced responses to familiar situations. The ability to learn, especially to grasp, use abstractions involving words and other symbols.

On similar understanding, Estes (1982) had defined intelligence, as "adaptive behavior of the individual, usually characterized by some element of problem solving and directed by cognitive processes and operations". Anastasi (1986) has remarked that such definitions emphasize intelligence as not an entity within the organism, but a quality of behavior.

Creativity is the ability to produce work that is original, but still appropriate and useful (Berk, 2002). Most psychologists agree that there is no such thing as all-purpose creativity; people are creative in a particular area. Although, we frequently associate the arts with creativity, any subject can be approached in a creative manner. Howard Gardner defines a creative individual as a person who regularly solves problems, fashions products, or defines new questions in a domain in a way that is initially considered novel but that ultimately becomes accepted in a particular cultural setting (Gardner, 1993)

The meanings of the terms intelligence, and creativity clearly imply them as two complementary mental processes. The models relating to the structure of intelligence discussed in the following section point to problem solving and creative skills as major constituents of intelligent activity. But the question of relationship as reported in the research literature is not that simple and strait forward. Several studies indicate that a substantial amount of intelligence is a precondition for any creative activity, but not necessarily a person with high intelligence can always be creative; or in order to be creative a person always needs high intelligence (Oakes & Wells, 2002). The present study is intended to examine the exact nature of relationship between creativity and intelligence in a sample of young children.

The following section presents some updated theoretical outlines, and research evidences about intelligence, creativity, and the relationship between them. The discussion builds the framework for developing the rationale, objectives, and hypotheses for the present study.

1.1 Organization of Intelligence

Most psychologists agree that there is a general mental ability, or general intelligence, which they call g-factor. They derive the notion from the fact that all tests of intelligence tend to correlate positively with one another. Besides the g-factor, there are specific factors controlling specific single activity. This notion was originally advanced by Charles Spearman (1927).

Further; researchers have also discovered that tests of mental abilities can be grouped into clusters that are highly correlated. Some tests of mental abilities tend to go together more than they go with other tests. These clusters of related tests are group factors, which can be called as primary mental abilities. Louis L. Thurstone (1938) suggested that intelligence includes seven such primary mental abilities: verbal comprehension, numerical abilities, spatial relations, perceptual speed, word fluency, memory, and inductive reasoning. For example, tests of vocabulary, verbal analogies, reading comprehension, and a dozen of other tests that rely on language are highly correlated to form a primary mental ability of verbal factor. Researchers have consistently identified group factors like verbal, numerical, spatial, and so on. Each of these group factors can be identified as a specific ability. But they also correlate positively with tests of other group factors, although not as high as with tests of their own group. These findings also suggest for a g-factor in intelligence.

Arthur Jensen (1969) proposed two level theory of intelligence, Level I and Level II intelligence based on genetic variations. The level I intelligence involves associative learning, which consists of short term memory, rote learning, attention and simple associative skills. The level II intelligence involves cognitive learning which consists of abstract thinking, symbolic thought, conceptual learning, and the use of language in problem solving. He argued that level I intelligence is equally distributed across all the racial and national groups, but on the contrary, different national, racial, and cultural groups possess different level II intelligence.

J.P. Guilford (1967) advanced a model of intelligence based on factor analysis. In his 'Structure of Intellect Model', all mental abilities are conceptualized in a three-dimensional framework. In other words, there are three features of intelligent activity: the content or the type of information; the product, or the form in which the information is represented; and the operation, or the type of mental activity performed. The structure-of-intellect model shows that there are five types of contents (visual, auditory, symbolic, semantic, and behavioral), five kinds of operations (cognition, memory, divergent production, convergent production, and evaluation), and six varieties of products (units, classes, relations, systems, transformations, and implications). In other words, there are 150 (5 X 5 X 6) basic intelligent activities relating to various cognitive functions.

Haward Gardener (1983) proposed a somewhat different theory about the structure of intelligence. He believes that we have multiple intelligent skills each relatively independent of the other and not as proposed in the group factor theory of Thurstone. Gardener proposed that we possess seven type of intelligence each relatively independent of the others. The utility and value of each type is culturally nourished and determined. He identifies the following seven intelligence or cognitive abilities.

- Linguistic intelligence which involves skills in the production and use of language. It includes abilities like language fluency, flexibility, comprehension, and to create linguistic images.
- Logical-mathematical intelligence, which is a skill in scientific thinking, abstract reasoning, and problem solving. This refers to one's ability to think logically and critically
- Spatial-intelligence involves abilities of spatial configurations such as those used by artists and architects.
- Musical intelligence involves the ability for the production and creation of music, and music sensibilities.
- Bodily-Kinesthetic intelligence, which involves skills used in the construction of products or display using the whole body or portion of it. Athletes, dancers, actors, sportsmen, and surgeons demonstrate such abilities.
- Interpersonal intelligence includes skills in interacting with people by being sensitive to their moods, temperaments, and motives. This is a skill of understanding oneself and others, and placing oneself in a comfortable relationship with others.
- Intrapersonal intelligence involves skills in knowing and understanding oneself, one's feelings and emotions. It refers to one's sensitiveness to his strengths and weaknesses.

J. B. Carroll (1993) reported the most comprehensive approach to the organization of intelligence in his book "Human Cognitive Abilities'. He conducted factor analysis on 468 correlations that had appeared through

significant researches in intelligence over several decades. His findings proposed a three stratum theory of intelligence, which have three levels of generality.

Stratum I. This stratum consists of around 60 narrowest abilities. These abilities are relatively discrete (do not correlate so highly among themselves) and needed to function in particular context. Examples: (1) General-sequential-reasoning ability, which requires the subject to start from stated premises, rules, or conditions and engage in one or more steps of reasoning to reach a conclusion. (2) Printed-verbal-language ability, which consists of vocabulary knowledge and reading comprehension. (3) Spatial-relation ability, which involves manipulating simple visual patterns by mental rotation, transformation or otherwise.

Stratum II. In the second stratum there are about 12 abilities, which correlate more highly with one another than they do with measures of competency in other stratums. This stratum is formed in two groups: crystallized intelligence and fluid intelligence. Relatively small in number crystallized intelligence applies to contexts or materials previously learned in school or on the job. Reading skills and levels of general information are examples of crystallized intelligence. A good deal of verbal ability requires crystallized intelligence. Fluid intelligence applies to solving problems in different contexts and using different or novel materials. Complex reasoning and mathematical ability involves fluid intelligence.

Stratum III. The third stratum involves some form of general mental ability that correlates the relatively distinct second-stratum abilities, i.e., the common skill that runs along the second stratum abilities.

1.2 The Heredity-Environment Controversy

There is perhaps no issue in the history of science that presents such a complex mingling of conceptual, methodological, psychological, ethical, political, and sociological questions as the controversy over whether intelligence has a substantial genetic component. Public interest in intelligence climbed in the mid-1990s when Herrnstein and Murray (1994) published their book, '*The Bell Curve'*. The book with full of references, statistical analyses, and other earmarks of scholarship, argued that intelligence is important for success, and for prevention of personal and social problems. They argued that intelligence is largely inherited and therefore unalterable. This conclusion, after a century of research and debate on the relative importance of heredity and environment in determining variations among people in intelligence, is really bewildering. It is, therefore, necessary to discuss some relevant issues and research findings over this controversy.

Two kinds of factors determine any human characteristics: heredity (nature) and Environment (nurture). Both are indispensable to human development. The question of which factor is more important is meaningless. It is like asking whether the length or the breadth of a rectangle contributes more to its area. Without heredity factors, no food, air, education, or other environmental elements would produce growth. Without proper environment, heredity factors would also be powerless. Hence the sensible question about this controversy is; what is the relative importance of the variations in each factor in producing variations in a given characteristic?

1.2.1 Relative Importance of heredity and Environment

The degree to which variation in heredity and variation in environment determine variation in human characteristics has major implications for educational policy. This position is based on the assumption that highly heritable characteristics are highly unchangeable. For example, lower SES people tend to have lower intelligence test scores. If these scores are determined by heredity factors, improving the environment through schooling, housing, welfare, family life etc., may not solve the problem of low SES people in gaining equal education, jobs, income, social status, and self-esteem. However, so far as lower intelligence is caused by inferior environment can be addressed by changes in environmental conditions. At least this is the reason for which many social scientists continue to keep the issue alive. The following are some significant approaches with respect to the issue of heredity and environment.

When there are no variations in heredity factors-as is the case with identical twins differences in intelligence result from variations in environmental factors. Similarly if there were no differences in environmental factors (a condition that cannot exist) all variations in intelligence would result from hereditary factors. However, the problem of getting any clear answers here is that heredity and environment usually vary together, making it difficult to separate their effects. People who are genetically related tend to have similar environment. Further evidences suggest that with a group sharing a similar cultural environment, individual differences in intelligence are in good part genetically determined and group differences in intelligence are more a matter of environment. Several studies on the relative importance of heredity and environment categories nine levels of genetic and environmental similarities ranging from least different to most different. Bouchard (1993) presents the most recent updating of the

evidence. The figure shows the median correlation coefficients obtained in several studies for each kind of genetic and environmental similarities. It is clearly observed in the table that correlations tend to decrease as genetic and environmental similarities decrease. At the highest level of genetic-environmental similarity, that of identical twins reared together, the median of 34 correlation coefficients is .86. It is almost as high as the coefficient expected from IQ scores of the same people obtained a few days apart. For identical twins reared apart, the environments differ enough to lower the median correlation to .72. This correlation based on four studies, is so high that many psychologists consider it to be strong evidence of the importance of genetic similarities in determining IQ similarity. As we interpret the two correlations, heredity-environment similarity explains 74% ($.86^2$ X 100) of variations in IQ development, while similar heredity with environment differences account for about 52% ($.72^2$ X 100) of variations in IQ development. The findings point to the larger importance of heredity in IQ development.

Studies that deal with children raised from infancy by adoptive parents also reveal a lot about the relative importance of heredity and environment. These studies are conducted with the assumption that if heredity makes the greater difference, the correlations between the children's and biological parent's IQ scores will be higher. If environment makes the greater difference, the correlations between the children's and adoptive parent's IQ scores will be higher. Figure 2.1 shows that heredity has a greater contribution (parent-offspring reared together, r =.42) than environment (adoptive parents and foster children, r =.24) in the development of IQ.

However, researchers using various complex statistical methods (Chipeur, Rovine, & Plomin, 1990) have concluded that environmental variability contributes about 49% and genetic variability about 51% of the influence on the development of cognitive abilities. On the other hand, Devlin, Daniel, & Roeder (1997) pointed out that in most studies the heredity effect is confounded with the intrauterine environmental effect (mother's nutrition, maternal health, alcohol and drug abuse etc.). By partialling out such effects, they reported the genetic influence to be below 50%. So the evidence does not simply support either complete hereditarianism or complete environmentalism. In short, although the issue is still controversial, the evidence suggests that variations in hereditary factors are about as powerful as variations in environmental factors in producing individual differences in intelligence within a single racial or cultural group.

1.3 Organization of Creativity

Creativity is the capacity of persons to produce compositions, products, or ideas of any sort, which are essentially new or novel. Berk (2002) defined creativity as the ability to produce work that is original but still appropriate and useful. Researchers have studied cognitive processes, personality factors, motivational patterns, and background experiences of creative people to discover the sources of creativity. Tersa Amabile (1996) proposes a four-component model of creativity.

1. Domain relevant skills including talents and competencies that are valuable for working in the domain.

2. Creativity relevant processes including work habits and personality traits.

3. Intrinsic task motivation or deep curiosity and fascination with the task.

4. Social factors of acknowledgement, which means whether or not the environment is ready and willing to accept the contribution

1.3.1 Fostering Creativity among Children

Teachers are in an excellent position to encourage creativity through their acceptance of the unusual and imaginative**.** Following are the guidelines (Sattler, 1992) for teachers to foster creativity among children

Accept and encourage divergent thinking. For example during class discussion, the teacher may ask: "Can anyone suggest a different way of looking at this question?" or the teacher may reinforce attempts at unusual solutions to problems. *Tolerate Dissent*. For example, the teacher may train the students to respect dissenting opinion. The teacher should make sure that nonconforming students receive an equal share of classroom privilege rewards.

Encourage students to trust their judgment. For example, when students ask questions which the teacher feels that they can answer, the teacher should reframe the questions and direct them back to the students.

Emphasize that everyone is capable of creativity in some form. For example, the teacher should avoid describing the feats of great artists or inventors as if they were superhuman accomplishments. The teacher should recognize the creative efforts in each students work.

Be a stimulus for creative thinking. The teacher should use a class brain storming session whenever possible. He should provide model for creative problem solving by suggesting unusual solutions for class problems. The

teacher should encourage the students to delay judging a particular suggestion for solving a problem until all the possibilities have been considered.

Develop a broad and rich knowledge base. The teacher should look into the aptitude of students and suggest them sources to enrich their knowledge in their aptitude area.

Foster independence. Internal locus of control and independence in personality and thinking are some major attributes of creative persons. Teacher should help the growth of independence among children by respecting their individual judgment, and by allowing them to fulfill their responsibilities independently.

Encourage curiosity. Curiosity is the prime mover of creativity. Unless children are curious about their environment they are not likely to engage themselves in creative activities. Curiosity helps them to be motivated for novel ideas and actions. Therefore, the teachers should promote curiosity by providing many and different kinds of stimulations, by never discouraging the children when they involved in solving problems and by rewarding them appropriately when they show enthusiastic interest in some activity.

Sensitivity Training. Teachers should provide opportunity to children to think in different and new ways. For example, the teacher may ask such questions: What sounds can you hear around your house? What forms do you see in the clouds, and so on?

Skill of observation. Observation is a primary skill associated with creativity. To promote the skill of observation, the teacher asks children to keenly observe things and events in their environment and write about them.

Multiple uses. Teacher should train children how to make multiple uses of common things. For example, the teacher may ask the students to write in how many different ways they can use pencil, cup, bulb, news paper, etc. Story writing. Story writing is an important skill for literary creativity. Teacher should encourage the habit of story writing among children by providing them themes, and ideas.

Promoting inventing skills. The teacher may promote inventing skills among children by asking them to make a pen stand, bookmarker, or any other item of daily use.

Classification skill. Classifying objects in many different ways is a required skill for creativity. The teacher may give several objects to the students and ask them to classify the objects in as many different ways as possible.

2. Review of Literature

Flynn (1987) observed massive average gains in IQ of people in 14 nations from one generation to the next. The samples for the study were comprehensively large. The Raven's Progressive Matrices Test, a test relatively free from cultural and educational influences, was used in the study. The men tested were quite mature and so had reached their highest test performance. The evidence for such massive gains in IQ was obtained for people of Belgium, France, Norway, New Zealand, Canada, United States, East Germany, Great Britain, Australia, Japan, West Germany, Switzerland, and Austria. The following figure presents the average gain in IQ across for all the 14 nations from 1920 to1990. Interpretations for IQ gain-Flynn concluded that IQ gains could not have been genetic. No genetic change of such a magnitude could occur in whole populations in a single generation. Flynn claimed that some unidentified environmental variables other than increase in educational level, socioeconomic status, father's occupation, sophistication at taking the test, are responsible for about 15 points of a 20-point gain.

Lynn (1993) argued for a nutritional explanation in IQ gain. He reported that the countries in the studies had poor nutrition during 1930s and 40s. Then living standard improved over the next five decades so that people were able to better food. Height, head size, and brain size improved over the same period about as much as intelligence. Lynn considered the nutritional explanation more plausible than one based on improvement in intellectual stimulation. He argued that (i) intellectual stimulation should have increased verbal intelligence more than nonverbal, but the opposite was true; (ii) the increase in mental and motor development have also occurred among infants, whom cognitive stimulation would not have affected; and (iii) evidence from early education programs indicate that the effects of intellectual stimulation tend to fade away over time.

3. Methodology

3.1 Objectives

- To examine the relationship between WISC-R test performance and teacher's rating of creativity of grade V children.
- To observe whether gender-differences in correlation between creativity and IQ exists among young children.

3.2 Hypotheses

- Intelligence would be highly correlated with creativity.

- Boys would show greater creative potential than girls because of supportive environment in the favor of the former.

3.3 The sample

The sample for the present study consisted of 40 children. 20 boys and 20 girls were randomly selected form 400 grade-V students in seven different schools. All the schools are located in a radius of 10 kilometers of Banpur in the district of Khurda. All the subjects were in age range of 8-10 years and belong to middle-class socio-economic families who have not much problems in meeting the basic necessities of life. All the schools where the study was conducted are standard government schools having adequate number teachers and teaching facilities. The Headmasters and teachers of the schools were requested to cooperate with the investigators.

3.4 The Tests: Two tests were used in the present study. The Coding Form of the Wechsler Intelligence Scale for Children- Revised was used to estimate an approximate IQ of children. Teacher's Rating of Children's Creativity Questionnaire was used to assess children's creativity.

3.4.1 The Coding form: The instrument used in the present study was the Coding subtest of the WISC-R. The coding work sheet- B was used as all the subjects were between 10 to 11 years of age. The top part of the work sheet- B shows 9 symbols for each of the 9 digits from 1 to 9. It is called the 'Key Table'. In this key table, all the 9 digits are written in the top boxes, and the symbols for each of the digits are presented in the corresponding bottom boxes. Just below the key table lies the 'Performance Table' which consists of four rows of boxes. In each row, there are 25 top boxes, and 25 bottom boxes. Digits from 1 to 9 are randomly filled in the top boxes of each row resulting in 100 items. The bottom boxes in all four rows are empty, which are to be filled by the subjects with appropriate symbols. The first seven items are called practice items, which the subjects had to practice before doing the actual test. The investigators were given adequate practice to give appropriate instructions to the subjects. The scoring for the test was done by using the scoring key in the WISC manual.

3.4.2 Teacher's Rating of Children's Creativity Questionnaire: The instrument used in the present study was the 'Teacher's Rating of Children's Creativity, Scale developed by Sattler (1992), which consists of 36 items to tap 12 dimensions of creativity like curiosity, concentration, adaptability, energy, sense of humor, independence, playfulness, nonconformity, risk taking, attraction to complex and mysterious, willingness to daydream, and intolerance to boredom. The children were rated on each item on a 5-point scale. In the present investigation, 12 of those items, which directly address the above dimensions, were used.

3.5 Procedure

With permission from the headmasters of the schools, the investigators collected data from 40 students, and their 5 class teachers. The data were then scored and analyzed using appropriate statistical methods: Correlation and't' test.

4. Results and Discussion

The results were analyzed using SPSS package for statistical analysis. The results of the present study clearly revealed distinct relationship between IQ and creativity in Table-2. In the present study, correlation of creativity with high moderate, and low IQ boys and girls were obtained. It is observed that for both high IQ boys and girls, IQ-creativity correlation is very high. It is higher for boys than for girls. In the moderate range of IQ, the IQ-creativity correlation is high for boys but not for the girls. With respect to low IQ, no significant correlation is obtained between IQ and creativity. The results have been shown by group means and standard deviations and percentage of ratio graphs for both boys and girls.

The findings of the present study are consistent with Berk (2002) that (i) at least moderate-high intelligence is a pre-requisite for creativity; (ii) Creativity is a deep inward involvement of intelligent people, who as a consequence develop as strong intrinsic motivation for problem solving; (iii) Intelligence is a multi-structured phenomenon, having creativity as a dimension and an individual's creative potential can be nurtured; (iii) People with average and sub-average intelligence are not very much likely to be creative; and (iv) Children show creative potential, and exhibit a natural tendency to develop it., which may gradually wean out under least supportive environment.

Although in the review of present literature, high IQ is not considered as essential for creativity, and any creative potential can be nurtured with above average IQ, the finding of the present study may be interpreted that during childhood years high IQ is more relevant to creativity. Creativity potential is not enough goal-directed for young children. They tend to show varieties of creative interests for which they are supposed use their intelligence more often. Gender differences were very clearly observed in present study. The observed gender-differences may be attributed to cultural variations in child rearing practices between boys and girls. In the Indian rural cultural set up, boys are usually more reinforced than girls for demonstration of creative skills. These environmental

influences are very likely to help the boys to become more creative than girls even with similar intelligence. Hence, they are rated as higher in creativity than girls. The present study highlights a smooth positive relationship between creativity and intelligence.

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Tables:

Table 1

Means and SDs for IQ and Teacher's Rating of Student's Creativity for Boys and Girls						
Boys	IQ Range					
	High		Moderate		Low	
	Mean	SD	Mean	SD	Mean	SD
	120.33	5.86	109.31	6.18	86.36	5.23
Creativity Score	47.86	4.18	35.82	4.21	16.45	4.06
Girls	IQ Range					
	High		Moderate		Low	
	Mean	SD	Mean	SD	Mean	SD
	129.55	5.83	105.28	5.16	89.54	5.31
Creativity Score	28.59	3.98	22.25	4.15	12.66	3.34

Table 2

Correlation of creativity with high, moderate, and low IQ boys and girls			
IQ	High	Moderate	Low
Boys	0.81**	0.57*	0.26
Girls	0.55**	0.38	0.24

**p < 0.01 level, *p < 0.05 level