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GENDER, AGE, GRADE AND SOCIO-ECONOMIC STATUS DIFFERENCES ON RAVEN COLOURED PROGRESSIVE MATRICES

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This study was designed to determine the effect of gender, age, grade and social class on the intellectual ability of children aged 6 to 8 years. 102 students of first, second, and third grades with equal number of boys and girls were taken from different schools of Islamabad. The subjects were divided into three socio-economic status (SES) groups i.e., upper, middle, and lower on the basis of monthly family income. The Raven's Coloured Progressive Matrices (RCPM) was used as a measure of intellectual ability. The reliability estimate of RCPM was .81 for the present sample. t-test showed that there was no significant difference between the performance of girls and boys on RCPM. One way analysis of variance indicated that grade and SES had a significant effect, whereas the effect of age on the performance on RCPM was not significant. Children of grade 3 obtained higher RCPM scores than children of grade 1 and 2. RCPM scores of children belonging to the upper SES were higher than that of the middle and the SES.

Within past few decades, there has been an increasing interest in the nature and development of intellectual ability in young children and its relation to various personal, social, and environmental factors. Nevertheless, performance on intelligence tests have some genetic determinants, it undoubtedly has substantial environmental determinants - the environment consists of the family, school, and social milieu in which the person lives (Sternberg & Salter, 1982). Raven (1938) designed the Progressive Matrices to "test...a person's present capacity to form comparisons, reason by analogy, and develop a logical method of thinking". Abstract figural context of Raven test having the highest "g-loading" is considered as the "purest" measures of intelligence (Spearman & Jones, 1950). Carpenter, Just, and Shell (1990) report in their review that Raven's test "consists of the

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construction of representations that are only loosely tied to perceptual inputs and instead are more dependent on high-level interpretation of inputs that provide a generalization over space and time" (p. 428). As Raven's Coloured Progressive Matrices has been found to be a valid measure of nonverbal intelligence for children in the West (Richard, 1984) as well as in Pakistan (e.g., Ansari & Iftikhar, 1984; Zaki & Beg, 1969), it was used in the present study to determine the associative effect of gender, grade, and socio-economic class on the intellectual development of children as measured by Raven's Coloured Progressive Matrices (RCPM).

Previous studies on gender differences in intellectual development (e.g., Jones, Garrison, & Morgan, 1985) suggested that boys and girls do not differ in their general intellectual abilities. However, differences in the specific intellectual abilities of children of both sex were found. For example, Benbow and Stanley (1980) reported that at grades 7 and 8, boys performed better than girls on mathematical reasoning ability test. Similarly, Liben and Golbeck (1980) reported better competence scores for boys than girls on Piagetian spatial tasks. However, no gender differences were found in students of grades 6 to 8 on Raven's Standard Progressive Matrices (Ansari & Iftikhar, 1984; Ismail & Mehmood, 1986).

As regards the intelligence-schooling relationship, several psychometric researchers have found that these variables are related with substantial positive correlation between the number of years of completed schooling and IQ. For example, Ceci and Licker (1986) in a study of racetrack experts found this correlation to be .94. Similarly in the study of monozygotic twins reared apart, this correlation is .96 (Bouchard, 1984). According to Ceci (1991, p.709) "the number of years of school attended determined increase in not only verbal and quantitative tests but also, to a reduced degree, so called figural or fluid tests like Raven Matrices". In a validity study of Raven's Standard Progressive Matrices (SPM) for urban and rural school children in Pakistan, Ansari and Iftikhar (1984) reported that while there is no significant effect of grade on SPM scores in the rural group, a significant effect of grade on SPM scores does appear in the urban group. Mahmood (1991, p. 35) in his recent review explains that schooling "is more than dissemination of cultural knowledge; [it] trains a child to be more reflective and helps the child to think not only in perceptive terms but also develop conceptual formulation. Such training is extremely helpful in taking the IQ tests".

In the Western studies in addition to grade, the effect of age on intelligence has also been taken into account. For example, Cahan and Cohen (1989) found that in a group of fourth, fifth, and sixth graders the effect of schooling was more substantial than that of chronological age. They reported that "...for nine out of the 12 [intelligence] tests, the effect of one year of schooling is larger than the effect of one year of age" (p. 1245).

Intelligence-Socio-economic status (*SES*) relationship has been well documented. Yando, Seitz, and Zigler (1979) in their study on second and third graders, reported extensive differences in intellectual characteristics as a function of social class. Similarly, Blau (1981) found that social class had a stronger effect than any other variable for both Black and White 5 and 6 grade children. Several other studies (e.g., Golden, Birns, Bridger, & Moss, 1973; Jones et al., 1985) also demonstrate that children from low *SES*, as compared to children of upper class, generally perform poorly on measures of intellectual competence and academic achievement. Scarr-Salapatek (1971) theorized that the person with the superior potential has a greater capacity to utilize an enriched environment and would show the greater decrease in IQ under deprived conditions. It is therefore assumed that environmentally disadvantaged child fails to achieve the optimum intellectual development. In this respect, the indigenous research document different findings. Chaudhri (1960) investigated the relationship between *SES* and intelligence in a group of 200 Pakistani children, aged 10 years. He reported that the RSPM did not discriminate between different *SES* levels. In a similar vein, Jamal (1964) compared the RCPM scores obtained by children of low *SES* school and high *SES* school. Half of each school group was taken from a lower grade and the other half from a higher grade of the same school. The findings indicated that significant difference does appear between children of high and low *SES* at the higher grade, but no significant difference was found in the children of lower grade.

The purpose of this study was to investigate the associative effect of gender, grade, age, and social class on the intelligence scores. The study was based on the assumption that children in three age, grade, and social class brackets would perform differentially on the Raven's Coloured Progressive Matrices. The gender differences on the test was, however, not expected.

METHOD

Subjects

The sample consisted of 102 students including 51 boys and 51 girls of first, second, and third grade. 34 students at each grade level was taken from federal government schools of Islamabad. The average age of students of first, second, and third grades was 6, 7, and 8 years, respectively. Subjects were classified into three *SES* groups i.e., lower, middle, and upper class on the basis of their monthly family income. The family income range of lower, middle, and upper *SES* groups was Rs. 2000-4000, Rs. 4500-7000, and Rs. 7500-10,500, respectively. In this way 20 subjects belonged to lower, 45 subjects to middle, and 37 to upper *SES* groups.

Instrument

Raven's Coloured Progressive Matrices (Raven, Court, & Raven, 1977) was used as a measure of intellectual abilities of children. It measures cognitive processes of children under 11 years. RCPM consists of three sets including set A, Ab, and B containing 12 problems in each set. These sets assess whether a child is able to distinguish identical figures from different figures, and similar figures from dissimilar figures and whether he can compare analogous changes in the characters perceived, and adopt this as a method of logical reasoning. Moreover, these sets clearly differentiate between different degrees of intellectual deficiency or impairment. It indicate clearly whether a person is, or not capable of forming comparisons and reasoning by analogy.

Procedure

Before the actual test administration rapport was build up with the children and nature of testing was explained to them to reduce their test anxiety. The subjects were administered the whole test comprising of sets A, Ab, and B, individually according to the standard instructions (Raven, Court, & Raven, 1977). However, the instructions were given in the Urdu language for better understanding of the children. Illustration of the item types was given to the

children, so that the nature of problems to be solved was clearly grasped by them. No time limit was set for the completion of test. The average time taken by the children was 15 minutes. After filling the particulars of the child the RCPM test booklet from the first illustration (A1) was opened to the child. The child was given following instructions:

> Look at this pattern (pointing to the upper figure). See it is pattern with a piece cut out of it. Each of these pieces (pointing to the bottom figures each in turn) is the right shape to fit the space, but only one of them is the correct pattern. No. 1 is the right shape but not the right pattern, No. 2 is not the pattern at all, No. 3 is quite wrong, No. 6 is nearly right but wrong here, (pointing to the white space) Only one is right (pointing to the right piece). In this way the child is explained to point to the right answer. Similarly, other problems (A2-A12) are presented to the child and he is a given the same instructions and is asked to point out the right answer". Same instructions are given for sets Ab, B.

However, those children who were able to fill the answer sheets themselves were allowed to do so, other wise the responses given by the child were filled in the answer sheets by the examiners. RCPM was scored by hand scoring keys. Number of correct responses given by the subjects constituted the total score on the test. Demographic information sheet requesting to record the monthly family income and exact age of children was filled by their respective parents. The age (in years) of children was also verified from the school record registers.

RESULTS

Kuder-Richardson formula 20 was used to determine the internal consistency of the test for the present sample. The reliability estimate of .81 was obtained, which indicates that RCPM is a reliable measure for the total sample. The *t*-test for independent groups was applied to determine the gender differences on RCPM. Means and standard deviations of RCPM scores of different grade, age, and *SES* groups were calculated. Moreover, seperate one way analyses of variance were carried out to examine the differences of grade, age, and *SES* on RCPM scores of the sample.

Table 1

Means and standard deviations and t-values of RCPM scores of boys and girls

Gender	*n*	*Mean*	*S.D*	*t*	*p*
Boys	51	25.22	4.87	1.28	.203
Girls	51	26.51	5.31		

$df = 100$, $^{*}p < .05$

Gender differences on RCPM scores, $t(100) = 1.28$, at $p < .203$, were not found significant (table 1).

Table 2

Means and standard deviations of RCPM scores for the variables of grade, age, and SES

Groups	*n*	*Mean*	*S.D*
Grade			
1	34	24.24	5.38
2	34	25.47	4.69
3	34	27.88	4.68
Social Class			
Lower	20	23.45	4.83
Middle	45	25.42	5.18
Upper	37	27.70	4.62
Age in years			
6	35	24.31	5.37
7	39	26.41	5.38
8	28	27.01	3.97

Means and standard deviations of the RCPM score across grade, age, and SES groups indicate mean score differences among these groups (table 2). These differences were analyzed by applying one way analysis of variance.

Table 3

Effect of age, grade, and SES on RCPM scores

Source of Variance	*SS*	*df*	*MS*	*F*	*p*
Age					
Group	134.135	2	67.08		
				2.647	.076
Residial	2507.9430	99	25.33		
Total	2642.078	101			
Grade					
Group	233.961	2	116.980		
				4.81	.01**
Residial	2408.118	99	24.324		
Total	2642.078	101			
Social Class					
Group	250.421	2	125.210		
				5.18	.007**
Residial	2391.658	99	24.158		
Total	2642.078	101			

*$p < .05$, **$p < .01$

Table 3 is a summary table of the one way analysis of variance of RCPM scores of subjects on age, grade, and SES. The findings indicate that the effect of grade is significant, $F(2, 99) = 4.81$, $p < .01$ and social class, $F(2, 99) = 5.18$, $p < .007$, also have a significant effect on the performance of children on RCPM. The intelligence scores of children, however, remained unaffected by different age brackets, $F(2, 99) = 2.647$, $p < .076$. As the reported age of children in majority cases could not be verified in terms of months, therefore to overcome the age overlaps in the three age brackets the performance of the lower age group of 6 years old children was

compared with that of upper age group of 8 years old children. *t*-test indicated that 8 years old children performed significantly better on the RCPM than 6 years old children, $t(61) = 2.24$, at $p < .02$.

DISCUSSION

The hypotheses of the study regarding the variables of gender, grade, and *SES* were supported by our data. However, the assumption regarding age was partially supported. More specifically, the findings indicate that RCPM scores are gender neutral, however, these scores vary with the variation in the levels of socio-economic status as well as the grades. The findings of gender and RCPM scores suggest that the performance of boys was not significantly different from that of the girls, which is consistent with previous findings (e.g., Aiken, 1982; Halpern, 1986). It may be inferred that the quality of stimulation and feedback which fosters the development of mental abilities such as to educe relationships and analogical reasoning, is more or less similar for the both sexes. In addition the stimulating potential of the rearing environment including reinforcement of the problem solving behaviour, encouragement, and sex typing by parents and teachers may not be different for the children of age included in the present study.

The present data indicate that the effect of three age groups on RCPM scores was not significant. However, the significant difference was found between the scores of two extreme groups as 8 years old children performed better than that of 6 years old. One can argue that the better scores of older children may be due to the confounding effect of schooling experience. As the exact age of children was not available and this assumption could not be confirmed, therefore these findings need to be interpreted with caution.

The results regarding the grade indicate that the higher grade children perform better than the lower grade children. Our findings do not support the stance of Raven, Court, and Raven (1975), and Horn (1978) who argued that fluid intelligence is acquired independently of schooling. The increase in mean test score following the increase in educational level may be accounted for by the similarity between test and learning experience involved in schooling in terms of content and underlying cognitive abilities and perceptual skills. As school

education involves an indirect training of intellectual skills and facilitates the individual's ability to analyze complex concepts and building their cognitive structure, therefore, intellectual abilities in children are likely to progress with educational experience. In other words, schooling appears to facilitate several perceptual skills (e.g., mental rotation, same-different judgements, visual-spatial reasoning, figure-ground discrimination), and conceptual skills (e.g., rule learning, free association, analogical reasoning, multiple classification) that is required for successful performance on IQ tests. In addition, schooling experience also prepare students with attitudes and values (e.g., to attend to testing environment, to monitor and time their responses, and intrinsic motivation) that may foster standardized test performance. However, one can not dismiss the possibility of the confounding effect of maturation (chronological age) on better performance of higher grade children.

As regard the social class, findings of the present study indicate that the upper *SES* children perform better than the lower *SES* children on RCPM. The differences in cultural and learning experiences provided for children from different socio-economic classes may account for these differences. It may be argued that upper *SES* children's environment contain more stimulating items (e.g., radios, televisions, videos, computers, books, toys, etc.,) as compared to the environment of lower *SES* children. These environmental stimulation enhance the development of cognitive skills which inturn contribute to the performance on intellectual tests. In general, that children from different social classes may vary in their learning experiences, learning styles, learning attitudes, as a result of the socialization provided in their homes.

These findings explain the role of learning and environment which can not be neglected in the intellectual growth of children. Based on the present findings it may be suggested that such programs may be conducted in the schools that should focus on compensating for lack of cognitive stimulation to the children growing in economically depressed environment. This early enrichment program may in turn permit the children to develop their cognitive potentials and thinking skills to profit from school experiences in a better way. For future research it is suggested to extend this study on a larger sample and to include children of higher grades also to test how far the generalizability of the findings can be extended.

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