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Short Note

Differential abilities and academic achievements of the adolescents

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Abstract

The study was conducted in eight schools of Hisar district of Haryana state. From one school 10 boy and 10 girl students were selected from each educational stream using proportionate random sampling method. Hence for each school 40 boys and 40 girls, 10 each from medical, non medical, art and commerce streams were selected. Finally from all the eight selected schools, there were 320 boys and 320 adolescent girls equally representing medical, non-medical, arts and commerce stream. Total sample size comprised of 640 adolescents. For this investigation, David's Battery of Differential Abilities (1994) was used to assess differential abilities of the adolescents. The study revealed that the higher percentage of adolescents in all the abilities were in average category which depicted a normal distribution. Surprisingly the numerical ability results concluded that nearly 50 per cent sample was in low numerical ability category. Results indicated that differential abilities significantly influenced academic performance of adolescents from various streams.

Key words: Differential abilities, parenting style, parental encouragement, educational aspiration, parental support and school environment.

In today's world of cut throat competition, academic performance of the students influences their future life. In modern Indian system of education, 10th, 11th and 12th grades have become crucial from career point of view. The academic achievement at this level is of vital importance. The decisions taken as well as the efforts made in academics during this period determine the direction of his life. Thus to be successful in life, proper course selection is necessary for academic achievement. Selection of the educational stream as per their abilities will enhance academic performance. Many of us are unaware of our own natural gifts, trying to excel in educational field /careers that just don't fit to our aptitude.

Educational researchers all over the world are seeking a breakthrough in elucidating the phenomenon of differential abilities. For the most part, students are viewed as a blank slate, able to "learn" all subjects, and expected to put in "hard" work if they're struggling. Yet, we all know that working hard doesn't always add up to better performance. In fact, it's often apparent that people who excel don't struggle much. They are "naturals" in specific subjects. Since most schools (and parents) do not understand inborn ability, they usually don't make clear distinctions between someone being generally "smart" and someone who is natural in specific areas. As a result, most young people are encouraged to specialize in educational fields and professions that don't fit their strongest inborn ability. Students must use their strongest talents and abilities, while minimizing the use of their weakest talents. Many of us are unaware of our own natural gifts, trying to excel in education field /careers that just don't fit .Every occupation, whether it is engineering, medicine, law or management uses certain aptitudes. The work you are most likely to enjoy and be successful in it is work that uses your aptitudes. For example, if you are an engineer but possesses aptitude not used in engineering, your work might seem unrewarding. If you lack the engineer's aptitudes, your work may be difficult or unpleasant. Marjoribanks (2002) concluded that educational aspiration is the

impression formed about academic abilities and highest level of education an individual would like to attain (Furlong and Cartmel, 1995) and educational attainment are the bedrock of career development and choice.

Every occupation, whether it is engineering, medicine, law or management uses certain specific ability. Each subject of study requires some set of differential abilities. Thus it is important for parents and teachers to guide adolescents in selecting right field of study. After Matriculation, students are always seen confused which line of study they choose. Usually parental pressure and peer decisions influence their selection of stream but later they realize that they are in wrong field of study, when their performance goes down. Some researchers differ in their view of differential abilities and consider other factors such as parental involvement and support, motivation, aspiration, parental encouragement and many more factors helpful in promoting success in academics. One of the most important unresolved questions in education is how to enhance the academic performance of children, adolescents and college students. Two explanations for unsatisfactory academic performance come to mind: wrong selection of educational field and lack of stimulation. Therefore, ability alone is not important factor for academic achievement. The results of the study will provide basis for guiding the students and parents after matriculation in selection of stream and after higher secondary in selecting professional line of study. Further the results will help parents in controlling responsible factors, and hence improving the academic achievement of their wards and reducing the stress on adolescents after matriculation. Thus, to understand the construct of achievement, present study was planned to study the differential abilities of adolescents and to find out the effect of differential abilities on adolescent's academic achievement.

The present study was conducted purposively in Hisar city of Haryana due to easy accessibility of the adolescent students from different educational streams. Also the study required follow up of the adolescent for a long duration. Eight schools were selected purposively admitting boys and girls in 12th class with different streams like medical, non medical, art and commerce. From one school 10 boy and 10 girl students were selected from each stream using proportionate random sampling method. Hence from each school 40 boys and 40 girls, 10 each from medical, non medical, art and commerce were selected. Finally from all the eight selected schools, there were 320 boys and 320 adolescent girls equally representing medical, non-medical, arts and commerce streams. Total sample size was 640 adolescents. Academic achievement in terms of percentage of marks in the 12th class board examination was considered as dependent variable. Several tools were used and developed for the present study. David's Battery of Differential Ability (Kapoor, 1994) was used to assess differential abilities of the adolescents.

Differential abilities of adolescents

Differential abilities are actual power of the adolescents to perform whether or not attained by training or education to perform. Eight differential abilities viz. Clerical, Closure, Mechanical, Numerical, Spatial, Psychomotor, Reasoning and Verbal were studied and results are presented in this section.

Closure ability is perceptual ability. It refers to ability to see quickly a whole stimulus when parts of it are missing. Predictor occupation for closure ability include those involving speedy visual perception, office work, computer programming, art painting and designing as given by Kapoor (1994). Regarding closure ability data revealed that out of the total sample, 38.59 per cent students were having average closure ability followed by low and high (31.25% and 30.16% respectively).

Clerical ability is a perceptual activity primarily concerned with making rapid evaluations of features of visual stimuli. Reasoning ability expected to be relevant for success in occupation involving assembly line of work drafting, clerical jobs, medical profession, lawyer, areas that stress logic, engineering, economist, computer programme, science related field etc. The table 1 highlights that out of the total sample, highest (39.84%) per cent of adolescents possessed average

clerical ability, followed by high (33.91%) and low (26.25%).

Mechanical ability is concerned to understanding of basic mechanical principles, simple machines tools and automotive tasks. The predictor occupation for this ability is those related to physical science field, electronic tasks, carpentry, engineering, architecture, builder etc. Table 1 indicates highest percentage (42.5%) of total adolescent sample possessed average mechanical ability followed by high (29.68%) and low levels (27.81%).

Numerical ability refers to facility in manipulating numbers quickly and accurately in task involving subtraction, addition, multiplication, division, squaring and dealing with fractions etc. The predictor occupations for this ability are those related to computational tasks, clerical, accounting, engineering, technological etc. Data revealed that for total sample, 35.31 per cent were having low numerical ability followed by average (34.84%) and high (29.84%). This shows that selected population had low numerical ability.

Table 1. Distribution of adolescents for differential abilities

n=640

Sr. No	Differential abilities	Categories	Frequency	Percentage
1.	Closure ability	Low	200	31.25
		Average	247	38.59
		High	193	30.16
2.	Clerical ability	Low	168	26.25
		Average	255	39.84
		High	217	33.91
3.	Mechanical ability	Low	178	27.81
		Average	272	42.50
		High	190	29.68
4.	Numerical ability	Low	226	35.31
		Average	223	34.84
		High	191	29.84
5.	Psychomotor ability	Low	196	30.62
		Average	267	41.72
		High	177	27.66
6.	Reasoning ability	Low	158	24.69
		Average	192	30.00
		High	290	45.31
7.	Spatial ability	Low	177	27.66
		Average	243	37.97
		High	220	34.38
8.	Verbal ability	Low	148	23.12
		Average	226	35.31
		High	266	41.56

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Psychomotor ability here refers to precise movement requiring eye-hand coordination under highly speedy conditions. The predictor occupations for this ability are those related to physical science field, electronic tasks, carpentry, engineering, architecture, builder etc. It is apparent from the table 1 that out of total sample, maximum (41.72%) percentage of adolescents possessed average psychomotor ability followed by low (30.62%) and high (27.66%). This shows that large percentage of sample had adolescents with average psychomotor ability.

Reasoning ability refers to the ability to apply the process of induction or to reason from some specific information to a general principle. Reasoning ability is expected to be relevant for success in occupations involving assembly line of work, drafting, clerical jobs, medical profession, lawyer's areas that stress logic, engineering, economics, computer programming and science related fields etc. Data unfold that out of total sample 45.3 per cent of adolescents possessed high reasoning ability followed by 30 per cent possessing average and 24.69 per cent having low reasoning ability. It is clear from the results that maximum percentage of adolescents possessed high reasoning ability.

Spatial ability is concerned with perceiving spatial pattern accurately and following the orientation of figures when their position in a plane or space is altered. Predictor occupations for spatial ability are those involving figural material such as those dealing with shop work, architecture, building construction, engineering, commercial art, dress designing, die-making, decoration, aviation etc. Results revealed that out of total sample 37.97 per cent possessed average spatial ability followed by high (34.38%) and low (27.66%).This shows that the present population had adolescents with average spatial ability.

Verbal ability is concerned with the comprehension of words and ideas, or a person's ability to understand written language. Predictor occupations for verbal ability are those involving reading and writing of reports, management tasks, mass communication, translator, marketing/business etc. It is obvious from the table that out of total sample 41.56 per cent possessed high verbal ability followed by 35.31 per cent, average and 23.12 per cent were possessing low verbal ability. Thus we can say that maximum percentage of adolescents in the population possessed high verbal ability.

From the results of table 1, a very clear result regarding distribution of adolescents for differential abilities has emerged. As per law of nature the higher percentage of adolescents for all the abilities was in average category which depicts a normal distribution, further near about 40 per cent adolescents were in average category of clerical, closure, mechanical, psychomotor and spatial ability. The results agree with those of Treena and Lee (2007). The reason which can be thought of is that the sample was from a moderate income group class and majority of them were having one sibling and nuclear family. The parents were educated to high standard, so they provided all the opportunities and facilities to children from the very beginning in terms of toys, electronic media. Parent's guidance and support to develop different skills was provided from the early years, which enhanced their different skill acquisition.

Further the results of the above section highlighted that reasoning and verbal abilities were comparatively high in the selected sample. The base for these two abilities is again in the parenting style where full freedom is provided to child for interaction and parents provide literature, puzzles, vocabulary material, and books since nursery school age. Thus emphasis is being laid by the parents on enhancing different skills in the world of competition. The communication skills contribute to greater extent in their success at later life. The data of present study regarding parental support and encouragement show that the majority of the parents provide high support and encouragement. The results get support form the result of Robert (2003) who showed that child's verbal ability test score was positively associated with the family's resources, parental educational level, parents own ability and income. Smith *et al.* (1997) also showed strong association between parental educational level

and children's ability. Webb *et al.* (2007) pointed out that openness of parents was strongest predictor of SAT (Scholastic Aptitude Test) verbal scores.

Surprisingly the numerical ability results concluded that nearly 50 per cent population was in low numerical ability category. These results need to be taken seriously as in ancient times Indians were known for their mathematical skills and numerical ability. This means that ancient method of teaching was the best and change in the method had led to adverse effects. Nowadays from the very early schooling child start using calculators and computer and other medium for solving their mathematical problems. Results get support from Priyadarshini (2008) who in a study of World Bank economists tested 14 year old students in Rajasthan and Orissa to find either they were very good or very bad in mathematics. Close to 17 million Indian students did not meet the lowest international benchmark of basic mathematical knowledge. This puts average Indian students among the worst scorer in subject of mathematics.

Comparison of differential abilities by sex

Differential abilities were compared using Z-test. Mean differences and 'Z' values for male and female for differential abilities are presented in table 2. Results presented in this table show that there were non significant differences in male and female for closure, clerical, psychomotor and verbal abilities. Table 2 further indicates significant differences in male and female for mechanical, numerical and spatial ability (Z=12.90, Z=13.01 and Z=14.46 P<0.05 respectively).

This means that closure, clerical, psychomotor and verbal abilities were same in both sexes. Whereas for mechanical, numerical and spatial abilities the sex made a dent as both groups differed significantly. On the basis of mean values males had higher mechanical, numerical and spatial abilities, whereas females were higher on closure, clerical, psychomotor, reasoning and verbal abilities.

The results get support from Robinson *et al.* (1996) who found that boys scored higher on 8 of 11 quantitative measures and spatial measure. Owen and Lynn (1993) reported sex differences; males obtained significantly higher means on spatial and mechanical aptitude.

Differential abilities and academic performance

Table 3 unveils the correlation of differential abilities with academic achievements of adolescents in 10^{th}, 11^{th} and 12^{th} class. Results indicate that academic achievement of adolescents in 10^{th} and 11^{th} classes had highly significant correlation with closure, clerical, mechanical, numerical, reasoning, spatial and

Table 2. Comparison of differential abilities by sex

Sr. No.	Differential abilities \ Sex	Male	Female	Z-value
1	Closure ability	9.83±4.26	10.21±4.47	1.08
2	Clerical ability	38.70±18.26	39.45±17.96	0.52
3	Mechanical ability	20.46±16.93	10.99±5.75	12.90*
4	Numerical ability	26.37±17.23	9.88±6.39	13.01*
5	Psychomotor ability	29.73±18.31	31.84±19.18	2.46
6	Reasoning ability	6.57±3.08	6.89±2.97	1.30
7	Spatial ability	46.22±19.42	32.97±17.62	14.46*
8	Verbal ability	13.51±6.36	13.85±6.32	0.68

*Significant at P<0.05
**Significant at P<0.01

Table 3. Correlation between differential abilities and academic achievement n=640

Sr. No.	Academic achievement / Differential Abilities	10th class	11th class	12th class
1.	Closure ability	0.43**	0.43**	0.46**
2.	Clerical ability	0.39**	0.42**	0.41**
3.	Mechanical ability	0.35**	0.35**	0.35**
4.	Numerical ability	0.26**	0.21**	0.21**
5.	Psychomotor ability	0.01	0.03	0.13*
6.	Reasoning ability	0.62**	0.60**	0.61**
7.	Spatial ability	0.45**	0.45**	0.45**
8.	Verbal ability	0.70**	0.65**	0.67**

** Significant at p<0.01
*Significant at p<0.05

verbal abilities (r=0.43, 0.39, 0.35, 0.26, 0.62, 0.45 and 0.70 respectively, p<0.01) except psychomotor ability.

Regarding 12th class academic performance, all differential abilities had significant correlation. It is interpreted that as the differential abilities increase the performance of students in their academic also increases.

From the results presented in this section (Table 3) it is concluded that the differential abilities significantly influence academic performance of adolescents from various streams. The results get support from the previous research by Peter *et al.* (2008) who conducted three year longitudinal study and found that cognitive abilities predicted higher grades and revealed significant path from cognitive abilities to academic performance. More recently Aavo and Kersti (2008) also proved the value of ability testing in predicting college performance. Similar findings reported by Hunter (1991) found that cognitive abilities and academic performance are interrelated and various combinations of abilities are employed by a person to complete specific task.

Further it can also be concluded from the results of the above presented table 3 that to be successful in medical stream the adolescent requires closure, numerical, psychomotor, reasoning and verbal abilities. Whereas, to score high in non-medical stream, the students should possess mechanical and clerical ability in addition to all other abilities required to be successful in medical side. The results are in line with prediction made by (Kapoor, 1994) David's Battery of Differential Abilities (DBDA) Test which says that students possessing all these abilities perform better in profession related to science field, engineering, computer programmer, lawyer, clerical jobs and accounting.

The abilities which lead to higher performance in arts students were clerical, psychomotor, reasoning, spatial and verbal abilities because subject related to arts require more expression of justification. The results related to commerce students concluded that these students possessed closure, psychomotor, verbal, clerical, numerical and reasoning abilities to have success in their academics.

From the results of the study it can be concluded that majority of the population had all abilities in average category which depicts a normal distribution. Results further showed that these abilities in specific stream enhance their academic performance.

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