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Achievement and Higher Order Learning

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Abstract

The main purpose of the present study was to investigate, whether the streams of subjects could predict abstract and rote learning. The sample used for the study consisted of randomly selected 40 students of +1 class of different schools of Haryana were tested on verbal and non-verbal lab tasks with their scores on different subjects. The results showed that verbal and non-verbal subjects predicted that verbal subjects in academic streams have predicted verbal lab task better and non-verbal subjects tapped non-verbal lab task better. The main rationale is based on the assumption (elsewhere discussed) that if verbal and non-verbal tests of intelligence and creativity predicted achievement separately for academic achievement then even streams could also predicted learning Powers of the students.

Keywords: Problem solving and Academic achievement.

Introduction

Achievement in education implies one's knowledge, understanding and skills in a specified subject or group of subjects (Sharma, 2011). It may also be viewed as the progress made by students after a particular period of training imparted by their teachers in the school (Bandura Barbaranelli, Coprora & Postorelli, 1996; Anastasia, Maria, Georgia & Grigoris, 1998). Thus, we may define achievement as the performance of the students in the classroom situation also which determines the extent to which the instructional objectives have been attained, so, it may be referred to as the knowledge attained and skills developed among students during their academic career in the subjects which are assessed by the school authorities with the help of teacher made or standardized tests (Tackett & Eckenrode, 1997 and Choudhary & Basu, 1998).

Academic achievement is the specified level of attainment of proficiency in academic work as evaluated by teachers, standardized test or by a combination of both (Ashman & George, 1982).Those who attain specific proficiency in achievement also should have mastery in attaining in certain real life situation like higher order learning and problem solving. It has been reported in the previous investigation that a positive and significant relationship of academic achievement with intelligence and creativity viz a viz achievement is far from satisfactory because when we try to predict through one test then different subjects add up to the total and hence the picture becomes clouded. If we use different tests of intelligence and creative thinking for different sets of subjects then the haziness could be removed and has been removed to the certain extent on the lines of recommendation of Sharma, 2008, 2010.The different types of intelligence and creativity tests (Non-verbal and Verbal) predict different types of abilities in academic streams. Non-verbal test (intelligence and creativity) predict non-verbal subjects i.e. mathematics and science subjects better (Carpenter, 1990; Pind, Eyrun, Gunnardottir, & Johannesson, 2003; Laidra, Pullmann & Allik, 2007; Chetna and Singh, 2010; Sharma, 2010). Non-verbal test pertaining to logical and abstract reasoning involves the streams such as Science and Mathematics. Verbal tests of intelligence and creativity tapped languages and social sciences subjects better (Kaur, 1983; Kailes, 1985; Rani, 1997; Cheung, Rudovicz, Yue & Anna, 2003; Sharma, 2010).Verbal test are highly loaded with verbal material as it is verbal educational in nature(V:Ed) and hence shows the maximum correlation with languages and social science subjects as these subjects call for more verbal abilities. It has been discussed elsewhere (Sharma, 2008, 2010) that intelligence, creativity and academic achievement are the stable determinants of academic achievement. Further, intelligence, learning, problem solving and performance are again intimately related (Malhotra, Chaudhary & Jerath, 1993).On the basis of above, the deduction may be allowed to permitted from the above that even achievement could be a good predictor of higher order learning. With this contention the present effort has been designed to see whether the verbal and non-verbal achievement subjects could predict abstract and rote learning.

METHOD

Design: A correlational analysis technique has been used to find out the relationship of academic subjects with verbal and non-verbal lab tasks and multiple regression analysis has also been computed to find out the variance explained by academic subjects (Verbal and Non-verbal) in lab tasks (Verbal and Non-verbal) in randomly selected sample of 40 subjects of +1 class from different schools of Haryana.

Measures:

In the present investigation the following verbal and non-verbal tasks have been used.

Non-verbal Lab Tasks:

(i) The problem solving squares (Bhatia, 1955): The problem consists of a big square made of 29 broken lines making a small squares in all. Each square on the corners is divided by a diagonal broken lines and the central one too. The subject is supposed to trace all the lines without lifting the pen and retracing any line.

(ii) Concept Formation (Hanfmann, 1937): The test consists of 22 wooden blocks. The blocks are of five different colours, six different shapes, two different heights (tall and flat) and two different sizes (large and small). They are packed in a wooden box in the appropriate places. Then the subject has to shuffle them for mixing the varied categories and then arrange them roughly into a circle on a table. This test is intended to test whether the subject is able to abstract on seeing many types of material and able to classify from taking into account the common characteristics found in the objects.

(iii) Nine-Dot Problem (Maier, 1930): The nine dot problem requires that nine dots arranged in a square to be connected by four straight lines drawn without lifting the pen from the paper and without retracing lines.

Verbal Lab tasks

(i) Anagram Problem Solving (adapted version of Dominowski, 1966 used by Sehgal in 1990 and Kapila in 1992): An anagram consists of several letters which are jumbled up and the subject must rearrange them to form a meaningful word. Anagram structure is the most commonly and frequently used task in research on problem solving. Several attempts have been made to account for the difficulty of anagrams in terms of their structural properties. In the problem solving task subjects had to rearrange the given 15 anagrams in the questionnaire with the time limit of ten minutes.

(ii) Nonsense Syllables (serial learning) by Gamble, 1909, 1927; Malhotra,1979: Nonsense syllables are formed by putting a vowel between two consonants. A list of 15 nonsense syllables was made. The syllables were arranged and written down in series and the subjects were asked to memorize the list in the same order as it appeared in the series. This type of learning is called the serial learning. This list was shown through the memory drum apparatus.

(iii) Discrete Controlled Association (Word Association Test) (Cattell and Bryant, 1889) The subject will be provided with 10 stimulus words visually. The subject will have to respond orally to all the stimulus words by giving the opposite stimulus word.

Academic achievement:

The marks secured by the students in different subjects in the class 10^{th} annual examination were used as the measure of academic achievement.

RESULTS

In this study academic achievement scores were used as predictors of lab tasks. In the first phase, correlations between academic achievement in different lab tasks were computed separately for randomly selected sample (boys and girls) and presented in inter-correlational matrix in Table I. The inter-correlational matrix shows that the magnitudes of correlation of non-verbal subjects are higher with non-verbal lab tasks and verbal subjects are higher with verbal lab tasks.

In the second phase, multiple regression analysis was computed to find out the predictors of the

non-verbal and verbal lab tasks scores on academic achievement. The regression analysis has shown that as predicted and expected,non-verbal subjects shown its higher variance in explaining non-verbal lab tasks and verbal subjects have contributed its variance in verbal lab tasks.

DISCUSSION

In the present investigation the results have depicted that mathematics has turned to be the better correlate of non-verbal lab task. Mathematics has accounted for 14% of variance in Concept Formation Trials ($r = .36$, $\beta = .37$, R^2 change = .14), 13% of variance in Problem Solving Time ($r = .37$, $\beta = .36$, R^2 change = .13), 11% of variance in Concept Formation Time ($r = .39$, $\beta = .34$, R^2 change = .11) 10% of variance in Problem Solving Trials ($r = .50$, $\beta = .34$, R^2 change = .10), and 2% of variance in Nine Dot Trials($r = .58$, $\beta = .31$, R^2 change = .02)(See Table I and II).
In the same vein, science has explained 34% of variance in Problem Solving Square Trials ($r = .57$, $\beta = .57$, R^2 change = .34), 29% of variance in Nine Dot Trials ($r = .54$, $\beta = .54$, R^2 change = .29), 20% of Variance in Concept Formation Trials ($r = .45$, $\beta = .45$, R^2 change =.20) and 11% of variance in Concept Formation time ($r = .33$, $\beta = .33$, R^2 change = .11) (See Table I and II) .
Similarly, Mathematics and Science has also explained its variance in predicting verbal lab tasks (anagrams, nonsense syllables and discrete controlled association), but not as much as they have tapped in non-verbal lab tasks.
On the other hand, English has explained more variance in verbal lab tasks i.e., 20% of variance in Anagrams Right Responses ($r = .44$, $\beta = .44$, R^2 change = .20), 20% of Variance in Anagram Time ($r = .44$, $\beta = .44$, R^2 change =20 .) and 15% of variance in Nonsense Syllable Trials ($r = .37$, $\beta = .37$, R^2 change = .15) (See Table I and II).
Hindi has shown highest variance of 55% in verbal lab tasks i.e., 20% of variance in Anagrams Right Responses ($r = .43$, $\beta = .45$, R^2 change = .20), 20% of Variance in Discrete Controlled Association ($r = .43$, $\beta = .43$, R^2 change = .20) and 16% of variance in Anagrams Time ($r = .40$, $\beta = .43$, R^2 change = .16) (See Table I and II).

Social science has shown positive and significant relationship with Anagrams Right Responses and Time ($r = .63$, $p < .01$, $r = .54$, $p < .01$), Nonsense Syllables Time and Trials ($r = .50$, $p < .01$, $r = .57$, $p < .01$), Discrete Controlled Association ($r = .58$, $p < .01$) (See Table I). But in regression analysis it has failed to reach the level of significance.
Sanskrit contributed 8% of variance in nonsense syllables trials($r = .58$, $\beta = .31$, R^2 change = .08) (See Table I and II).
Languages and Social science have also predicted nonverbal lab task (problem solving square, nine dot and concept formation) but not as higher as they have predicted verbal lab tasks.
The results of the present investigation very well show that verbal and non-verbal subjects can predict problem solving task separately. Verbal subjects have predicted verbal lab task better and non-verbal subjects tapped non-verbal lab tasks better. Hence, the circle is complete, in the sense that, the predictors of achievement and further achievement can predict lab tasks in terms of its verbal and non-verbal content.

Table I
Intercorrelational Matrix for Academic Subjects and Lab Tasks (Verbal and Non-verbal) (N = 40)

Variables		Math	Eng	Sci	Hindi	Soc. Sci.	Sansk	P.S Time	P.S Trials	ND Time	ND Trials	CF Time	CF Trials	Ana. R.R.	Ana Time	Non Syllable Time	Non syllable Trials	D
(a) A.S.	Math	X	.44**	.68**	.43**	.46**	.38*	.37*	.50**	.54**	.58**	.39**	.36*	.32*	.39**	.02	.35*	.17
	English		X	.49**	.65**	.59**	.42**	.20	.26	.12	.22	.13	.34*	.44**	.44**	.47**	.37*	.63*
	Science			X	.42**	39**	.35*	.48**	.57**	.65**	.54**	.33*	.45**	.40**	.32*	.04	.21	.35*
	Hindi				X	.57**	.64**	.05	.39**	.12	.31*	.27	.20	.43**	.40**	.54**	.44**	.43**
	Social Science					X	.74**	.08	.32**	.12	.40**	.31*	.39**	.63**	.54**	.50**	.57**	.58**
	Sanskrit						X	.13	.36*	.04	.38*	.04	.21	.38*	.58**	.58**	.58**	.44**
(b) N.V. L.T	P.S. Time							X	.51**	.36*	.38*	.47**	.40**	.05	.16	.16	.27	.07
	P.S. Trials								X	.30*	.60**	.46**	.61**	.29	.46**	.24	.14	.24
	ND Time									X	.55**	.63**	.60**	.28	.29	.06	.26	.26
	ND Trials										X	.39**	.68**	.26	.51**	.20	.15	.13
	CF Time											X	.59**	.28	.21	.17	.13	.32
	CF Trials												X	.18	.38*	.19	.07	.18
(c) V.L. T.	Anagram Response													X	.79**	.40**	.56**	.48
	Anagram Time														X	.44**	.37*	.55**
	Non syllable Time															X	.68**	.63**
	Non syllable Trials																X	.68**
	DC Association T.T.																	X

*p < .05; **p < .01

Table II
Regression of different variables in terms of their importance in different Academic Subjects in Randomly Selected Sample (N = 40)
Stepwise Regression Analysis: Predictors of Lab Tasks

(a) Problem Solving Square (Time)								
Variables	**Order of Entry**	**r**	**Regression coefficient**	**Beta weight** (β)	**t**	**R^2**	**R^2 Change**	**F**
Mathematics	1	.37	.51	.36	2.36	.13	.13	5.57*
(b) Problem Solving square (Trials) non-verbal lab tasks								
Science	1	.57	4.271E	.57	4.30	.34	.34	18.49**
Mathematics	2	.50	2.220E	.34	2.67	.44	.10	7.14*
(c) Nine dot (Trails) non-verbal lab tasks								
Science	1	.54	4.013E	.54	3.91	.29	.29	15.29**
Mathematics	2	.58	2.080E	.31	2.37	.31	.02	5.62*
(d) Concept formation (Time) nonverbal lab tasks								
Science	1	.33	.72	.33	3.19	.11	.11	10.18**
Mathematics	2	.39	.46	.34	2.30	.22	.11	5.29*
(e) Concept formation(Trials)nonverbal lab task								
Science	1	.45	3.942E	.45	3.11	.20	.20	9.67**
Mathematics	2	.36	2.299E	.37	2.74	.34	.14	7.51**
(f) Anagram (Right response) verbal lab task								
English	1	.44	6.055E	.44	3.49	.20	.20	12.38**
Hindi	2	.43	5.493E	.45	3.06	.40	.20	9.36**
(g) Anagram (Time) verbal lab task								
English	1	.44	9.600E	.44	3.12	.20	.20	9.73**
Hindi	2	.40	7.999E	.43	3.05	.36	.16	9.30**
(h) Nonsense syllables (Trials) verbal lab task								
English	1	.37	3.356E	.37	2.47	.15	.15	6.10*

(a) Problem Solving Square (Time)								
Variables	**Order of Entry**	**r**	**Regression coefficient**	**Beta weight** (β)	**t**	**R^2**	**R^2 Change**	**F**
Sanskrit	2	.58	3.404E	.31	2.15	.23	.08	4.62*
(i) Discrete controlled association verbal lab task								
Hindi	1	.43	.43	.43	2.96	.20	.20	8.76**

*p <.05; **p <.01

The results of the present investigation are unique and novel. Hence, for the future purpose, on the basis of performance of academics, one's placement in job can be ascertained, where such kind of abilities can be used in the area of industry, education and technical professions.

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