Revista Review Index Journal of Multidisciplinary 2022; 2(2):28-36
eISSN: 2583-0031
Double-blind peer reviewed | Refereed Quarterly Online Journal

A study of Academic Achievement of Senior Secondary School Students in relation to their Cognitive Style and Personality

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Abstract

The study aims to investigate the effects of cognitive style and personality on senior secondary school students' academic achievement in district Rohtak (Haryana, India). 160 secondary school science students were included in the sample; they were chosen at random from 10 senior secondary schools in Rohtak. Cognitive Style Inventory by Dr. Praveen Kumar Jha, and Introversion- Extroversion Inventory by Dr. P. F. Aziz and Dr. Rekha Gupta were used to measure the variables cognitive style and personality respectively. Marks obtained by respondents in class Xth were used as a measure of their academic achievement. Two-way ANOVA (2x2 factorial design) was used to analyze the gathered data. The findings show that the students' academic achievement is average and that cognitive style and personality have a significant independent impact on students' academic achievement. The results also show that these variables have a substantial two-factor interaction influence on students' academic achievement.

Keywords: *Academic Achievement, Cognitive Style, Personality, Senior Secondary School Students*

Article Publication

Published Online: 30-Jun-2022

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10.31305/rrijm2022.v02.n02.005

Introduction

Education has been recognized to be essential to the development of people as it holds the potential to not only alter one's socio-economic status but also to ensure the all-round development of an individual through the realization and discovery of his hidden skills and abilities.

What distinguishes developed countries from developing ones is not their ethnic composition, but the extent of knowledge and education among the citizens. Hence, with the rise of knowledge economies, the role of education has become more important than ever before. Given this advent of the role of education as an investment in an increasingly globalized world, an individual's credentials are judged through the level of academic achievement possessed by him. Hence, it is imperative to promote academic achievement among students to ensure positive outcomes in the long run. One of the ways to measure academic achievement is through the scores obtained by them in their final examination indicating the extent of proficiency or success attained by them in the course. Hence, academic achievement, as measured by exam scores, is an indicator of students' growth in response to the teaching-learning undertaken on the school premises. Apart from being indicative of students' performance in subjects taught at the school (Pandey, 2008), this measure of academic achievement also acts as an incentive

for students to improve their conceptual understanding for scoring better and to develop their talents further, which ultimately advances the goal of the concept of 'education'. In today's competitive world, parents want their children to be high achievers, which puts children under pressure from a very young age. In addition to dealing with the demands of numerous pressures, fierce competition, and academic requirements, they must also endure criticism and social disgrace if they fail to achieve the appropriate outcomes. Adolescents who perform well academically tend to attain a high social position in the eyes of society, their families, and peers while getting good career opportunities, which further build their leadership skills. Contrarily, academic failure causes dissatisfaction, stress, inferiority complexes, rejection from loved ones, a rise in suicides, discouragement, and eventually dropping out (Ekstrom et al., 1986; Steinberg, Blinde, and Chan, 1984; Gadwa and Griggs, 1985). Hence, academic outcomes set in motion a cycle that feeds on itself, directly influencing future prospects. Therefore, it is essential to pay attention to the factors affecting academic achievement both, directly and indirectly. Preliminary analysis reveals the presence of multiple factors like the student's aptitude, motivation, self-concept, interest in the subject, socioeconomic status, family background, etc. (Behrens and Vernon, 1978; Pandey, 2008) affects their academic achievement. This paper focuses on the role of two crucial factors - students' cognitive style, and their personality on the level of their academic achievement.

Cognition is the act or process of knowing. It comprises mental processes like judgement, remembering, reasoning, and perception. Every individual perceives and understands things differently and this uniqueness of learning patterns across individuals manifests itself in the form of different 'Cognitive Styles'. In the context of students, cognitive style indicates how students acquire (cognition), process (conceptualization), and apply information. Cognitive styles play a vital role in students' vocational preferences, academic choices, learning outcomes, and their interaction during the teaching-learning process (Habieb-Mammer et al. 2001). Piaget (1950) emphasized the effect of cognitive styles on learning. Further, evidence (Feiji (1976)) shows that students who were field independent performed better than those who were field dependent. Nordin's (1985) research highlighted the impact of cognitive style on students' acquisition of linguistic knowledge and abilities. The findings of Witkin,(1972); O'Brien and Terrance (1994; Bassey, et. al. (2013). Idika, (2017); Balasubramanium, & Sivakumar,(2018); Hooda & Devi,(2018); Nadaf, et. al. (2019) and Hussin, et.al.(2021) further support these claims. Hence, the existing literature provides a case to test this relationship.

The second factor being considered for the purpose of this study, i.e. Personality is claimed to have a bearing on students' academic achievement. Differences in personalities have traditionally explained the causal relationships between a person's inner self and its expression through the response to external stimuli. In the educational context, personality traits lead to development, define individual choices and describe the extent of involvement across different activities. Studies reveal the existence of personality-based differentials between academic achievement and cognitive styles. Kifer (1975) was the first to examine the relationship between personality and academic achievement while many researchers thereafter have emphasized the role of personality traits in explaining a significant proportion the of variance in academic achievement (Chamorro-Premuzic & Furnham,2003; Furnham et.al., 2003; Duff, Boyle,Dunleavy & Furguson,2004; Komarraju & Karau, 2005; ; Lounsbury,2005; Martin et al., 2006; Laidra et al., 2007; Lei et al.,2011; Harsha et al., 2015). Hence, this study considers the impact of personality independently, and in conjunction with different cognitive styles on the academic achievement of school students.

Significance of the Study

Cognitive style and personality encompass the higher mental procedures of humans, which shape how they understand and know the world. Hence, they undoubtedly have an influence on the academic achievement of learners. Despite little research on the aforementioned relationship than what is needed, it is evident that personality and cognitive style are crucial factors in shaping students' academic achievement. Keeping this in view the present investigation was undertaken.

The focus of present study is on academic achievement of secondary school students. Here secondary school students mean students who were promoted to class XI in April, 2022 after taking exams of class Xth in March, 2022. Equal number of boys and girls studying in science stream were included in the sample in view of the reported differences in academic

achievement with respect to academic stream and gender in some studies (Nyikahadzoi (n.d.), Islam (2014), Voyer et al., 2014).

Objectives of the Study

The objectives of the study are as follows:

1. To assess the academic achievement of senior secondary school students.
2. To study the influence of cognitive style and personality and their interaction on academic achievement of senior secondary school students.

Methodology

Research Design

For the present investigation, a factorial design based on two independent variables viz., Cognitive Style and Personality was followed. The independent variable, i.e., Cognitive Style (A) differed in two ways - high cognitive style value (A1) and low cognitive style value (A2); while the second independent variable Personality (B) was divided in to two categories -extroverted (B1) and introverted (B2). Five different dimensions of cognitive styles were considered independently. Using the formula Mean ±SD, the highest and lowest grouping of cognitive Style and personality was determined. Two-way ANOVA (2 X 2 factorial design) was used to examine the data in order to determine how various dimensions of cognitive style and personality interact to influence the academic achievement of senior secondary school students.

Sample and Procedure

A study was conducted in govt. senior secondary school students of district Rohtak in the month of April, 2022. An official list of senior secondary schools in the Rohtak district was obtained from the office of the relevant district education officer. From that list, 10 schools were chosen at random in order to gather data. Each school was individually visited by the investigator. The tools were distributed to all of the science stream XIth class students present on the day after rapport-building exercises.

Out of an initial set of 270 responses, 230 were finally selected after the elimination of values near averages so as to establish a clear distinction in the levels of independent variables (High/Low for cognitive styles and Introvert/Extrovert for personality styles). A random sample of 160 students was drawn in accordance with the paradigm's criteria for 2x2 cells with 40 in each cell (20 girls and 20 boys) as follows:

Table1: Distribution of Sample (N=160)

	High Level on Cognitive Style	Low Level on Cognitive Style
Extroverts	40	40
Introverts	40	40

Tools

The study utilized the following tools to derive reliable data and results:

1) **Cognitive Style Inventory by Dr. Praveen Kumar Jha :** The study utilized a five dimension-based classification of cognitive styles as established in the cognitive style inventory. The five dimensions are: Systematic, Split, Integrated, Intuitive, and Undifferentiated Cognitive Styles. The inventory identifies these categories on the basis of a five-point Likert scale.
2) **Introversion- Extroversion Inventory by Dr. P. F. Aziz and Dr. Rekha Gupta:** The inventory consisted of sixty items - thirty regarding the different introversion characteristics and thirty regarding extroversion characteristics. Given that the reliability coefficient of the inventory stands at 0.95, it has been employed in the study to identify the personality types of students as introverted or extroverted.

For the purpose of this study, academic achievement was determined by the marks obtained by students in class Xth examination.

Analysis and Interpretation

Data was analyzed and interpreted in order to meet the objectives under the heads (1-4) below:

1. **Level of Academic achievement of senior secondary school students**

Table- 2: Subject Classification based on Percentage of Xth Standard Scores

S. No.	Range of Scores	N (percentage)	Category
1	85% & above	90 (30%)	High
2	60% to 84%	113 (37.67%)	Average
3	59% & below	97 (32.33%)	Low

The results summarized in Table 2 indicate that majority of students ie. 37.67% had average performance and 32.33% students are low performers, while 30% students fall in the category of high performance in academics.

2 **Influence of Cognitive Style and Personality and their Interaction on Academic Achievement of students**

Table 3: Summary of 2x2 Factorial Design ANOVA of Academic Achievement of Students

	Cognitive Style(A)			Personality (B)			Interaction AxB		
Dimensions	**SS**	**MS**	**F-ratio**	**SS**	**MS**	**F-ratio**	**SS**	**MS**	**F-ratio**
Systematic style	7344.5	7344.5	84.42*	9037.2	9037.2	103.87*	680.5	680.5	7.82*
Intuitive style	428.7	428.7	3.42 NS	410.1	410.1	3.27 NS	370.4	370.4	2.95 NS
Integrated style	587.6	587.6	4.66**	9808.8	9808.8	77.92*	430.8	430.8	3.42 NS
Undifferentiated style	415.9	415.9	3.41 NS	408.7	408.7	3.35 NS	401.5	401.5	3.29 NS
Split style	7688.5	7688.5	65.35*	9106.8	9106.8	77.40*	890.7	890.7	7.57*

*df =(1,156),**p<.05,*p<.01 NS- not significant even at .05 level of significance*

2.1 Academic Achievement by Cognitive Style

Table 3 shows that the F-values for the three cognitive style dimensions i.e. systematic, integrated, and split style, are all statistically significant. This indicates that cognitive style significantly and independently influenced students' academic achievement. The t-test was used to interpret this. Table 4 contains the findings for the same.

Table 4: Mean, SD and t-value of Academic Achievement of Students in relation to their Cognitive Style

Dimensions	Group	N	Mean	SD	t-ratio
Systematic style	A1	80	76.40	9.06	8.69*
	A2	80	63.46	9.76	
Integrated style	A1	80	73.15	10.36	5.65*
	A2	80	61.74	14.77	
Split style	A1	80	71.46	12.44	2.91*
	A2	80	65.99	11.27	

*A1-High on dimension, A2-Low on dimension, *Significant at .01 level,** Significant at .05 level, NS – not significant.*

Table 4 shows that t-ratios of academic achievement of students on three dimensions i.e. systematic, integrated and split style of cognitive style are significant. The average scores show that students with high scores on cognitive styles, such as systematic, integrated, and split style, do better academically than children with low scores on these dimensions.

2.2 Academic Achievement by Personality

Table 3 shows that the personality F-values for the three cognitive style dimensions—systematic, integrated, and split style—are all statistically significant. This indicates that, for these factors, personality had a considerable independent impact on students' academic achievement. The t-test was used to interpret this. Table 5 contains the findings for the same.

Table 5: Mean, SD and t-value of Academic Achievement of Students in relation to their Personality

Dimensions	Group	N	Mean	SD	t- value
Systematic style	B1	80	75.11	11.79	6.25*
	B2	80	62.58	13.50	
Integrated style	B1	80	79.50	12.60	8.32*
	B2	80	63.37	11.89	
Split style	B1	80	77.68	13.08	7.50*
	B2	80	62.98	11.66	

*B1-Extrovert, B2-Introvert, *Significant at .01 level.*

The t-ratios of students' academic achievement on the aforementioned cognitive style dimensions in relationship to personality are significant, as shown in Table 5. Extroverts are observed to do better than their counterparts, according to the mean scores.

2.3 Academic Achievement by Cognitive Style and Personality

The significance of the F-values (see table 3) for the twofold interaction between systematic style and personality, and split style and personality suggests that the two factors are interacting. The t-ratios were calculated in order to better examine the interaction. Tables 6 and 7 show the outcomes for the same.

2.4 Academic Achievement by Systematic Style and Personality.

Table 6: Mean, SD and t-value of Academic Achievement of Students in relation to Systematic Style and Personality (A x B)

Groups	M	SD	t-ratio
A1B1 vs A1B2	80.44 72.37	10.26 7.68	3.98*
A1B1 vs A2B1	80.44 73.85	10.26 10.02	2.90*
A1B1 vs A2B2	80.44 53.07	10.26 9.50	12.37*
A1B2 vs A2B1	72.37 73.85	7.68 10.02	0.74 NS
A1B2 vs A2B2	72.37 53.07	7.68 9.50	9.99*
A2B1 vs A2B2	73.85 53.07	10.02 9.50	9.51*

A1-high on dimension, A2- low on dimension, B1-extrovert, B2- introvert,- significant at .01 level of significance, **- significant at .05 level of significance, NS- not significant even at .05 level of significance.*

Table 6 shows that

a) Extrovert students who scored more on 'systematic style' do better than introvert students who scored more on 'systematic style' (M=80.44 vs. M=72.37).
b) Extrovert students who scored more on 'systematic style' do better than extrovert students who scored less (M=80.44 vs. M=73.85).

c) Extrovert students who scored more on 'systematic style' do better than extrovert students who scored less (M=80.44 vs M=53.07).
d) Extrovert students who score lower on 'systematic style' outperform introvert students who score higher on "systematic style" (M=73.85 vs M=72.37).
e) When compared to introvert students who scored lower on the 'systematic style' scale (M=72.37), introvert students who scored higher on the scale do better. (M=53.07)
f) Extrovert students who scored lower on 'systematic style' outperform introvert students who scored lower on 'systematic style' (M=73.85 vs. M=53.07).

Additionally, the table demonstrates that extrovert students who scored higher on 'systematic style' had the highest academic achievement scores (M=80.44), whereas introvert students who scored lower on 'systematic style' had the lowest academic achievement scores (M=53.07).

2.5 Academic Achievement by Split style and Personality.

Table 7: Student Academic Achievement Mean, SD, and t-value in relation to Split Style and Personality (A x B)

Groups	M	SD	t- ratio
A1B1 vs A1B2	79.87 63.05	14.80 9.52	6.03*
A1B1 vs A2B1	79.87 70.50	14.80 13.60	2.94*
A1B1 vs A2B2	79.87 64.48	14.80 8.33	5.73*
A1B2 vs A2B1	63.05 70.50	9.52 13.60	2.83*
A1B2 vs A2B2	63.05 64.48	9.52 8.33	0.71 NS
A2B1 vs A2B2	70.50 64.48	13.60 8.33	3.57*

A1- high on dimension, A2- low on dimension, B1- extrovert, B2- introvert,-significant at .01 level of significance, NS-not significant even at .05 level of significance*

Table 7 shows that

a) Extrovert students who scored higher on the 'split style' scale outperform introvert students who scored higher on the split style scale (M= 79.87 vs.M=63.05).
b) Extrovert students with higher 'split style' scores do better than extrovert students with lower split style scores (M= 79.87 vs M=70,50).
c) Extrovert students who score higher on the 'split style' scale outperform introvert pupils who score lower (M=79.87 vs M=64.48).
d) Extrovert students who score lower on the 'split style' scale outperform introvert students who score higher on the split style scale (M=63.05 vs. M=70.50).
e) Introvert students who score lower on the 'split style' scale perform better than those who score higher on the 'split style' scale (M=64.48 vs M=63.05).
f) Extrovert students who scored lower on the 'split style' scale do better than introvert students who scored lower on the 'split style' scale (M=70,50 vs M=64.48).

Additionally, Table 7 indicate that introvert students higher on 'split style' have the lowest scores on academic success (M=63.05), whereas extrovert students higher on 'split style' have the highest scores (M=79.87).

Discussion and Conclusion

The findings of the investigation are discussed under following two subheads:

a. **Academic Achievement and Cognitive Style:** Results of the study indicate that respondents belonging to higher levels of the dimensions of systematic, intuitive, integrated, and split cognitive style perform better than their counterparts. This distinction arises on account of the various styles possessed by different students. A task that is approached in a systematic and orderly way by a student might be performed in a totally unsystematic way by another student. Students with systematic cognitive style fare better in terms of their logic, analysis, and prioritization of different aspects of problem-solving (Praveen Kumar, 2001). Students belonging to this cognitive style are known to be well-organized and prefer dividing tasks in such a way that the deadlines are met. While students with a high score on intuitive style are more creative and show keen interest in matters that involve thinking out of the box. Further, there are some students which have a high rating on both, intuitive and systematic style. They belong to the category of Integrated cognitive style and are able to switch between styles smoothly and unconsciously depending on the situation which might explain their superior performance in academics. Students with this cognitive style are labeled as "problem seekers" because of their ability to identify issues and prospective solutions for the same. On the other hand, there are some students who possess both, systematic and intuitive styles, but are unable to shift between the two smoothly. They exhibit a particular style in a given situation, which is why they belong to the category of Split Cognitive Style. Since only one style dominates their cognitive process at a given point in time, they tend to have sharp focus on the problem at hand and are able to consciously select their style of response given the situation. However, it is imperative to note that the differences in academic achievement cannot be solely attributed to different cognitive styles. Different learning outcomes are a function of many other variables that include, but are not limited to, how students decide to apply their intelligence. Therefore, cognitive styles are simply an indicator of the propensity, rather than the abilities of an individual and are a means of channeling one's intellect in ways that are found to be suitable by the person (Sternberg,1990).

b. **Academic Achievement and Personality:** The result also suggests that a students' personality has a role in how well they achieve academically**.** Results indicate that extroverted personalities tend to perform significantly better than introverted personalities in terms of academic scores. This might be because extroverted students are more open-minded and receptive to the teaching-learning process, in addition to being more participative. They prefer learning with and from others and proactively indulge in projects requiring group participation which augments their learning. Further, extroverted students tend to be emotionally positive and better at communicating. Moreover, such students are more active and ask more questions, which improves their learning process, thereby enabling them to have higher academic achievement. This could explain, in part, their better performance. The study of Lounsbury, et.al.,(2005); Lei et al., 2011; Harsha et al., 2015; Rohtash & Dhull (2019) provides evidence to support the findings of the current investigation.

Educational Implications

In today's fast-paced education-based world, it is of immense importance to develop a deeper understanding of the reasons driving differential learning outcomes, perceptions, issues, and thought processes among students in order to develop a more inclusive education system that empowers every student alike. Educators need to be made more sensitive to the relevance of cognitive styles in driving outcomes. This need has become more urgent with the roll-out of the New Education Policy, which aims to create a more inclusive educational environment and escape the rote-learning practices of the present day. Given the diversity of students, which manifests itself into different needs for learning, the identification of different cognitive styles must become the foundation of the teaching-learning process. If students are enabled to learn as per their cognitive styles, the uniqueness of each student can make the country's growth more vibrant and dynamic. It must be emphasized that no learning style is superior and there should be extra efforts to ensure that there is no stigma attached to a particular style as that would be counter-productive for the academic achievement and motivation of students. In addition, one must appreciate the fact that intelligence, as a factor, is independent of a student's learning style. The differences in academic achievement observed above

are not due to differences in intelligence, but rather an indication of the failure of our system to teach as per differing needs of students.

On the other hand, while personality might have an effect on the outcomes to some extent, it must be noted that no personality type is inherently superior to the other. The difference arises because of how our teaching practices are skewed in favour of those who tend to be more outgoing and open. Introverts, when provided with the right teaching styles can improve their outcomes over the current system. The class can "think-pair-share," which implies that when the instructor poses a question, students turn to their partners and discuss their responses with one another rather than having to speak in front of the entire class, is an illustration of one such method that has been demonstrated to be successful. The crux is to design educational plans that recognize and nurture the different personality and cognitive styles to truly derive the true purpose of education.

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