

INTELLIGENCE, MOTIVATION AND STUDY HABITS AS PREDICTORS OF SCHOLASTIC ACHIEVEMENT IN SCIENCE AMONG SECONDARY SCHOOL BOYS

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ABSTRACT

The present study aimed at exploring the relationship of Intelligence, Motivation, and Study Habits with Scholastic Achievement in Science of Secondary School boys. The study revealed a significant positive relationship of Scholastic Achievement in Science with Intelligence and a significant negative relationship with recording (A sub scale of study habits). Factor analysis was applied to locate the factor structure of scholastic achievement and the analysis yielded seven factors namely Intelligence, Comprehension, Motivation, A-motivation, Language, Task orientation and supports. These factors explained 72.58% variance. Multiple regression analysis located intelligence as the important predictor of Scholastic Achievement in Science.

KEYWORDS: Intelligence, Motivation, Study Habits, Scholastic Achievement, Secondary School Boys

INTRODUCTION

Achievement is a fundamental aspect of everyday life, affecting people's work, inter-personal relationships, sense of being and leisure (Struthers, Menec, Schonwetter, & Perry, 1996). Academic or scholastic achievement refers to the degree or level of success attained in some specific task especially school performance or the success achieved at the end of the educational program. In other words scholastic achievement is the performance of the pupil's accomplishment in a subject of study (Krishnamurthy 2003). Scholastic achievement is the sole criteria to evaluate the ability of scholars and is the main criterion for selection, promotion or recognition in various walks of life. It has become an index of students' future in this highly competitive world. Students with higher levels of achievement at school, college or university are more likely to obtain good employment and salaries (Joppke & Morawska, 2003). In short, academic achievement is important because it promotes success in different phases of life (Areepattamanni & Freeman, 2008).

Academic or scholastic achievement is a complex phenomenon and requires different approaches for understanding and interpretation. It is the function of many cognitive and non-cognitive factors such as intelligence, thinking, motivation, level of aspiration, interests, anxiety, family environment, school environment, social environment, study habits, optimism, hope for success etc (Vendal, 1994). Many studies have been done in the past to establish the relationship between these variables and scholastic achievement separately but these variables have not been studied together. Due to time constraint and paucity of resources, it is not possible to study all the variables. Keeping in mind the contribution of the above stated variables, the investigator has made an attempt to find out the predictive value of intelligence, motivation and study habits in the scholastic achievement in science of secondary school students. A brief introduction of these variables is given below:

Intelligence

Intelligence provides insight and direction to human potential to achieve goal. Intelligence is related to the process of mental mechanism, which is the best way to increase scholastic achievement of children. Children who possess high scores are not necessarily more intelligent than the children who possess low scores. Galton (1822-1911) believed that intelligence is a function of psycho-physical abilities. Binet and Simon (1916) described intelligence as a function of the ability to learn within an academic setting. Intelligence is the ability to learn from one's experiences, acquire knowledge and use resources to adapt to new situations or solving problems (Sternberg and Kaufman, 1998; Wechsler, 1975). Thus, intelligence is mental energy available with the individual who enables him to cope with environment in terms of adaptation and dealing with novel situations. Researchers found significant positive correlation between intelligence and achievement in different disciplines viz. English (Bond, 1940; Kaur 1982), Science (Rastogi, 1964; Jha, 1970; Freeman, 1975; Peterson, 1976; Kaur 1982), Social studies (Cattell, 1972) and Mathematics (Gakhar, 1986). Intelligence is predictive of academic achievement (Parker & Benedict, 2002; Naglieri & Bornstein). Cerbo and Eignor (2003) discovered significant relationship between intelligence test scores and English language proficiency scores.

Motivation

Motivation is one of the constructs thought to account for a part of variance in school performance not explained by intelligence. Several researchers have suggested that it is only motivation that directly impacts academic achievement; all other factors affect achievement only through their effect on motivation (Tucker, et. al; 2002). Motivation is a significantly important factor for academic learning and achievement during childhood and adolescence (Elliot & Dweck, 2005). A student's achievement can be influenced by a number of factors which have been classified into four broad categories: personal characteristics, cognitive processes, organizational characteristics and social factors (Chan, 1999). In this study, academic motivation is viewed within the context of the self-determination theory of Deci and Ryan (1985). The self-determination theory indicates that there exist three types of motivations, namely intrinsic motivation, extrinsic motivation and a-motivation. Deci and Ryan (1985) conceived that intrinsic motivation refers to the motivation of any behavior that is dependent on factors that are internal in origin. It refers to actions performed because people want to perform them, and for which they do not need external incentives (Crous et al. 2000). Extrinsic motivation refers to actions that are performed for external rewards that these actions will bring. It originates in factors lying outside the individual. It pertains to a wide variety of behaviors that are motivated by rewards and/or punishments administered by outside forces, dictates from superiors, surveillance and competition by peers. A-motivation, a third motivational concept given by Deci and Ryan (1985) wherein a-motivated individuals experience a lack of contingency between their behaviour and outcomes. A-motivation can best be described as having no motivation and a feeling of helplessness and incompetence. A-motivated behaviors are neither intrinsically nor extrinsically motivated because there is no sense of purpose and no expectations of reward and possibility of changing the course of events. Kamaei and Weisani (2013) assessed the relationship between achievement motivation, critical thinking and creative thinking with academic performance of secondary girl's school students. Sandhu (2014) conducted a study to investigate the relation between Academic Achievement of Adolescents and their Achievement Motivation and Study Habits. Steinmayr and Spinath (2009) examined to which extent different motivational concepts contribute to the prediction of school achievement among adolescent students independently from intelligence.

Study Habits

According to Encyclopedia of Educational Research (1969), study habit is defined as the time preferred, the time lapse between study sessions, the degree of noise or music tolerated, the extent to which extra-curricular activities interfere and the particular study mechanisms employed by different students. According to the Dictionary of Education (2007), "Study habits indicate settled tendency of practice and thought to acquire knowledge and information from the book." Study habit is auto nominally learned behaviour pattern that enables the student to acquire how to study". A good study habit actually develops a behaviour pattern which enables him to sit down and begin working on his assignment with minimum fuss and maximum concentration. Kohli (1977) pointed out that in the academic field; study habits have particular theoretical and practical importance. Students, who practice study habits, study individually, in groups or attend tutorials. Study habits vary from culture to culture. Black students study 8-10 hours/week. Chinese students study 14 hours/week in which 8-10 hours they work alone and 4 hours in company of other students. Study habits can be used as predictors of achievements in different disciplines (Thathong, 2002; Nickerson et. al.2006). Effective study habits help students to achieve good results (Sadia, 2005).

Although it is important to study the problems related to achievement of students at all the stages but the most important stage is adolescence. One third of an individual's life is spent in school. Apart from family, school influences the youth, shapes friendships and success in life. It is the time of growth and development, a time for change, a time to struggle with dependence and independence and a time to make mistakes and learn from them (Fenwick & Smith, 1994). The unrealistic expectation of the society on academic achievement especially in India has resulted in students and their parents taking academic a do or die affair. Thus students, teachers, schools and parents wish to compensate by engaging in one form of examination malpractice or the other. It is imperative, therefore to look for more justified devices that can facilitate teaching and learning, make knowledge permanent and result into an academic performance commensurate with student's ability.

To find lasting solutions to this problem, there is a need to investigate the relationship among intelligence, intrinsic and extrinsic motivation, study habits, and scholastic performance of students in secondary schools in India. Therefore, this study titled "**Intelligence, Motivation and Study Habits as predictors of Scholastic Achievement in Science among Secondary School Boys**" had been conceived and planned.

Objectives of the Study

The present study was undertaken keeping in view the following broad objectives:

- To study the relationship of scholastic achievement of secondary school students in science with intelligence, motivation and study habits.
- To locate the factor structure of scholastic achievement in science.
- Predicting the impact of different independent variables included in the study on scholastic achievement in science of secondary school students.

Hypotheses of the Study

The study was done keeping in view the following hypotheses:

- Intelligence and motivation will have positive relationship with scholastic achievement in science of secondary school students.
- Positive and negative study habits will have positive and negative relationship with scholastic achievement in science of secondary school students respectively.
- All the independent variables are the predictors of scholastic achievement of secondary school students.

METHODOLOGY

Sample

The study was conducted on a sample of 75 boys of XI standard. The sample was drawn randomly from different secondary schools of Amritsar city affiliated to Central Board of Secondary Education (CBSE). The average age of boys was 16.4 years.

Assessment Measures

The following assessment measures were used for the purpose of collecting the required data:

Scholastic Achievement

Scholastic achievement of secondary school students in science was measured from the grades scored in science in the 10th standard and the same was procured from the school records. The grades were converted into percentage by applying the conversion formula provided by Central Board of Secondary Education.

Raven's Standard Progressive Matrix (SPM: Ravens, 2000)

Raven's SPM is a test of observation skills and clear-thinking ability. It offers insight about someone's capacity to observe, solve problems, and learn. The test has a total of 60 items presented in 5 sets (A–E), with 12 items per set (e.g., A1 through A12) and level of difficulty increases as we move from item 1 to 12. There is no time limit for either SPM or SPM Plus.

Academic Motivation Scale (AMS: Vallerand Et Al. 1993)

Academic Motivation Scale (AMS) is composed of 28 items (4 items per sub-scale) and can be assessed on 7 point scale anchored by the end point "Not at all" (1) to "Exactly" (7) with a midpoint at 4 ("Moderately"). The whole scale is used to assess intrinsic motivation, extrinsic motivation and a-motivation.

Study Habit Inventory (Shi: Mukhopadhaya & Sansanwal, 1995)

The present inventory was designed to measure the study habits of students at the secondary and post secondary level. The inventory consists of 52 items and scoring is based on five point scale. The positive items will be scored as 4,3,2,1 and 0 for 'always', 'frequently', 'sometime', 'rarely' and 'never' responses respectively. On the other hand the scoring process for negative items will be reversed as 0, 1, 2, 3, and 4. In this manner maximum total score will be 208 and minimum total score will be Zero. The complete scale constitutes 9 different kinds of study behaviors such as

Comprehension, Concentration, Orientation Task, Study Sets, Interaction, Drilling, Supports, Recording, Language. Reliability of the whole inventory was worked out by applying split-half method. The reliability coefficient reported was 0.91 which is fairly high and indicates that the inventory is reliable.

RESULTS AND DISCUSSIONS

Co Relational Analysis

Pearson Product Moment correlation was used to study the relationship of Scholastic achievement with Intelligence, different types of motivation and study habits. A significant positive correlation was found between academic achievement in science and intelligence (r=0.499). Correlation coefficient does not indicate cause and effect relationship but the positive correlation between achievement in science and intelligence indicates that boys, who scored higher on intelligence performed better in science i.e. intelligence is the factor responsible for achievement in science. On the other hand a significant negative correlation was found between academic achievement in science and recording i.e. a subscale of study habits (r= -0.275). It means that extra notes prepared by the student other than those prepared in the class are not helpful in the achievement in science. This may be because of spending extra time in preparing extra notes and thus spending less time in understanding the concepts of science. Several studies have concluded that effective study habits play a decisive role in the scholastic achievement of different disciplines (Thathong, 2002; Sadia, 2005; Nickerson et. al.2006).

Table 1: Relationship of Academic Achievement in Science with Intelligence and Recording (A Component of Study Habit) of Secondary School Boys

| Subject | Correlation Coefficient Intelligence | Correlation Coefficient Recording |
|---------|--------------------------------------|-----------------------------------|
| Science | 0.499** | -0.275* |

* Correlations significant at 0.05 levels

** Correlations significant at 0.01 levels

Factor Analysis

Factor analysis is a statistical method used to locate a small number of factors in a large set of independent variables. The distinctive feature of factor analysis is the reduction of data. The analysis is started with large set of variables and the variables that correlate highly with each other are identified as representing a single factor. The values indicated in the inter-correlation matrix simply indicate the relationship between the different variables but did not provide objective view because these relationships are influenced by a large number of uncontrolled factors. Therefore, to obtain a clear understanding of the inter-correlations, factor-analysis was used. Factor- analysis of inter-correlation matrix can however, partial out at least to some extent the influence of extraneous variables. The inter-correlation matrix was factor analyzed by the method of principal component. This method, developed by Hotelling (1933, 1936) ensures in extracting the maximum amount of variance and gives the smallest possible residual. This also has the advantage of giving a mathematically unique solution for a given table of correlation. Following Kaiser (1958), the extraction of factors was stopped when the value of latent root came out to be 1.00. The factors thus obtained were rotated using the Varimax rotation. Unrotated and Rotated factor matrices yielded 7 factors and the same are reported in Table 3 and 4. A factor loading of .30 or above considered as significant.

Factor I (Intelligence)

| Variable | Factor Loadings |
|------------------|-----------------|
| Intelligence (+) | 0.84 |
| Science (+) | 0.84 |
| Recording (-) | 0.34 |

The significant loadings on this factor include intelligence, science and recording. It means that intelligent boys spend time in understanding concepts of science rather than spending time in preparing extra notes and thus show achievement in science. Achievement in science may be due to basic intelligence and this factor has got a highest loading on intelligence, therefore, the factor has been named so. This factor has contributed 15.37 % of variance.

Factor II (Comprehension)

| Variable | Factor Loadings |
|-------------------|-----------------|
| Comprehension (+) | 0.75 |
| Interaction (+) | 0.67 |
| Recording (+) | 0.44 |

This factor explains 12.87% of variance and has loadings on comprehension, interaction and recording. The factor has highest loading on comprehension that is why it has been named so.

Comprehension is the ability to understand and grasp the study material and it can be achieved through interaction with other students, friends, teachers and parents. Learning of extra material may also help the students to improve their comprehension. So comprehension is the independent factor and different means should be introduced to improve it.

Factor III (Motivation)

| Variable | Factor Loadings |
|----------------------|-----------------|
| Intrinsic Motivation | 0.85 |
| Extrinsic Motivation | 0.74 |

This factor has been named motivation due to highest loadings on intrinsic and extrinsic motivation. It means motivation is an important factor whether it is due to intrinsic or extrinsic reasons. This factor has explained 10.97% variance.

Factor IV (A-Motivation)

| Variable | Factor Loadings |
|------------------|-----------------|
| A-motivation (+) | 0.86 |
| Recording (-) | 0.61 |

This factor has highest loading on a-motivation, which is why it has been named so. Learning of extra material or preparation of extra notes may take the student out of focus and can lead to lack of motivation. So lack of motivation may be an important factor of academic achievement in science. A-motivation explains 9.41% of variance.

Factor V (Language)

| Variable | Factor Loadings |
|-------------------|-----------------|
| Language (-) | 0.81 |
| Concentration (+) | 0.74 |

The factor V has been named language because of highest loading on it. Language capacity or the command over a language helps the individual to focus or concentrate on the study task. It has been found that a good number of students are not able to perform better due to language problems. This factor explains 8.52% variance.

Factor VI (Task Orientation)

| Variable | Factor Loadings |
|----------------------|-----------------|
| Task orientation (+) | 0.75 |
| Study sets (-) | 0.71 |

This factor has been named task orientation because of highest loading on it. Student’s orientations and behaviors toward accomplishment of the tasks in a pre-decided time frame is task orientation. It implies formulating fixed study routine and dividing the study time among the different subjects and it is related to physical and situational characteristics which a student adopts for study. This factor explains 8.09% of variance.

Factor VII (Supports)

| Variable | Factor Loadings |
|--------------|-----------------|
| Supports (+) | 0.79 |
| Drilling (+) | 0.71 |

This factor explains 7.32% of variance and has highest loading on supports, so it has been named so. Supports implies the extra material or books that a student refers to, apart from the course books for the syllabus and it is related to drilling i.e. amount of practice and repeated revision that a student does.

REGRESSION ANALYSIS

Multiple regression analysis is a versatile dependence statistical technique used to analyze the relationship between a dependent variable (criterion) and several independent variables (predictors). Multiple regression analysis was used to analyze the predictors of Scholastic achievement in science among boys. The values in the Table 2 revealed that intelligence turned out to be the only predictor of achievement in science. The value of R Square change (.249) indicate that intelligence explained 24.9% of variance. The value of “Beta” coefficient (0.499) is the standardized regression coefficient which shows the relative explanatory power of the dependent variable i.e. scholastic achievement.

Table 2: Multiple Regression Analysis with Science as Dependent Variable

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | | Durbin-Watson |
|--------------|--------------------|----------|-------------------|----------------------------|-------------------|----------|-----|-----|---------------|---------------|
| | | | | | R Square Change | F Change | Df1 | Df2 | Sig. F Change | |
| Intelligence | 0.499 ^a | 0.249 | 0.239 | 8.611 | 249 | 24.234 | 1 | 73 | 0.000 | 1.529 |

Multiple regression analysis was used to analyze the predictors of Scholastic achievement in science among boys. The values in the Table 4 revealed that intelligence turned out to be the only predictor of achievement in science. The value of R Square change (.249) indicate that intelligence explained 24.9% of variance. The value of “Beta” coefficient (0.499) is the standardized regression coefficient which shows the relative explanatory power of the dependent variable i.e. scholastic achievement.

CONCLUSIONS

The study indicates that basic intelligence is an essential element for achievement in any discipline. It is not possible to change intelligence level of an individual but performance can be definitely changed. It has been found that students of the countries like India give too much emphasis on notes and spend lot of time on preparation of notes. The results of the study suggested that students should not spend much time in preparing extra notes, rather they should spend that time in understanding the concepts of a discipline.

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Table 3: Unrotated Factor Matrix (Boys N=75)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | H2 |
|------------------|--------|--------|--------|-------|--------|--------|--------|------|
| Intelligence | -.253 | .684 | .147 | .004 | .227 | .214 | .303 | .743 |
| Intrinsic M | .203 | -.202 | .704 | .401 | -.091 | .192 | -.024 | .784 |
| Exintrinsic M | .066 | -.511 | .425 | .104 | -.209 | .373 | .186 | .674 |
| Amotivation | -.462 | -.477 | .193 | .250 | .347 | -.303 | -.232 | .807 |
| Comprehension | .685 | .029 | .270 | .177 | .388 | -.108 | .020 | .736 |
| Concentration | .247 | .252 | .571 | -.284 | -.195 | -.344 | .177 | .719 |
| Task Orientation | .401 | .311 | .106 | .044 | .016 | -.370 | -.551 | .712 |
| Study Sets | -.196 | -.459 | -.093 | -.147 | .457 | -.257 | .449 | .756 |
| Interaction | .478 | .175 | -.185 | .140 | .235 | -.259 | .300 | .526 |
| Drilling | .231 | -.108 | -.018 | -.710 | .059 | .358 | -.218 | .748 |
| Supports | .355 | -.078 | .027 | -.110 | .650 | .417 | -.200 | .781 |
| Recording | .698 | -.083 | -.208 | .016 | -.204 | .058 | .341 | .699 |
| Languages | .192 | .052 | -.484 | .623 | -.059 | .258 | -.083 | .739 |
| Science | -.411 | .613 | .268 | .156 | .211 | .217 | .074 | .738 |
| % of Variance | 15.377 | 12.879 | 10.986 | 9.409 | 8.519 | 8.093 | 7.319 | |
| Cumulative % | 15.377 | 28.256 | 39.241 | 48.65 | 57.169 | 65.262 | 72.581 | |

Table 4: Rotated Factor Matrix (Boys: N=75)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | H |
|------------------|--------|--------|--------|-------|--------|--------|--------|------|
| Intelligence | .837 | .041 | -.112 | -.134 | .076 | -.068 | -.009 | .743 |
| Intrinsic M | .048 | .133 | .846 | .115 | .067 | .173 | -.041 | .784 |
| Extrinsic M | -.184 | -.143 | .738 | -.063 | .033 | -.258 | .063 | .674 |
| A-motivation | -.135 | -.075 | .111 | .862 | -.029 | -.138 | -.086 | .807 |
| Comprehension | -.041 | .753 | .246 | .005 | .074 | .205 | .243 | .736 |
| Concentration | .083 | .203 | .158 | -.179 | .740 | .202 | -.159 | .719 |
| Task Orientation | -.108 | .284 | -.153 | .091 | .132 | .754 | .040 | .712 |
| Study Sets | -.156 | .227 | -.144 | .357 | .144 | -.714 | .034 | .756 |
| Interaction | -.013 | .671 | -.180 | -.184 | -.042 | -.036 | -.074 | .526 |
| Drilling | -.196 | -.231 | -.092 | -.275 | .254 | .010 | .713 | .748 |
| Supports | .082 | .308 | .091 | .097 | -.178 | .001 | .794 | .781 |
| Recording | -.336 | .439 | .102 | -.608 | -.084 | -.078 | -.004 | .699 |
| Languages | -.027 | .159 | .022 | -.164 | -.806 | .134 | -.136 | .739 |
| Science | .842 | -.103 | .012 | .103 | .004 | .076 | -.047 | .738 |
| % of Variance | 15.377 | 12.879 | 10.986 | 9.409 | 8.519 | 8.093 | 7.319 | |
| Cumulative % | 15.377 | 28.256 | 39.241 | 48.65 | 57.169 | 65.262 | 72.581 | |