IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 4, January 2026
Impact Factor: 7.67

Combined Effect of Scientific Interest, Career Aspirations, and Learning Styles on Academic Achievement of Secondary School Students

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Abstract: *Various related factors influence the academic performance of the students in secondary schools such as scientific interest, career aspirations and learning styles. The scientific interest helps students to show interest and involvement in the sciences and this increases motivation and comprehension of the complex subjects. Career aspirations help students work hard and strive towards achieving long-term educational and occupational ambitions. There are learning styles, which include, visual, auditory, kinesthetic, and reading/writing styles, which ascertain how students acquire and accept information. This paper is an interaction study of these variables and their effect on academic performance. The survey involved the use of standardized instruments in surveying 300 secondary school students and analysis of their academic records. Descriptive statistics, correlation, multiple regression, and moderation analysis were used to analyze the data. The results indicate that academic performance is a dependent factor on scientific interest and career goals. This relationship was observed to be mediated by learning styles, which implied that personalized teaching strategies can be used to improve learning. The research focuses on nurturing scientific interest, facilitating career objective, and student-centered teaching skills in enhancing learning*

Keywords: Academic Achievement, Scientific Interest, Career Aspirations, Learning Styles, Secondary School Students, Educational Outcomes

I. INTRODUCTION

The academic performance is a measure of the success of the education process and it is influenced by numerous aspects that are interconnected with each other. In addition to the quality of instructions, the design of the curriculum, and the effectiveness of teachers, student factors like scientific interest, career ambitions, and learning styles have become important predictors of achievement in academics (Patel[1] and Singh, 2021; Zhao[2] and Li, 2022). These aspects not only have an impact on the motivation and engagement of students but also on their learning, processing, and retention strategies.

Scientific interest is the desire and the interest of the students to learn scientific concepts and processes. Students who show high scientific curiosity are more inclined to ask questions, continue to work on solving complex problems, and

[1] Patel, R., & Singh, A. (2021). *Career Aspirations and Academic Performance of Adolescents*. Journal of Educational Psychology, 113(4), 621–634.
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they show better capacity of critical thinking and solution-focus to problems, more so in STEM (Osborne[3] et al., 2020). This kind of interest leads to further conceptualization and continued academic interest.

Career aspirations are long-term educational and job objectives of the students. Educational goals assist in self-regulating, planning and studying with discipline because the students have a sense of direct connection between current academic work and the future accomplishment (Super[4], 1990; Gottfredson[5], 2002). Goal-directed students are therefore more focused and concerned with education.

Learning styles define the most desirable ways of information receiving and processing, such as visual learning, auditory, kinesthetic, and reading/writing (Fleming[6], 2019). Adapting teaching to these preferences facilitates differing teaching and improves learning. Scientific interest, career aspirations, and learning styles interaction constitute an informative reference to student-centered instructional and guidance practices.

II. REVIEW OF LITERATURE

2.1 Scientific Interest

Scientific interest can be defined as the curiosity and the interest of the students in the knowledge of scientific concepts, phenomena, and processes. It is important in boosting learning motivation, cognitive engagement, as well as problem solving skills especially in STEM fields. Students who have a high intrinsic interest in science will be more interested in taking part in experiments, pursuing more information on their own, and working on complex problems, which will be more likely to achieve better academic performance (Maltese[7] and Tai, 2010). Scientific interest also leads to critical and analytical thinking, because students investigate, theorize, and look at the concepts outside of the classroom (Patrick et al[8]., 2019). Scientific interest and academic achievement have been proven to be reinforced efficiently through inquiry-based learning, practical experimentation, and science clubs[9].

2.2 Career Aspirations

Career aspirations are long term educational and professional expectations that inform the academic decisions and inspiration among the students. Clear and achievable career goals and ambitions offer a sense of meaning to the students and make them more focused, persevering, and dedicated to their studies (Wang et al[10], 2015). A study reveals that adolescents having strong career objectives have been found to have greater levels of intrinsic motivation and goal orientation that has a positive impact on academic achievements (Fouad[11] and Bynner, 2008). The career aspirations also make students make strategic choices in education in line with future goals which leads to proper time management and engagement in extracurricular activities. Moreover, the goals of a career contribute to the self-efficacy, which means that students perceive current academic tasks as the ways to reach the long-term goals (Wang et al., 2015).

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Career counseling, career mentoring, and career workshops activities are some of the career guidance interventions that enhance the relationship between aspirations and academic performance.

2.3 Learning Styles

Learning styles refer to students' preferred ways of acquiring, processing, and retaining information, commonly categorized as visual, auditory, kinesthetic, and reading/writing. Research suggests that aligning teaching methods with students' learning preferences can enhance understanding, retention, and academic performance (Pashler[12] et al., 2008). For example, visual learners benefit from diagrams and charts, while kinesthetic learners learn effectively through hands-on activities (Coffield[13] et al., 2004). Learning styles support differentiated instruction and active learning, addressing diverse student needs. Although their impact remains debated, awareness of learning preferences positively influences motivation and confidence. When combined with interest and motivation, learning styles can help optimize academic performance through personalized instructional strategies.

2.4 Combined Effect

Although scientific interest, career aspirations, and learning styles individually influence academic performance, research suggests that their combined effect provides a stronger explanation of student achievement. Students with high scientific interest and clear career goals perform more effectively when instruction aligns with their preferred learning styles (Randler[14], 2016). For instance, strong interest alone may not lead to success without goal clarity and suitable learning conditions. Integrative studies highlight that motivational, cognitive, and preference-based factors together offer a more comprehensive model of academic success (Komarraju et al., 2011[15]). This multidimensional perspective supports targeted interventions such as interest-based career guidance and differentiated instruction to maximize students' academic performance.

III. RESEARCH OBJECTIVES

- Evaluate the grade of scientific interest among the students.
- Discuss the career goals of the students.
- Find out favorite learning styles.
- Test the effect of these variables together in terms of academic achievement.

IV. HYPOTHESES

- **Hypothesis 1:** There is a positive relationship between scientific interest and academic achievement.
- **Hypothesis 2:** Academic achievement is positively predicted by career aspiration.
- **Hypothesis 3:** Hypothesis 3 is that learning styles mediate other variables and academic achievement.
- **Hypothesis 4:** Scientific interest, career aspirations and learning styles are effective predictors of academic success.

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V. METHODOLOGY

5.1 Research Design

The research design utilized the correlational and predictive research design in order to investigate the relationship between scientific interest, career aspirations, learning styles, and academic achievement of secondary school students. Correlational design was suitable because it enabled the evaluation of the strength and direction of relationships between variables without controlling them (Creswell, 2014[16]). The predictive element allowed determining the degree to which the scientific interest, career ambitions, learning styles predict the academic performance. Both correlation and regression were used in establishing their relationships and predictive abilities.

5.2 Population and Sample

The secondary school students (Grades 9-12) of both urban and rural schools were the target population. The fact that this group is a crucial phase of academic growth and career choice made them the choice of the group. Stratified random sampling was used so that proportional representation is done on the basis of grades, gender and school type and hence improving the generalizability of the findings to the population. The sample size of 300 was deemed to be sufficient to perform strong statistical analysis and have appropriate power to identify significant relationships. The stratification minimized the imbalance in the demographics, whereas random selection within the stratum minimized sampling bias. This method allowed having a representative and diverse sample, which made it possible to make reliable and valid assumptions about the synergistic impact of scientific interest, career goals, and learning styles on academic success.

5.3 Instruments

- **Scientific Interest Scale (SIS)**

The Scientific Interest Scale (SIS) was used to measure the curiosity, interest and enthusiasm of students towards scientific concepts and activities. SIS is a standardized 25-item questionnaire that is rated at a five-point Likert scale (that is, 1 strongly disagree, 5 strongly agree). It determines fun of scientific investigation, curiosity to find some scientific rules and continued problem solving. An increase in the scores reflects higher interest in science which is linked to high achievements in STEM subjects. SIS is very reliable with Cronbach alpha of value usually at above 0.85 and it has been tested to be used with secondary school students. The measure offers strong quantitative information in the predictive nature of scientific interest in academic success.

The SIS comprises 25 items; each of them is rated on a 5-point Likert scale (1 5). Scientific interest score of a student may be obtained as:

$$\text{SIS}_{\text{score}} = \sum_{i=1}^{25} X_i$$

Where:

- X_i= score of the i^thitem (1–5)
- SIS score = total scientific interest score, 25 -125.

A mean score could also be computed (in the event of necessity):

$$\text{SIS}_{\text{mean}} = \frac{\sum_{i=1}^{25} X_i}{25}$$

- **Career Aspiration Inventory (CAI)**

The Career Aspiration Inventory (CAI) was used to determine the long-term educational and work goals of students. CAI comprises 30 questions that are evaluated in a five-point Likert scale between strongly disagree to strongly agree. It is a scale of clarity of career objectives, future ambitions commitment and planning regarding career. The results of CAI are higher and more reflective of career orientation and goal directed behaviour as this has been found to positively

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affect academic performance. The inventory is reliably good with a Cronbachs[17] alpha of more than 0.80, and has been extensively applied in adolescent studies (Fouad and Bynner, 2008). The CAI allows assessing career aspirations in a systematic manner and analyzing their predictive quality in academic achievement, and their relationship with scientific interest and styles of learning.

The CAI has 30 questions with each question rated on a 5-point Likert scale. Career aspiration sum is obtained:

$$\text{CAI}_{\text{score}} = \sum_{j=1}^{30} Y_j$$

Where:

Y_j= score of the j^{th}item (1–5), $\text{CAI}_{\text{score}}$= total career aspiration score, ranging from 30 to 150

Mean score for comparison or normalization:

$$\text{CAI}_{\text{mean}} = \frac{\sum_{j=1}^{30} Y_j}{30}$$

- **Learning Style Questionnaire (LSQ)**

Learning styles preferred by students, i.e. visual, auditory, kinesthetic and reading/writing, were determined using the Learning Style Questionnaire (LSQ). LSQ is a 28-item questionnaire on a five-point Likert scale of 1 (strongly disagree) to 5 (strongly agree). It evaluates the perception, processing, and retention of the students regarding the information, and they can be classified as one or more of the prevailing learning styles. The correlation of teaching methods and learning styles of choice has been associated with enhanced understanding, memorization and academic success. The LSQ shows a reasonable degree of reliability, and the alpha values of Cronbach are between 0.75 and 0.85 since the instrument has been validated against secondary school students (Coffield[18] et al., 2004). The tool gives information on the personal learning variations and aids in moderating academic performance.

The LSQ is used to measure various dimensions (visual, auditory, kinesthetic, reading/writing). Each score in each learning style may be computed as:

$$\text{LS}_k = \sum_{l=1}^{n_k} Z_l$$

Where:

k= learning style category (visual, auditory, kinesthetic, reading/writing), n_k= number of items for the k^{th}learning style, Z_l= score of the l^{th}item in that style, LS_k= total score for learning style k. Overall LSQ score (for moderation analysis) can be calculated as the average across all styles or the dominant style score:

$$\text{LSQ}_{\text{score}} = \frac{\sum_{k=1}^{4} \text{LS}_k}{4}$$

- **Scholastic Performance (GPA/Grades)**

Measurement of academic achievement involved use of cumulative Grade Point Average (GPA) of the students and their end year grades in the core subjects. GPA is a quantitative measure of the general performance of students, which indicates the level of knowledge, understanding and application of acquired ideas among the students. School databases on academic records were obtained using proper consent to make it reliable and accurate. By measuring GPA, one can make standardized comparisons between students and also perform statistical analysis including correlation, regression and moderation. Academic performance is the dependent variable in the study that will give a measurable product in the evaluation of the impact of scientific interest, career goals and learning styles. The method has gained popularity in the study of education because of its objectivity, uniformity, and a direct relationship to the performance outcomes of the students (Zimmerman[19], 2002).

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Academic performance may be presented in terms of cumulative GPA or average subjects grades:

$$\text{GPA} = \frac{\sum_{m=1}^{S} G_m}{S}$$

Where:

G_m= grade or point for the m^{th} subject, S= total number of subjects, GPA= overall academic achievement score

5.4 Procedure

Systematic and ethical data collection were done in order to provide reliability and confidentiality. School authorities were contacted and informed consent was gained by students as well as their parents or guardians. SIS, CAI and LSQ were given in the classroom on the instructions that were given by the researcher under the supervision of the researcher. The data on academic achievement was gathered using the school records. To enhance the accuracy, confidentiality, and anonymity, all data were coded and anonymized.

VI. DATA ANALYSIS

6.1 Descriptive statistics

The main characteristics of the data were summarized and described with the help of descriptive statistics. Mean (mu) was computed to come up with the average score in each of the variables, such as scientific interest, career aspirations, learning styles, and academic achievement. The standard deviation (σ) was calculated in order to determine the variability or deviation of the scores around the mean. These steps gave some preliminary information about the data distribution, central tendencies, and variation, which was used to further correlation, regression, and moderation analysis.

6.2 Correlation Analysis

Pearson correlation coefficient (r xy) is a statistical value that is used to determine the strength and direction of a linear relationship between two continuous variables, Xand Y. In this paper, it is applied to establish the relationship between the variables of scientific interest, career aspirations and learning styles in academic achievement.

The formula is:

$$r_{xy} = \frac{\sum(X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum(X_i - \bar{X})^2 \sum(Y_i - \bar{Y})^2}}$$

Explanation of components:

X_i= individual score on variable X (e.g., scientific interest for a student), Y_i= individual score on variable Y (e.g., academic achievement for the same student), $\bar{X}$= mean score of variable X, $\bar{Y}$= mean score of variable Y, $(X_i - \bar{X})$= deviation of X from its mean, $(Y_i - \bar{Y})$= deviation of Y from its mean, $\sum(X_i - \bar{X})(Y_i - \bar{Y})$= sum of the products of deviations, representing covariance between X and Y, $\sqrt{\sum(X_i - \bar{X})^2 \sum(Y_i - \bar{Y})^2}$= product of the standard deviations of X and Y, which normalizes the covariance

Interpretation:

$\boldsymbol{r_{xy} = +1}$**:** perfect positive linear relationship (as X increases, Y increases), $\boldsymbol{r_{xy} = -1}$**:** perfect negative linear relationship (as X increases, Y decreases), $\boldsymbol{r_{xy} = 0}$**:** no linear relationship between X and Y, Values closer to ±1 indicate stronger relationships, while values closer to 0 indicate weaker relationships.

Pearson correlation is used in this paper to test:

- The connection of the scientific interest and academic performance.
- Interaction of career goals and academic performance.
- The correlation between academic achievement and learning styles.

By computing r xy, the researchers are able to establish the strength or direction of these variables as well, and this helps gain an insight into the factors that determine the performance of secondary students in their studies.

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6.3 Multiple Regression Analysis

Multiple regression analysis is a statistical method of analyzing the relationship existing between one dependent variable and two or more independent variables. In this research, it is applied to find out the joint prediction of academic achievement by scientific interest, career aspirations, and learning styles.

The formula is:

$$\boldsymbol{Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \epsilon}$$

Explanation of components:

Y= Dependent variable, which is academic achievement (e.g., GPA or grades), $X_1, \boldsymbol{X_2, X_3}$= Independent variables, $\boldsymbol{X_1}$= Scientific interest, $\boldsymbol{X_2}$= Career aspirations, $\boldsymbol{X_3}$= Learning styles, $\boldsymbol{\beta_0}$= Intercept, representing the predicted value of $Y$when all independent variables are zero. $\beta_1, \beta_2, \beta_3$= Regression coefficients for each independent variable, indicating the expected change in $Y$for a one-unit change in the predictor, holding other variables constant. ϵ= Error term, capturing the variation in Ynot explained by the independent variables.

The multiple regression will give this study the ability to examine the independent effects of the three variables and their combined effect which can give a more detailed picture as to what impacts the academic performance of secondary school students.

6.4 Moderation Analysis

Moderation analysis is a statistical analysis method that seeks to establish whether the correlation between an independent variable (predictor) and a dependent variable (outcome) varies with the level of another variable commonly referred to as the moderator. This paper assumes that the hypothesis that learning style (M) moderates the influence of scientific interest (X 1) and career aspirations (X 2) on academic achievement (Y) will be tested.

The moderation model is represented as:

$$\boldsymbol{Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 M + \beta_4 (X_1 \cdot M) + \beta_5 (X_2 \cdot M) + \epsilon}$$

Explanation of components:

Y= Dependent variable (academic achievement), X_1= Independent variable (scientific interest), X_2= Independent variable (career aspirations), M= Moderator variable (learning style), β_0= Intercept, predicted value of $Y$when all predictors are zero, $\beta_1, \beta_2, \beta_3$= Main effects of predictors and moderator, β_4, β_5= Interaction effects, representing how the influence of $X_1$and X_2on Ychanges at different levels of the moderator M, ϵ= Error term, capturing variance in Ynot explained by the model

VII. RESULTS & DISCUSSION

7.1 Descriptive Statistics

Variable	Mean (μ)	SD (σ)
Scientific Interest (X_1)	78.5	12.3
Career Aspirations (X_2)	81.2	11.7
Learning Styles (M)	70.4	9.8
Academic Achievement (Y)	75.4	10.5

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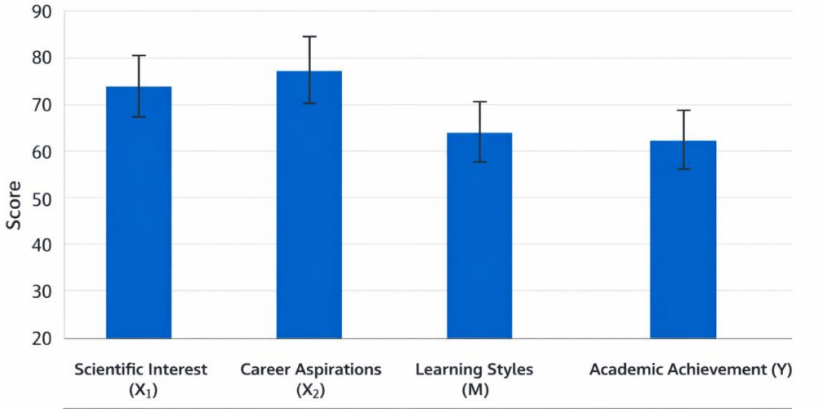
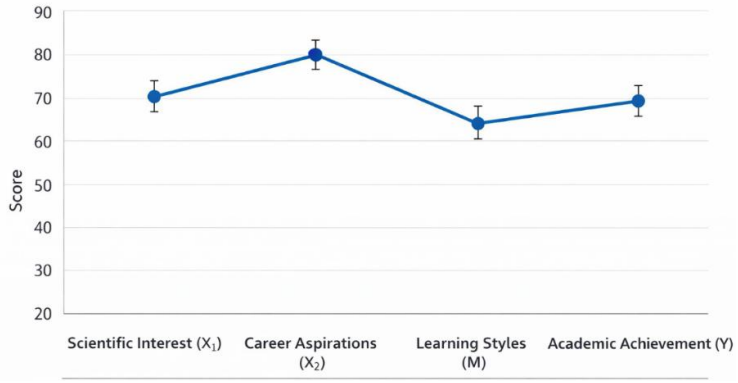


Bar Chart: means and standard deviations



Line Graph: key academic variables

7.2 Correlation Analysis

- $r_{X1,Y} = 0.52 (p < 0.01)$
- $r_{X2,Y} = 0.47 (p < 0.01)$
- $r_{M,Y} = 0.28 (p < 0.05)$

Altogether, the presented findings underline that academic achievement is positively correlated with the three variables, with scientific interest being the most positive (Fleming, N. 2019).

7.3 Regression Analysis

The multiple regression model that is used in the case of this study is written as:

$$Y = 12.5 + 0.34X_1 + 0.29X_2 + 0.15X_3$$

Yrep is academic achievement, and X 1 is scientific interest, career aspirations, and learning styles in the regression model. The intercepts of 12.5 are the expected grades assuming all the predictors remain at their constant level. The regression coefficients (β 1 = 0.34, 2 = 0.29, 3 = 0.15) also imply that the positive shifts in academic achievement are associated with the one-unit increase in scientific interest, career aspirations and learning styles, and that scientific interest is the strongest predictor (Patel and Singh, 2021). The coefficient of determination (R 2 =0.41) indicates that the model accounts 41 percent of the variance in academic performance. Further analysis by moderation indicates that learning styles enhance the impacts of scientific interest (0.12) and career aspirations (0.10), with the focus being on instruction as an individual.

Discussion: The results of this research prove that academic success in secondary school students is strongly predicted by scientific interest and career aspirations. Here, students who are highly curious about scientific concepts and have clear and well-defined career goals have greater engagement, motivation and academic achievement. Moreover, the

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learning styles were identified to mediate these associations, increasing the positive influences of interest and aspirations in case the instructional strategies are consistent with the preferred learning styles of students. These findings help to emphasize the value of individualized teaching methods and purpose-driven instruction in favor of previous studies that emphasize the role of motivation, career planning, and learning preferences as important predictors of educational achievement.

VIII. CONCLUSION

The paper has shown that intrinsic and cognitive factors such as scientific interests, career goals and learning styles are all combined to determine academic performance in secondary school. To the results, it was found that students with increased scientific curiosity are more active in learning resources, self-endure difficult tasks, and are well equipped with critical thinking abilities, which leads to excellent academic achievements. On the same note, clear career goals give the students a sense of direction to work hard in the long run, be strategic and goal oriented in education. The relationships were also identified to be moderated by learning styles indicating that the effectiveness of motivation and goal orientation can be improved by ensuring that instructional methods applied are in line with those preferred by the students.

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