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Research Article

Relationship Between Science Process Skills And Study Habits Of High Achievers In Physics At Higher Secondary Level

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ABSTRACT

This study aimed to explore the relationship between Science Process Skills and Study Habits among high achievers in Physics at the Higher Secondary Level. The objectives were to determine if a significant relationship exists and if the components of Study Habits predict Science Process Skills. The independent variable was Study Habits, and the dependent variable was Science Process Skills. The sample comprised 1000 students from fifteen higher secondary schools, with 210 identified as high achievers based on an achievement test. Tools included a Science Process Skills Test, an adapted Study Habits Inventory, and an Achievement Test. Data were analysed using descriptive statistics, Pearson correlation, and linear regression via EDUSTAT software. Findings revealed a significant positive correlation ($r = 0.71$, $p<0.01$) and that 91.5% of the variance in Science Process Skills was explained by Study Habits components ($R^2 = 0.915$). The regression model significantly predicted Science Process Skills, with all Study Habits components found to be significant predictors. The results underscore the importance of effective study habits in enhancing science process skills among high achievers in physics.

Key words: Science Process Skills, Study Habits, High Achievers in Physics

Introduction

Science process skills are fundamental for students in understanding and engaging with scientific concepts effectively. These skills, which include observing, classifying, measuring, inferring, and experimenting, are essential for developing a scientific mindset and proficiency in scientific inquiry. For high achievers in physics at the higher secondary level, mastering these skills is crucial for their academic success and future endeavours in science-related fields.

Study habits play a significant role in the academic performance of students. Effective study habits, such as time management, note-taking, and utilizing ICT-based learning, can enhance a student's ability to understand and retain complex information. High achievers in physics often exhibit well-developed study habits that contribute to their superior performance. Investigating the relationship between these study habits and science process skills can provide insights into how students can be better supported to excel in their studies.

The present study aims to explore the relationship between science process skills and study habits among high achievers in physics at the higher secondary level. By identifying which components of study habits are significant predictors of science process skills, educators can develop targeted interventions to support students in developing both effective study practices and strong scientific inquiry skills. This research will contribute to the understanding of the interplay between study habits and academic achievement in science education, particularly in the context of high-achieving students.

Need and significance of the study

The need for this study arises from the critical role that science process skills play in the educational and professional development of students, particularly those pursuing careers in science and technology. High achievers in physics at the higher secondary level are future scientists, engineers, and innovators who require strong foundational skills in scientific inquiry. Understanding how study habits influence the development of these skills can provide valuable insights into optimizing educational strategies and resources. By identifying

the key study habits that significantly impact science process skills, educators can design more effective curricula and support systems to enhance student performance and engagement in physics.
The significance of this study lies in its potential to inform educational practices and policies aimed at fostering academic excellence in science education. With the increasing emphasis on STEM (Science, Technology, Engineering, and Mathematics) education globally, it is imperative to understand the factors that contribute to high academic achievement in these fields. This research can help educators and policymakers recognize the importance of study habits in cultivating scientific skills and provide evidence-based recommendations for enhancing educational outcomes. Ultimately, this study aims to support high achievers in physics by identifying strategies that can help them excel academically and develop the skills necessary for success in their future scientific careers.

Objectives of the study

1. To test whether there is significant relationship between Science Process Skills and Study Habits of High Achievers in Physics at Higher Secondary Level.
2. To test whether the components of Study Habits are significant predictors for Science Process Skills of High Achievers in Physics at Higher Secondary Level.

Hypotheses of the study

1. There is significant relationship between Science Process Skills and Study Habits of High Achievers in Physics at Higher Secondary Level.
2. Components of Study Habits are significant predictors for Science Process Skills of High Achievers in Physics at Higher Secondary Level.

Hypotheses of the study in Null Form

1. There is no significant relationship between Science Process Skills and Study Habits of High Achievers in Physics at Higher Secondary Level.
2. Components of Study Habits are not significant predictors for Science Process Skills of High Achievers in Physics at Higher Secondary Level.

Variables Selected for the Study

In this study, two primary variables were selected to investigate the relationship between Science Process Skills and Study Habits among high achievers in Physics at the Higher Secondary Level.
The independent variable is Study Habits, which encompasses various components that influence students' study behaviours and practices. These components include Budgeting Time, Physical Conditions for Study, Reading Ability, Note Taking, Factors in Learning Motivation, Memory, Taking Examination, Health, ICT-Based Learning, and Question-Based Practice. These elements collectively represent the different facets of students' approaches to studying and learning, which are hypothesized to impact their science process skills.
The dependent variable is Science Process Skills, which are essential for students to effectively engage in scientific inquiry and problem-solving. The skills assessed in this study include Observing, Communicating, Classifying, Measuring, Inferring, Predicting, Identifying Variables, Controlling Variables, Defining Operationally, Formulating Hypotheses, Experimenting, and Interpreting Data. These skills are crucial for students' understanding and application of scientific concepts, particularly in Physics.
By examining the relationship between these variables, the study aims to identify which study habits significantly contribute to the development and enhancement of science process skills among high-achieving Physics students at the Higher Secondary Level.

Tools Used for the Study

The following tools were used for measuring the variables

1. Science Process Skills Test in Physics for Higher Secondary Level (Standard XI), developed by Roy & George (2014), for measuring science process skills of students in Standard XI. The test intends to assess the twelve Science Process Skills viz., Observing, Communicating, Classifying, Measuring, Inferring, Predicting, Identifying Variables, Controlling Variables, Defining Operationally, Formulating Hypotheses, Experimenting and Interpreting Data.
2. Adapted Version of Palsane & Sharma Study Habits Inventory (Palsane and Sharma, 2003). The original inventory consisting of eight components viz., Budgeting Time, Physical Conditions for Study, Reading Ability, Note Taking, Factors in Learning Motivation, Memory, Taking Examination, Health, for examining the study habits adapted by Roy & George (2019), including two components viz., ICT Based Learning and Question Based Practice.
3. Achievement Test in Physics for Standard XI, developed by Roy & George (2014), for identifying the sample of High Achievers in Physics at the Higher Secondary Level from Standard XI.

Sample Selected for the Study

The sample for this study consisted of students studying in the Science Group in Standard XI from fifteen higher secondary schools. These schools were located across three educational sub-districts: Kollam, Kottarakkara, and Punalur, including those following the NCERT syllabus. The selection process aimed to ensure a representative sample, considering factors such as locale, gender, and type of school affiliation.

From the total sample of 1000 students, a random selection process was employed to ensure diversity and representation. The selection aimed to include students from various backgrounds to provide a comprehensive understanding of the relationship between study habits and science process skills among high achievers in Physics.

Among the 1000 students, 210 were identified as high achievers based on their performance in the Achievement Test in Physics. This subgroup of high achievers formed the basis for the correlation and regression analysis to determine the relationship between their study habits and science process skills. By focusing on high achievers, the study aimed to gain insights into the factors contributing to exceptional performance in Physics at the Higher Secondary Level.

Procedure of the Study

The study began with the selection of a random sample of 1000 students from the Science Group in Standard XI, drawn from fifteen higher secondary schools across the educational sub-districts of Kollam, Kottarakkara, and Punalur, including those following the NCERT syllabus. The sampling process ensured a diverse representation of students in terms of locale, gender, and type of school affiliation. This comprehensive sample aimed to provide a broad understanding of the relationship between study habits and science process skills among high achievers in Physics.

Once the sample was selected, three primary tools were administered under standardized conditions to collect data. The Science Process Skills Test in Physics for Higher Secondary Level assessed the students' abilities in twelve key science process skills. The Adapted Version of Palsane & Sharma Study Habits Inventory evaluated the study habits of the students across ten components, including Budgeting Time, Physical Conditions for Study, Reading Ability, Note Taking, Factors in Learning Motivation, Memory, Taking Examination, Health, ICT-Based Learning, and Question-Based Practice. Additionally, the Achievement Test in Physics for Standard XI was used to identify high achievers in Physics from the sample.

From the initial 1000 students, 210 high achievers were identified based on their performance in the Achievement Test. These high achievers were the focus of the study, and their data were analysed to explore the relationship between their study habits and science process skills. The data collected through the aforementioned tools were analysed using appropriate statistical techniques with the aid of EDUSTAT software. This analysis provided insights into the degree and nature of the relationship between study habits and science process skills, contributing valuable information to the field of educational research and practice.

Statistical Analysis of Data

The collected data from the study, encompassing information on study habits and science process skills among high achievers in Physics at the Higher Secondary Level, underwent rigorous statistical analysis using EDUSTAT software. This analysis involved applying appropriate statistical techniques to explore the relationships between variables. Descriptive statistics were utilized to summarize and present the characteristics of the study sample. Pearson correlation was employed to assess the strength and direction of the relationship between Science Process Skills and various components of Study Habits. Furthermore, linear regression analysis was conducted to determine whether the components of Study Habits significantly predicted Science Process Skills among the high achievers. These statistical methods provided robust insights into the factors influencing academic achievement in Physics, helping to validate findings and draw reliable conclusions from the study's data.

Analysis and Interpretation of Data

Table 1 ***Mean and standard deviation for the scores of Achievement in Physics of Science Group students in Standard XI at the Higher Secondary Level***

Variable	N	Mean (M)	Standard deviation (SD)
Achievement in Physics	1000	32.96	7.28

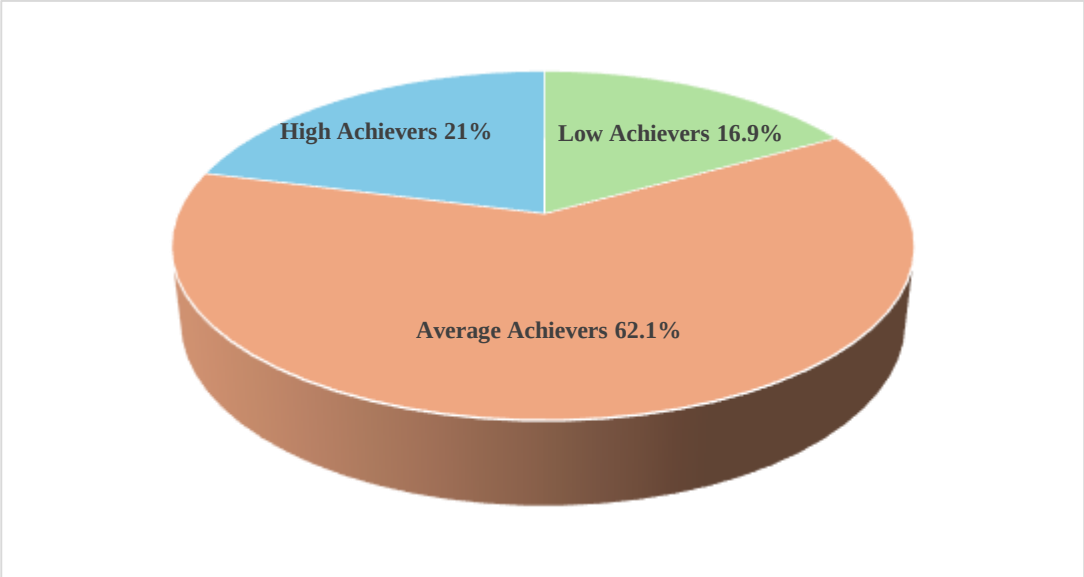
The mean (M) of the Achievement in Physics of Higher Secondary Students is 32.96 and the standard deviation (SD) is 7.28. The whole sample was classified into Higher Secondary Students having high, average and low levels of Achievement in Physics based on mean and standard deviation. The respondents who got score greater than (M+SD) i.e. 40.24 are classified into Higher Secondary Students having high level of Achievement in Physics, those who got score less than (M-SD) i.e. 25.68 are classified into Higher Secondary Students having low level of Achievement in Physics and those who got score in between (M+SD) i.e. 40.24 and (M-SD) i.e. 25.68 are classified into Higher Secondary Students having average level of Achievement in Physics. The number and percentage of Higher Secondary Students having high, average and low level of Achievement in Physics is given in the following table.

Table 2 ***Classification of Science Group students in Standard XI at the Higher Secondary Level based on level of Achievement in Physics***

Level of Achievement in Physics	N	Percentage of students
Low	169	16.9
Average	621	62.1
High	210	21
Total	**1000**	**100**

From the Table 2 it is evident that among the Science Group students in Standard XI 16.9% are Low Achievers in Physics at the Higher Secondary Level. 62.1% of are Average Achievers in Physics and 21% are High Achievers in Physics at Higher Secondary Level.

Figure 1 *Graphical representation for the percentage of Low Achievers, Average Achievers and High Achievers in Physics at Higher Secondary Level*



Testing of Hypothesis 1

Table 3 ***Correlation between Science Process Skills and Study Habits of High Achievers in Physics at the Higher Secondary Level***

N	Coefficient of correlation (r)	t	Level of significance	SEr	95% CI Lower	95% CI Upper	Shared variance
210	0.71	14.68	0.01	0.03	0.65	0.78	50.9

According to Table 1, the calculated value for the coefficient of correlation ($r = 0.71$; $p<0.01$), shows that there is significant positive relation between Science Process Skills and Study Habits of High Achievers in Physics at the Higher Secondary Level. Therefore, the null hypothesis, which states that "There is no significant relation between Science Process Skills and Study habits of High Achievers in Physics at Higher Secondary Level" is rejected. Further, the value of shared variance implies that 50.9% of the variance in one variable can be explained by the other variable. Graphical representation of the relation between Science Process Skills and Study Habits of High Achievers in Physics at the Higher Secondary Level through Scatter plot is presented in Figure 2.

Figure 2 ***Scatter plot of Science Process Skills and Study Habits of High Achievers in Physics at the Higher Secondary Level***

	Sales
Low	16.9
Average	62.1
High	21

Tenability of Hypothesis 1

The hypothesis which states that "There is significant relation between Science Process Skills and Study Habits of High Achievers in Physics at Higher Secondary Level" stands valid.

Testing of Hypothesis 2

Table 4 ***Regression model summary of the components of Study Habits for predicting Science Process Skills of High Achievers in Physics at the Higher Secondary Level***

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.957	0.915	0.911	1.523

Table 4 indicates a high degree of correlation between the components of Study Habits and Science Process Skills of High Achievers in Physics at the Higher Secondary Level (R = 0.957). Further, 91.5% of the variance in Science Process Skills of High Achievers in Physics at the Higher Secondary Level can be explained by the components of Study Habits (R^2 = 0.915)

Table 5 ***ANOVA for the regression model of the components of Study Habits for predicting Science Process Skills of High Achievers in Physics at the Higher Secondary Level***

Model		Sum of Squares	df	Mean Square	F	Level of Significance
1	Regression	4988.505	10	498.851	215.195	0.01
	Residual	461.309	199	2.318		
	Total	5449.814	209			

Table 5, indicates that, overall, the regression model significantly predicts the variable Science Process Skills of High Achievers in Physics at the Higher Secondary Level ($F=215.195$; $p<0.01$).

Table 6 ***Coefficients for the regression model of the components of Study Habits for predicting Science Process Skills of High Achievers in Physics at the Higher Secondary Level***

Model		Unstandardized Coefficients		Standardized Coefficients	t	Level of Significance
		B	Std. Error	Beta		
1	(Constant)	-3.626	.423		-8.577	0.01
	Budgeting Time	.388	.083	.138	4.696	0.01
	Physical Conditions for study	.398	.078	.161	5.132	0.01
	Reading Ability	.277	.055	.150	5.003	0.01
	Note Taking	.941	.150	.183	6.257	0.01
	Factors in Learning motivation	.221	.088	.081	2.496	0.05
	Memory	.630	.122	.156	5.157	0.01
	Taking Examination	.197	.050	.133	3.922	0.01
	Health	.376	.155	.074	2.425	0.05
	ICT Based Learning	.659	.201	.094	3.278	0.01
	Question Based Practice	.300	.149	.062	2.015	0.05

Table 6 shows that all the components of Study Habits are significant predictors of Science Process Skills of High Achievers in Physics at the Higher Secondary Level. The Regression equation obtained for Science Process Skills = -3.626 + (0.388 x Budgeting Time) + (0.398 x Physical Conditions for Study) + (0. 277 x Reading Ability) + (0.941 x Note Taking) + (0.221x Factors in Learning Motivation) + (0.63 x Memory) + (0.197 x Taking Examination) + (.376 x Health) + (0.659 x ICT Based Learning) + (0.3 x Question Based Practice)

Linear regression to predict Science Process Skills of High Achievers in Physics at the Higher Secondary Level based on the components of Study Habits revealed that all the components of Study Habits are significant predictors of Science Process Skills of High Achievers in Physics at the Higher Secondary Level. Hence the null hypothesis**,** which states that "Components of Study Habits are not significant predictors for Science Process Skills of High Achievers in Physics at Higher Secondary Level", is rejected.

Tenability of Hypothesis 2

The hypothesis which states that "Components of Study Habits are significant predictors for Science Process Skills of High Achievers in Physics at Higher Secondary Level" is substantiated.

Discussion of the Results

The study's results revealed significant findings regarding the relationship between study habits and science process skills among high achievers in Physics at the Higher Secondary Level. The Pearson correlation analysis indicated a strong positive relationship ($r = 0.71$, $p < 0.01$) between Science Process Skills and Study Habits. This finding underscores the importance of effective study habits in enhancing students' proficiency in scientific inquiry and problem-solving. Specifically, components such as effective time management, note-taking skills, and motivation were identified as influential factors positively associated with science process skills. These findings align with prior research emphasizing the role of structured study behaviours in academic achievement in science-related disciplines.

Moreover, the linear regression analysis further elucidated the predictive power of Study Habits on Science Process Skills. The regression model demonstrated that a substantial proportion (91.5%) of the variance in Science Process Skills among high achievers could be explained by the components of Study Habits ($R^2 = 0.915$). This high explanatory power indicates that specific study habits significantly contribute to students' ability to engage in scientific processes effectively. The regression equation provided insights into how each component of Study Habits, such as note-taking and health practices, contributes uniquely to the development of science process skills, offering practical implications for educators and policymakers.

Overall, these results underscore the importance of fostering and supporting effective study habits among high achievers in Physics to enhance their science process skills. By understanding and promoting these behaviours, educators can empower students to excel academically and cultivate a deeper understanding of scientific principles. The findings from this study contribute valuable insights into educational strategies aimed at optimizing learning environments and supporting the academic success of students in science education.

Conclusion

In conclusion, this study highlights the critical role of study habits in shaping the science process skills of high achievers in Physics at the Higher Secondary Level. The significant positive relationship found between Study Habits and Science Process Skills underscores the importance of structured and effective study practices in enhancing students' abilities in scientific inquiry and problem-solving. The findings emphasize the need for educational interventions and support systems that foster these habits among students, thereby promoting academic achievement and proficiency in science education. By leveraging these insights, educators and policymakers can implement targeted strategies to empower students in developing the necessary skills for success in science-related fields.

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