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Learning Strategy and Academic Achievement of Higher Secondary Students

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Abstract

Quantitative research has been conducted with a predictor variable of learning strategy and an outcome variable of academic achievement. The cross-sectional survey method was adapted to the 321 random samples of higher secondary students at Thiruvarur District, Tamil Nadu, India. The dimensions of learning strategy such as collaborative studying, writing, notes developing, reading, self-assessment, content organization, and time execution techniques were separately analyzed with the outcome variable, and both learning strategy and academic achievement were analyzed with demographic characteristics such as gender, locality of the school, type of management and medium of instructions. Descriptive, inferential, correlation, and regression analyses were made appropriately against the hypotheses. The study reveals that the level of learning strategy and academic achievement of the higher secondary students lies in the level of high and first class respectively. Learning strategy and academic achievement shows significant difference concerning gender, locality of the school, and medium of instruction. The learning strategy dimensions such as notes developing technique with gender, content organization and time execution techniques with the locality of the school, collaborative studying, reading, and time execution techniques with the medium of instruction are not significant and all others are significant with respective variables. The relationship between learning strategy and academic achievement is very high and academic achievement is highly influenced by the dimension of learning strategy at different levels. However, the collaborative studying dimension highly influences academic achievement followed by notes developing, reading, time execution, self-assessment, writing, and content organization techniques.

Keywords: Academic Achievement, Cross-Sectional Survey, Learning Strategy, Quantitative, Regression, Simple Random Sample.

Introduction

Education is an essential input to lead the quality and disciplined life of human beings. It engraves human behavior and cultivates good citizens for social, national, and global development. Education is a powerful weapon to make a human being morally well. Education makes the human being from an animal to a rational animal. It helps to develop cognitive as well as moral values among human beings. Teaching and learning are the backbone of the education. Higher secondary students are the students in the stage of adolescence. Generally, the learner, the stage attains adolescence; the learning becomes so complex because of the discontinuity of curriculum. The discontinuity and heavier syllabus in higher secondary curriculum make the students more concentrated on the curriculum. During the adolescent period, gonadal hormones, coristol hormones, and may other hormones play a role in causing the onset of puberty (1) and the reproductive organs begin to function, the secondary sex characteristic developed (2). This makes them show interest in sexual relationships (3) and it is diverse from learning and rises in infatuation or desire with the other gender. Reaching puberty makes the adolescent a daydreamer and a period of temporary insanity (especially, sexual fears can also be manifested in daydreams (4). G. Stanley Hall, 1904, the adolescents have a period of stress and strain and storm and strife (5, 6). Erik Erickson, an important identity researcher, proposed that identity crisis (role confusion) occurs in adolescence period of personal and psycho-social conflicts (7). Due to these, the learning method can be modified by adolescents themselves. Each individual executes different learning regards their capabilities. Many research proved that achievement is fully based

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on learning and it's independent individually. Teaching is a social process and learning is a psychological process that develops the cognition of human beings. Teaching was considered as prominent activity for learning in ancient days and so the students learning was depended on the teacher. Those days, teacher considered as a primary source of knowledge by didactic teaching and it provided structured passive learning on the development of passive skills. Nowadays, the students are preferred as first and the teaching becomes learner centered which makes active learning. The students are free from stress when they learn themselves and so many researches are going on new trends of self-learning methods, strategies and styles. Psychologists define learning as a relatively permanent change in behaviour. Learning is a product of reading, practice, training, and experiences. Learning increases the cognition of the human being profitably. Due to the individual differences of human beings, they are all not at the same cognitive level. The cognitive level directly depends on the learning and experiences obtained by an individual. Learning strength depends on different factors of an individual that how much the individual spends preference time to the factors such as reading, writing, studying, and notes developing, etc. Based on the preferences on the dimensions of learning leads to successful learning and the individual's preferences are varied. Every individual has their preference and leads their learning strategy.

A learning strategy is a well-defined activity for learning and can be called a secret algorithm of learning. Learning strategies are the steps taken by students to enhance their learning (8). A learning strategy is a method or technique or approach used by learners to enable their learning in new situations. It is helpful to enhance the individual learning and comprehension skills in that the individual is ready to learn the learning content. "Learning strategies are specific actions taken by the learner to make learning easier, faster, more enjoyable, more self-directed, more effective, and more transferable to the new situation" as stated by Oxford in the year 1990 (9). Learning strategy can be defined as it is as a mental activity carried out by an individual to achieve a particular cognitive level. Individual differences strive to adapt to learning strategies themselves individually which may cause various achievement levels. There is a variety of learning strategies is available and according to previous study the following learning strategies are used widely such as "cooperation strategies, elaboration strategies, motivational and emotional strategies, revision strategies, organizational strategies, and control strategies" (10).

Academic achievement is an individual's cognitive performance. Most of the studies consider achievement as a dependent variable because the achievement of an individual depends on other factors associated with the learning like training, teaching and learning methods, practices, etc. Academic achievement can be defined as "it is a measure of how well a student meets their educational objectives and demonstrates their comprehension of the subject material" (11). It is an indicator of the effectiveness or the predictor of the learners' success in learning. Learning strategy is important to enhance the learning of the learners. Learning strategy enables the learning of the learners effectively as well as autonomously (12), and heavily influences their way of learning in later life (13). Academic achievement is stirred up by the appropriate learning strategies adopted by the learner. This research article deals with the influences of dimensions of learning strategy on academic achievement.

Rationale is important for any research and it is simply called justification, means why a study or a problem has to be taken into account and it emphasizes the problem with the support of reviews. Reviews are more accountable to the problem taken for the research. Studies conducted in India and other than India were presented here for justification and they are briefly described in the following passages.

Many studies were conducted on learning strategies in other than India and a few of them are briefly described in the following passage. A cross-sectional descriptive-analytical study was conducted with a random cluster sample of 365 students studying at Saudi University and found that learning strategies are significant with the predictor variable of academic achievement, and there is significance in the usage of learning strategies concerning the gender, especially female students have the favor in learning strategies (14). A survey study was conducted with a sample of 274 e-learners both 132 males and 142 females from various majors taking English courses in

Turkey and found that the language learning strategy has an effect on academic achievement (15). The study found that academic achievement increases with an increase in strategy (16). It is found that "there is a positive relationship between the overall usage of language learning strategy and academic achievement (17). "A study found that high-achieving students used a self-regulated learning strategy" (18). A study found the surface and deep-level learning strategies by confirmatory factor analysis and they explored surface learning strategy makes a negative prediction on achievement and deep learning strategy positively predicts achievement (19).

In India, many studies were conducted on learning strategies, and some of them are briefly described in the following passages. It was found that the cooperative learning group is significantly greater than the control classes (20). "The learning strategies make an effect on students' academic achievement and their attitude in 149 traditional classrooms" (21). "The academic achievement of students studying in private schools is better than government schools" (22). A cooperative learning strategy enhances the academic performances of students in the chemistry of VII and VIII standard students (23). Girl students perform high than boys and rural students perform fare poor than urban students in academic achievement (24). 'There is an additive effect in using the components of cooperative learning and heterogeneous grouping and group incentives appear necessary to maximize students' achievement' (25). Cooperative learning can be successfully used to promote student performance in secondary school students (26).

The studies were collected from 1990 to 2022. Most of the studies belong to surveys and few were experimental. Focusing on the sample selection most studies adopted probability sampling techniques and the range of the sample size is 100 to 1000. Most researchers adopted the tools that are easily available to the researcher and a countable number of researchers developed and standardized their self-developed tools for measuring the variables. Most of the research findings are contradictory. Based on the synthesis of the studies, the investigator has found the following gaps in the present study.

RG1: Countable studies were conducted on learning strategy and academic achievement as combined in India with compared abroad.

RG2: Most of the studies only found significant differences and few found a relationship between predictor and outcome variable.

RG3: No study has been conducted to find the influence of the predictor variable and its dimensions on the outcome variable.

These research gaps assist the investigator in identifying a problem of learning strategy and academic achievement and composed the topic, "Learning strategy and academic achievement of higher secondary students".

The hypothesis is a tentative assumption or scientific guess regarding the results of the study and it should be tested with appropriate statistical techniques. The investigator has formulated the following hypotheses to reach the findings.

$H_0$1: The level of learning strategy of higher secondary students is high.

$H_0$2: The level of academic achievement of higher secondary students is in first class.

$H_0$3: The level of dimensions of learning strategy of higher secondary students is high.

$H_0$4: There exist no significant difference in learning strategy of higher secondary students is high concerning demographic characteristics such as gender, locality of the school, and medium of instruction.

$H_0$5: There exists no significant difference in academic achievement of higher secondary students concerning demographic characteristics such as gender, locality of the school, and medium of instruction.

$H_0$6: There exists no significant difference in the dimension of the learning strategy of higher secondary students concerning gender.

$H_0$7: There exists no significant difference in the dimension of the learning strategy of higher secondary students concerning the locality of the school.

$H_0$8: There exists no significant difference in the dimension of the learning strategy of higher secondary students concerning the medium of instruction.

$H_0$9: There exists no significant difference in the learning strategy of higher secondary students concerning the type of management.

$H_0$10: There exists no significant difference in the academic achievement of higher secondary students concerning the type of management.
$H_0$11: There exists no significant difference in the dimensions of the learning strategy of higher secondary students concerning the type of management.
$H_0$12: There exists no relationship between learning strategy and academic achievement of higher secondary students.
$H_0$13: There exists no relationship between the dimensions of learning strategy and academic achievement of higher secondary students.
$H_0$14: There exists no influence of the dimensions of learning strategy on the academic achievement of higher secondary students.

Methodology

Quantitative research design especially the descriptive method with a cross-sectional survey technique was adopted for the research. Primary data has been collected from the 321 higher secondary students from Thiruvarur District, Tamil Nadu state, India by adopting a simple random sampling technique. The learning strategy is a predictor variable and academic achievement is an outcome variable. Gender, locality of the school, type of Management, and medium of instruction are considered demographic characteristics. Based on the hypotheses, descriptive, inferential, correlational, and regression analyses were computed. The sample distribution based of demographic characteristics is given in the following table.

Table 1: Sample Distribution Based on Demographic Characteristics

Demographic Characteristics	Sub-demographic Characteristics	Size of Sample		Total
		Number (n)	Percentage (%)	
Gender	Boys	184	57.32	321
	Girls	137	42.68	
Locality of the School	Urban	148	46.11	321
	Rural	173	53.89	
Type of Management	Government	108	33.65	321
	Government Aided	87	27.10	
	Private	126	39.25	
Medium of Instruction	Tamil	192	59.81	321
	English	129	40.19	

Vide Table 1, the 321 sample distributed based on the gender (184 boys and 137 girls), locality of the schools (148 urban and 173 rural schools), type of management (108 governments, 87 government aided and 126 private schools) and medium of instruction (192 Tamil and 129 English medium).
No variable can be measured without appropriate tool and here the authors have adopted learning strategy scale. The learning strategy scale was developed and standardized by the researchers and the process is briefly explained in the succeeding passages. The development of the learning strategy scale accompanied many steps such as planning, preparation of the preliminary draft, pre-tryout, editing, preliminary survey, item analysis, and development of the final draft. The content, number of questions, fixation of scale points, and dimensions were identified in the planning step. The dimensions of the learning strategy were identified by reading the definitions of learning strategies and their relevant scales. The dimensions of the scale are Collaborative Studying Technique (CST), Notes Developing Technique (NDT), Reading Technique (RT), Writing Technique (WT), Self-Assessment Technique (SAT), Content Organization Technique (COT), and Time Execution Technique (TET) and a blueprint for 48 items were prepared followed by items were developed in the step of preparation of the primary draft. The scale was sent to the panel of subject experts and it was further edited based on the subject experts in the step of pre-tryout, followed by a preliminary survey conducted to the random sample of 300 higher secondary students at Thiruvarur district, Tamil Nadu, India. The scale is 3 points rating so, the t-test analysis was done to find out the significance of the response of the rating according to researchers in past study, the item possesses 1.75 and its greater value in the t-test was retained (27) and all others are excluded in the scale, done in the step of item analysis. Development of the final draft is the final step, in

which, the retained 41 items comprised the final draft. The qualities of the learning strategy scale such as validity, reliability, and norms were established and it is said to be standardized. To find the face validity and content validity, the scale was sent to the panel of subject experts to check, whether the scale is ready to measure and coverage of its dimensions of contents and they recommended that the tool possess both face and content validity. After the validation process, the scale was subjected to reliability analysis using the split-half method, and the reliability was found to be 0.82. The mean norms have been established by using the Normal Probability Curve (NPC), i.e., the mean value is less than 41 is said to be low, a value between 42 and 82 is said to be average, and greater than 83 is said to be a high level of learning strategy. Based on the qualities of the learning strategy scale, it has a face and content validity, possesses reliability of 0.82, and norms established, and the scale is said to be standardized. Academic achievement encompasses examination scores and grades for successful completion of an academic course or a programme. Indian school system has a common examination system called public examination at two levels such as X and XII standards. Generally, six subjects such as Tamil, English, Mathematics, Physics, Chemistry, and Biology are taught at a higher secondary level for the mathematics group, and subjects of mathematics may be replaced by other subjects with alteration of science subjects for the non-mathematics group. Each subject was measured with 200 marks and overall 1200 marks. Measuring academic achievement is considered as the marks scored in the XII public examinations. A common classification that is above 60, between 60 to 45, and below 45 is referred to as First, Second, and Third class respectively.

Hypothesis testing is essential in the quantitative research and it is mandatory to direct the research. The following hypotheses have been formulated and tested with appropriate statistical techniques.

$H_0$1: The level of learning strategy of higher secondary students is high.

$H_0$2: The level of academic achievement of higher secondary students is in the first class.

Table 2: Descriptive Analysis of Learning Strategy and Academic Achievement

Variables		N	Mean	Standard Deviation	Description
Predictor Variable	Learning Strategy	321	73.63	10.04	Average
Outcome Variable	Academic Achievement		943.72	36.01	First Class

Vide Table 2, the mean values of the predictor variable (learning strategy) and the outcome variable (academic achievement) are 73.63 and 943.72 respectively. The learning strategy lies in average level and the academic achievement is in first-class of higher secondary students based on the norms concern.

$H_0$3: The level of dimensions of learning strategy of higher secondary students is high.

Table 3: Descriptive Analysis of Dimensions of Learning Strategy

Variable		N	Dimensions	Mean	Standard Deviation	Description
Predictor variable	Learning strategy	321	CST	71.12	10.11	Average
			WT	101.13	6.30	High
			NDT	69.09	11.42	Average
			RT	87.62	8.03	High
			SAT	78.20	7.16	Average
			COT	70.92	11.56	Average
			TET	37.33	15.71	Low

Vide Table 3, the mean values of the dimensions of the predictor variable (learning strategy) such as CST, WT, NDT, RT, SAT, COT, and TET are 71.12, 101.13, 69.09, 87.62, 78.20, 70.92, and 37.33 respectively. In the dimensions of learning strategy, the WT and RT are at high level; CST, NDT,

SAT, and COT are at the average level; and TET is at a low level of higher secondary students based on the norms concern. But focusing on the standard deviation, the values greater than 10, i.e., the dimensions of learning strategy such as CST, NDT, COT, and TET in which the students' scores deviated largely to their respective means, and the standard deviation values lie between 5 and 10 which means the students' scores slightly deviated from its respective mean values. The WT has the highest mean score, and TET has the least mean score in the dimension set.

$H_0$4: There exists no significant difference in learning strategy of higher secondary students is high concerning demographic characteristics such as gender, locality of the school, and medium of instruction.

Table 4: Mean, SD, and t-values of Learning Strategy Concerning Demographic Characteristics

Demographic characteristics		Learning Strategy (Predictor Variable) n	Mean	Standard Deviation (SD)	Standard Error (SE)	t-value	Significance @ 0.05 level
Gender	Boys	184	68.32	11.45	1.12	9.48	Significant
	Girls	137	78.94	8.63			
Locality of the school	Urban	148	42.53	9.71	1.00	11.96	Significant
	Rural	173	30.59	7.88			
Medium of Instruction	Tamil	192	57.9	11.42	1.17	9.09	Significant
	English	129	68.5	9.36			

Vide Table 4, the t-values between boys and girls concerning gender, between urban and rural concerning the locality of the school, and between Tamil and English concerning medium of instruction under the predictor variable (learning strategy) are 9.48, 11.96, and 9.09 respectively. All the t-values are greater than the critical value of 1.96 with the degrees of freedom 319 at 0.05 level and it is evident that the learning strategy has a significant difference with the demographic characteristics. Generally, high t-values occur either as the large difference between the mean values of the sub-variables or less value of the respective standard deviation or opposite to each other. Here, the high t-values indicate the differences between mean values of the sub-variables of demographic characteristics such as boys and girls of gender, urban and rural of the locality of the school, and Tamil and English of the medium of instruction is slightly high. It means that most of the students' academic achievement scores are largely deviated from the respective mean values of all sub-variables, though the mean between the sub-variable of each demographic variable is large and hence the high t-values have occurred.

$H_0$5: There exists no significant difference in Academic Achievement of higher secondary students concerning demographic characteristics such as gender, locality of the school, and medium of instruction.

Table 5: Mean, SD, and t-Values of Academic Achievement Concerning Demographic Characteristics

Demographic characteristics		Academic Achievement (Outcome Variable) n	Mean	Standard Deviation (SD)	Standard Error (SE)	df	t-value	Significance @ 0.05 level
Gender	Boys	184	866.13	9.37	1.24		125.46	Significant
	Girls	137	1021.31	12.01				
Locality of the school	Urban	148	1082.8	11.64	2.62	319	95.21	Significant
	Rural	173	804.64	7.62				
Medium of Instruction	Tamil	192	994.97	9.47	1.02		99.13	Significant
	English	129	893.47	8.66				

Vide Table 5, the t-values between boys and girls concerning gender, between urban and rural concerning the locality of the school, and between Tamil and English concerning medium of instruction in the outcome variable (academic achievement) are 125.46, 95.21, and 99.13 respectively. All the t-values are greater than the critical value of 1.96 with the degrees of freedom 319 and it is evident that academic achievement has a significant difference with the demographic characteristics. Generally, high t-values occur either as the large difference between the mean values of the sub-variables or less value of the respective standard deviation. Here, the high t-values indicate the differences between mean values of the sub-variables of demographic characteristics such as boys and girls of gender, urban and rural of the locality of the school, and Tamil and English of the medium of instruction is slightly high. It means that most of the student's academic achievement scores largely deviated from the respective mean values of all sub-variables, though the mean between the sub-variable of each demographic variable is large and hence the high t-values occurred.

$H_0$6: There exists no significant difference in the dimension of the learning strategy of higher secondary students concerning gender.

Table 6: n, SD, and t- Value of Dimensions of Learning Strategy Concerning Gender

Dimensions of Learning Strategy	Gender	n	Mean	Standard Deviation (SD)	Standard Error (SE)	df	t-value	Significance at 0.05 level
CST	Boys	184	63.52	10.20	1.44	319	6.70	Significant
	Girls	137	73.20	14.43				
WT	Boys	184	50.76	15.11	1.79		7.69	Significant
	Girls	137	64.53	16.41				
NDT	Boys	184	51.57	10.42	1.10		0.31	Not Significant
	Girls	137	51.23	9.18				
RT	Boys	184	65.34	10.11	1.54		3.36	Significant
	Girls	137	70.53	15.81				
SAT	Boys	184	50.90	12.35	1.64		10.45	Significant
	Girls	137	67.99	15.91				
COT	Boys	184	62.13	11.45	1.82		3.49	Significant
	Girls	137	68.47	18.83				
TET	Boys	184	57.90	11.30	1.43		7.44	Significant
	Girls	137	68.53	13.60				

Vide Table 6, the t-values between boys and girls concerning the dimensions of the predictor variable (learning strategy) such as CST, WT, NDT, RT, SAT, COT, and TET are 6.70, 7.69, 0.31, 3.36, 10.45, 3.49, and 7.44 respectively. The t-value of the dimension such as NDT of the predictor variable is less than and all others are greater than the critical value of 1.96 with the degrees of freedom 319 and it is evident that the boys and girls are not significant in NDT but they are significant in all other dimensions of the predictor variable. Though other than the dimension of NDT, mean differences are not too large, the significance between the genders occurred based on the values of respective standard deviations. It denotes that the mean values of boys and girls lie near to each other but the deviation of each boy and girl from their respective mean score is varied and this made a significant difference between them.

$H_0$7: There exists no significant difference in the dimension of the learning strategy of higher secondary students concerning the locality of the school.

Table 7: n, SD, and t- Value of Dimensions of Learning Strategy Concerning the Locality of the School

Dimensions of learning strategy	Locality of the School	n	Mean	Standard Deviation (SD)	Standard Deviation (SE)	df	t-value	Significance at 0.05 level
CST	Rural	184	74.13	9.08	1.16	319	3.50	Significant

	Urban	137	70.06	11.13			
WT	Rural	184	65.17	15.81	1.38	9.48	Significant
	Urban	137	78.23	8.61			
NDT	Rural	184	38.14	15.90	1.58	3.83	Significant
	Urban	137	32.11	12.32			
RT	Rural	184	65.32	11.95	1.13	12.39	Significant
	Urban	137	79.34	8.32			
SAT	Rural	184	67.33	11.45	1.12	9.95	Significant
	Urban	137	78.48	8.63			
COT	Rural	184	36.84	13.63	1.60	1.62	Not significant
	Urban	137	34.25	14.62			
TET	Rural	184	40.14	15.93	1.59	1.69	Not significant
	Urban	137	37.45	12.62			

Vide Table 7, the t-values between rural and urban concerning the dimensions of the predictor variable (learning strategy) such as CST, WT, NDT, RT, SAT, COT, and TET are 3.50, 9.48, 3.83, 12.39, 9.95, 1.62, and 1.69 respectively. The t-value of the dimensions such as COT, and TET of the predictor variable is less than and all others are greater than the critical value of 1.96 with the degrees of freedom 319 and it is evident that the rural and urban are not significant in COT and TET and all other dimensions are significant. Though other than the dimension of COT and TET, mean differences are not too large, the standard deviations are greater and so the significance might occur. It denotes that the rural and urban students' scores largely deviated from their respective mean scores; also the deviation is varied and made significantly.

$H_0$8: There exists no significant difference in the dimension of the learning strategy of higher secondary students concerning the medium of instruction.

Table 8: n, SD, and t - Value of Dimensions of Learning Strategy Concerning Medium of Instruction

Dimensions of learning strategy	Medium of Instruction	n	Mean	Standard Deviation (SD)	Standard Deviation (SE)	df	t-value	Significance at 0.05 level
CST	Tamil	213	68.13	10.11	1.54		1.22	Not significant
	English	108	70.02	14.37				
WT	Tamil	213	89.31	16.12	1.76		4.02	Significant
	English	108	96.44	14.37				
NDT	Tamil	213	56.73	10.13	1.63		4.26	Significant
	English	108	63.72	15.41				
RT	Tamil	213	86.22	9.47	1.25	319	1.91	Not significant
	English	108	88.63	11.22				
SAT	Tamil	213	72.69	6.33	0.93		6.91	Significant
	English	108	79.11	8.53				
COT	Tamil	213	67.98	11.22	1.43		2.86	Significant
	English	108	72.10	12.62				
TET	Tamil	213	33.41	14.33	1.92		1.42	Not significant
	English	108	36.14	17.16				

Vide Table 8, the t-values between Tamil and English medium concerning the dimensions of the predictor variable (learning strategy) such as CST, WT, NDT, RT, SAT, COT, and TET are 1.22, 4.02, 4.26, 1.91, 6.91, 2.86, and 1.42 respectively. The t-value of the dimensions such as CST, RT, and TET of the predictor variable is less than and all others are greater than the critical value of 1.96 with the degrees of freedom 319 and it is evident that the Tamil and English medium students are not significant in CST, RT and TET and all other dimensions are significant. However other than the dimension of the CST, RT, and TET, the mean differences are slightly large and the standard

deviations are slightly greater so the significance may occur. It denotes, the Tamil and English medium students' scores largely deviated from their respective mean scores; also the deviations are varied and made significantly.

$H_0$9: There exists no significant difference in the learning strategy of higher secondary students concerning the type of management.

$H_0$10: There exists no significant difference in the academic achievement of higher secondary students concerning the type of management.

Table 9: F-Value of Learning Strategy and Academic Achievement Concerning Type of Management

Variable	Sum of Square (SS)		df	SS/df	F-ratio	Significance at 0.05 level
Learning Strategy	BSS	20071.130	2	10035.565	1.86	Not Significant
	WSS	1720190.854	318	5409.405		
	TSS	1740261.984	320	-		
Academic Achievement	BSS	10000321.461	2	5000160.731	5.80	Significant
	WSS	271304618.439	318	853159.177		
	TSS	281304939.900	320	-		

BSS – Between sum of squares, WSS – Within sum of squares, and TSS – Total sum of squares

Vide Table 9, the F-values of learning strategy and academic achievement concerning to type of management are 1.86 and 5.80 respectively. The F-value of the learning strategy is less than and the academic achievement is greater than the critical value of 3.02 with the degrees of freedom 2, 318 at 0.05 level. Hence the learning strategy is not significant and academic achievement is significant concerning the type of management. To find out the significant difference in academic achievement among the sub-variables of type of management, Turkey's post-hoc test was computed.

Table 10: Turkey's Post-Hoc Test of Academic Achievement Concerning Sub-Variables of Type of Management

Variable	Sub-Variables of Type of Management	n	Mean Value of Homogeneous Sub-set	
			Sub-set 1	Sub-set 2
Academic achievement	Government	108	927.31	-
	Government-aided	87	931.73	-
	Private	126	-	948.99

Vide Table 10, the mean values of sub-variables of type of management concerning academic achievement are categorized under two sub-sets, and the sub-variables listed within are homogeneous. No significance occurs between the variables within the homogeneous sub-sets and significance occurs between the sub-sets. Based on this, the government, and government-aided are listed within homogenous sub-set 1 and hence there is no significant difference between them. Private schools are other sub-set and hence private schools are significant with government and government-aided schools in academic achievement.

$H_0$11: There exists no significant difference in the dimensions of the learning strategy of higher secondary students concerning the type of management.

Table 11: F- Values of Dimensions of Learning Strategy Concerning the Type of Management

Dimensions of Learning Strategy	Sum of Square (SS)		df	SS/df	F-ratio	Significance at 0.05 level
CST	BSS	19011.397	2	9505.698	1.75	Not Significant
	WSS	1721250.587	318	5412.737		
	TSS	1740261.984	320	-		
WT	BSS	39402.901	2	19701.450	3.68	Significant
	WSS	1700859.083	318	5348.613		

	TSS	1740261.984	320	-		
	BSS	16932.108	2	8466.054		
NDT	WSS	1723329.876	318	5419.276	1.56	Not Significant
	TSS	1740261.984	320	-		
	BSS	37121.362	2	18560.681		
RT	WSS	1703140.622	318	5355.788	3.46	Significant
	TSS	1740261.984	320	-		
	BSS	18601.107	2	9300.553		
SAT	WSS	1721660.877	318	5414.027	1.71	Not Significant
	TSS	1740261.984	320	-		
	BSS	20123.875	2	10061.937		
COT	WSS	1720138.109	318	5409.239	1.86	Not Significant
	TSS	1740261.984	320	-		
	BSS	10421.550	2	5210.775		
TET	WSS	1729840.434	318	5439.749	0.95	Not Significant
	TSS	1740261.984	320	-		

BSS – Between sum of squares, WSS – Within sum of squares, and TSS – Total sum of squares

Vide Table 11, the F-values of the dimensions of learning strategy such as CST, WT, NDT, RT, SAT, COT, and TET are 1.75, 3.68, 1.56, 3.46, 1.71, 1.86, and 0.95 respectively. The F-value of the dimensions of learning strategy such as WT and RT is greater than the critical value of 3.02 with the degrees of freedom (2, 318) at 0.05 level, and the WT and RT are significant. The dimensions other than WT and RT are not significant due to having less F-value of the same critical value at 0.05 levels with the same degrees of freedom. Further, Turkey's post-hoc test was computed to find the significant difference in WT and RT dimensions concerning the sub-variables of type management.

Table 12: Turkey's Post-Hoc Test of WT and RT Dimensions Concerning Sub-Variables of Type of Management

Dimensions of Learning Strategy	Sub-Variables of Type of Management	n	Mean Value of Homogeneous Sub-set	
			Sub-set 1	Sub-set 2
	Government	108	82.31	-
WT	Government-aided	87	84.73	-
	Private	126	-	89.79
	Government	108	82.16	-
RT	Government-aided	87	-	87.11
	Private	126	-	90.26

Vide Table 12, the mean values of sub-variables of type of management concerning the dimensions of teaching strategy such as WT and RT are categorized with two sub-sets, and the sub-variables listed within the sub-sets are homogeneous. No significance occurs between the variables within the homogeneous sub-sets and significance occurs between the sub-sets.

Focusing on the WT dimension, there is no significant difference in learning strategy between government and government-aided school students but there is a significant difference in learning strategy between government and private school students and government-aided and private school students. However, private school students perform more in WT than in other types of management.

Focusing on the RT dimension, there is no significant difference between government-aided and private school students but there is a significant difference in government and government-aided school students and government and private school students. However, private school students perform higher in RT than others.

$H_0$12: There exists no relationship between learning strategy and academic achievement of higher secondary students.

Table 13: Correlation between Learning Strategy and Academic Achievement

Variables	Academic achievement	Status of Relationship
Learning strategy	0.93*	Very high

* Significant at 0.05 level

Vide Table 13, the correlation coefficient value between learning strategy and academic achievement is 0.93 and it is a positive very high correlation according to the strength of the relationship established by Karl Pearson. It denotes that 93 percent of students' scores of learning strategy and academic achievement either in ascending or descending order lie in the same rank and others may be dislocated. Hence, it proves that the students possess high or low scores in learning strategy and also they possess high or low scores in academic achievement respectively and correlation is said to be highly correlated. Here, 93 percent of students possess an average learning strategy concerning their academic achievement at first class instead of the whole.

$H_0$13: There exists no relationship between the dimensions of learning strategy and academic achievement of higher secondary students.

Table 14: Correlation between Dimensions of Learning Strategy and Academic Achievement

Variables and their Dimensions		Academic Achievement	Status
Learning Strategy	CST	0.93*	Very High
	WT	0.96*	Very High
	NDT	0.49*	Moderate
	RT	0.91*	Very High
	SAT	0.74*	High
	COT	0.71*	High
	TET	0.38*	Low

* Significant at 0.05 level

Vide Table 14, the correlation coefficient value between dimensions of learning strategy and academic achievement such as between CST and academic achievement, WT and academic achievement, NDT and academic achievement, RT and academic achievement, SAT and academic achievement, COT and academic achievement, and TET and academic achievement are 0.93, 0.96, 0.49, 0.91, 0.74, 0.71 and 0.38 respectively. The dimensions of learning strategy such as CST, WT, and RT have a very high positive correlation, SAT and COT have a high positive correlation, the NDT has a moderate positive correlation and TET has a low positive correlation with academic achievement. The correlation values indicate that the percentage of the value of the dimension of learning strategy is related to the academic achievement in the first class instead of the whole. On the other side, the students prefer one dimension of the learning strategy also the others too so the correlation value is minimal at a moderate level except for the TET. The correlation values denote the dimension such as CST, WT and RT have a very high correlation and the dimension such as TET has low correlation with academic achievement (Table 15).

$H_0$14: There exists no influence of the dimensions of learning strategy on the academic achievement of higher secondary students.

Table 15: Regression Analysis of Predictor and Outcome Variables

		ANOVA				
Predictor variables		**Sum of Square**	**df**	**Mean Square**	**F-ratio**	**Significance**
Dimensions of Learning Strategy	Regression	93473.237	2	46736.619	9.02	0.000*
	Residual	1646788.747	318	5178.581		
	Total	1740261.984	320	-		

a. Outcome variable: academic achievement

b. Predictor variables: CST, WT, NDT, RT, SAT, COT, and TET

* Output variable is significant with predictor variables @ 0.01 level

Table 16: Regression Values of Model Fit Analysis

Predictor Variables	Un-standardized Coefficients		Standardized Coefficients	t-value	Significance
	Beta	Standard Error (SE)	Beta		
Constant	4.723	0.425	-	11.112	0.000*
CST	9.262	0.529	8.362	17.509	0.000*
WT	1.732	0.692	3.427	2.503	0.041#
NDT	8.441	0.938	5.671	8.998	0.000*
RT	4.628	0.914	9.321	5.063	0.000*
SAT	2.374	0.564	1.602	4.209	0.000*
COT	0.017	0.022	0.924	0.773	0.032#
TET	3.536	0.179	2.963	14.168	0.000*

a. Outcome variable: academic achievement

b. Predictor variables: CST, WT, NDT, RT, SAT, COT, and TET

* Outcome variable is significant with independent variables @ 0.01 level

Outcome variable is significant with independent variables @ 0.05 level

Vide Table 16, the equation for the regression model with un-standardized coefficients is given below,

$$Y= 9.262X_1 + 1.732X_2+8.441X_3+4.628X_4+2.374X_5+0.017X_6+3.536X_7+4.723$$

Where,

Y - Outcome Variable (Academic Achievement)

X - Predictor Variables ($X_1, X_2, X_3, X_4, X_5, X_6$, and X_7 are CST, WT, NDT, RT, SAT, COT, and TET respectively)

Based on the equation mentioned above, the increase of one unit of academic achievement occurs by the increase in a unit of each dimension of learning strategies such as 9.262 of CST, 1.732 of WT, 8.441 of NDT, 4.628 of RT, 2.374 of the SAT, 0.017 of COT and 3.536 of TET with the constant value of 4.723. It indicates that the outcome variable such as academic achievement is highly influenced by the predictor variables such as CST and NDT highly influenced, and merely influenced by the dimension SAT.

Results

Based on the analysis, the following major findings are observed.

R_1: The level of learning strategy of higher secondary students lies in the average.

R_2: The level of academic achievement of higher secondary students is in first class.

R_3: The level of dimensions of learning strategy of Higher Secondary students such as reading and writing techniques are high, the collaborative studying, notes developing, self-assessment, and content organization techniques are average, and the time execution technique is low.

R_4: There exists a significant difference in the learning strategy of higher secondary students concerning gender, locality of the school, and medium of instruction.

R_5: The significant difference in the dimensions of learning strategy of higher secondary students is different for each dimension of learning strategy concerning gender such as the dimension that notes developing technique is not significant, and the dimensions that collaborative studying, writing, reading, self-assessment, content organizing, and time execution techniques are significant.

R_6: The significant difference in the dimensions of learning strategy of higher secondary students is different for each dimension of learning strategy concerning locality of the school, such as, the dimension that the content organizing and time execution techniques are not significant, and the dimension that collaborative studying, writing, notes developing, reading and self-assessment techniques are significant.

R_7: There exists a significant difference in academic achievement of higher secondary students is high concerning gender, locality of the school, and medium of instruction.

R_8: There exists no significant difference in the learning strategy of higher secondary students concerning the type of management.

R_9: There exists a significant difference in academic achievement of higher secondary students concerning the type of management. The significant difference in academic achievement among higher secondary students between the sub-variables of type of management, such as, Government and Government Aided schools are not significant, Government and Private schools are significant, and Government Aided and Private schools are significant.

R_{10}: The correlation between learning strategy and academic achievement of higher secondary students is high.

R_{11}: The correlation between each dimension of learning strategy and academic achievement of higher secondary students is such as, Collaborative studying technique and academic achievement is very high, Writing technique and academic achievement is very high, Notes developing technique and academic achievement is moderate, Reading technique and academic achievement is very high, Self-assessment technique and academic achievement is high, Content organization technique and academic achievement is high, and Time execution technique and academic achievement is low.

R_{12}: The one-unit increase in academic achievement is influenced by the increase of 9.262 in collaborative studying technique, 1.732 in writing technique, 8.441 in notes developing technique, 4.628 in reading technique, 2.374 in self-assessment technique, 0.017 in content organizing technique, and 3.536 in time execution technique.

Discussion

Based on the statistical analysis and results, the study revealed that the level of learning strategy and academic achievement of the higher secondary students lie in the level of high and first class respectively. Though, the dimensions of learning strategy in which time execution technique (TET) is low; collaborative studying (CST), notes developing (NDT), self-assessment (SAT), and content organization techniques (COT) are average; writing (WT) and reading techniques (RT) are high. The learning strategy is significant concerning gender, locality of the school, and medium of instruction, and especially girls highly utilize the learning strategy than boys (14). Firstly, focusing on the significance of learning strategy by its dimensions, the notes developing technique is not significant and all others such as collaborative studying, writing, reading, self-assessment, content organization, and time execution are significant, and girls are performing high than boys in the significant dimensions of learning strategy.

Secondly, the content organization (COT) and time execution techniques (TET) are not significant, and the dimensions of collaborative studying (CST), writing (WT), notes developing (NDT), reading (RT) and self-assessment techniques (SAT) are significant in which the rural students perform highly in collaborative studying (CST) and notes developing techniques (NDT), and focusing on other than these, the students studying in urban schools are performing high.

Thirdly, the dimensions of collaborative studying (CST), reading (RT), and time execution techniques (TET) are not significant; and writing (WT), notes developing (NDT), self-assessment (SAT), and content organization techniques (COT) in which English medium students perform high than Tamil medium students.

ANOVA on learning strategy shows no significant difference in it by type of management. The dimensions of writing (RT) and reading techniques (RT) are significant by type of management and others are not significant. In write dimension government and government-aided are homogeneous and private are isolated sub-sets, and read dimension government aided and private are homogeneous and the government is an isolated sub-set.

The academic achievement of higher secondary students is in first class and it is significant concerning demographic characteristics such as gender, locality of the school, and medium of instruction. Among them, girls are performing higher than boys in gender (24), students studying in urban schools achieved higher than students studying in rural schools (24), and Tamil students achieved higher than English medium students. ANOVA on Academic achievement towards the type of management is significant, especially government and government-aided are homogeneous and private is isolated sub-sets (22). The relationship between learning strategy and academic achievement shows very high (17, 18) and the dimensions of learning strategy such as self-assessment (SAT) and content organization techniques (COT) have a high correlation, the notes

developing technique (NDT) has a moderate correlation, and collaborative study (CST), writing (WT), and reading techniques (RT) have a very high correlation and these make a very high correlation between learning strategy and academic achievement.

Regression analysis reveals that the collaborative studying (CST) dimension highly influences academic achievement (15, 16, 19, 21, 23, 25, 26) followed by notes developing (NDT), reading (RT), time execution (TET), self-assessment (SAT), writing (WT) and content organization techniques (COT) and arranged in descending influential manner. It indicates that the outcome variable such as academic achievement is highly influenced by the predictor variables such as collaborative study and notes developing techniques, and is merely influenced by content organization technique. The higher secondary students prefer collaborative studying techniques than other for their learning.

Conclusion

A conclusion is not just a summary of results of the research but it provides 360° understanding of the research problem. The findings referred to in the present study have indicated that the student's academic achievement is influenced by the dimensions of learning strategy. For that, the researcher introduces a learning strategy scale and finds the preferences for the dimensions of the learning strategy by the students. The different dimensions of learning strategy have been analyzed for different criteria such as gender, locality of the school, medium of instruction, type of management, etc that should receive a greater influence on their academic achievement. The result reveals the influences of dimensions of the learning strategy on academic achievement.

Based on the findings and discussion made by the investigator, it is concluded that the dimension of learning strategy positively influences academic achievement and the teacher could follow the same learning strategy to maintain the student's academic achievement in first class. The teacher may concentrate on the dimension such as writing and self-assessment of the students to reach the achievement level at the first class with distinction and more concentration is essential towards the content organization dimension. A teacher can focus on the dimension which is a lack in the students' activity may assist in reaching improvement in students' learning, the curriculum may recommend some learning strategies to the students for successful learning and these are suggestive.

Abbreviations

BSS: Between Sum of Square, COT: Content Organizing Technique, CST: Collaborative Studying Technique, df: Degrees of Freedom, H_0: Null Hypothesis, n: Number, NDT: Notes Developing Technique, NPC: Normal Probability Curve, R: Result, RT: Reading Technique, RG: Research Gap, SAT: Self-Assessment Technique, SD: Standard Deviation, SE: Standard Error, SS: Sum of Square, TET: Time Execution Technique, TSS: Total Sum of Square, WSS: Within Sum of Square, WT: Writing Technique.

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Author Contributions

AKM: research, RB: research, ML: research, KS: guidance and supervision, developed this article with the assistance of the remaining authors. All authors approved the manuscript.

Conflict of Interest

The authors declare that they have no conflict of interest.

Ethics Approval

During the data collection, the fourth author provided an oral description of the study objectives, the importance of the study, data confidentiality and ensured the sample's rights to involve themselves. Informed consent and feedback on ethical issues of the scale were obtained from the sample of this research so it adheres to the ethics of the research.

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