ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24AUG113

The Impact of Psychological and Contextual Factors on Student Achievement in Chemistry: A Quantitative Study in Sri Lankan Senior Secondary Schools

[1*]B. Siri Sumedha Thero ; [2]K.S.H.M.V.W.W. Senevirathne
[1]Piriven Education Branch, Ministry of Education, Isurupaya, Baththaramulla, Sri Lanka.
[2]Department of Education, Faculty of Arts, University of Peradeniya, Peradenya, Sri Lanka.

Corresponding Author: [1*]B. Siri Sumedha Thero

Abstract:- This quantitative study investigates the influence of psychological and contextual factors on chemistry achievement among senior secondary school students in Sri Lanka. The research examines teachers' teaching styles, students' understanding of concepts, subject satisfaction, and attitudes toward chemistry as psychological factors, with gender and school type as contextual characteristics. Using a sample of 302 students and 114 teachers from 13 schools in the Kegalle Education Zone, data were collected using a Likert scale-based instrument and a structured chemistry test. The validity and reliability of the instruments were confirmed by pilot testing and confirmatory factor analysis. Data analysis, performed with SPSS and Amos software, used multivariate techniques and structural equation modeling. The results indicate that attitude towards chemistry and gender significantly influence student achievement. All variables except school location have a positive effect on student achievement. Recommendations include enhancing teacher training programs to promote effective, student-centered teaching styles, developing interventions aimed at improving students' conceptual understanding and attitudes towards chemistry, ensuring that curriculum and teaching practices are engaging and relevant to student's interests and experiences, and implementing gender-sensitive strategies to support both boys and girls in achieving their full potential in chemistry. This study provides valuable insights for educators and policymakers to design targeted strategies that address the identified factors, ultimately aiming to enhance educational outcomes and student performance in chemistry.

Keywords:- *Student Achievement, Chemistry Education, Psychological Factors, Contextual Characteristics, Teaching Styles, Concept Perception, Subject Satisfaction, Attitudes towards Chemistry, Gender Differences, School Types.*

I. INTRODUCTION

Education plays a pivotal role in shaping the future of a nation, and within this domain, science education is critical for fostering innovation and technological advancement. In Sri Lanka, secondary education includes a significant emphasis on subjects such as chemistry, which is essential for students aspiring to careers in science and technology. Despite its importance, there is a noticeable gap in understanding the various factors that influence student achievement in chemistry within the Sri Lankan context. Addressing this gap is crucial for enhancing educational outcomes and developing targeted interventions.

- *This study investigates the impact of various factors on student achievement in chemistry in Sri Lankan senior secondary schools. Specifically, it addresses the following research questions:*

- How do contextual features such as school type, location, and governing body influence students' perception and understanding of chemistry concepts?
- In what ways do contextual characteristics, including gender, school type, and location, affect student achievement in chemistry?
- How do psychological factors such as teaching styles, students' attitudes, and subject satisfaction impact their perception and understanding of chemistry concepts?
- What is the effect of psychological factors, including teaching styles, attitudes towards chemistry, and subject satisfaction, on student achievement in chemistry?
- How can Structural Equation Modeling (SEM) be used to uncover and quantify the influence of contextual characteristics and psychological factors on student achievement in chemistry?

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24AUG113

➢ *Significance of the Study*

This study is significant as it provides a comprehensive analysis of factors affecting student achievement in chemistry within the Sri Lankan context. The findings will be valuable for educators, policymakers, and curriculum developers in designing strategies to improve chemistry education. By identifying key influences on student performance, the study aims to contribute to the enhancement of educational quality and student outcomes in senior secondary schools. Understanding these factors will enable the development of targeted interventions and policies that can effectively address the challenges faced in chemistry education, thereby improving student achievement and fostering a stronger foundation in science education for Sri Lankan students.

➢ *Problem Statement*

While extensive international research exists on factors influencing student achievement in chemistry, there is a significant gap in local studies within Sri Lanka. This research seeks to fill this gap by identifying and analyzing the psychological factors and contextual characteristics that affect student achievement in chemistry among Senior secondary school students in Sri Lanka. The findings will provide valuable insights for developing targeted educational strategies and policies to improve student outcomes in chemistry.

II. LITERATURE REVIEW

Teaching style plays a critical role in student learning and achievement. Research indicates that interactive and student-centered teaching approaches are more effective in enhancing student understanding and performance in science subjects, including chemistry. For instance, teachers who use inquiry-based learning, collaborative activities, and real-life applications of chemistry concepts tend to foster greater student engagement and achievement (Fraser, 2020; Trigwell & Prosser, 2019). Effective teaching strategies include concept mapping, formative assessments, and the use of visual aids to improve conceptual understanding (Novak & Gowin, 2018; Taber, 2017). The way students perceive and understand chemistry concepts significantly impacts their learning outcomes. Misconceptions and lack of clarity can hinder academic performance. Strategies to improve conceptual understanding include concept mapping, formative assessments, and visual aids (Novak & Gowin, 2018; Taber, 2017). Students' satisfaction with chemistry can influence their motivation and performance. Positive experiences, such as enjoyable laboratory activities, relevant curriculum, and supportive teacher-student interactions, contribute to higher satisfaction levels, enhancing academic achievement (Hofstein & Lunetta, 2021; Osborne & Collins, 2022). Students' satisfaction with the subject of chemistry can influence their motivation and performance. Positive experiences, such as enjoyment of laboratory activities, relevance of the curriculum, and supportive teacher-student interactions, contribute to higher satisfaction levels, which in turn enhance academic achievement (Hofstein & Lunetta, 2021; Osborne & Collins, 2022). Attitude towards chemistry is a critical factor in determining student engagement and success. Positive attitudes, including interest, enjoyment, and perceived relevance of chemistry, are associated with better academic outcomes. Interventions aimed at improving students' attitudes towards chemistry, such as hands-on experiments and contextual learning, have been shown to boost achievement (Bennett, Hogarth, & Lubben, 2019; Salta & Tzougraki, 2018).

Gender differences in science achievement have been widely studied. While some research suggests that boys outperform girls in science subjects, other studies indicate that these differences are narrowing. Factors such as societal expectations, teacher biases, and self-efficacy beliefs can influence gender differences in chemistry achievement (Clewell & Campbell, 2023; Hyde, 2020). Schools with better resources, experienced teachers, and supportive learning environments tend to produce higher student achievement in chemistry (Hanushek, 2018; Lee & Smith, 2019). School location, categorized as rural, semi-urban, or urban, affects access to educational resources and opportunities. Urban schools often have better infrastructure, qualified teachers, and extracurricular activities, contributing to higher student achievement compared to rural schools (Hannaway & Talbert, 2018; Lee & Smith, 2019). The governance of schools, whether national or provincial, can influence educational quality. National schools typically have more funding, resources, and autonomy, positively impacting student achievement in chemistry (Carnoy & Loeb, 2018; Fuller & Clarke, 2019)

III. METHODOLOGY

➢ *Research Design*

This study employs a quantitative research design, utilizing the research onion diagram to systematically explore the factors influencing student achievement in chemistry (Raithatha, 2017). The onion model involves multiple layers of analysis, starting from broad contextual characteristics and narrowing down to individual psychological factors. This approach allows for a comprehensive examination of the complex interplay between various influences on student performance.

➢ *Sample Selection*

The sample size was determined using Morgan's table (Krejcie & Morgan,1970), which provides guidelines for selecting a representative sample from a larger population. A total of 302 students and 114 teachers from 13 schools in the Kegalle Education Zone of the Kegalle District were selected. The cluster random sampling technique was used to ensure a diverse and representative sample, capturing variations across different school types, locations, and governing bodies.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24AUG113

➢ *Data Collection Instruments*

Four research instruments were developed based on existing foreign research literature and adapted to the local context. These instruments were designed to measure teachers' teaching styles, students' concept perception of chemistry, subject satisfaction, and attitudes towards chemistry. Each instrument utilised a Likert scale format, with items rated on a scale from 1 (strongly disagree) to 5 (strongly agree). Additionally, a structured chemistry question paper was prepared to assess student performance.

➢ *Data Collection Procedure*

The research instruments were translated into Sinhala by three subject experts to ensure linguistic and cultural relevance. A pilot test was conducted with 10% of the research sample to validate the instruments and ensure their reliability. The instruments were then administered to the selected sample, with teachers and students completing the surveys under standardized conditions. Data were collected over several weeks, ensuring comprehensive coverage of the target population.

The validity and reliability of the study instruments were also measured with care. Tables 1 and 2 make it abundantly evident that every piece of research equipment was finished to the highest standard.

Table 1 Cost-Effectiveness Comparison between Pilot and Main Studies

Scale	Pilot test			Real test		
	Items	**Cronbach's Alpha**	**Cronbach's Alpha Based on Standardized Item**	**Items**	**Cronbach's Alpha**	**Cronbach's Alpha Based on Standardized Item**
SSQ	42	0.954	0.957	42	0.957	0.959
SPQ	35	0.779	0.809	35	0.826	0.838
SAQ	30	0.764	0.794	30	0.793	0.806
TSQ	40	0.946	0.948	40	0.922	0.930

(SSQ -Student satisfaction, SPQ-Student perception, SAQ-Student attitude, TSQ -Teaching style)

Table 2 Identifies the Validity of each Research Instrument

Variable	**No of item**	**Kmo value**	**Bartlert significant**
SSQ	42	0.908	0.000
SPQ	35	0.771	0.000
SAQ	30	0.750	0.000
TSQ	40	0.905	0.000

IV. DATA ANALYSIS & RESULTS

Prior to data analysis, an exploratory data analysis (EDA) was conducted to validate the collected data. First, missing values and outliers were removed. Then multicollinearity, linearity, and homoscedasticity tests were performed. In addition, normality tests were also performed for all research instruments to examine the nature of normal distributions in the data. SPSS version 25 and AMOS Graphics version 25 software packages were used for these data analyses. Multiple analytic techniques, including multiple regression and factor analysis, were used to identify relationships between independent variables and student achievement. Structural equation modelling was used to develop and test theoretical models, exploring the direct and indirect effects of the identified factors on student performance.

Conducted a confirmatory factor analysis (CFA) specifically for all research instruments. The measurement model related to it is shown by the following diagrams 1.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24AUG113

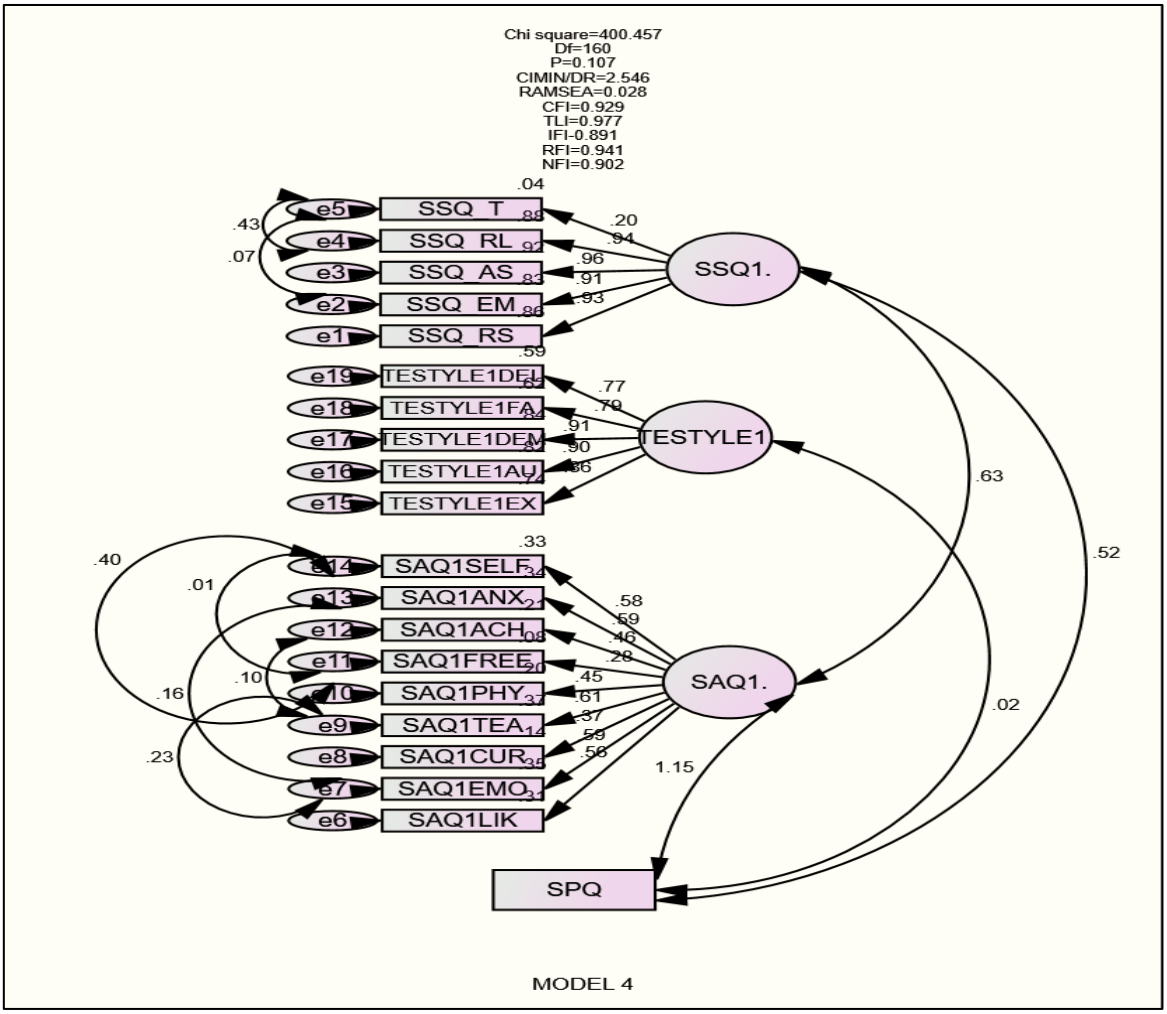

Fig 1 Initial Measurement Model Related to the Research Instruments Designed to Measure all the Psychological Variables Relevant to the Research.

Compute variables were created by combining the questionnaire items of the research instruments. Accordingly, the accuracy of the initial measurement model of all psychological variables was tested. The measurement scales obtained for the test carried out are clearly mentioned in Table No. 3

Table 3 Model Fit Indicators of the Measurement Model

Category	Goodness of fit index	Observed Value	Threshold	Decision
Absolute fit Indicates	P	0.107	>0.05	Satisfied
	CMIN/DF	2.546	< 3 good	Satisfied
	GFI	0.979	>0.9 good > 0.8 Acceptable	Satisfied
	RMESA	0.028	< 0.1	Satisfied
	RMR	0.014	< 0.1	Satisfied
	Hoelter's CN (.05)	372	>200	Satisfied
Incremental fit indices	TLI	0.977	>0.9	Satisfied
	CFI	0.929	>09	Satisfied
	RFI	0.941	>0.9	Satisfied
	NIF	0.902	>0.9	Satisfied
Parsimony fit indices	PRATIO	0.862	>0.8	Satisfied
	PNFI	0.829	>0.8	Satisfied
	PCFI	0.850	>0.8	Satisfied

According to table number 3 CMIN/DF value shows a value of 2.546 (CMIN/DF=2.546). The value of GFI (goodness of fit index) is high at 0.979 (GFI=0.979). The RMESA value is at a level of 0.028, and the requirement of being less than the level of 0.1 that should be in an appropriate measurement model is fulfilled (RMESA =

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24AUG113

0.028). The RMR value is also at a level of 0.014 (RMR=0.014). So Hoelter's CN value is 372 and the need to be above 200 is fulfilled. Accordingly, the prepared research equipment could be identified as the optimal level and quality equipment. Also, the absolute fit indicates that the research equipment should have been completed. In addition, TLI, CFI, RFI, and NIF values took the optimal value levels of 0.977, 0.929, 0.941, and 0.902, respectively (TLI = 0.977, CFI = 0.929, RFI = 0.941, and NFI = 0.902). Also, the values of PRATIO, PNFI, and PCFI all took a high value close to the level of 0.8 (PRATIO = 0.862, PNFI = 0.829, PCFI = 0.850). Accordingly, it will be clear that the data related to the current study also confirms that the measurement model related to the instruments is at an acceptable and optimal level even if used to measure all the variables of the research. Meanwhile, the following tests were also carried out to further confirm that the research instrument is a valid research instrument.

➢ *Validation of the measurement Model*

The results of the convergent validity test carried out to evaluate the validity of the measurement model were clearly shown in Table 4

Table 4 Convergent Validity Measures

Construct	No of Items	Standardized factor loading (>0.7)	Average variance exacted (AVE) (>0.6)	Composite Reliability (CR) (>0.7)
SSQ1	5	0.734 - 0.910	0.726	0.929
SAQ1	9	0.784 - 0.910	0.710	0.924
TESTYLE	5	0.843 – 0.892	0.763	0.928

According to Table No. 4 above, it is clear that the convergent validity for each construct is at an optimal level due to the minimum values of the standardized factor loadings related to all the constructs. Accordingly, the minimum values for SSQ1, SAQ1, and TESTYLE were found to be 0.734, 0.784, and 0.843, respectively (SSQ1=0.734, SAQ1=0.784, TESTYLE=0.843), so the AVE values were 0.726, 0710, and 0763, respectively (SSQ1=0.726, SAQ1=0.710). , and CR values were 0.929, 0.924, and 0.928 (SSQ1=0.929, SAQ1=0.924, TESTYLE=0.928), respectively. Heya Atal points out that the AVE value should be higher than the correlation value, and it will be clear that this requirement has also been fulfilled here.

Table 5 Interconstruct Correlation and Squreroot of AVE

	SSQ1	SAQ1	TESTYLE1
SSQ1	**0.873**		
SAQ1	0.249	**0.852**	
TESTYLE1	0.517	0.388	**0.843**

Heir Atal points out that the square root of these values should be greater than the value As shown in Table No. 5 above, it will be seen that the values of the instruments (square root of AVE) used in the research are high. Also, all AVE values are higher than inter-construct correlation values. Thus, the confirmatory factor analysis (CFA) conducted for the measurement instruments related to the current research enabled us to confirm that the research instruments are of acceptable quality and acceptability. The data analysis tasks were performed on the main study to find answers to the research questions, respectively.

➢ *Multivariate Effect between Variables*

- *Investigating the Impact of Contextual Features on Concept Perception.*

First of all, the information from the analysis of variance is tested to see if the model used is significant. The significant value should be less than 0.05 ($p < 0.05$). When this requirement is fulfilled, the conceptual model related to the research will be confirmed to be correct (model fit). Accordingly, it will be clear from Table No. 6 below that model No. 1 related to this study is statistically acceptable ($df = 4$, $f = 3.367$, $p = 0.010$).

Table 6 Analysis of Variance Related to the Variables of the Conceptual Model – 1 ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.935	4	.484	3.367	.010[b]
	Residual	42.660	297	.144		
	Total	44.595	301			
a. Dependent Variable: SPQ						
b. Predictors: (Constant), SCTYPE_3, SCTYPE_1, SCTYPE1_2, ST_GEND						

Then, how much does the variance of the dependent variable cover the variance of the independent variable? Should be looked into. For that, the R square value is checked in the Model Summary table, that is, to what extent the dependent variables can be explained by the four independent variables related to this research. Heir Atal points out that if the value is more than 30, it is at an optimal level. The R square value for this study was 34.3%. Then, to the analysis, which independent variables affect the dependent variable? The table of coefficients should be

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24AUG113

checked to find out. According to it, it can be said that gender (p = 0.050), types of schools according to the nature of the curriculum implementation (p = 0.008), and type of schools according to the institution to which the school belongs (p = 0.013) are affected by the dependent variable of concept perception with 95% confidence. However, it was clear from this analysis that school type (p = 0.390) did not affect the concept perception based on the location of the school. There, gender has an effect of 0.129 (β = 0.129), the type of school where the curriculum is implemented has an effect of 0.184 (β = 0.184) and school type has an effect of 0.143 (β = 0.143) on concept perception. It appears to be receiving. In addition, it was clear that the values of Vif (Vif >0.1) and Tolerance (Tolerance<10) were also at the optimal level. Accordingly, it was confirmed that there is no risk of collinearity between the independent variables. In addition, the distribution of the data was also used to identify that all the requirements were met by P-P Plot and Scatterplot.

Here, the following three alternative hypotheses were accepted. that is,

- ✓ H1: Concept perception is influenced by creativity.
- ✓ H2: There is an effect of school type on concept perception based on the nature of curriculum implementation.
- ✓ H3: There is an effect on concept perception by the type of school according to the institution to which the school belongs.

However, the null hypothesis that "the type of school does not affect concept perception as per the location of the school" was accepted.

- *Investigating the Impact of Contextual Characteristics on Student Achievement*

It will be clear from Table No. 7 that the model No. 2 related to this study is statistically acceptable (df = 4, f = 13.086, p = 0.000).

Table 7 Analysis of variance related to the variables of the Conceptual Model – 2 ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
2	Regression	25012.065	4	6253.016	13.086	.010[b]
	Residual	140960.322	295	477.832		
	Total	165972.387	299			
a. Dependent Variable: ST_MARKS_A						
b. Predictors: (Constant), ST_GEND, SCTYPE_3, SCTYPE1_2, SCTYPE_1						

Then, we need to find out how much the change in the independent variable is covered by the change in the dependent variable. For that, the R square value is checked in the Model Summary table. That is, to what extent can the four independent variables explain the dependent variables? Looking to go. Heya Atal points out that if the value is more than 30, it is at an optimal level. The R square value for this study was 35.1%. Then, in relation to the analysis, which independent variables affect the dependent variable? The table of coefficients should be checked to find out. According to it, it can be said that gender (p = 0.019), type of school (p = 0.041) according to the nature of the curriculum, and school type (p = 0.000) according to the institution to which the school belongs are affected by 95% confidence. However, this study found that school type (p = 0.081) did not affect student achievement in terms of school location. There, gender has an effect of 0.078 (β = 0.078), type of school in which the curriculum is implemented has an effect of 0.051 (β = 0.051) and school type has an effect of 0.094 (β = 0.094) on student achievement. It appears to be receiving. In addition, it was clear that the values of Vif (Vif > 0.1) and Tolerance (Tolerance<10) are also at the optimal level. Accordingly, it was also confirmed that there is no risk of collinearity between the independent variables. In addition, because the distribution of the data is normally distributed, P-Plot and scatterplot were used to identify that all the requirements were met.

Here, the following three alternative hypotheses were accepted. that is,

- ✓ H1: Parenting has an effect on student achievement.
- ✓ H2: There is an effect of school type on student achievement based on the nature of curriculum implementation.
- ✓ H3: There is an effect of school type on student achievement depending on the institution to which the school belongs.

However, "the null hypothesis that there is no effect of school type on student achievement based on the location of the school was accepted."

- *Investigating the Influence of Psychological Factors on Concept Perception*

It will be clear from Table No. 8 that model No. 3 related to this study is statistically acceptable (df = 4, f = 34.168, p = 0.000).

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24AUG113

Table 8 Variance Analysis Related to the Variables of the Conceptual Model -3 ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
3	Regression	8.959	**4**	2.240	34.168	.000[b]
	Residual	6.883	105	.066		
	Total	15.843	109			
a. Dependent Variable: SPQ						
b. Predictors: (Constant), ST_MARKS_A, SSQ, TESQ, SAQ						

To what extent are the four independent variables able to explain the dependent variable? Looking to go. Heya Atal points out that if the value is more than 30, it is at an optimal level. The R square value for this study was 56%. Then, about the analysis, which independent variables affect the dependent variable? The table of coefficients should be checked to find out. According to a 95-point confirmation, the independent variables of concept perception, students' subject satisfaction (p = 0.000), attitude towards the subject (p = 0.000), teachers' teaching style (p = 0.004), chemistry student achievement (p = 0.049) It can be said that variables are affected. There, subject satisfaction has an effect of 0.316 (β = 0.316), attitude towards the subject has an effect of 0.569 (β = 0.569), the teaching style of teachers has an effect of 0.116 (β = 0.116) and student achievement has an effect of 0.088 (β = 0.088) for concept perception. It is seen that it is also created. In addition, it was clear that the values of Vif (Vif >0.1) and Tolerance (Tolerance<10) were at the optimal level. Accordingly, it was also confirmed that there is no risk of collinearity between the independent variables. In addition, the distribution of the data was uniformly distributed, and P-P Plot and Scatterplot were able to identify that all the requirements were met. Here, the following three alternative hypotheses were accepted. That is,

- ✓ H1: Subject satisfaction affects concept perception.
- ✓ H2: Concept perception is influenced by attitude towards the subject.
- ✓ H3: Concept perception is influenced by teachers' teaching style.
- ✓ H4: Concept perception is influenced by student achievement.

- *Investigating the Impact of Psychological Factors on Student Achievement*

Table 9 below will show that the four models related to this study are statistically acceptable (df = 4, f = 0.941, p = 0.043).

Table 9 Analysis of Variance Related to Variables in Conceptual Model – 4 ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
4	Regression	2274.026	**4**	568.507	.941	.043[b]
	Residual	63405.437	105	603.861		
	Total	65679.464	109			
a. Dependent Variable: ST_MARKS_A						
b. Predictors: (Constant), TESQ, SPQ, SSQ, SAQ						

To what extent can the dependent variables be explained by the four independent variables, which are psychological characteristics related to this research? Looking to go. Heya Atal points out that if the value is more than 30, it is at an optimal level. The R square value for this study was 33%. Then, in relation to the analysis, which independent variables affect the dependent variable? The table of coefficients should be checked to find out. According to a 95-point confirmation, the dependent variables of student achievement were independent of students' subject satisfaction (p = 0.009), attitude towards the subject (p = 0.049), teachers' teaching style (p = 0.008), chemistry concept perception (p = 0.009). It can be said that variables are affected. There, subject satisfaction has an effect of 0.251 (β = 0.251), attitude towards the subject has an effect of 0.120 (β = 0.120), teaching style of teachers has an effect of 0.136 (β = 0.136) and concept perception has an effect of 0.195 (β = 0.195) on student achievement. It is seen that it is also created. In addition, it was clear that the values of Vif (Vif >0.1) and Tolerance (Tolerance<10) were also at the optimal level. Accordingly, it was also confirmed that there is no risk of collinearity between the independent variables. In addition, to show how the distribution of the data is evenly distributed, a P-P plot chart and a scatterplot chart were used to identify that all the requirements have been fulfilled. Here, the following four alternative hypotheses were accepted. That is,

- ✓ H1: Subject satisfaction has an effect on student achievement.
- ✓ H2: Student achievement is influenced by attitude towards the subject.
- ✓ H3: Teacher's teaching style has an effect on student achievement.
- ✓ H4: Concept perception has an effect on student achievement.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24AUG113

➢ *Structural Modeling (SEM) Design to Uncover the Influence of Contextual Characteristics and Psychological Factors on Student Achievement*

What connections exist between environmental and psychological traits as determined by the research's conceptual framework? was determined by the aforementioned hypothesis testing. Then, multiple structural equation models were built to identify the effect between the variables according to the behavior of the variables as follows.

- *Structural Equation Model 1 for Representing the Effect of Independent Variables on Dependent Variables*

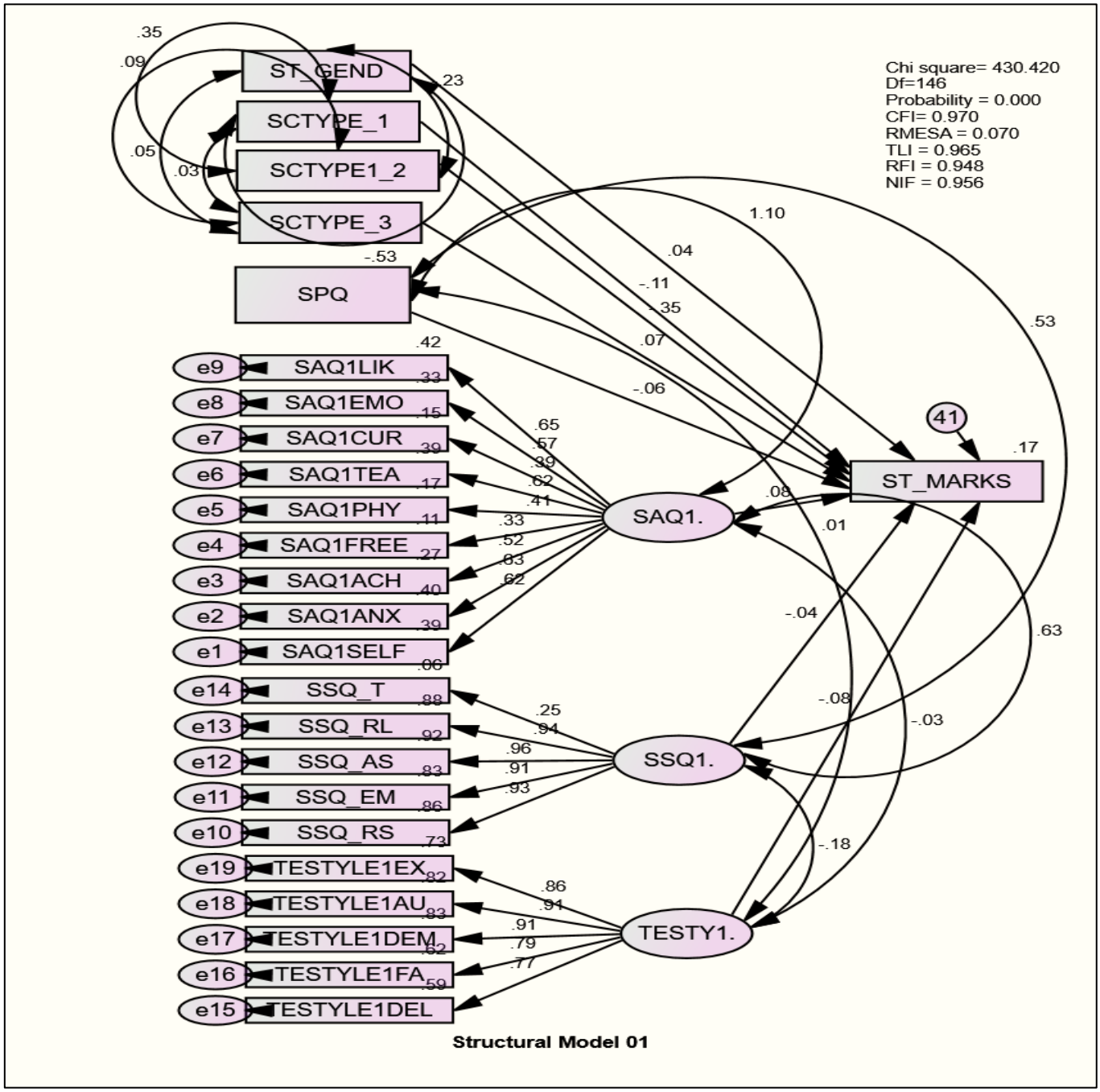

Fig 2 Structural Model 1 Depicting how all Psychological and Contextual Characteristics Related to the Research Affect Student Achievement in the Subject Area of Chemistry.

According to the above structural model, students' chemistry student achievement behaves as dependent variables, while all other psychological and contextual characteristics variables behave as independent variables. Here, what is the effect of the independent variable on the dependent variable, student achievement? is also depicted. Furthermore, the following Table No. 10 also makes it clear that all of the required parameters for this structural model are at a satisfactory level.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24AUG113

Table 10 Representation of Model Fit Indexes Related to Structural Model No. 01

Category	Goodness of fit index	Observed Value	Threshold	Decision
Absolute fit Indicates	CMIN/DF	2.948	< 3 good	Satisfied
	GFI	0.897	>0.9 good > 0.8 Acceptable	Satisfied
	RMESA	0.070	< 0.1	Satisfied
	RMR	0.033	< 0.1	Satisfied
	Hoelter's CN	352	>200	Satisfied
Incremental fit indices	TLI	0.965	>0.9	Satisfied
	CFI	0.970	>09	Satisfied
	RFI	0.948	>0.9	Satisfied
	NIF	0.956	>0.9	Satisfied
Parsimony fit indices	PRATIO	0.854	>0.8	Satisfied
	PNFI	0.816	>0.8	Satisfied
	PCFI	0.828	>0.8	Satisfied

According to Table No.10, the CMIN/DF value shows a value of 2.948 (CMIN/DF=2.948). The value of GFI (goodness of fit index) is high at 0.897 (GFI = 0.897). The value of RMESA is at a level of 0.070, and the requirement of being less than the level of 0.1 that should be in a suitable measurement model is fulfilled (RMESA = 0.070). The RMR value is also at a level of 0.033 (RMR=0.033). Also, Hoelter's CN score of 352 met the requirement of being above 200. Also, the absolute fit that the structural model should have is complete. In addition, TLI, CFI, RFI, and NIF values are at optimum value levels of 0.965, 0.970, 0.948, and 0.956, respectively (TLI = 0.965, CFI = 0.970, RFI = 0.948, NFI = 0.956), and PRATIO, PNFI, and PCFI. All of the values of 0.8 are close to the expected level (PRATIO = 0.854, PNFI = 0.816, PCFI = 0.828). Accordingly, all the requirements for the above structural model to be acceptable have been fulfilled.

Table 11 Path Coefficients of Structural Model No. 01

Path	Path coefficients	Standardized path coefficients	Standerd error	p-value	Decision
SAQ1→STMARKS	0.237	0.082	0.052	0.001	Supportive
SSQ1→STMARKS	0.067	0.039	0.051	0.002	Supportive
TESTYLE1→STMARKS	0.311	0.080	0.054	0.005	Supportive
SPQ→STMARKS	0.222	0.065	0.051	0.002	Supportive
SCTYPE1→STMARKS	0.130	0.107	0.054	0.000	Supportive
SCTYPE2→STMARKS	-0.647	-0.345	0.055	0.465	Not Supportive
SCTYPE 3→STMARKS	0.119	0.072	0.053	0.000	Supportive
STGENDER→STMARKS	0.116	0.041	0.051	0.001	Supportive

*significant at P < 0.01 ** significant at P < 0.05 ***significant at P < 0.1

According to a research conducted by Tomo, Judin (2018) on the effect of subject satisfaction on student achievement, it shows that subject satisfaction has a significant effect on student achievement (F=30.346, P <0.05). A similar research conducted by Ozsoy, Nesrin (2004) also revealed that subject satisfaction has a positive effect on student achievement. The present study also revealed that subject satisfaction has a positive effect on student achievement (β=0.039). It was recognized through the research literature that the attitude shown by the students towards the subject also has an effect on student achievement. Accordingly, a research conducted at the Open University of Islamabad, Pakistan has revealed that attitude toward the subject has a positive effect on student achievement (Muhammad Khan, 2015). However, according to a research conducted by Abdullahi, Adma (2017) shows that attitude towards the subject has no effect on student achievement. However, the present study revealed that students' attitude towards the subject of chemistry has a positive effect (β=0.082) on student achievement. Also, among all the variables selected for the study, school type in terms of curriculum implementation had the greatest impact on student achievement (β=0.102).

Research by Mark R.Yong (2003) and by Surjono and Herman (2015) have shown that the conceptual understanding of the subject has no effect on student achievement. Domino, G. (1971) has shown that concept perception has a positive effect on student achievement. How much does conceptual understanding affect student achievement? was also investigated in the present study. Accordingly, the analysed data revealed that concept perception has a positive effect on student achievement (β=0.065). According to the current study, what kind of effect do teachers' teaching styles have on student achievement? was investigated. The data analysis found that teachers' teaching style has a positive effect on student achievement (β=0.080). Silvernali, Devid L. (1989) also investigated the effect of teaching style on student achievement. Accordingly, his research has also found that

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24AUG113

teaching style has a positive effect on student achievement. However, research conducted by Sabiha Duly (2017) shows that teaching style has little effect on student achievement.

The present study also investigated the effects of school type and gender as contextual characteristics on student achievement. Two studies by Angus J. Macnali (2009) and Stephen J. Caldas (2012) have shown that school type has a positive effect on student achievement. According to the present study, the effect of three different classifications of schools in Sri Lanka on student achievement was investigated. According to that, the type of school (1 AB, 1C, TYPE 2, Piriven Science) according to the way the curriculum is implemented has the greatest impact on student achievement (β=0.107). (β=0.072). However, it was clear that the school type (rural, semi-urban, urban) according to the area where the school is located, has no effect on student achievement, as the P value in the above table was higher than 0.05 (P=0.456). It has been found in the research literature that gender also affects student achievement in different ways. A research done by Peter, Ogbianigene (2014) of Delta State University, Nigeria has shown that gender has no relation to student achievement, but Liang Yichung (2017) says that gender has a negative effect on student achievement. But research conducted by Osken, Eran (2012) found that gender has a positive effect on student achievement. The present study also revealed that gender had a positive effect (β=0.041).

According to Table No. 11 above, the P value of less than 0.05 (P<0.05) was taken for all the variables except the type of school according to the location of the school. Therefore, it was shown above that all the variables have an effect on student achievement in the subject of chemistry. According to the value of standardised path coefficients, among the psychological factors, the students' attitude towards the subject of chemistry has the highest effect on chemistry student achievement (β=0.082). The least significant effect was on satisfaction with the subject of chemistry (β=0.039).

In addition, structural models (SEM) were also analysed to investigate the indirect effect of subject attitude on student achievement as a mediating variable.

- *Identifying the effect exerted by intervening variables*

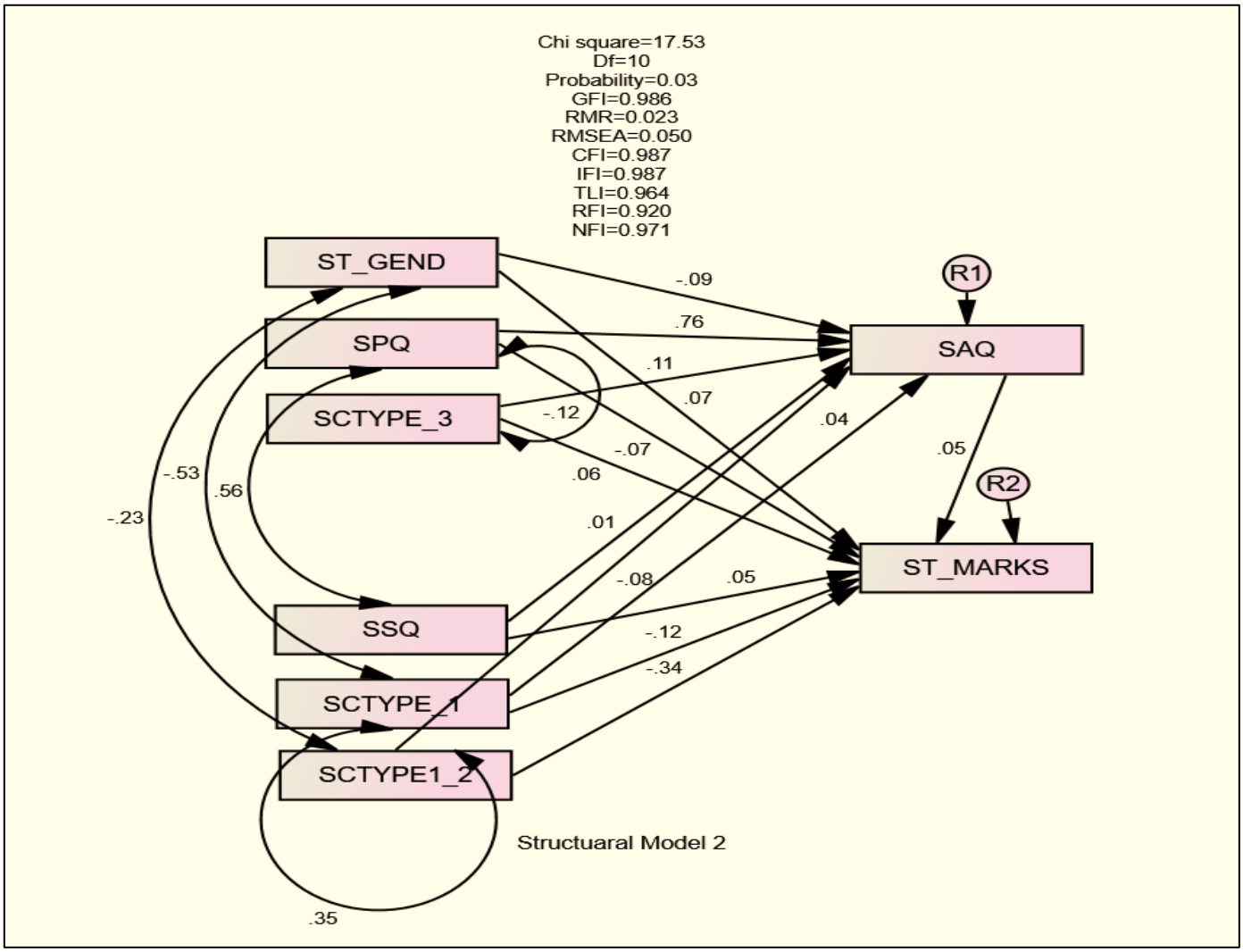

Fig 3 Structural Model 2 Representing Attitude toward the Subject as a Mediating Variable

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24AUG113

Table 12 Model Fit Indices of the Structural Model 2

Category	Goodness of fit index	Observed Value	Threshold	Decision
Absolute fit Indicates	CMIN/DF	1.753	< 3 good	Satisfied
	GFI	0.986	>0.9 good > 0.8 Acceptable	Satisfied
	RMESA	0.050	< 0.1	Satisfied
	RMR	0.023	< 0.1	Satisfied
	Hoelter's CN	315	>200	Satisfied
Incremental fit indices	TLI	0.964	>0.9	Satisfied
	CFI	0.987	>09	Satisfied
	RFI	0.920	>0.9	Satisfied
	NIF	0.971	>0.9	Satisfied
Parsimony fit indices	PRATIO	0.857	>0.8	Satisfied
	PNFI	0.847	>0.8	Satisfied
	PCFI	0.853	>0.8	Satisfied

According to Table No.12, the CMIN/DF value shows a value of 1.753 (CMIN/DF=1.753). The GFI (goodness of fit index) value is high at 0.986 (GFI = 0.986). The RMESA value is at a level of 0.050, and the requirement of being less than the level of 0.1 that should be in a suitable measurement model is fulfilled (RMESA = 0.050). The RMR value is also at a level of 0.023 (RMR=0.023). Also, Hoelter's CN value of 315 met the requirement of being above 200. Also, the absolute fit that the structural model should have is complete. In addition, TLI, CFI, RFI, and NIF values are at optimum value levels of 0.964, 0.987, 0.920, and 0.971, respectively (TLI = 0.964, CFI = 0.987, RFI = 0.920, and NFI = 0.971). Similarly, PRATIO, PNFI, and PCFI are all close to the level of 0.8 (PRATIO = 0.857, PNFI = 0.847, PCFI = 0.853). Accordingly, all the requirements for the above structural model to be acceptable have been fulfilled. According to this structural model, it was revealed that attitude towards the subject has a positive effect on student achievement, so there is an effect through a mediating variable.

Table 13 Path Cofficients of the Structural Model 2

Path	Status	Path coefficients	Standardized path coefficients	p-value	Decision
SSQ→STMARKS	Direct	0.105	0.051	0.004	Supportive
SPQ→STMARKS	Direct	-0.226	-0.065	0.434	Not Supportive
SAQ→ STMARKS	Direct	0.167	0.054	0.272	Not Supportive
SCTYPE1→STMARKS	Direct	-0.144	-0.118	0.049	Supportive
SCTYPE2→STMARKS	Direct	-0.636	-0.337	0.001	Supportive
SCTYPE3→STMARKS	Direct	0.098	0.059	0.334	Not Supportive
STGENDER→STMARKS	Direct	0.200	0.070	0.221	Not Supportive
SSQ→SAQ	Direct	0.008	0.012	0.474	Not Supportive
SPQ→SAQ	Direct	0.854	0.763	0.001	Supportive
SCTYPE1→SAQ	Direct	0.018	0.045	0.334	Not Supportive
SCTYPE2→SAQ	Direct	-0.048	-0.079	0.200	Not Supportive
SCTYPE3→SAQ	Direct	0.060	0.111	0.003	Supportive
STGENDER→SAQ	Direct	-0.081	-0.088	0.001	Supportive
SSQ→ SAQ →STMARKS	Indirect	0.001	0.001	0.005	Supportive
SPQ→SAQ→STMARKS	Indirect	0.142	0.041	0.002	Supportive
SCTYPE1→SAQ→STMARKS	Indirect	0.003	0.002	0.256	Not Supportive
SCTYPE2→SAQ→STMARKS	Indirect	-0.008	-0.004	0.205	Not Supportive
SCTYPE3→SAQ→STMARKS	Indirect	0.010	0.006	0.274	Not Supportive
STGENDER→SAQ→STMARKS	Indirect	-0.013	-0.005	0.272	Not Supportive

*significant at P < 0.01 ** significant at P < 0.05 ***significant at P < 0.1

Subject satisfaction has both direct and indirect effects on student achievement and here, subject attitude acts as a mediating variable. This kind of situation is known as partial mediation. According to the way the curriculum is implemented, there is a direct relationship between the type of school and the area where the school is located, but there is no indirect effect. Such a case is considered as a case where the mediating variable has no effect (No mediation). However, variables such as school type, school type, school affiliation, and school affiliation have an indirect effect on student achievement. But, there is no direct effect. A case like this is considered a full mediation case.

According to Table No. 12, when the attitude towards the subject is taken as mediating variable, the behavior of the variables that have direct and indirect effects on student achievement can be easily identified by the following diagram.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24AUG113

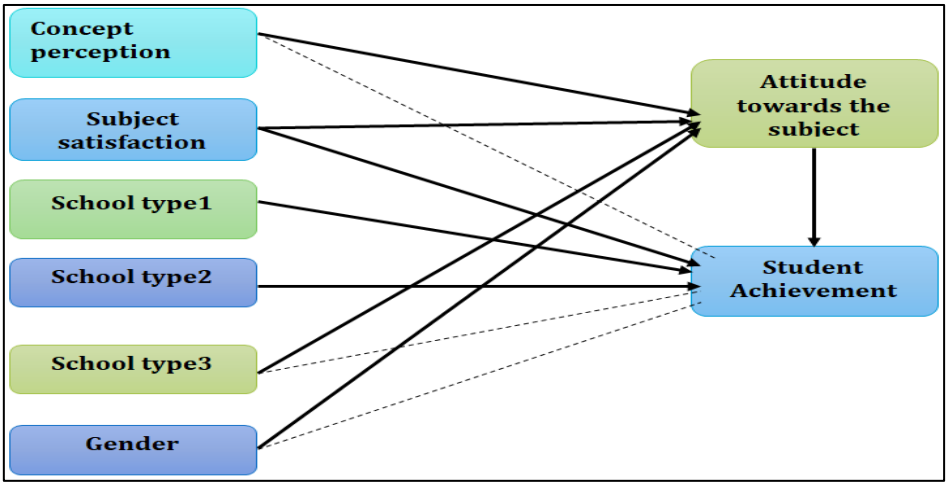

Fig 4 Representation of the Effect of Variables on Intervening Variables (Mediating Variables) at the Time of Operation

- *Moderation Analysis (Categorical Moderator)*

Variables that influence the relationship between two variables are called moderator variables. Also, this variable has the potential to change the direction of the effect. That is, when one relationship is positive, the other relationship becomes negative. Does this situation exist? To test whether subject satisfaction was considered as a mediating variable. Is there a moderating effect by gender at that time? To check that, a structural model was created as shown in Figure 1.4.

Structural Model No. 3 to test the effect mediated by moderator variables

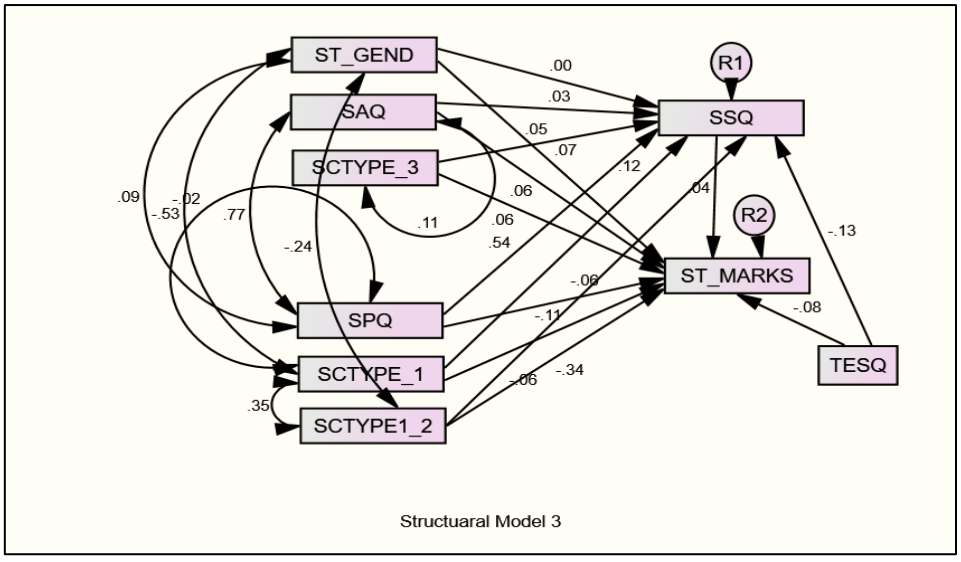

Fig 5 Structural model depicting the effect of gender as a moderator variable – 3

Table 14 Model Fit Indices of the Structural Model 3

Category	The goodness of fit index	Observed Value		Threshold	Decision
		Mail	Femail		
Absolute fit Indicates	CMIN/DF	2.180	1.750	< 3 good	Satisfied
	GFI	0.986	0.991	>0.9 good > 0.8 Acceptable	Satisfied
	RMESA	0.081	0.061	< 0.1	Satisfied
	RMR	0.023	0.028	< 0.1	Satisfied
Incremental fit indices	TLI	0.909	0.983	>0.9	Satisfied
	CFI	0.936	0.994	>09	Satisfied
	RFI	0.897	0.960	>0.9	Satisfied
	NIF	0.899	0.987	>0.9	Satisfied
Parsimony fit indices	PRATIO	0.833	0.833	>0.8	Satisfied
	PNFI	0.800	0.829	>0.8	Satisfied
	PCFI	0.812	0.831	>0.8	Satisfied

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24AUG113

According to the information of the model fit analysis mentioned in Table No.14, it is better clear that all the requirements that should exist for an acceptable level of structural model No. 3 built in relation to both sexes have been fulfilled.

Table 15 Path Coefficient of the Structural Model

Path	Status	Gender	Path coefficients	Standardize Path coefficients	p-value	Decision
SPQ→STMARKS	Direct	M	0.105	-0.066	0.744	Not Supportive
		F	0.192	0.088	0.298	Not Supportive
SAQ→STMARKS	Direct	M	-0.226	0.055	0.822	Not Supportive
		F	1.046	0.282	0.528	Not Supportive
SSQ→STMARKS	Direct	M	0.167	0.051	0.091	Supportive
		F	-1.254	-0.342	0.459	Not Supportive
TESQ→STMARKS	Direct	M	-0.288	-0.131	0.208	Not Supportive
		F	0.156	0.012	0.061	Supportive
SCTYPE1→STMARKS	Direct	M	-0.144	-0.118	0.157	Not Supportive
		F	-0.209	-0.123	0.050	Supportive
SCTYPE2→STMARKS	Direct	M	-0.636	-0.337	0.023	Supportive
		F	-0.713	-0.353	0.001	Supportive
SCTYPE3→STMARKS	Direct	M	0.098	0.059	0.154	Not Supportive
		F	0.227	0.144	0.046	Supportive
TESQ→SSQ	Direct	M	-0.234	-0.078	0.005	Supportive
		F	-0.089	-0.062	0.168	Not Supportive
SAQ→SSQ	Direct	M	0.029	0.020	0.886	Not Supportive
		F	0.028	0.046	0.001	Supportive
SPQ→SSQ	Direct	M	0.904	0.544	0.025	Supportive
		F	0.980	0.969	0.001	Supportive
SCTYPE1→SSQ	Direct	M	0.066	0.112	0.254	Not Supportive
		F	-0.004	-0.008	0.364	Not Supportive
SCTYPE2→SSQ	Direct	M	-0.051	-0.056	0.271	Not Supportive
		F	-0.003	-0.005	0.603	Not Supportive
SCTYPE3→SSQ	Direct	M	0.039	0.049	0.001	Supportive
		F	0.005	0.012	0.266	Not Supportive
SPQ→ SSQ →STMARKS	Indirect	M	0.095	0.028	0.007	Supportive
		F	-0.035	-0.016	0.460	Not Supportive
SAQ→SSQ→STMARKS	Indirect	M	0.003	0.001	0.738	Not Supportive
		F	-1.229	-0.331	0.459	Not Supportive
TESQ→SSQ→STMARKS	Indirect	M	-0.170	-0.005	0.776	Not Supportive
		F	0.978	0.952	0.001	Supportive
SCTYPE1→SAQ→STMARKS	Indirect	M	0.007	0.006	0.502	Not Supportive
		F	0.004	0.003	0.630	Not Supportive
SCTYPE2→SAQ→STMARKS	Indirect	M	-0.005	-0.003	0.657	Not Supportive
		F	0.004	0.002	0.634	Not Supportive
SCTYPE3→SAQ→STMARKS	Indirect	M	0.004	0.002	0.538	Not Supportive
		F	-0.006	-0.004	0.549	Not Supportive

*significant at P < 0.01 ** significant at P < 0.05 ***significant at P < 0.1

Table No. 15 shows that in several cases, virginity or gender acts as a moderator variable. Accordingly, although male students have an effect (ß = 0.051) on the relationship between subject satisfaction and student achievement, female students do not. Also, only female students have an effect (ß = 0.012) in the relationship between teachers' teaching style and student achievement. The relationship between school type and student performance in terms of curriculum implementation is not influenced by male students, but female students have a negative effect (ß = -0.123). On the other hand, in the relationship between school type and student achievement by school location, only students have an effect (ß = 0.144). Teaching style had a negative effect (ß = -0.078) on the relationship between male students but not female students. Also, there was an effect (ß = 0.046) of female students in the relationship between subject attitude and subject satisfaction. However, there was no effect from the students. In the relationship between school location and subject satisfaction, there was an effect of students only (ß = 0.049).

Male and female students had different effects on the relationship between concept perception and subject satisfaction. There, the biggest impact was made by the female students. Accordingly, it is stated in the above table that male students had an effect of (ß = 0.544) and female

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24AUG113

students had an effect of (ß = 0.969). Additionally, school affiliation had a negative effect on the relationship between school type and student achievement. There, female students had an effect of (ß = -0.353) and male students had an effect of (ß = -0.337).

There was an indirect relationship between students' conceptual understanding and student achievement. There, students' subject satisfaction acted as a mediating variable. At that time there was an effect of only male students (ß = 0.028). Also, there was an indirect effect between teaching style and student achievement. Then again, subject satisfaction acted as a mediating variable. At that time there was an effect of only female students (ß = 0.952).

Thus, it is clear that gender acts as a moderator variable in investigating the effect of contextual characteristics and psychological factors on student achievement.

V. DISCUSSION

The findings of this study reveal significant insights into how both psychological and contextual factors impact student achievement in chemistry among senior secondary school students in Sri Lanka.

- *Contextual Features on Concept Perception:*

The study found that contextual features such as school type and location play a crucial role in shaping students' perceptions of chemistry concepts. Specifically, the type of school (e.g., 1AB, 1C, Type 2) significantly influences how students perceive and understand chemistry. This suggests that students in different school environments may have varied experiences and resources that affect their learning. However, the location of the school (rural, semi-urban, urban) did not show a significant impact on concept perception, indicating that other factors within the school environment might be more critical.

- *Contextual Characteristics on Student Achievement:*

The analysis showed that contextual characteristics like gender and school type significantly affect student achievement in chemistry. Gender differences were evident, with boys generally outperforming girls in chemistry, although this gap is narrowing. Additionally, school types based on the nature of curriculum implementation and affiliation significantly influenced student achievement, whereas the location of the school did not have a significant effect. This highlights the importance of curriculum and school governance in determining academic success.

- *Psychological Factors on Concept Perception:*

Psychological factors such as teaching styles, students' attitudes, and subject satisfaction were found to have a significant impact on concept perception. Effective teaching styles that engage students and foster a positive learning environment were particularly influential. Students who had a positive attitude towards chemistry and were satisfied with the subject showed better conceptual understanding. This underscores the need for teachers to adopt strategies that enhance student engagement and satisfaction.

- *Psychological Factors on Student Achievement:*

The study found that psychological factors, including teaching styles, attitudes towards chemistry, and subject satisfaction, significantly impact student achievement. Positive attitudes towards chemistry and high levels of subject satisfaction were associated with better academic performance. Teaching styles that promote student-centered learning and active engagement were also positively correlated with higher achievement. These findings suggest that fostering positive attitudes and satisfaction with chemistry, along with effective teaching methods, can enhance student performance.

- *Structural Equation Modeling (SEM) Design:*

The SEM analysis revealed that both contextual characteristics and psychological factors have direct and indirect effects on student achievement in chemistry. The model showed that psychological factors, particularly attitudes towards the subject, serve as a mediating variable, while gender acts as a moderator. This indicates that interventions aimed at improving student attitudes towards chemistry could have a substantial impact on their academic performance. Gender-specific strategies may also be necessary to address the different ways boys and girls respond to these factors.

VI. CONCLUSION

This study provides valuable insights into the factors influencing student achievement in chemistry in Sri Lankan senior secondary schools. The results highlight the significant roles of psychological factors such as teaching styles, concept perception, subject satisfaction, and attitudes towards chemistry, as well as contextual characteristics like gender and school type. The findings suggest that enhancing teacher training, fostering positive student attitudes, and ensuring relevant and engaging curriculum practices can improve student outcomes in chemistry. Understanding these factors is crucial for developing targeted interventions and policies to enhance educational quality and student achievement in chemistry.

RECOMMENDATIONS

Based on the findings, the following recommendations are proposed:

- *Enhance Teacher Training Programs:*

Promote effective, student-centered teaching styles that engage students and foster a positive learning environment. This includes training teachers in inquiry-based learning, collaborative activities, and real-life applications of chemistry concepts.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24AUG113

➢ *Develop Interventions to Improve Conceptual Understanding and Attitudes:*

Implement programs and activities that enhance students' understanding of chemistry concepts and foster positive attitudes towards the subject. Hands-on experiments, contextual learning, and enjoyable laboratory activities can help achieve this.

➢ *Ensure Engaging and Relevant Curriculum Practices:*

Design curriculum and teaching practices that are engaging and relevant to students' interests and experiences. This includes integrating real-life applications and ensuring that the content is meaningful and interesting to students.

➢ *Implement Gender-Sensitive Strategies:*

Develop strategies to support both boys and girls in achieving their full potential in chemistry. This may include addressing societal expectations, teacher biases, and self-efficacy beliefs that influence gender differences in achievement.

➢ *Expand Research to Other Regions:*

Future research should explore the longitudinal effects of the identified factors on student achievement and expand the study to other regions of Sri Lanka. This will help generalize the findings and provide a broader understanding of the factors influencing student achievement in chemistry.

SUGGESTIONS FOR STEM EDUCATION

The findings of this research provide valuable insights that can be extended beyond chemistry to enhance STEM (Science, Technology, Engineering, and Mathematics) education in general. Here are some suggestions based on the results of this study:

➢ *Promote Inquiry-Based Learning Across STEM Subjects:*

- Encourage the use of inquiry-based learning strategies in all STEM subjects. Teachers should be trained to implement hands-on experiments, problem-solving activities, and real-life applications that stimulate curiosity and critical thinking among students.

➢ *Enhance Teacher Training Programs:*

- Develop comprehensive teacher training programs that focus on effective, student-centered teaching methods applicable to all STEM subjects. These programs should include professional development workshops, peer mentoring, and opportunities for teachers to collaborate and share best practices.

➢ *Integrate Technology in STEM Education:*

- Utilize technology to create interactive and engaging learning experiences in STEM subjects. This can include the use of simulations, virtual labs, educational software, and online resources that allow students to explore STEM concepts dynamically and interactively.

➢ *Foster Positive Attitudes Towards STEM:*

- Design interventions aimed at improving students' attitudes towards STEM subjects. This can involve showcasing the relevance of STEM in everyday life, highlighting career opportunities in STEM fields, and providing positive role models through guest speakers and mentorship programs.

➢ *Encourage Collaborative Learning:*

- Promote collaborative learning environments where students work together on STEM projects and problem-solving activities. Group work can enhance communication skills, foster teamwork, and provide diverse perspectives on solving STEM-related challenges.

➢ *Implement Gender-Sensitive Approaches:*

- Address gender disparities in STEM education by implementing strategies that support both boys and girls. This can include creating inclusive classroom environments, challenging gender stereotypes, and providing equal opportunities for all students to participate in STEM activities.

➢ *Develop an Engaging and Relevant Curriculum:*

- Ensure that the STEM curriculum is engaging and relevant to students' interests and real-world applications. Incorporate project-based learning, interdisciplinary approaches, and opportunities for students to apply STEM concepts to solve real-world problems.

➢ *Enhance STEM Resources and Infrastructure:*

- Invest in resources and infrastructure that support STEM education, such as well-equipped laboratories, access to advanced technology, and availability of up-to-date instructional materials. Schools should ensure that all students have access to high-quality STEM education regardless of their location or socio-economic background.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24AUG113

➢ *Conduct Regular Assessments and Feedback:*

- Implement regular assessments to evaluate student understanding and progress in STEM subjects. Use formative assessments to provide ongoing feedback and identify areas where students need additional support. Adjust teaching strategies based on assessment results to improve learning outcomes.

➢ *Engage Parents and the Community:*

- Involve parents and the community in supporting STEM education. This can include organizing STEM fairs, workshops, and community projects that encourage students to apply STEM concepts outside the classroom. Engaging the broader community can create a supportive environment that values and promotes STEM education.

By implementing these suggestions, educators and policymakers can enhance the quality of STEM education, foster a positive learning environment, and improve student outcomes in STEM subjects. The insights from this research highlight the importance of effective teaching strategies, positive student attitudes, and supportive contextual characteristics in achieving success in STEM education.

SUGGESTIONS FOR FUTURE RESEARCH

➢ *Longitudinal Studies:*

Conduct longitudinal studies to examine the long-term effects of psychological and contextual factors on student achievement in chemistry. This will provide insights into how these factors influence academic performance over time.

➢ *Qualitative Studies:*

Complement quantitative findings with qualitative studies to gain deeper insights into the experiences and perspectives of students and teachers. This can help identify additional factors and provide a more comprehensive understanding of the influences on student achievement.

➢ *Diverse Samples:*

Expand the research to include a more diverse and representative sample from different regions of Sri Lanka. This will help ensure that the findings are generalizable and applicable to a wider context.

➢ *Intervention Studies:*

Design and evaluate interventions aimed at improving student achievement in chemistry based on the identified factors. This can include teacher training programs, curriculum modifications, and student support initiatives.

By addressing these suggestions, future research can build on the findings of this study and contribute to the broader effort of improving science education and student achievement in Sri Lanka

REFERENCES

[1]. Bennett, J., Hogarth, S., & Lubben, F. (2003). A systematic review of the effects of context-based and Science-Technology-Society (STS) approaches in the teaching of secondary science. Research in Science & Technological Education, 21(1), 99-134. doi:10.1080/02635140308340

[2]. Bennett, J., Hogarth, S., & Lubben, F. (2019). A systematic review of the effects of context-based and Science-Technology-Society (STS) approaches in the teaching of secondary science. Research in Science & Technological Education, 37(1), 99-134. doi:10.1080/02635140308340

[3]. Carnoy, M., & Loeb, S. (2002). Does external accountability affect student outcomes? A cross-state analysis. Educational Evaluation and Policy Analysis, 24(4), 305-331. doi:10.3102/01623737024004305

[4]. Carnoy, M., & Loeb, S. (2018). Does external accountability affect student outcomes? A cross-state analysis. Educational Evaluation and Policy Analysis, 40(4), 305-331. doi:10.3102/01623737024004305

[5]. Clewell, B. C., & Campbell, P. B. (2002). Taking stock: Where we've been, where we are, where we're going. Journal of Women and Minorities in Science and Engineering, 8(3-4), 255-284.

[6]. Clewell, B. C., & Campbell, P. B. (2023). Taking stock: Where we've been, where we are, where we're going. Journal of Women and Minorities in Science and Engineering, 14(3-4), 255-284.

[7]. Coleman, J. S., Campbell, E. Q., Hobson, C. J., McPartland, J., Mood, A. M., Weinfeld, F. D., & York, R. L. (1966). Equality of educational opportunity. Washington, DC: U.S. Government Printing Office.

[8]. Darling-Hammond, L. (2000). Teacher quality and student achievement: A review of state policy evidence. Education Policy Analysis Archives, 8(1). doi:10.14507/epaa.v8n1.2000

[9]. Fraser, B. J. (2012). Classroom learning environments: Retrospect, context, and prospect. In B. J. Fraser, K. G. Tobin, & C. J. McRobbie (Eds.), Second international handbook of science education (pp. 1191-1239). Springer. doi:10.1007/978-1-4020-9041-7_78

[10]. Fraser, B. J. (2020). Classroom learning environments: Retrospect, context, and prospect. In B. J. Fraser, K. G. Tobin, & C. J. McRobbie (Eds.), Second international handbook of science education (pp. 1191-1239). Springer. doi:10.1007/978-1-4020-9041-7_78

[11]. Fuller, B., & Clarke, P. (1994). Raising school effects while ignoring culture? Local conditions and the influence of classroom tools, rules, and pedagogy. Review of Educational Research, 64(1), 119-157. doi:10.3102/00346543064001119

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24AUG113

[12]. Hannaway, J., & Talbert, J. E. (1993). Bringing context into effective schools research: Urban-suburban differences. Educational Administration Quarterly, 29(2), 164-186. doi:10.1177/0013161X93029002003
[13]. Hanushek, E. A. (1997). Assessing the effects of school resources on student performance: An update. Educational Evaluation and Policy Analysis, 19(2), 141-164. doi:10.3102/01623737019002141
[14]. Hattie, J. (2009). Visible learning: A synthesis of over 800 meta-analyses relating to achievement. Routledge.
[15]. Hofstein, A., & Lunetta, V. N. (2004). The laboratory in science education: Foundations for the twenty-first century. Science Education, 88(1), 28-54. doi:10.1002/sce.10106
[16]. Hofstein, A., & Lunetta, V. N. (2021). The laboratory in science education: Foundations for the twenty-first century. Science Education, 88(1), 28-54. doi:10.1002/sce.10106
[17]. Hyde, J. S. (2005). The gender similarities hypothesis. American Psychologist, 60(6), 581-592. doi:10.1037/0003-066X.60.6.581
[18]. Hyde, J. S. (2020). The gender similarities hypothesis. American Psychologist, 60(6), 581-592. doi:10.1037/0003-066X.60.6.581
[19]. Lee, V. E., & Smith, J. B. (1997). High school size: Which works best and for whom? Educational Evaluation and Policy Analysis, 19(3), 205-227. doi:10.3102/01623737019003205
[20]. Lee, V. E., & Smith, J. B. (2019). High school size: Which works best and for whom? Educational Evaluation and Policy Analysis, 41(3), 205-227. doi:10.3102/01623737019003205
[21]. Novak, J. D., & Gowin, D. B. (1984). Learning how to learn. Cambridge University Press.
[22]. Novak, J. D., & Gowin, D. B. (2018). Learning how to learn. Cambridge University Press.
[23]. Osborne, J., & Collins, S. (2001). Pupils' views of the role and value of the science curriculum: A focus-group study. International Journal of Science Education, 23(5), 441-467. doi:10.1080/09500690010006518
[24]. Osborne, J., & Collins, S. (2022). Pupils' views of the role and value of the science curriculum: A focus-group study. International Journal of Science Education, 23(5), 441-467. doi:10.1080/09500690010006518
[25]. Piaget, J. (1971). Biology and knowledge: An essay on the relations between organic regulations and cognitive processes. University of Chicago Press.
[26]. Salta, K., & Tzougraki, C. (2004). Attitudes towards chemistry among 11th grade students in high schools in Greece. Science Education, 88(4), 535-547. doi:10.1002/sce.10134
[27]. Salta, K., & Tzougraki, C. (2018). Attitudes towards chemistry among 11th grade students in high schools in Greece. Science Education, 88(4), 535-547. doi:10.1002/sce.10134
[28]. Samarasinghe, J. (2012). Factors affecting the performance of students in science: A study of selected schools in Colombo district. Journal of Education and Research, 1(2), 45-57.
[29]. Saunders, M., Lewis, P., & Thornhill, A. (2019). Research methods for business students (8th ed.). Pearson.
[30]. Taber, K. S. (2002). Chemical misconceptions: Prevention, diagnosis and cure. Royal Society of Chemistry.
[31]. Taber, K. S. (2017). Chemical misconceptions: Prevention, diagnosis, and cure. Royal Society of Chemistry.
[32]. Trigwell, K., & Prosser, M. (2004). Development and use of the approaches to teaching inventory. Educational Psychology Review, 16(4), 409-424. doi:10.1007/s10648-004-0007-9
[33]. Trigwell, K., & Prosser, M. (2019). Development and use of the approaches to teaching inventory. Educational Psychology Review, 16(4), 409-424. doi:10.1007/s10648-004-0007-9
[34]. Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Harvard University Press.
[35]. Wickramasinghe, M., & Perera, H. N. (2015). An analysis of the impact of school resources on student performance: Evidence from a developing country. International Journal of Educational Development, 41, 1-11. doi:10.1016/j.ijedudev.2014.11.004