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A Causal Model for Psycho-social Aspects of Science Learning Environment on Academic Performance of Secondary School Students in Region X, Philippines

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Abstract: The study geared to develop a causal model for the psychosocial attributes of the learning environment on Grade 10 students' science performance in secondary schools divisions of Region X, Northern Mindanao. This study utilized descriptive correlational and causal-comparative research design. A random sample of 1,123 Grade 10 students was utilized in this study. Data were analyzed using descriptive statistics, Correlation, Regression, and Path Analyses. The results revealed that students' performance in Science was found out of low mastery level. In terms of psychosocial aspects, the students generally practiced their science activities in both laboratory and classroom environments, possessed moderate confidence in their emotion and self-efficacy in chemistry, having average science process skills, and were mentored by science teachers with very satisfactory teaching ability. Classroom environment and teacher ability were the psychosocial aspects that significantly correlated with performance. The best-fitting causal model on students' performance is anchored on the classroom environment, supported by teachers' qualifications. A classroom learning environment that is highly conducive can stimulate students' interest to enhance their science learning. It is highly recommended that administrators and policymakers revisit curricular activities, particularly on students' classroom learning environment in the teaching-learning process.

Keywords: academic performance, a causal model, and psychosocial aspects of the learning environment

Introduction

Through the years, the Philippine government supports the Department of Education (DepEd) advocacy towards providing Filipino students a repertoire of competencies imperative for the country's global development. Competencies can escalate from multiple areas of education- in natural sciences or social sciences, for instance. However, many literature sources have cited that students find areas most especially science-related subjects, and in this case, chemistry, as a difficult and irrelevant subject because of its abstract nature (Sirhan, 2007; Cardellini, 2013; Woldeamanuel, Atagana & Engida, 2014). This notion results in students failing in their chemistry subjects (Arbutante, 2010).

Moreover, students' globally poor performance in science was also reported in the International Science Study and International Assessment of Educational Achievement (Imam, Mastura, Jamil and Ishmael, 2014), and Trends in International Mathematics and Science Study (TIMSS, 1997 and 2003). These assessment studies concluded that Filipino students may still lack the scientific knowledge and skills to meet 21st century education's globalization demands.

In the local setting, Region X, the National Achievement Test (NAT) performance of students in the three consecutive S.Y.s 2012, 2013, and 2014 was labeled as low. This phenomenon poses a significant challenge to students, teachers, and administrators in the region and the entire Department of Education. Filipino students' predicament in science entails an intensive investigation vis-à-vis the educational goals of the K-12 program. To

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date, few or no studies have been conducted on the simultaneous relationship of secondary students' academic performance concerning the psychosocial aspects of science learning environment using Path analysis.

For almost three decades, assessment studies of students' perceptions towards science classroom and laboratory learning environments have been conducted intensively using the instruments such as Science Learning Environment Inventory (SLEI) and What Is Happening In This Class (WIHIC). The studies revealed that conducive environments could enhance the students' academic achievements (Che Ahmad et al., 2010, 2013, & 2014). Many works of literature cited have pronounced that emotional intelligence (E.I. or E.Q.), self-efficacy, science process skills, and teacher characteristics are good predictors of improving students' academic performance. E.Q. serves as a foundation of social skills that students must possess to work together collaboratively successfully and in cooperative groups (Norman & Ruderson, 2001 p.1; Preeti, 2013). Those students with high self-efficacy beliefs tend to engage in activities and are persistent in facing difficulties, thus achieving more academic success (Dogan, 2015; Dehyadegary et al., 2013; Evangelista et al., 2010). However, E.Q. and self-efficacy cultivate process skills of the students to promote quality learning in science.

Hence, this study was conducted to ascertain the factors that could significantly contribute to junior high school (JHS) students' academic performance. Likewise, the study sought to provide effective remedies to the problems faced by young students who perform low in science.

Objectives of the Study

The main purpose of this study was to develop a causal model that best fits the academic performance of Grade 10 students in science in the six school divisions of Region X (Northern Mindanao). Specifically, the study sought to answer the following:

Determine the level of performance of students in Grade 10 science;

Assess the psychosocial level of Grade 10 science students' learning environment in terms of:

a. laboratory, b. classroom, c. emotional quotient, d. high school chemistry self-efficacy,

e. science process skills, and f. teacher quality;

Find out the relationship exists among performance and psychosocial aspects of the science laboratory environment of the students in Grade 10 science;

Identify the variable, singly or in combination, best predicts students' performance in science; and

Develop a causal model best fits students' performance in Grade 10 science.

Conceptual Framework

Figure 1 presents the proposed conceptual framework paradigm using the systems approach.

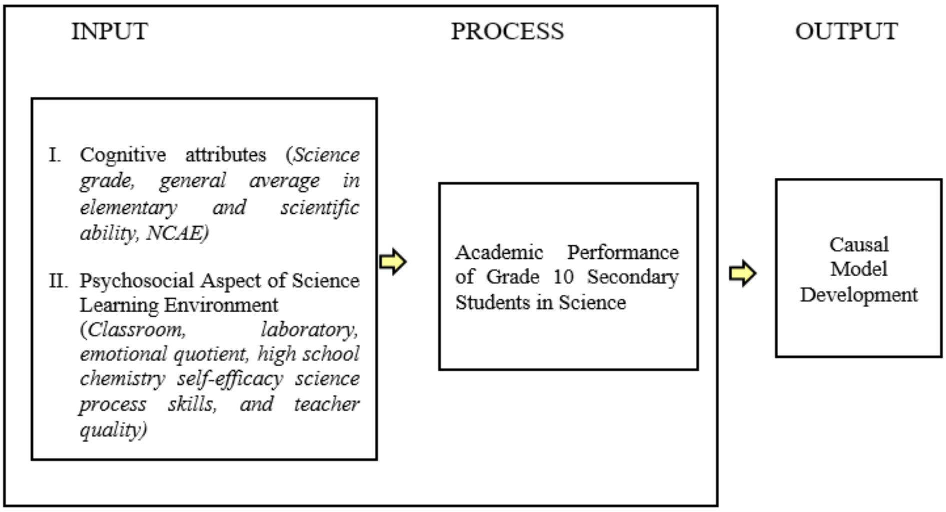

Figure 1. Conceptual framework paradigm using the systems approach

Methodology

This study employs a quantitative approach, as reflected in Figure 2. Descriptive-correlational and causal-comparative designs were employed in this study. The descriptive-correlational design was utilized to determine students' performance in their science learning environment and the psychological aspects of their academic performance in science. The causal-comparative research design was employed to determine the students' classroom/laboratory environment's cognitive and psychosocial aspects on their science academic performance. Path Analysis was used to find out what model best links to Grade 10 students' academic performance in science.

The triangulation technique validated the different survey instruments used through semi-structured/one-on-one interviews, class observation, and literature review. Thus a qualitative approach of validation was employed. This technique was used to strengthen and ensure the study results' reliability, validity, and accuracy.

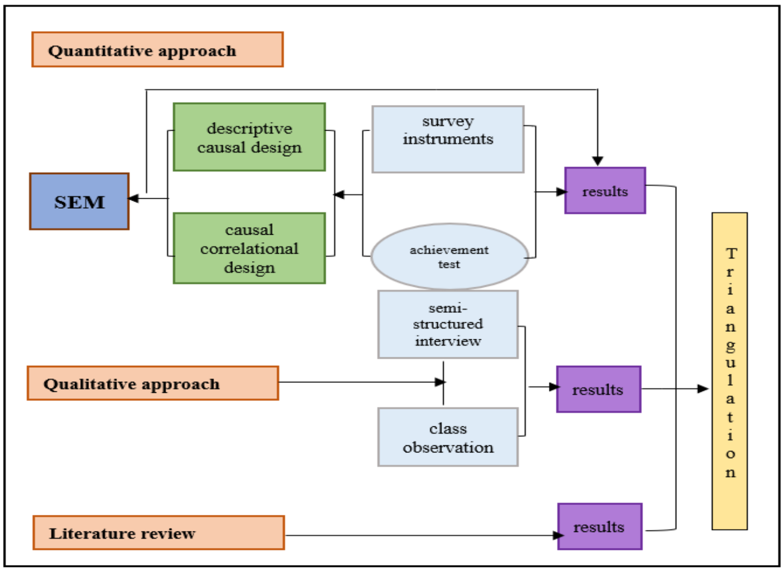

Figure 2. Research Flowchart of the Study

Research Instruments

In this study, there were six instruments for psychosocial aspects employed during the collection of data. The following modified/validated instruments are: a) Science Laboratory Environment Inventory (SLEI) for Laboratory aspect using the study of Fraser, McRobbie & Giddings(1993); b)What Is Happening In This Class (WIHIC) for Classroom environment using Fraser, McRobbie & Fischer (1999); c) Teacher Quality by Bonney, Amoah, Micah, Ahiamenyo & Lemaire, (2015); d) Emotional quotient using the Assessing Emotions Scale (AES) of Schutte et al., (1998); e) High School Chemistry Self-Efficacy (HSCS) using Capin & Uzuntiryaki, (2014), Lin & Tsai, (2012); and f) Assessment Format for Science Process Skills (SPS) of Akani (2015).

Grade 10 achievement test in science was used to measure students subjected to content validation by the local experts in their respective disciplines.

Data Collection Methods

A two-stage sampling procedure was used in determining the respondents of the study. The first stage was by divisions in the region and the second stage was the national high schools in each division. Before the survey questionnaires were administered, the participants were informed that the survey's complete results and their performance in the achievement test would be kept confidential. The data collected were then be tallied, tabulated, and analyzed.

Data Analysis

Descriptive statistics, such as mean and frequency counts, were used to determine the level of performance and psychosocial aspects. Correlation and regression analysis were employed to assess the relationship and predictors of student performance, respectively. Path analysis was used to identify the best fitting causal model on students' performance. The following standard criterion fit indices (Arkbucle, 2006) were computed; Chi-square degrees of freedom (X2/df), Goodness of Fit Index (GFI), Normal Fit Index (NFI), Tucker-Lewis Index (TLI), Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA).

Causal Model

The proposed causal model was generated to determine the relationship between psychosocial factors: laboratory environment, classroom, teacher's quality, E.Q., psychomotor skills and chemistry self-efficacy, and science achievement test. The model that follows (Figure 3) assumes that the science laboratory environment's psychosocial aspects are predictors of students' performance.

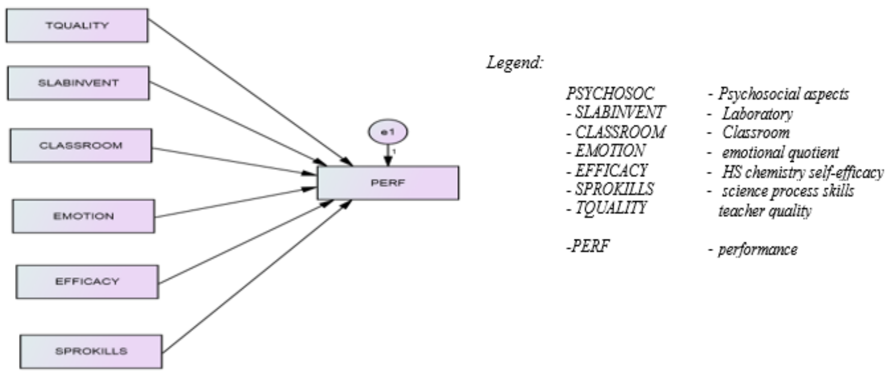

Figure 3. A hypothesized causal model of psychosocial aspects of science

Results and Discussion

Determine the level of performance of students in Grade 10 science.

A total of 1123 Grade 10 students' performance was measured in terms of their science achievement test. Table 1 provides the distribution of students' scores on the achievement test. Data in the table shows that only two participants obtained a 0.27% percentage rating score, which displays moving towards mastery of the scientific concepts taught in class; 427 got 38.02% percentage rating of 38.02%, with the descriptive equivalent of average mastery and 659 (58.6%) obtained a very low mastery and 0.089% for one participant with absolutely no mastery at all. The overall percentage rating score of the respondents is 32.46%, which indicates that they have manifested low mastery of the concepts, principles, and theories taught during their science class.

Table 1. Distribution of students' level of performance on the achievement test

Range	Frequency	Percentage	Descriptive equivalent
96 % - 100 %	0	0 %	Mastered
86 % - 95 %	0	0 %	Closely approximately mastery
6 6% - 85 %	3	0.27%	Moving towards mastery
35 % - 65 %	427	38.02 %	Average mastery
16 % - 34 %	659	58.68 %	Low mastery
5 % - 15 %	33	2.94 %	Very low mastery
0 % - 4 %	4	0.089 %	Absolutely no mastery

TOTAL	**1123**	**100 %**	
OVERALL		**32.46%**	**LOW MASTERY**

The literature of Sirhan, (2007); Cardellini, (2013); Woldeamanuel, Atagana & Engida, (2014); Treagust, Duit & Nreswandt (2016) support the findings of this study. They reported that many students find science subjects (such as chemistry) very difficult to comprehend. Also, the comprehensive reports of Benito (2014) and Briones (2014) on the low performance of Filipino students in the two national examinations National Career Assessment Examination (NCAE) and National Achievement Test (NAT), especially the science area, conforms to this study.

(2) . Assess the psychosocial level of Grade 10 science students' learning environment in terms of: a. laboratory, b. classroom, c. emotional quotient, d. high school chemistry self-efficacy, e. science process skills, and f. teacher quality;

Laboratory. The mean scores of the five components of SLEI employed in this study evaluating Grade 10 science students' performance are presented in Table 2with an overall mean (2.505), which means the five dimensions are practiced often. The data in the table shows that the rule clarity scale has the highest mean score (2.667). This is followed by student cohesiveness (2.610), open-endedness (2.467), material environment (2.413), and the lowest mean score for the integration scale (2.355). Nevertheless, these indicators are often practiced within the laboratory setting.

Table 2. Mean scores and qualitative description of the SLEI dimensions

SCALE	MEAN	DESCRIPTIVE RATING	QUALITATIVE INTERPRETATION
Student cohesiveness	2.640	Often	Observed on some occasions
Open-mindedness	2.467	Often	Observed on some occasions
Integration	2.355	Often	Observed on some occasions
Rule clarity	2.668	Often	Observed on some occasions
Material environment	2.413	Often	Observed on some occasions
OVERALL MEAN	2.505	OFTEN	OBSERVED ON SOME OCCASIONS

Moreover, the high mean score of rule clarity reveals that public students like the respondents typically follow certain laboratory rules as a guide and the science subject teacher outlines safety precautions before they do laboratory activity. The finding of this scale conforms to the literature of Fischer et al. (n.d.), Aledajana & Aderibigne (2007), and Che Ahmad et al. (2013). However, the former authors stressed that the rule of clarity in chemistry is highly structured investigations prescribed what the students do and observe.

On the student cohesiveness, the dimension ranked second. The science students experience less interaction and cooperation among themselves during the laboratory activity. The previous studies of Akinbobola (2015), Kwok (2014), Che Ahmad et al. (2010), and Aladejana & Aderibigne (2007) are consistent with the findings of this study.

For the open-mindedness (2.467) and material environment (2.413) scales, their mean score values are close to each other but are not quite significant. Akinbobola (2015) stressed that a laboratory setting is an effective means for comprehension, understanding, and knowledge applications. A local researcher, Mendija (2009), carried out a similar result of this current study using SLEI. However, her findings of the five scales differ in the degree of practice in the laboratory, which is sometimes demonstrated by secondary chemistry students.

Classroom. The summary of the mean score for each scale of WIHIC to assess Grade 10 students' performance towards their science learning environment is shown in Table 3. The scales on cooperation and task orientation garnered the highest mean scores of 3.107 and 3.082, respectively. These values indicate that the two dimensions are often practiced in the classroom. Results of this study corroborate with the research outcomes of Rajoo (2013) for the two scales, Aldridge et al. (2010) and Koul and Fischer (n.d.), concerning task orientation.

The other five dimensions reported with lower mean values show that they are seldom practiced in the classroom. These include student cohesiveness (mean-2.959), equity (mean=2.279), teacher support (2.587), involvement (2.567), and investigation (mean= 2.567). The overall mean (2.70) implies that WIHIC dimensions are seldom practiced among the science classroom respondents.

Table 3. Mean scores and qualitative description of the WIHIC dimensions

SCALE	MEAN	DESCRIPTIVE RATING	QUALITATIVE INTERPRETATION
Student cohesiveness	2.959	Agree	Observed in some occasions
Teacher support	2.587	Agree	Observed in some occasions
Involvement	2.567	Agree	Observed in some occasions
Investigation	2.468	Agree	Observed in some occasions
Task orientation	3.082	Strongly agree	Observed in all occasions
Cooperation	3.107	Strongly agree	Observed in all occasions
Equity	2.795	Agree	Observed in some occasions
OVERALL MEAN	2.780	AGREE	OBSERVED IN SOME OCCASIONS

The study results suggest that science teachers allow learners to explore the topics by doing the investigation, such as designing laboratory activities that will stimulate students' minds and interests in science. This is in accordance with John Dewey's principle of learning by doing. Therefore, the students' learning becomes more meaningful and relevant to their everyday real-life experiences.

E.Q. Table 4 presents the descriptive statistics of the four factors of the Assessing Emotions Scale (AES) of the respondents to measure their emotional intelligence as a group. Managing others' emotion (or empathy) scale has the highest mean score (3.094), which implies that it is observed in most occasions. Next, the ability to use emotions (3.035) and managing emotions and perception of emotions (2.991) are observed on some occasions. The overall mean (3.030) has a descriptive rating of observed on some occasions.

Table 4. Descriptive analysis of four domains of emotional intelligence

SUBSCALE	MEAN	DESCRIPTIVE RATING	QUALITATIVE INTERPRETATION
Managing own emotions	2.991	Agree	Observed in some occasions
Managing other's	3.094	Strongly agree	Observed on all occasions

emotions			
Perception of emotions	2.991	Agree	Observed in some occasions
Utilization of emotions	3.035	Agree	Observed in some occasions
OVERALL MEAN	3.030	AGREE	OBSERVED IN ALL OCCASIONS

Recognizing the feelings and emotions among the students is a good indicator that there is an honest and healthy relationship between them. This study's findings correspond to the research outcomes of Vasavi et al. (2017) and Yahaya et al. (2012). Mohzan et al. (2012)'s results, however, contradict the findings of the present study.

High school chemistry self-efficacy. Table 5 provides the Grade 10 respondents of their self-efficacy in learning their science (chemistry) subjects, both the lecture and laboratory. The corresponding mean scores for self-efficacy for chemistry application, self-efficacy for chemistry laboratory, and self-efficacy for cognitive skills are 4.78, 4.50, and 4.47, respectively. The mean scores for these dimensions ranging from 4.47 to 4.78. The values of the mean indicate moderate confidence. The overall mean (4.53) shows moderate confidence.

Table 5. Mean scores of the dimensions of high school chemistry self-efficacy

INDICATOR	MEAN	DESCRIPTIVE RATING	QUALITATIVE INTERPRETATION
Self-efficacy for cognitive skills	4.47	Well	Moderate confidence
Self-efficacy for chemistry laboratory	4.50	Well	Moderate confidence
Self-efficacy for applications of chemistry	4.78	Well	Moderate confidence
OVERALL MEAN	4.53	WELL	MODERATE CONFIDENCE

The higher mean score for the self-efficacy for chemistry applications implies that the students are more confident in applying what they have learned in their science (chemistry) class. Self-efficacy for cognitive skills and chemistry laboratory, which mean scores are very close, reveal that students have not fully acquired the self-confidence to explain the fundamental concepts of chemistry and interpretation of graphs and charts.

The studies of Ramnarain and Ramaila (2017), Baanu et al. (2016), Dogan (2015), and Dehyadegary (2013) are in line with the results of the study. This study found out that the chemistry (science) student respondents had high self-efficacy. The former revealed that the students scored more firmly on the self-efficacy for cognitive and psychomotor skills that have everyday application. This is contrary to the findings of Ramnarain and Ramaila (2017).

Science Process Skills. As depicted in Table 6, the mean scores of the different process skills indicators range from 2.65 to 2.73. The communication skill (2.73) has the highest mean, followed by experimentation skill (2.75), observation skill (2.73), inference skill (2.70), and measurement skill (2.70). The overall mean (2.72) indicates that the region of medium or average level of possession of science skills was highly observed among the respondents.

Table 6. Mean scores of the indicators of science process skills

INDICATORS	MEAN	DESCRIPTIVE RATING	QUALITATIVE INTERPRETATION
A.Observation Skill	2.73	High	Possessed

B.Experimentation Skill	2.75	High	Possessed
C.Measurement Skill	2.65	High	Possessed
D.Communication Skill	2.81	High	Possessed
E. Inference Skill	2.70	High	Possessed
OVERALL MEAN	2.72	HIGH	POSSESSED

The descriptive statistics in Table 6 imply that the students have acquired the necessary skills needed to understand the scientific concepts and theories covered in the lecture. The works of Gokul Raj and Nirmala Devi (2014) are consistent with the findings of this study. Akani's (2015) study gives support to these findings where the students possess high-level skills in science (observation and experimentation); Abd Rauf et al. (2017) found experimenting skill the most inculcated skill in the classroom, and Lati et al. (2012) identified experimenting skill of students as good.

Teacher Quality. A summary of the teacher's profile is provided in Table 7. The majority (62%) of the science subject teachers are female and 100% Licensure Examination for Teachers (LET) passers. They hold a minimum degree of Bachelor of Science in Secondary Education. However, during the informal conversation with the teachers, some of the teachers are enrolled in masters in education. Most of the teachers have served their respective schools for more than 11 years.

Table 7. Mean scores of the dimensions in teacher quality

A. **Teacher's Profile**	B. **MEAN**	C. **DESCRIPTIVE RATING**	D. **QUALITATIVE INTERPRETATION**
F. Gender	G.	H. Female (62%)	I.
K. Age	L.	M. 30-39 years (57%)	N.
P. Educational Qualification	Q.	R. Bachelor of Science (53%)	S.
U. Length of years in service	V.	W. 11 years and above (90%)	X.
Z. Type of Teacher	AA.	BB. Professional (LET passer 100%)	CC.
DD. Teachers' Qualification	EE. 3.00	FF. Agree	GG. Satisfactory
HH. Teachers' Teaching Experience	II. 3.37	JJ. Strongly agree	KK. Very satisfactory
LL. Teachers' Pedagogical Skills	MM. 3.32	NN. Strongly agree	OO. Very satisfactory
PP. OVERALL MEAN	QQ. 3.26	RR. STRONGLY AGREE	SS. VERY SATISFACTORY

Table 7 reveals that the teachers' teaching experiences have the highest mean with regards to teacher quality (3.37) with a very satisfactory rating. The teachers' pedagogical skills (3.32) also have a very satisfactory rating and satisfactory rating for the teacher's qualification (3.00). Overall mean (3.26) shows a very satisfactory rating as well.

Moreover, the table depicts teachers having more than 11 years of teaching experience teaching science (especially chemistry) relatively better than those with fewer years in the teaching profession. Thus, well-experienced teachers contribute to increased academic performance (achievement) of science learners. The finding of this study is in line with the previous studies of Oni (2014), Kosgei et al. (2013); Akiri (2013); Magsayo (2009), and Adeyemi (2008). The researchers stressed that students performed better when taught by well-experienced teachers than less experienced ones.

On the other hand, the teachers' pedagogical skills obtained a mean of 3.32, second to the highest indicator. These pedagogical skills comprise the teaching strategies, learning materials, and assessment tools to effectively imparting the subject matter for better retention of knowledge and thereby generate a remarkable school performance. The result of this study corroborates with the finding of Yusuf & Amali (n.d.). They discovered a positive correlation between the teachers' pedagogical skills and students' academic performance.

Another factor is the teachers' qualification. This finding confirms with Ibe et al. (2016), Bonney et al. (2015), Unanma et al. (2013), who reported that high qualification of teachers could foster the performance of the students. Interviewees' statements strongly support these results.

(3) Find out the relationship exists among performance and psychosocial aspects of the science laboratory environment of the students in Grade 10 science;

Assessment of the relationship of the psychosocial variables of the students' science learning environment concerning academic achievement (or performance) in science is shown in Table 8. Pearson Product-Moment Correlation was employed. Only two psychosocial aspects in science are significantly related to student's performance, which are classroom environment and teacher quality.

Classroom environment is highly significantly correlated with students performance (r =0.165, p =0.000). These results suggest that science classes where the students have experienced greater cohesiveness, cooperation, and higher task orientation help them improve their academic performance. This statistically significant relationship agrees with the results of Tragus (2003), Rajoo (2013), Fischer et al. (n.d.), and Aldridge et al. (2010) for the latter subscale. Likewise, teachers who are fair and just in dealing with students also contribute to enhancing the students' performance. This also supports Usaini & Abubakar (2015) statement, who claimed that classrooms must be favorable, that would give students room to work and enhance their academic achievement.

Table 8.Correlational Analysis of the psychosocial aspects of the science learning environment of Grade 10 science students on the performance

Indicators	**Correlation Coefficient (r)**	**Probability (p)**
Laboratory (SLEI)	0.041	0.173 ns
Classroom (WIHIC)	0.165	0.000**
Emotional quotient	0.009	0.773ns
High school chemistry self-efficacy	-0.026	0.381ns
Science process skills	0.016	0.598ns
Teacher quality	0.078	0.009**

** correlation is significant at the e0.01 level (2-tailed); ns – not significant

On the other hand, teacher quality also reflects the significant correlation with respect to students' performance. The teachers' higher qualifications positively correlate to the science achievement test of students (r=0.078, p= 0.009). The results imply that teachers are teaching science with higher qualifications and enriched pedagogical skills impacted greater performance to students. The research outcomes of this study did agree with the literature of Yusuf and Dada (2016); Kosgei (2013), Magsayo (2009), which stated that the teaching experiences and approaches employed by the teachers have a positive and significant impact on improving the academic achievements of students in science. Thus, the null hypothesis that there is no relationship between performance and psychosocial aspects in the science learning environment is rejected.

(4) Identify the variable, singly or in combination, best predicts students' performance in science.

Table 9 provides the stepwise regression analysis in the learning environment's psychological aspects concerning Grade 10 students' academic achievement in science. The stepwise method in multiple linear regression is used to determine the best predictors of performance. As shown in Table 9, the r2 or the coefficient of multiple determination 0.031 indicates that about 3.1 % of performance variation is attributed to the science learning environment. Thus, 96.9% of the variance can be explained by other factors or variables not capture in the study.\

Table 9. Regression analysis of students' performance.

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	S.E.	Beta		
(Constant)	21.058	1.953		10.783	0.000
classroom	4.156	.690	0.177	6.026	0.000
r = 0.177	**r2 = 0.031**	**F-value = 36.314**	**p-value= 0.000**		

The science classroom environment is the only predictor of performance, having the beta weights of 0.177. This implies that the performance of students is solely affected by their classroom environment. The regression equation of students' performance is given by y = 21.058 + 4.156X1, where y is the students' performance, and X1 is the science classroom learning. The regression equation explains that, for every unit increase of the classroom environment, there is a corresponding increase of 4.156 in the performance of students.

This study implies that the conducive classroom learning environment considering the aspects of student cohesiveness, teacher support, involvement, investigation, task orientation, cooperation, and equity will yield good results in students' academic achievement (performance) in science. The studies of Murugan & Rajoo (2013); Iram & Ambreen (n.d.) claim that the classroom environment positively influences the students' achievement. The null hypothesis that no variable predicts performance is rejected.

(5) Develop a causal model best fits students' performance in Grade 10 science.

In this study, path analysis is employed to reveal what variables or combinations affect students' performance (PERF). Each independent variable such as teachers' quality (QUALITY), science laboratory (SLABINVENT), classroom (CLASSROOM), E.Q. (EMOTION), self-efficacy (EFFICACY), and science process skills (SPROKILLS), played an essential role in their influence on performance using different path diagrams. The degree of influence of each path is measured in terms of the corresponding beta weights, which is similarly measured in the regression analysis.

Figure 4 is the obtained Causal Model. QUALITY, CLASSROOM, and PERFORMANCE are the exogenous variables. EMOTION, SLABINVENT, and SPROKILS are exogenous less EFFICACY. QUALITY and CLASSROOM serve as the mediator of EMOTION, SLABINVENT, and SPROSKILLS towards PERFORMANCE. The double arrows connecting EMOTION, SLABINVENT, and SPROSKILLS connote correlation among the independent variables. This is one capability of path analysis doing simultaneous computations and relationships among variables.

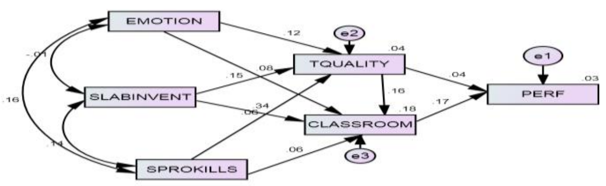

***Figure 4**. Best causal model of psychosocial aspects of the science learning environment on Grade 10 students' performance*

Legend:

QUALITY	Teacher's Quality
SLABINVENT	Science Laboratory Environment
CLASSROOM	Classroom Environment
EMOTION	Assessing Emotions
SKILLS	Science Process Skills
PERF	Performance / Achievement of students

Table 10 presents the direct, indirect, and total effects computed in the causal model. The highest total effect was found from the CLASSROOM as an independent variable that directly affected performance with a beta weight of 0.178. QUALITY with combined total effects of beta weight = 0.069 also influences performance (PERF), which also implies a positive influence.

Table 10. Direct, indirect, and total effects of causal model 1 on students' performance

VARIABLES	DIRECT EFFECT	INDIRECT EFFECT	TOTAL
QUALITY	.042	0.027	0.069
SLABINVENT	-	0.064	-0.064
CLASSROOM	.178	-	0.178
EMOTION	-	0.019	0.019
SKILLS	-	0.029	0.029

The values generated for the best causal model is shown in Table 11. Comparing the obtained values in the model with the standard values produces good results. All the standard values of the different indices are satisfied. CMIN/DF is 0.360 < 2; p-value is 0.782> 0.05; GFI is 1.000 > 0.95; NFI is 0.997 > 0.95; CFI is 1.000 > 0.95 and RMSEA is 0.000 < 0.05.

Table 11. Standard fit indices and standard value for the best causal model.

INDEX	CRITERION	MODEL FIT VALUE
CMIN/DF	< 2.0	0.360
P-value	>.05	0.782
NFI	>.95	0.997
TLI	>.95	1.028
CFI	>.95	1.000
GFI	>.95	1.000

RMSEA	<.05	0.000

With the results, The parsimonious model or the best fitting causal model on students' performance in science is best anchored on the CLASSROOM learning environment, which is supported by TQQUALITY. The results are supported by the study of Suleman & Hussain (2014), Murugan & Rajoo (2013), and Iram & Ambree (n.d.). The classroom learning environment that is highly conducive can stimulate students' interest to enhance their science learning. This will have a significant effect on the students' performance.

Conclusion

This study concludes that the Grade 10 students' academic performance measured using the standardized achievement test in science was very low in the mastery of the subject matter. The cognitive attributes of the students obtained very satisfactory and satisfactory ratings for their elementary general weighted average and general weighted average in science grade, respectively. Further, their performance in NCAE scientific ability displayed moving towards mastery of the science concepts taught.

Moreover, the psychosocial factors of the science learning environment can positively enhance their science performance. The findings of this study revealed that the classroom environment, which is supported by student cohesiveness, task orientation, cooperation, and equity, and teacher's qualification, are found to have a significant correlation to students' achievement. It is considered the best predictor of their performance. Having a conducive classroom environment can provide students with multiple learning experiences that will help them augment their conceptual knowledge and understanding of the science to further acquire the 21st century scientific skills and values for their holistic development. Thus, the best fitting causal model on students' performance is anchored on the classroom environment, supported by teachers' qualifications.

Recommendation

Based on the conclusion, the following are the recommendations of the researcher:

- The assessment of students' learning environment will be considered vital information for the Department of Education administrators and policymakers to revisit students' curricular activities in the teaching-learning process, thus achieving quality education goals towards 2030.
- Teachers' teaching strategies, methods and approaches, and assessment tools may find ways to employ a science learning environment in catering to students' needs for effective and meaningful science learning.
- Government officials may provide the public secondary schools with an adequate supply of learning resources (such as textbooks, laboratory rooms, science models, etc., instructional materials) to improve the science students' academic performance.
- Government offices may provide continuous support such as sponsoring seminars, training, and conferences for public science secondary teachers to strengthen knowledge and experiences in their field of specialization.
- Education officials in charge of the formulation of instructional materials may be aware of the alignment of the current status on 21st science and technology to enhance students' academic performance in terms of competence.

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