ISSN: 2714-2965 (Print)
ISSN: 2714-3449 (Online)
The African Journal of Behavioural and Scale Development Research
AJB-SDR Vol. 4, No 1, 2022

Modelling Physical Chemistry Achievement using Concept Difficulty, Numerical Ability and Interest

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Abstract
Physical Chemistry concept is a major area students find difficult. The study adopted correlational design. Twenty Public Senior Secondary schools from four local government areas in Education District III of Lagos State were randomly selected with five hundred and seven students (507) samples. Physical Chemistry concept difficulty scale (r = 0.76), student Chemistry interest questionnaire (r = -0.87), Numerical ability test (r = 0.79) and Physical Chemistry Achievement Test (r = 0.83) were used. They were validated using face and content validity, while Ordinal alpha, and Kr-20 were used for reliability. Frequency, Percentage, PPMC and multiple regression at $p < 0.05$ was used. The results revealed that 61% of the students find the physical concepts difficult. Results also showed a low positive relationship between concept difficulty and achievement in Physical Chemistry and no significant relationship between numerical ability and students. There is a relative significant contribution of concept difficulty (b = 0.108, t (506)= 2.423, $p < 0.05$) on Physical Chemistry achievement while students' numerical ability (b = 0.023, t (506)= 0.508, $p > 0.05$)and students' interest (b = - 0.029, t (506)= -0.649, $p > 0.05$) are not significant in the study. It could be concluded that concept difficulty is a potent predictor of students' Physical Chemistry achievement. Therefore, Chemistry teachers should improve in their method of teaching concept difficult topics in Chemistry.

Keywords: Chemistry, Physical Chemistry, Concept difficulty, Chemistry interest, Chemistry interest and Modelling

Introduction

Chemistry is a required subject in the senior secondary school. It contributes significantly to the advancement and growth of science and technology. Many activities in our daily lives involve chemistry, its application and role in the world cannot be overemphasized. Chemistry plays important role in unifying other science related subjects as a science subject itself. It is taught in secondary schools to prepare students for science-related courses at the university level. Such a course needs to be handled well at the secondary school level to generate a high level of interest from students.

Physical chemistry is a branch of chemistry that focuses on how matter behaves at the molecular and atomic levels and how chemical reactions occur, which results in the development of new theories, such as how complex structures are formed. Physical chemistry is regarded as a challenging subject to teach and learn at both the secondary and tertiary levels. Major learning difficulties could be caused by learners' perceptions of chemical phenomena and concepts, which appear abstract and difficult to understand, as well as their relationship to everyday life. As a result, misunderstandings occur when students attempt to understand chemical explanations within the context of the instruction provided but are unable to interact with this concept due to difficulty encountered. It could be due to their lack of fundamental scientific knowledge or scientific concepts. If there is no conceptual understanding of concepts and topics, chemistry may not be appealling and this may affect the learner's level of interest and curiosity (Uchegbu, & Anozieh 2015).

Scientific concepts especially chemical concepts requires understanding of chemical phenomena at three interlinked levels namely macroscopic (phenomena that we can see, feel, and hear), symbolic (chemical formulas and equations), and sub-microscopic (individual atoms and molecules), and the relation among the three. However, most of the times, teachers

ISSN: 2714-2965 (Print)
ISSN: 2714-3449 (Online)

focus only on one level, usually at the macroscopic and representation parts, microscopic parts are sometimes of forgotten and most explored. This causes students to often have difficulty in understanding and visualizing microscopic concepts such as atom, molecules, or chemical reaction.

Physical chemistry difficulty can be traced back to the nature of science itself, the method by which the subject has been taught and the method by which students learn. Thus, teachers' acquisition of appropriate scientific and technological skills, as well as their ability to impart knowledge to students, will aid in improving performance. Students must actively participate in the learning process by constantly equipping, testing, speculating and building their construct and knowledge. They perceive the subject as abstract if they are not taught or carried along in the teaching. According to the five pillars of effective learning, learning should be active, gender-sensitive, consistent, meaningful, and productive (FME & UNESCO 2007). Thus, for effective learning to occur, the learner must be active in the classroom, both males and females must be carried along equally, the learning must be consistent with the curriculum and the societal goals, the concepts learned must relate to the needs of everyday life and the society and the learners must be able to produce items and products required by the society as needed (Uchegbu, Anozieh, Mbadiugha, Ibe, Njoku 2015)

The study of chemistry at all educational levels necessitates knowledge, a logical thought process and numerical ability. Mathematics is a necessary and integral part of all scientific disciplines. Mathematics, Physics and Chemistry are essential science subjects at the senior secondary school level in Nigeria and serves as the bedrock of many subjects in the secondary school curriculum especially those that are science related. In this scientific age, having a basic understanding of mathematics and numeracy allows students to understand and solve some important chemistry problems in terms of concepts and principles. For example, knowledge gained from learning concepts such as fractions, ratios and proportions, percentages, the function of integration and differentiation in mathematics could be used to solve numerical problems in chemistry such as solution mixing and dilutions, mole concept, stoichiometry reactions, acid-base reactions and gas laws. Furthermore, the understanding of indices and logarithms in mathematics could be applied to the understanding of the pH scale and rate of reactions in Chemistry. Many researchers and chemistry educators believe that mathematics is one of the issues impeding students' progress in chemistry (Offiah & Samuel, 2008; Akpan & Okoro, 2012; Oyedeji, 2011; Awodun & Ojo, 2013; Allan & Rory, 2014). This demonstrates that learning chemistry necessitates several mathematical concepts and principles for easy comprehension and understanding.

A students' success in any activity is determined by the amount of required information that he has on the activity, his interpretation of it, and, most importantly, the application of his entire knowledge on it. In most cases, acquiring such information is dependent on reading and learning. However, the desire to learn may be influenced, to some extent, by the person's interest in the activity. It is up to the individual to determine why he wishes to study materials on activity and participate in the activity. What one learns may be determined by the degree to which one succeeds in achieving that goal or aim. According to Isangedighi, 1997, there is a strong correlation between high school student's interest in learning, study habits, and academic achievement. He also mentioned that the length of time a child actively engages in learning influences his or her level of learning. Time used for study improves the retention level of materials learnt by the students, which may eventually improve their performance outcomes during tests or examinations. A person does not naturally devote much time to studying materials that do not pique his or her interest and attention. When analyzing students' academic achievement in science, interest and attitudes are two complementary terms that should not be separated. Students' lack of interest may have resulted in a negative attitude and, as a result, continued poor performance. There is a need to establish an empirical position, which has necessitated this study to determine empirically if there is a relationship between chemistry students' interest and numerical ability and their achievement in the subject. Students' interest is important for high level of achievement in that subject, and it is related to attitude. (Olaboopo, 1999; Odiaka, 2002; Ogunnaike, 2002).

According to Ayanniyi, (2009) learners' interest in the learning process determines the importance students place on the learning process and what they will gain from the learning situation. Following the preceding, it is expected that learners' motivation (interest) in reading a given chemistry text and engaging in learning activities is influenced by their feelings and dispositions toward such activities. This will undoubtedly affect their cognitive development and learning outcomes in Chemistry. In a science subject like chemistry, where students must perform some numeracy skills and calculations, students' phobia for mathematics-related subjects may be a contributing factor to their perception that the chemistry subject is difficult. They now show little or no interest in the subject, which leads to poor achievement performance.

Aina & Adedo (2013) mentioned one of the causes of low science enrollment to be insufficient trained science personnel in post-primary schools. It is important to mention that schools also lack sufficient instructional resources for teaching, as well as textbooks, which are written in incomprehensive language for students. It is also discovered that chemistry seems to be difficult to understand and problem-solving that requires calculation was a challenge. Teaching that motivates students and piques their interest in learning should make sense to them. Concepts should be presented with appropriate instructional materials to ensure effective learning of the students with step-by-step delivery of contents. When students are unable to connect what they are learning with real-world experiences, they lose interest in the subject, which manifests itself in poor academic performance. When students' interest is boosted, learning becomes a breeze (Aina and Adedo, 2013; Hermitt 2007). Benjamin's (2014) research findings revealed a significant impact on the use of performance evaluation as a teaching strategy in the science classroom. This increases students' interest in class and improves their academic performance. The recent rise in average student performance in examinations administered by the Senior Secondary Certificate Examination (SSCE) and the National Examination Council (NECO) raises concerns. Poor chemistry performance reveals that students found it difficult to learn and master the subject. As a result, they were unable to perform well in their examination. Many studies have revealed that it is due to a lack of sufficient qualified teachers, teaching materials, motivation, laboratory equipment, etc.

In addition, difficulties experienced by even some chemistry teachers in the delivery of the subject content can lead to the inability of the students to understand chemistry concepts. Teachers face difficulties in teaching chemistry when they lack conceptual understanding of the subject chemistry. Technology can make teaching easier to teach chemistry by using multiple representations such as pictures, drawing, using simulation, videos and audio. Chemistry teachers are currently faced with the challenge of presenting material to students who frequently arrive with negative preconceived notions of the subject being "difficult" or "complicated." Some believe that the subject's abstract nature contributes to the difficult issues. The inability of teachers to use concrete materials and facilities, as well as real-life situations, to teach students makes it less interesting for the students. A lack of understanding of the languages or words used to convey teaching in the subject, as well as a lack of understanding of technical terms, suggests that there is a link between the perception of chemical science as a difficult subject and a lack of student motivation to pursue careers in the fields.

Irrespective of importance of the chemistry's basic knowledge, large proportion of students leave introductory topics without having deep understanding of the subject that is required which has been attributed to complexity of some of the contents in the subject. Some students dislike the subject because of the chemistry

ISSN: 2714-2965 (Print)
ISSN: 2714-3449 (Online)

teachers' inability to comprehend and internalize concepts and skills. One of the main challenges that make the subject appear abstract and difficult is students' lack of access to and exposure to practical activities. Students will struggle to integrate what they learn in the classroom and laboratory. According to some researchers, the abstract nature of many chemical concepts, teaching styles used in class, a lack of sufficient teaching aids and the difficulty of the chemistry language are all factors contributing to students' poor understanding and misunderstandings, from primary school to the university. With all of the lingering issues concerning chemistry's difficult and abstract concepts, we should examine some concepts and topics in physical chemistry that appear difficult for the students and compare them to their achievement in physical chemistry.

Methods

The study adopted a non-experimental type of research of a correlational design. Population of the study includes all senior secondary school 2 students of District 3, Lagos State. Five public schools were selected randomly from all the four local governments in district three. The study adopts multi-stage sampling procedures. Lagos State Educational district 3 was stratified into four local governments (Eti-Osa, Epe, Ibeju-Lekki, Lagos Island,). All four local governments were used. In the first stage, simple random sampling was used to select 5 senior secondary schools from each local government. In the second stage, random sampling was also used to select a participant from chemistry intact classes from the five secondary schools from each local government. All the five senior secondary schools two were selected purposively due to their intact classes. A total number of 20 public senior secondary schools were used.

Four instruments were used for data collection activities in the study. Physical chemistry achievement test (PCAT) (r = 0.83). Physical Chemistry concept difficulty scale (PCCD, r = 0.76), Student Chemistry interest questionnaire (SCIQ, r = -0.87) Numerical ability test (NAT, r = 0.79),

All instruments were validated by seeking the opinion of experts and the reliability of the items was established using the Kr-20 formula

The quantitative method was used for data analysis. SPSS software was used for the analysis, the researcher made use of descriptive statistics, correlation, and multiple regression to answer the research question at 0.05 significant level. Percentage and frequency were used to answer research question one, Correlation was used to answer research question two. While multiple regression was used to answer research questions three and four. at 0.05 of significant.

RESEARCH QUESTIONS

1. What is the extent to which students find physical chemistry concepts difficult?
2. What is the strength and direction of the relationship among Concept Difficulty, Students' Numerical Ability, Students' Interest and Achievement in Physical Chemistry?
3. What is the composite contribution of Concept Difficulty, Students' Numerical Ability, Students' Interest and Achievement in Physical Chemistry?
4. What is the relative contribution of Concept Difficulty, Students' Numerical Ability, Students' Interest and Achievement in Physical Chemistry?

ISSN: 2714-2965 (Print)
ISSN: 2714-3449 (Online)

ANALYSIS

Research Question One

What is the extent to which students find physical chemistry concepts difficult?

Table 1: Descriptive analysis of Concept Difficulty Level

S/N	CONTENTS/INDICATORS	RATING					
		VE	E	SD	D	TD	ED
		Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)
1.	What are the chemical formulae? I. Calcium Trioxocarbonate (iv)? II .Iron(ii) Tetraoxosulphate (iv) is?	272 (53.6%)	18 (16.0%)	67 (13.3%)	52 (10.3%)	17 (3.4%)	18 (3.5%)
2.	Calculate is the percentage of water of crystallization in $ZnS0_4$. $7H_20$?.	113 (22.3%)	30 (5.9%)	38 (7.5%)	92 (18.1%)	74 (14.6%)	160 (31.6%)
3	Given that $^{14}{}_{6}X$ and $^{38}{}_{19}Y$. Write out the mass number, Number of protons, and neutron.	151 (29.8%)	11 (2.2%)	39 (7.7%)	38 (7.5%)	135 (26.6%)	133 (26.2%)
4	Consider the following reaction $A_2 + 3B \rightleftharpoons 2AB$ Write an expression for the equilibrium constant for the reaction	54 (10.7%)	5 (1.0%)	10 (2.0%)	96 (18.9%)	103 (20.3%)	239 (47.1%)
5.	Determine the oxidation number of phosphorous in HPO_3^{2-}?	119 (23.5%)	17 (3.4%)	37 (7.3%)	68 (13.4%)	110 (21.7%)	156 (30.8%)
6.	The equilibrium constant at 427 °C for the reaction: $N_2(g) + 3H_2(g)$? $2NH_3(g)$ is $K_p = 9.4 \times 10^{-5}$. Calculate the value of? G° for the reaction at 427°.	20 (3.9%)	1 (2.0%)	7 (1.4%)	36 (7.1%)	110 (21.9%)	333 (65.7%)
7.	Determine the values of x, y, and z in the following equation xKClO3(aq)? yKCl(aq) + $zO_2(g)$	193 (36.1%)	9 (1.8%)	16 (3.2%)	34 (6.7%)	92 (18.1%)	193 (32.1%)
8.	Calculate the amount of sodium chloride in 20.0g of the pure salt (Na = 23, Cl = 35.5)	74 (14.6%)	12 (2.4%)	23 (4.5%)	89 (17.6%)	126 (24.9%)	183 (36.1%)
9.	What is the pH of $0.01moldm^{-3}$ of HNO_3?	34 (6.7%)	0.2 (.9%)	14 (2.8%)	40 (7.9%)	120 (23.7%)	298 (58.8%)
10.	If 2g of zinc granules react with excess dilute HCL in 5minute, what will be the rate of reaction?	29 (5.7%)	1 (0.2%)	8 (1.6%)	26 (5.1%)	96 (18.9%)	347 (18.9%)
11.	Divalent metals such as copper will discharge how many coulombs of electricity?	39 (7.7%)	2 (0.4%)	8 (1.6%)	22 (4.3%)	70 (13.8%)	366 (72.2%)
12.	What quantity of electrons in moles is lost when one mole of iron (ii) ions is oxidized to iron (iii)?	20 (3.9%)	3 (0.6%)	15 (3.0%)	36 (7.1%)	73 (14.4%)	360 (71.0%)
13.	Write the equation for the reaction at the Anode when electrolysis of brine takes place.	13 (2.6%)	5 (1.0%)	16 (3.2%)	59 (11.6%)	77 (15.2%)	96 (18.9%)
14.	What is the quantity of electricity used during electrolysis when a current of 0.21a flows for 2hours?	70 (13.8%)	5 (1.0%)	13 (2.6%)	40 (7.9%)	57 (11.2%)	322 (63.5%)
15.	Balance the ionic reaction $MnO_4^- + H^+ \longrightarrow Mn^{2+} + 4H_20$	99 (19.5%)	7 (1.4%)	21 (4.1%)	53 (10.5%)	75 (14.8%)	252 (49.7%)
16.	Write the electronic configuration of Mg^{2+}	33 (6.5%)	72 (14.2%)	120 (23.7%)	100 (19.7%)	57 (11.2%)	125 (24.7%)
17.	The heat of combustion of carbon is -393.5kj. calculate the heat of change, when 60g of carbon undergoes complete combustion (c =12)	18 (3.6%)	12 (2.4%)	6 (1.2%)	121 (23.9%)	49 (9.7%)	301 (59.4%)
18.	Calculate the concentration of the solution obtained when $500cm^3$ of $0.10moldm^3$ solution was evaporated to $125cm^3$	35 (6.9%)	4 (0.8%)	42 (8.3%)	45 (8.9%)	47 (9.8%)	334 (65.9%)
19.	$\Delta G = \Delta H - T\Delta S$. State what each letter represents?	42 (8.3%)	15 (3.0%)	45 (8.9%)	74 (14.8%)	78 (15.8%)	253 (49.9%)
20.	What does each symbol represent in the equation? $Zn_s/Zn2^+_{aq}// Cu^{2+}{}_{aq)}$ / Cu.	17 (3.4%)	8 (1.6%)	34 (6.7%)	82 (16.8%)	70 (13.8%)	296 (58.4%)

ISSN: 2714-2965 (Print)
ISSN: 2714-3449 (Online)
The African Journal of Behavioural and Scale Development Research
AJB-SDR Vol. 4, No 1, 2022

The results from Table 4.1 show the extent to which the students find physical Chemistry concepts difficult.

Stoichiometry concepts show about 53.6% have no difficulty in writing simple chemical formulae of the compound, 46.6% have difficulty in writing the correct formulae. Also 11. 3% have no difficulty in calculating the percentage of an element in a compound, .71.8% have difficulty in either calculating the relative molecular mass or in calculating the percentage composition required. 14.6% have a good mastery of dilution formulae and use them well. 85.5% have difficulty in recalling the formulae and using the formulae properly.

Quantum Chemistry Concepts, 29.8% of the respondent possess a good mastery of mass numbers, atomic numbers, 72.2.3% of the respondents have a problem in differentiating mass numbers from atomic numbers, proton numbers from neutron numbers. 23.5% of the respondents could write the correct valency of the element given, 10.7% of the respondents could collect like terms properly, while 65.9% of the respondent do not know the valency of hydrogen and oxygen and could not rightly slot the oxidation number of those elements. About 6.5% of the respondents have no difficulty in giving the correct electronic configuration, 93.1% of the respondents have challenges and could not write correct electronic configuration or do not know the right configuration of the element.

In the chemical equilibrium concept, about 10.5% of the respondents have no difficulty in giving the correct expression for the equilibrium constant, while 89.3% have a load of difficulty in giving the expression or could not retain the method for writing the expression. Also, 3.9% of the respondents have no difficulty in equilibrium constant calculation, while 89% find the concept difficult, they cannot remember the formulae nor give the right answer. About 6.7% of the respondents write the correct formula for pH and were able to calculate the pH of the acid, while 93.4% could not write correct formulae and were not able to calculate the pH value.

For concepts involving chemical kinetics, 5.7% of the respondents have no difficulty in calculating the rate of reaction, 94.1% do not comprehend the concept of rate of reaction and have several difficulties. 38.1% of the respondents could balance well the equation with the appropriate number of moles, with no difficulty. 63.4% of the respondents have difficulty balancing the equation. Also, 3.9% of the respondents know when an element is oxidized or not and have difficulty, 96.1% have trouble difficulty in the concept. 19.5% could balance the ionic equation properly, .80.5.0% find the concept difficult.

Thermochemistry concepts show 7.7% of the respondents have no difficulties with the first law of electrolysis, 92.3% have difficulties. 93.3% find the concept difficult. 13.8% of the respondents have no difficulties with the first law of electrolysis, 82.6% have concept difficulty in the topic. 3.4% of the respondents could identify the symbols of the part of electrolysis properly, while 88% could not identify the parameters and difficulty for them.

For thermodynamics, 3.6% of the respondents have a good understanding of the concept, 3.6% of the respondents have also found the concept difficult a little, 87.0% do not understand the concepts very well.

Research Question Two: What is the strength and direction of relationship among Concept Difficulty, Students' Numerical Ability, Students' Interest and Achievement in Chemistry Physical?

Table 4.1b: Correlation Matrix of Concept Difficulty, Students' Numerical Ability, Students' Interest and Achievement in Physical Chemistry

ISSN: 2714-2965 (Print)
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Variables	C.D	SNUAB	Students' Interest	Achievement in Physical Chemistry
Concept Difficulty	1			
Students' Numerical Ability	0.008	1		
Students' Interest	-0.136**	0.065	1	
Achievement in Physical Chemistry	0.112*	0.022	-0.042	1

*Significant at p< .05 level C.D = *Concept Difficulty, SNUAB = Students' Numerical Ability*

From the result above, a significant level was observed at $p<0.05$. The table above shows the intercorrelation matrix showing the correlation coefficients of the independent variables. There was no significance between numerical ability and achievement in physical chemistry ($r = 0.022, p =0.629, p > 0.05$), It was also found that there was no significant relationship between students' interest and achievement in physical chemistry, ($r = -0.042, p = 0.342, p > 0.05$). Concept difficulty and achievement in physical chemistry show a significant relationship, ($r = 0.112, p < 0.05$) Concept Difficulty, Students' Numerical Ability, Students' Interest, and the criterion variable (Achievement in Physical Chemistry) reveal a small significant relationship between the three independent variables. Hence, it can be concluded that concept difficulty determines students' achievement in Physical chemistry.

Research Question Three: What is the composite contribution of Concept Difficulty, Students' Numerical Ability, Students' Interest and Achievement in Physical Chemistry?

Table 4.1c: Regression Summary and ANOVA of Concept Difficulty, Students' Numerical Ability, Students' Interest and Achievement in Physical Chemistry

Multiple R = 0.118
R Square = 0.014
Adjusted R Square = 0.008
Standard Error = 2.529

Analysis of Variance					
Source of Variance	**Sum of Square**	**Df**	**Mean Square**	**F**	**Sig.**
Regression	45.340	3	15.113	2.362	.071
Residual	3218.376	503	6.398		
Total	3263.716	506			

Significant at p< .05 level

Table 4.1c shows that the multiple regression correlation coefficients indicating the relationship between the predictor variables (concept difficulty, students' numerical ability and students' interest) and Achievement in Physical Chemistry indicators are 0.118. The adjusted R squared is 0.008. This means that the predictor variables accounted for 0.8% achievement of students in Chemistry. Also, it has been further ascertained using multiple regression ANOVA, $F_{(3,506)} = 2.362; p>0.05$. This indicated that there is no significant linear relationship between the predictor variables and Achievement in Physical Chemistry indicators.

Research Question Four: What is the relative contribution of Concept Difficulty, Students' Numerical Ability, Students' Interest and Achievement in Physical Chemistry?

ISSN: 2714-2965 (Print)
ISSN: 2714-3449 (Online)

Table 4.1d: Relative contribution of Concept Difficulty, Students' Numerical Ability, Students' Interest and Achievement in Physical Chemistry

Variables	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	8.235	1.215		6.776	0.000
Concept Difficulty	0.026	0.011	0.108	2.423	0.016
Students' Numerical Ability	0.025	0.049	0.023	0.508	0.611
Students' Interest	-0.011	0.018	-0.029	-0.649	0.517

Table 4.1d shows that among the predictor variables, only concept difficulty#(b=0.108,# t(506)#=2.423, $p<0.05$) was found to have a significant relative contribution towards students' achievement in Physical chemistry. However, students' numerical ability#b=0.023,# t(506)#=0.508, $p>0.05$) and students' interest (b=-0.029,# t(506)#=-0.649, $p>0.05$) did not contribute significantly to the prediction of students' achievement in physical chemistry. Hence, it can be concluded that concept difficulty is the only potent predictor of students' achievement in Physical chemistry.

Discussion

The findings in this study show the general trend of senior secondary school concept difficulty in physical chemistry. Results indicate the generality of secondary school students has difficulty in physical chemistry concepts. Concepts like thermodynamics, electrochemistry, chemical equilibrium, findings from this study revealed 61 % of the students have concept difficulty in physical chemistry concepts. This result of this research revealed that there was a significant relationship between concept difficulty and students' physical achievement in chemistry. It was revealed that the majority of the students do not have in-depth knowledge of symbols, notation and formulas in concepts such as electrolysis.

The results of the finding show that there was no significant relationship between numerical ability and achievement of students in Physical Chemistry. The results show there is no significant relationship between students' interest and achievement in physical chemistry of this study support the assertion of some authors and researchers.

Cecilia Obi Nja et al (2019) in their study reported there is a significant relationship between academic achievement and the interest of students in chemistry. It revealed a level of dependence of student's achievement in Chemistry on students' interest in Chemistry. Hence, for students to do well in Chemistry, it is important that such students have high level of interest in it given that there are difficult topics that only a student who has developed interest can be determined to learn them.

Conclusion and Recommendation

From the findings of this study, it is concluded that Concept difficulty, Numerical ability, Student's interest is not statistically and significantly related to students' achievement in Physical chemistry. Among the predictor variables, only Concept difficulty shows a significant relationship to physical chemistry achievement. It shows that if they have a good mastery of Physical Chemistry Concepts, they will perform high in their Physical Chemistry Achievement.

Also, students should be encouraged to develop good study habit. Students should work more on their numerical and mathematical skills because it's key to proficiency in science subjects. There should be re-orientation of student's interest and idea to the science subject. Chemistry teachers should improve in their method of teaching difficult concepts in chemistry. They should use real-life examples plus technology-driven computer simulation concepts that could enhance easy understanding...Chemistry curriculum planners and textbook writers should make chemistry textbooks more interesting. There should be an easy method of identification of concepts; concepts should be explained based on socio-cultural contexts. In addition, chemistry text vocabulary and terminology should be more precise and direct. Generally, students need to study hard in their studies to do well in their internal and external exams.

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