International Journal of Instruction *April 2023 ● Vol.16, No.2*
e-ISSN: 1308-1470 ● www.e-iji.net *p-ISSN: 1694-609X*
pp. 15-30

Article submission code: 20220218041537
Received: 18/02/2022 Revision: 10/09/2022
Accepted: 07/10/2022 OnlineFirst: 01/01/2023

Predictors of Chemistry Learning Among First Year University Students

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Early diagnosis of prevailing factors that either promote or impede learning is necessary in order to minimize problems in chemistry instruction and overall student performance. Extracted from reports on various factors affecting the teaching and learning of Chemistry, this study draws out determinants that affect first year university students' achievement in chemistry courses. Using descriptive-correlational research, university students (n= 253) were surveyed using a checklist instrument (CKI = 0.70) to determine the factors that influenced their Chemistry learning. Multiple regression analysis revealed five determinants that significantly correlated with their achievement in this course namely, high school chemistry grade, parents' educational attainment, books, type of school enrolled, and fire extinguishers. A supportive learning environment along with other motivational factors can help underprepared students to be academically successful even in the most challenging course like Chemistry.

Keywords: chemistry learning, regression model, tertiary education, determinants of chemistry, Philippines

INTRODUCTION

Science education continuously face challenges of students losing interest in learning science subjects including chemistry (Musengimana et al., 2021). The abstract and complex nature of this discipline renders it susceptible to students' negative perceptions and learning experiences, consequently affecting their learning outcomes. Moreover, students are diverse in terms of their level of chemistry preparation (Khaddoor et al., 2017). With the ongoing changes in the curriculum, it created a massive complexity of the concepts they learned previously and recently because they come from various schools with different instructional approaches (Chen & Wei, 2015). Chemistry is also one of the hated subjects in Science, which students would likely fail completing the necessary requirements and get low performances in both academic and conceptual reasoning skills (Espinosa, 2014). A percentage of scholars, educators, and mentors

Citation: Mangubat, F. M., & Picardal, M. T. (2023). Predictors of chemistry learning among first year university students. *International Journal of Instruction*, *16*(2), 15-30. https://doi.org/10.29333/iji.2023.1622a

shared similar view for the reason of intellectual aspects of several chemistry terms and concepts, instructional approaches utilized during class, shortage in instructional materials as well as the complexity and the broad contents of the subject (Bellou et al., 2018).

Different investigations identified many determining factors that affect the teaching and learning of Chemistry in the basic education (Al-Amoush et al., 2014; Cho & Baek, 2019; Musengimana et al., 2021; & Sibomana et al., 2021). For instance, Sibomana et al. (2021) examined various factors affecting chemistry learning in secondary students through a literature review and found that school factors, content area, teachers and students' factors, teaching approaches, effect of class size, family socioeconomic status, and leadership styles were influential to students' academic achievement in Chemistry. Ejidike et al. (2015) on the other hand explored major factors influencing the effective chemistry instruction. Cho & Baek (2019) determined the factors affecting instructor–student communication and feedback between theoretical and laboratory classes in science subjects including chemistry. Few investigations examined the teaching and learning problems in chemistry in tertiary education (Apotheker, 2014; Lund & Stains, 2015; Cohen & Kelly, 2018). One of the findings revealed on the exploration of biology, chemistry, and physics faculty on their instructional practices is that the chemistry faculty ($n = 20$) had primarily teacher-centered views and experienced contextual factors that hindered the adoption of student-centered practices as compared to Physics and Biology faculty (Lund & Stains, 2015). The prevailing complex issues surrounding chemistry instruction has led to students in higher education to either drop their chemistry course or shift to another degree program. The attrition rates of students in the STEM fields in higher education continue to be a point of discussion. With more and new findings from various researches, technological advances, and socio-cultural shifts inevitably necessitate an ongoing investigation as to how students approach learning (Atieh et al., 2020). For many matriculated students, chemistry is a required gatekeeping course for postsecondary retention and advancement in STEM majors (Cohen & Kelly, 2018). Informed by their methodology and findings, this study focused on the university students taking Chemistry courses who are on their first year of undergraduate degree program. It is crucial to investigate further this area as there is a high attrition rate in chemistry and chemistry related subjects in the Philippine setting particularly in the early stages of university education.

In the Philippine context, Aggabao et al. (2018) pointed out that students' learning in science is associated with a series of reforms made in the science curriculum. They found that underlying factors such as the utilization of outdated instructional approaches, limited resources, academic capabilities of the teachers, type of high school graduated from, ethnicity, high school curriculum, and course, to name a few, accounted for the students' learning in basic science education. Magdara (2015) looked into the chemistry teaching in a public secondary school and nuanced that there is a dearth of experience in experimental learning and inaccessibility of essential tools and laboratory services affecting the level of preparedness and competence to enter higher education level. Findings from the aforementioned literatures establishes the research gap on exploring predictors that contribute to the university students performance in chemistry

and their overall learning experience of the course during their first year chemistry subjects. Findings from this study aimed to contribute to the burgeoning literature on potential intervening variables in the teaching and learning of chemistry in the higher education level as a source of intervention and actions to support university students. This study aimed to determine the various predictors to learning chemistry among tertiary students using selected determinants from literature.

Theoretical Background

In order to examine the various factors that influence university students' academic performance and successful learning most especially among first year students, key intervening factors are clarified both in the context of chemistry as a course and in consideration to other discipline. While several authors in the above section presented different sets of factors that contribute significantly to the teaching and learning of chemistry, relevant studies framing the theoretical constructs of this study are considered. Quinn (2013) explored the socio-cultural, structural, policy, institutional, personal and learning factors that lead to students' dropout. Sevinc and Gizir (2014) and McCulloch (2014) regard the academic, social, personal-emotional, and institutional adjustment of first-year university students as essential factors that affect negatively the studies. Aljohani (2016) singles out such categories of influencing factors as family background, student-related factors, social factors, economic factors, students' goals, institutional experience and institutional factors. Musengimana et al., 2021 conducted a literature review on different factors affecting secondary students' attitude towards Chemistry. They found out that gender, instructional methods, and grade level are the most common factors attributed to positive attitude towards this discipline. Other variables such as students' interest, classroom environment, curriculum, teacher's behaviour, perceived difficulty of the subject matter as well as their self-directed efforts towards science subjects were also examined. Erath Sirin & Sahin (2020) employed logistic regression analysis in investigating the factors affecting the achievement of university students in Physical Education such as their sociodemographic characteristics that served as important indicators in students' academic success. Moreover, Raychaudhuri et al. (2010) examined the factors affecting school students' performance through regression analysis and found out that students' attendance, mother's education, and trained teachers in the school positively influence students' academic performance. Al-Sheeb et al. (2018) looked into the overall satisfaction of first year university students based on their academic, social, and environmental aspects and found out that their sense of belonging and citizenship knowledge and skills were determinants to their overall college experience. A more relevant work of Cohen & Kelly (2018) explored Chemistry achievement related to student background characteristics and degree persistence among community college students in their introductory Chemistry courses. They found out that chemistry enrolment particularly their performance in chemistry served as a significant predictor to students switching of degree to non-STEM discipline. Albeit, their background (e.g., gender, ethnicity, socioeconomic status) did not influence their decision to leave or stay with their STEM degree programs.

The ideas of the abovementioned researches were used as the theoretical background for researching the factors influencing exploring studies of the first-year students while focusing on exploring intrinsic, extrinsic and school-related factors. The categories of factors such as intrinsic, extrinsic, and school-related factors stem from the recent report of Orvis et al. (2018) and Gambari et al. (2016) that students are adopting a consumerist approach to education in which motivation drives and sustains students learning behaviour resulting to best academic outcome. Among the many motivational constructs associated with academic performance particularly in higher education, the most common categories are extrinsic, intrinsic, and in this study, it includes school related factors that influence first year university students to do well in their chemistry courses. Intrinsic factors are those that motivate students to do an activity because it makes them inherently satisfied and happy because of the pleasant experience, interest, and excitement they feel (Ryan & Deci, 2000). Meanwhile, extrinsic factors are those that motivate students to perform an activity because of the reward or punishment that goes with the behaviour or action (Ryan & Deci, 2000). Identification of factors that will facilitate effective chemistry learning is necessary for providing equitable learning environment and support mechanism for these students to refine their skills and make them successful in the chemistry course (Atieh et al., 2020).

METHOD

Research Design

This study employed a descriptive-correlational research design. This method allows the researcher to obtain information relating to learning chemistry among tertiary students. Specifically, different factors that significantly contribute to university students' academic performance in Chemistry as identified from literature were categorized into intrinsic, extrinsic and school-related factors.

Context and Respondents

The locale of this study are the private and public higher education institutions offering different degree programs with chemistry as one of the embedded subjects in the curriculum where these student-respondents were enrolled. These students came from Cebu and neighboring provinces from selected parts of Region VII, Philippines. Specifically, there were three (3) state universities and colleges (SUCs), three (3) private-sectarian, and three (3) private –non-sectarian involved in this study to provide an adequate representation of higher education institutions (HEIs). The state university and colleges are composed of many satellite schools and extension campuses delivering education to the clientele that offer different degree programs. Respondents were tertiary students enrolled in Higher Education Institutions (HEIs) in Region VII, Philippines who took their first chemistry subject during their first year in the university. HEI's covered the 253 students from three state universities and colleges, three private-sectarian and three private non-sectarian. These universities offer courses with chemistry as one of the primary subjects in the discipline students are enrolled in. The study utilized a multistage sampling technique. Region 7 consists of four provinces, namely, Cebu, Bohol, Siquijor, and Negros Oriental. The first stage of sampling involved stratifying the population of tertiary students according to province, followed

by stratification according to the type of school in four categories. Everyone in the selected school may be sampled. However, due to restrictions in travel and data collection brought by the pandemic, the target respondents from other provinces such as Siquijor were not included in this actual data collection and the researcher acknowledged this limitation. The next stage of sampling had to employ non-probability sampling technique to reach out to the respondents, specifically purposive sampling technique. These were the inclusion-selection criteria. The total number of respondents accounted for a sample size of 253.

Research Instruments

The research instrument is composed of three parts. The first part is a checklist that collects students demographic profile. The information in this part were classified as intrinsic factor that included age, sex, high school GPA in chemistry, number of study hours per day, SHS academic track, and career influence. The second part of the instrument was also a checklist of the extrinsic factors that included parents' educational attainment, number of siblings, combined monthly income, and assistance in learning. The third part of the instrument was another checklist of the school-related factors like teacher-student ratio, type of school enrolled, school location, utilization of instructional materials, and laboratory facility availability. The checklist instrument undergone face validity using Cohen's Kappa Index (CKI) with a Kappa of 0.70 for inter-rater agreement.

Data Gathering Procedure

An informed consent was obtained from both students and teachers of different higher education institutions. The researcher notified them about the objective of the study as well as its protocol. The questionnaire was distributed through online platforms like google forms due to limited access brought about by the ongoing health crisis. Instructions were appropriately explained to guide respondents and how to fill in the questionnaires. They were also encouraged to feel free to ask questions if they noticed some ambiguous terms.

Statistical Treatment

The study aimed to determine the predictors affecting chemistry learning among tertiary students by utilizing a logistic regression analysis to generate a model for each variable's explanatory influence. There were two types of logistic regression analysis employed on the data. The binary logistic regression is considered a dependent variable with two outcomes. In comparison, the multinomial logistic regression was used to a dependent variable with more than two outcomes. This model showed if variables in the present study explained statistically significant variance in the dependent variable, tertiary students' learning in chemistry when accounting for all other variables. All statistical analysis was done using SPSS v. 24.

FINDINGS AND DISCUSSION

The results presented were arranged logically from the identification of the significant variables that served as predictors of Chemistry learning through multivariate logistic regression model.

Table 1
Correlation matrix of independent variables

Variable	1	2	3	4	5	6	7	8	VIF
1	1.000								1.134
2	0.183	1.000							1.648
3	0.198	0.589	1.000						2.431
4	0.141	0.072	0.098	1.000					1.047
5	0.164	0.549	0.716	0.154	1.000				2.301
6	0.086	0.272	0.390	0.113	0.414	1.000			2.477
7	0.131	0.361	0.478	0.129	0.458	0.763	1.000		2.862
8	0.244	0.055	0.132	0.038	0.089	0.388	0.431	1.000	1.354

[a] Variable 1- HS Chemistry Grade; 2- Parents' educational attainment; 3- Combined monthly family income; 4- Books; 5- Type of school enrolled; 6- Glassware; 7- Heating instruments; 8-Fire extinguisher.

Table 1 shows the correlation matrix of independent variables that determines the best model that can describe the chemistry learning of tertiary students. The assumptions of the model are taken into consideration. First, the study's dependent variable is chemistry performance, based on the chemistry grade brackets (Conditional Failure, Fair/Passing, Good, Very Good, Superior, and Excellent). The study points out that this variable is categorical. Second, the study's independent variables are nominal, such as SHS, and ordinal, such as assistance in learning. Third, the observations do not come from repeated measures or matched data, as data are obtained once from the students, and no re-gathering was done after some time. Fourth, all the significantly correlated variables do not have a correlation value (*r*-value) greater than 0.80. VIF values are less than 10, signifying no high correlations between the independent variables. For that reason, there should be no multicollinearity between the independent variables. Fifth, there is a linear relationship between the continuous independent variables and the logit transformation of the dependent variable. There are no continuous independent variables in the data set.

Table 2
Regression model of the determinants in learning chemistry

Description	Model 1	Model 2	Model 3	Model 4
Number of explanatory variables	1	4	5	8
Valid cases	253	253	253	253
Missing cases	0	0	0	0
Subpopulation	6	154	175	222
Chi-square value (likelihood ratio test)	43.199	154.738	172.147	246.906
df	15	75	81	117
R-square Cox and Senell	0.157	0.458	0.494	0.625
R-square Nagelkerke	0.169	0.494	0.532	0.674
R-square McFadden	0.065	0.234	0.260	0.374
Number of correct predicted				
"Fair/ Passing"	6.1%	42.9%	44.9%	65.3%
"Good"	54.0%	57.5%	55.2%	62.1%
"Very Good"	68.6%	68.6%	69.8%	79.1%
"Superior"	12.9%	29.0%	29.0%	35.5%
Classification Overall Percentage	44.7%	54.9%	54.9%	65.2%

Table 2 presents the regression model of the determinants in learning chemistry among first year university students, indicating the comparison of the four models. As seen in the table, the significantly correlated variables (p<.05) are identified as predictors of the dependent variable's chemistry performance at the tertiary level. These predictors were subjected to a stepwise regression method employing multinomial logistic regression analysis using the forced entry primary effects model to examine each independent variable's statistical significance iteratively. First, the identified significant intrinsic factor, the high school Chemistry Grade, was subjected to the regression analysis on Model 1. Second, significant extrinsic factors such as parents' educational attainment, combined monthly income and books were added to Model 1 and subjected to the same analysis on Model 2. Third, the school-related factors, including the type of school enrolled was added to Model 2 and subjected to analysis on Model 3. Lastly, the school facilities and instructional support such as glassware, heating instruments, and fire extinguishers were added and subjected to the last regression analysis on Model 4. Based on the table above, Model 1 has the least significant classification overall percentage of 44.7% while Model 4 is the best appropriate model compared with other models subjected to regression. It has the most significant overall percentage (65.2%) and R-square (Nagelkerke: 0.693). The result further describes that Model 4 is considered as a "fit" among the four models. In terms of the goodness-of-fit, Model 4 emerged as the best model among the four models. It highlights the eight (8) predictors such as high school grade in chemistry, parents educational attainment, combined monthly family income, books, type of school enrolled, glassware, heating instruments and fire extinguisher. The predictive value of χ^2=392.82 and p=.000, the regression model (*final model*) is significantly different from the null (*intercept only*) model. The result suggests that the present model substantially improves the baseline null model, thereby giving better predictions. Moreover, the table shows large chi-square values (χ^2=423.141 & $\chi^{2=}$371.832) but insignificant p-values (p=1.000) indicating a good fit model.

Table 3
Likelihood ratio tests of the determinants in learning chemistry among tertiary students

Effect	Model Fitting Criteria -2 Log Likelihood	Likelihood Ratio Test Chi-square	df	p-value (<.05)
Intercept	392.862	0.000	0	
HS Chemistry Grade	453.036	60.174	15	.000
Parents' Highest Educational Attainment	447.051	54.189	30	.004
Combined Monthly Family Income	420.014	27.152	18	.076
Books	428.577	35.715	12	.000
Type of School enrolled	411.512	18.65	6	.005
Glassware	407.612	14.75	12	.255
Heating Instruments	404.164	11.302	12	.503
Fire Extinguisher	430.675	37.813	12	.000

Table 3 simplifies the likelihood of the identified significant determinants in learning chemistry among tertiary students. The likelihood ratio test is utilized to evaluate if the

variables fit with the model fitting criteria. The correlation in learning chemistry pointed out eight (8) determinants; however, five (5) predictors significantly affect the regression model based on the likelihood ratio tests above. Only a single intrinsic factor that pertains to *High School in Chemistry grade* (χ^2=60.174, p=.000) significantly contributes to the model. Extrinsic factors include *parents' highest educational attainment* (χ^2=54.189, p=.004) and *books* (χ^2=35.715, p=.000) significantly contribute to the model. On school-related factors, explicitly on the school environment, only the type of school enrolled (χ^2=18.65, p=.005) contributes significantly to the model. For school facilities and instructional support, the availability of laboratory facilities such as fire extinguishers (χ2=37.813, p=.000) significantly affects the model, respectively.

The five significant factors affecting tertiary students' chemistry learning comprising the regression model obtained from the study. The following variables are arranged in an ascending order according to the level of significance. These are high school grades in chemistry (0.000), books (0.000), fire extinguishers (0.000), parents' education (0.004) and type of school enrolled (0.005). The result shows that among the sixteen variables taken from previous studies, only five emerged as predictors of Chemistry learning. These findings are relevant to address poor performance, which could be due to students experiencing motivational shifts in their chemistry courses such that they tend to be highly motivated at the beginning of the semester and decline further over time (Orvis et al., 2018). For instance, the lack of laboratory facilities, equipment, reagents, and other supplies for practical applications of chemistry concepts may affect their interest in the discipline, thereby considering it as an extrinsic factor. As to the intrinsic factor such as their inherent competence in the subject, which could be attributed to their prior chemistry instruction during secondary education and manifested in their high chemistry grade, it is found helpful to students to perform well in their college chemistry courses. As Orvis et al. (2018) nuanced, best academic outcomes are associated with intrinsic motivation. This finding is in congruence to Allen et al. (2007) claim that student motivation either intrinsic or extrinsic factors served as determinants of academic achievement and performance among first year university students.

Table 4
Logistic Regression Model for four categories of Chemistry performance

Variable	B	Std. Error	Wald	df	p-value
Regression Model for Good vis-à-vis Fair/Passing Achievers[a]	-0.114	3427.851	0.000	1	1.000
Intercept	33.294	1.365	594.791	1	.000
HS Chemistry Grade (76-80)	32.867	0.672	2395.48	1	.000
HS Chemistry Grade (81-85)					
HS Chemistry Grade (86-90)	32.904	0.692	2261.79	1	.000
School type (Private sectarian)	-1.492	0.648	5.293	1	.021
Glassware (Available but not enough)	2.286	1.003	5.189	1	.023
Regression Model for Very Good vis-à-vis Fair/Passing Achievers[a]	18.214	2847.459	0.000	1	.995
Intercept					
Books (1-2 times a week)	-2.306	0.798	8.355	1	.004
School type (private sectarian)	-2.684	0.776	11.979	1	.001
Glassware (Available but not enough)	2.517	1.021	6.072	1	.014
Regression Model for Very Good vis-à-vis Superior Achievers[a]	0.311	4976.419	.000	1	1.000
Intercept	-4.128	1.602	6.643	1	.010
HS Chemistry Grade (81-85)					

Note: [a] Only significant ($p<.05$) variables are shown in the model.

Table 4 shows four categories of Chemistry performance: Fair/Passing, Good, Very Good, and Superior, wherein the first one is the reference category. Hence, only three sets of logistic regression coefficients exclude the reference category. The three logits are presented in the table above. Five coefficients were statistically significant based on the logit model for good vis-à-vis fair/passing achievers. Three of these coefficients are from HS grades in chemistry, particularly on brackets 3 [76-80] (Wald=594.791; p=.000), 4 [81-85] (Wald=2395.484; p=.000), and 5 [86-90] (Wald=2261.7992; p=.000). This means that students who had chemistry achievement within the said grade brackets in high school are most likely to be good achievers than just fair/passing ones. This situation would most likely occur to a greater percentage towards higher education students' good academic rating, particularly chemistry.

The school type, private sectarian university, has significant logit coefficients (Wald=5.293; p=.021). Being enrolled in a private sectarian university would most likely contribute to students getting good Chemistry grades than fair/passing ratings. The result of the data would only occur 1.346 times higher than a student not enrolled in the said university. The other negative coefficient was the coefficient of books (Wald=8.355; p=.004) as a form of learning assistance. The table suggests that students assisted by or used books 1-2 times a week would most likely obtain a fair/passing grade than very good ones. The availability of glassware has a significant coefficient (Wald 5.189, p=.023). Even though not enough, the result suggests that glassware can most likely contribute to very good grades than just fair/passing grades for students. The difference would occur 7.338 times higher than other levels of glassware availability. The results also denote that only one coefficient is statistically significant albeit

negative—the HS chemistry grade, bracket 4 [81-85] (Wald = 6.643; p=.010). The finding means that students with a high school chemistry grade between 81 and 85 would most likely have a fair/passing grade than superior grades. Hence, in the present study, the best predictors for learning Chemistry at the tertiary level were determined by six variables out of sixteen reported from the literature. The table shows that R^2 is measured in linear regression analysis to estimate the proportion of the variance that the model can explain. In logistic regression, this is called pseudo-R^2 because of the similar properties with R^2. Pseudo R^2 has many measures, namely Cox and Snell (0.625), Nagelkerke (0.674), and McFadden (0.374). Usually, the largest R^2-value from among the three R^2 statistics is the "best" R^2 model. In the present study, the R^2-value is 0.674. This means that about 67.4% of the explanatory variables contribute to the model's total variance in learning Chemistry. Each of the significant predictor is discussed.

High school grades in chemistry

This intrinsic factor emerged as predictor of chemistry learning as supported by several studies (Orvis et al., 2018; Gambari et al., 2016) which can be attributed to their prior positive experience with the course. The present study supports the finding of Horowitz et al. (2013) that prior chemistry aptitude is a significant factor that affects students Chemistry learning in the tertiary level. Grades are forms of feedback on how well they master the subject (Musengimana et al., 2021). Grades may encompass high stakes, affecting the student's likelihood of gain access to higher education programs or applying for a job, which means that a student who has lower grades than required for the desired program may increase their effort. To illustrate, university students in the Philippines had to reach a certain General Weighted Average for them to be admitted to a science-related degree program, which consequently motivate students to perform better in all subjects including Chemistry. This could be the reason why this emerged as one of the predictors of Chemistry learning. As reported in various scientific reports, grades are linked with all measures of academic achievement comprising standardized assessment tests marks (Sibumana et al., 2021), admission, performance and determination in college (Westrick et al., 2015); and lifetime educational attainment (French et al., 2015).

Books

As for the significance of instructional resources, it is evident from the result of the study that any effort to improve effective teaching and learning of chemistry will involve the accessibility and usage of instructional materials, including books, manipulatives, simulation materials and other supplemental learning resources. This claim supports Ben Ouahi et al. (2022) report that the use of interactive simulations in investigative science teaching and learning is very effective for both teachers and students. Meanwhile, Upahi & Ramnarain (2019) reported that most books for science teaching are significantly helpful towards an effective teaching-learning process in terms of representation of chemical phenomena. In this context, university students who are situated in depressed areas or far-flanged areas may be challenged to access such kinds of quality learning materials thereby affecting their learning process. Although, students in both private and public higher education institutions were provided with reference materials such as

books that may have contributed to their performance in Chemistry, but the issue of equitable and equal access to these learning materials may be one of the contributing factors to their chemistry learning. Although Picardal & Sanchez (2022) revealed that some teachers employed varying contextualization strategies in teaching Chemistry to bridge abstract concepts to real-life scenarios, it is unavoidable that they still had to utilize print media such as books to supplement the lesson. This could be explained by what Musengimana et al. (2021) observed that some Chemistry teachers still prefer active learning methods though they still use traditional teaching methods. Another interesting explanation of this predictor is explained by Tai et a. (2006) that some high school chemistry curricula and textbooks have chosen to take a qualitative or conceptually-based approach, de-emphasizing important chemistry concepts (i.e., stoichiometry) which necessarily includes the application of mathematics, which also appears as a highly significant predictor of college performance. Pulukuri & Abrams (2021) recommends that textbook reading materials must have question-embedded videos to enforce productive feedback-driven problem-solving behaviors and overall learning gains in chemistry as it enhances metacognitive ability.

Fire extinguishers

This factor may come unexpected than the usual scientific reports but the study's result illustrates that the presence or at least availability of fire extinguishers is a significant predictor that affects students learning in chemistry. This contention could be because it signifies the safety and security of the students performing science activities inside the laboratory. Safety and security affect students' learning, including the equipment available in the laboratory and fire extinguishers accessible by students in times of emergencies. With fire extinguishers in the chemistry laboratories, students will be interested and eager to attend the laboratory sessions. The result further implies that students can obtain good academic performance because they have the assurance that they are safe on the entire class sessions and can focus on performing well and certainly getting a good rating at the end of the semester. This finding agrees to Olubo (2015) report that material environment had the highest contribution to students' performance in chemistry. Aside from the need to be compliant with the higher education standards, there are some reasons that fire protection equipment is essential. First, the students and teachers must have adequate protection in case of emergencies. A fire extinguisher is an excellent selection because they are convenient and easy to operate. Moreover, fire extinguishers will increase the likelihood of small fires being controlled before they cause significant destruction to life and property.

Parent's Educational attainment

The present study illustrates that parents with a higher level of education most likely have children with good academic performance. The study's outcome showed that the higher the parents' education level, the higher the probability of studying hard to achieve their academic goals. Parents' education attainment is fundamental in motivating children's academic learning and development. It is a fact that parents with high educational attainment have a habit of positively impacting children's knowledge and enthusiasm to make learning enjoyable. This finding is in consonance with the claims of

Tai et al. (2006) and Halim et al. (2018) that the level of the home influence has implication on school learning and that performances of students in science are a function of their attitudes to the subject. Therefore, learners of highly educated parents are prospective to develop more interests in academic learning than less-educated ones. Parental participation in the education of students commences in the household with fathers and mothers, giving a safe and healthy learning atmosphere, appropriate learning understandings, provision, and an encouraging outlook headed for school in the attainment of better education, thus resulting in a good academic achievement. This finding also supports the report of Sanchez (2019) that looked into the different indicators of Chemistry achievement in the Asian context including the Philippines and pointed out that prior achievement in Science, home educational resources and Science laboratory resources significantly contribute to better Chemistry performance.

Type of School enrolled

Getting a quality school education is essential as it enables access to higher education and learning outcomes. Several recent empirical works have examined the influence of private schooling on students' learning outcomes (DeAngelis, 2019 and Kumar, 2018). DeAngelis (2019) uses the Programme for International Student Assessment (PISA) tallies of 63 countries from 2000 to 2012 and finds that a more significant portion of private schooling in total schooling leads to better-quality PISA scores worldwide. The findings from this study may support the reports from the literature that is it a significant predictor to Chemistry learning. This is because some schools are not fully equipped with complete facilities for science activities (i.e., performing sophisticated experiment in the highly controlled laboratory). Alimi et al. (2012) cited a difference in terms of facilities for private schools compared to public school but it did not report a statistical difference in the academic performance of students in these types of schools. While this contention may mirror the Philippine context, it is still a predictor of Chemistry learning due to other essential teaching and learning resources available. On the aspect of class size, type of school also matters in learning chemistry because in a state university, it has a bigger class size compared to its counterpart in private schools that affects the teaching and learning process.

CONCLUSION AND RECOMMENDATIONS

The study shed light on the importance of recognizing the extrinsic, intrinsic, and school related factors that influence chemistry education among first year university students. Preparatory training during their secondary education is a significant predictor of their success in their chemistry courses. Those with parents whose educational attainment is considerably higher demonstrated significant effect to their performance along with the availability of resources such as books and school facilities. Moreover, the type of school where the student enrolled significantly contribute to their learning success in Chemistry course, which relates to the provision of quality of learning opportunities in their coursework in both theoretical and practical laboratory experiments. This study draw out insights on areas where chemistry learning can be fully supported and intervention programs can be developed to ensure successful chemistry learning. Based on the foregoing results, this study recommends the following. 1.) Encourage positive

reinforcement of learning and learning opportunities to motivate students to thrive in their chemistry courses as reflected in better academic performance 2.) Budget allocation for the different chemistry teaching-learning paraphernalia may be prioritized, such as books, glassware, heating instruments, and fire extinguishers to ensure safety and protection among students especially when they perform experiment. Future research may be done to find out the relationship between types of learning modalities and chemistry performance.

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