

PROFILE VARIABLES AFFECTING ACADEMIC PERFORMANCE IN CHEMISTRY: AN ASSESSMENT

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Abstract: *This study focused on the assessment of the students' profiles and their performance in chemistry. It further determined whether there is a significant relationship between their profile and their performance in the subject. The 244 respondents were from a government school and some private schools in the province of Cagayan. This study used the descriptive-correlational survey method. The data were gathered through a structured questionnaire of two parts. The first part of the profile includes, among others, their performance in Math and English; and the other part for their performance in chemistry. The data were treated using the simple frequency count and the weighted mean, standard deviation, the t-test, and the Pearson product-moment correlation technique. This study found out that the parents, though most of them earned some education, did not land jobs in the offices but went into farming. Most of the respondents, therefore, attended a public school for their high school education. The respondents' profile on the type of school attended significantly relates to their performance in the cognitive subjects, especially Chemistry. The researcher recommends that, in order to make learning more meaningful especially in Chemistry, the school should make it a point to provide the necessary tools, materials, and equipment to study the subject. A creative and more up-to-date teaching force would be necessary to make learning Chemistry enjoyable and worth learning for the students.*

(Keywords: *cognitive performance, science learning, science teaching*)

INTRODUCTION

Since the scientific revolution, which began in the 17th century and continues to this day, science has been characterized in a variety of ways. To be sure, there is a wealth of definitions available in the Merriam-Webster Dictionary (2018), such as "the state of knowing that distinguishes from ignorance," "a departmentalized and systematized knowledge as an object of study," and "a system of knowledge covering general truths or the operation of general laws as obtained through the scientific method." It is worth noting that the majority of these definitions all emphasize the notion that science is only an extension of knowledge, which for a six-year-old child can simply mean a massive repository of facts and trivia to be discovered. Scientists educate in a variety of settings, and science education is a complex activity that is at the heart of the vision for science education. The teaching standards serve as a set of criteria for evaluating progress toward the goal; they explain what science teachers at all grade levels should know and be able to do in order to effectively teach science. Despite the fact that teachers are fundamental to education, they should not be held completely responsible for transformation. Collaborative, organizational, and policy environments that are supportive of effective scientific education will be required for teachers, Chaudhry (2007). Apart from that, they must acknowledge and share responsibility for their own learning. According to the concept of science education, competent science instructors create an environment in which they and their students may collaborate as active learners to solve problems. At the same time as students are engaged in learning about the natural world and the scientific principles that are required to understand it, teachers are collaborating with one another to extend their knowledge of science education. Teachers who wish to teach science must possess both theoretical and practical knowledge and abilities in the fields of science, learning, and science education.

After gaining experience in the K-12 system, a career in chemistry education can lead to growth opportunities as well as increased compensation. In broad science, chemistry professors may be able to deal with younger children, Abana (2021). Advanced courses in the specific subject field of chemistry can be taught by chemistry teachers at all levels of high school, including public and private institutions of learning. Young students may be able to take chemistry courses in private, advanced learning academies that are discipline-specific. The following factors have an impact on the students' performance in Chemistry. Following this, the researcher hypothesizes that respondents' achievement in tertiary schools is influenced by their parents' educational attainment, their occupation, and the high school from which they graduated. Numerous studies have revealed that students have trouble connecting concepts in Chemistry at the submicroscopic level to their everyday lives. The duplicated study conducted revealed that most students were more competent in answering questions that used symbols and numbers in the standard test questions than conceptual questions using particles, as demonstrated, Farsides and Woodfield (2003). Many students were unable to deduce the meaning of their balanced chemical equation in terms of atoms and molecules, according to another study conducted. When it comes to mastering science courses, however, difficulties are almost unavoidable.

Believed by Chaudhry and Rahman(2009), the general challenge in all science courses is the introduction to the process of learning how to learn. Traditional school topics, such as history and geography, rely on memorizing to collect key knowledge and provide answers to issues. As a matter of fact, talents in investigating and comprehending concepts are essential in the field of science. On the concepts of calculations in Chemistry teaching and learning, students require conceptual knowledge in Chemistry, and methods for testing this kind of information are essential. Questions with word responses were one of the various methods of reinforcing and assessing conceptual knowledge, and they should be offered in the Chemistry course as an option. Participants in this study believed that they performed better on numerical questions than they did on conceptual or word questions, Zinampan (2021). Many pupils, despite having the appropriate level of knowledge, were found to be having difficulty with problem-solving skills. It was discovered that students have trouble applying abstraction and that they are frequently misled when given a choice of probable correct solutions.

Chemistry as a science was the focus of the research undertaken, which was focused exclusively on Chemistry as science at San Carlos University. According to the information gathered from teachers and students, the most challenging tasks for students include creating and balancing chemical equations, as well as executing mathematical equations. Their study habits and lack of prior mathematics experience are the primary causes of their difficulty. A further consideration is given to other elements that have an impact on student performance and achievement, as will be discussed in the following conversations and presentations. As an example, it found that accomplishment was substantially correlated with gender, ethnicity, parents' education, verbal opportunities in the home, and the frequency with which children engaged in mathematical practices, Dubow, Boxer, and Huesmann (2009). It is not only pupils' performance that is influenced by their parents' educational background. Various factors, such as a lack of time, a lack of resources, and the immediate area in which they live have an impact on their levels of achievement, Tumanguil (2021).

A child's mental capacity is not determined solely by his or her parents' educational level, according to him; parental monitoring helps the youngster develop his or her mind, he or she explained. Those who motivate their children to study may be confident in their children's ability to achieve high academic results. Parents with advanced degrees, on the other hand, can better attention to their children's needs and respond to them. However, a number of studies have demonstrated that the level of education of parents is highly connected to a number of educational characteristics, including scholastic achievement, persistence in school, and educational plans beyond secondary school.

Believed by Gabel (1999), the educational attainment and occupation of parents did not have a statistically significant association. The lack of significance of predictive factors such as gender, family income, parents' education, and educational attainment lends support to the findings of a study conducted by Flynn and MacLeod (2015), which found that students' ability to reason using proportion is not significantly related to their gender or socio-economic status, among other things. The findings are consistent with those of Farooq, Chaudhry, Shafiq, and Berhanu, (2011), who found that there was no statistically significant relationship between knowledge of scientific process skills and socio-economic position in the overall results. The findings of a recent study revealed that many college freshmen are unprepared for the abstract content of chemistry classes (Dennis, Phinney, and Chuateco, 2005). Following Checa, P., Abundis-Gutierrez, Pérez-Dueñas and Fernández-Parra (2019) findings in their study, they came to the conclusion that mental capacity predicts satisfactory achievement in Chemistry. According to her, study habits, age, the occupation of one's parents, and the education of one's parents have no effect on one's performance.

According to the findings of Dumka, Gonzales, Bonds and Millsap (2008), there is a statistically significant relationship between students' academic achievement and the profile of their parents in terms of educational attainment, occupation, household appliances owned, and membership in social organizations, among other variables. In light of the prevalence of studies conducted on profile and science achievement today, the researcher would like to know, as an extension of the previously conducted studies and in addition to the variables used, whether or not parents' educational attainment, parents' occupation, and type of school, along with performances in math, chemistry, and English, are still having an impact on (or not having an impact on) students' achievement in chemistry (or not). So, this research was undertaken.

Statement of the Problem

This study aimed to assess the profile and Chemistry performance of students. Specifically, it aimed to seek answers to the following:

1. What is the profile of the respondents in terms of:
 - a. Parents' educational attainment

- b. Parents' occupation
 - c. Type of school
 - d. Math performance
 - e. Chemistry performance
 - f. English performance
2. What is the level of performance of students in Chemistry?
 3. Is there a significant relationship between the respondents' profile and performance in Chemistry?

METHODOLOGY

Research Design

The descriptive survey as well as the correlational approach were employed in this study. It is descriptive in nature because one of the aims of this study was to determine the profile of the respondents in terms of their educational attainment, their occupation, and the type of school they attended, among other things. Also included in the report were their results in three cognitive subjects, namely mathematics, chemistry, and English. It is correlational in nature because the final goal was to determine whether there was any relationship between the respondents' profiles and their achievement or performance in the three disciplines, particularly in Chemistry.

Simple frequency counts and percentages, as well as the mean and standard deviation, were used to analyze the information. The t-test was used to determine whether or not there is a statistically significant difference in the performance of the pupils in the various cognitive subjects studied. The Pearson product-moment correlation approach was also used to see whether there was a statistically significant association between the profile characteristics and the performance of the respondents.

Sampling Procedure

The respondents of this study are first-year students of selected tertiary schools in Cagayan. The selected respondents comprised only one section and were chosen using random sampling. Complete enumeration was used in some selected sections.

Table 1. Distribution of students by school

Respondent Schools	Sample
CSU- Aparri Campus	23
International School of Asia and the Pacific	40
Lyceum of Aparri	16
Florencio Vargas College	33
CSU- Andrews Campus	47
CSU- Lallo Campus	49
CSU- Sanchez Mira Campus	36
Total	244

Locale of the Study

The research was carried out in Cagayan's tertiary educational institutions. Aparri Campus, Andrews Campus, Lallo Campus, and Sanchez Mira Campus are the four campuses of California State University. These are the state universities in the province of Cagayan. Private colleges such as the International School of Asia and the Pacific, Lyceum of Aparri, and Florencio Vargas College were among those that took part in the competition.

Research Instrument

In this study, a structured questionnaire that was adapted from Villaflor (1987) and modified by the researcher to include the concepts of Kinetic Molecular, Gas Laws, Formula Writing, Chemical Reaction, the Periodic Table and Periodicity, Particles of Matter, Orbitals, and Levels of Energy, Bonding Acids and Bases Redox and Stoichiometry was used as the primary instrument. The questionnaire was divided into two sections. Part I dealt with the personal and demographic characteristics of the students. Part II of the survey focused on the respondents' performance in the subjects of mathematics, chemistry, and English.

Data Gathering Procedure

Permission from the principals of the various respondent schools was obtained before the study could be carried out. A request letter was created by the researcher in this regard, and then they were personally handed by the researcher to the appropriate authorities for approval. After being granted permission, she

physically administered and collected the questionnaire from the respondents. This provided the researcher with an opportunity to lead the respondents through the questionnaire. In addition, the researcher conducted an informal interview with a few of the respondents in order to gain extra information for the study.

Statistical Tools and Analysis

The scale below was used in describing the weighted grade average or performance of respondents in Math, Chemistry and English:

Scale Value	Category
1.00 – 1.67	High
1.68 – 2.34	Average
2.35 – 3.00	Low

The following scale below was used to interpret the cognitive achievement of students in Chemistry

Scale	Category
33 – 40	Excellent
25 – 32	Very Satisfactory
17 -24	Satisfactory
9 – 16	Fairly Satisfactory
1 – 8	Poor

RESULTS AND DISCUSSION

This part of the paper contains the presentation of the data gathered, analysis, and interpretation.

A. Profile of Respondents

Table 2. Frequency and percentage distribution of respondents according to the educational attainment of parents

<i>Educational Attainment</i>	<i>Father</i>		<i>Mother</i>	
	<i>f</i>	<i>p</i>	<i>f</i>	<i>p</i>
Did not finish elementary	22	9.02	18	7.38
Elementary graduate	37	15.16	46	18.85
Did not finish high school	37	15.16	28	11.48
High school graduate	48	19.67	58	23.77
Did not finish college	44	18.03	39	15.98
College graduate	52	21.31	50	20.49
Masters graduate	4	1.64	4	1.64
Ph. D. graduate	0	0	1	1
TOTAL	244	100.00	244	100.00

Table 2 shows that 52 (21.31 percent) of the 244 respondents had fathers who have graduated from college, while 58 (23.77 percent) have moms who have graduated from high school, according to the results of the survey. This statistic merely indicates that the vast majority of respondents' fathers have a higher degree or greater educational achievement than their moms, as indicated by the data. In addition, this implies that their fathers were more committed to their academic pursuits than their mothers.

Table 3. Frequency and percentage distribution of respondents according to parents' occupation

<i>Parents' Occupation</i>	<i>F</i>	<i>p</i>
Father:		

Farmer/fisherman	126	51.64
Laborer	24	9.84
Carpenter	11	4.51
Overseas worker	5	2.05
Military/fireman	10	4.10
Security guard	3	1.23
Teacher	7	2.87
Office worker	13	5.33
Businessman	9	3.69
Driver	25	10.25
Pastor/Minister	2	.82
Deceased	9	3.69
Total	244	100.
Mother:		
Housewife	172	70.49
Office worker	15	6.15
Overseas worker	11	4.51
Market vendor	16	6.56
Teacher	15	6.15
Dressmaker	5	2.05
Nurse	1	0.41
Decease	1	0.41
Total	244	100.00

With regard to the occupations of their parents, Table 3 reveals that 126 or 53.62 percent of the respondents have fathers who are farmers, and 172 or 70% of the respondents have mothers who are merely stay-at-home mothers. This data reveals that the majority of respondents' parents had a non-fixed source of income, with only a small number earning a regular salary as a teacher, office worker, military member, security guard, firefighter, or church minister, among other occupations.

Table 4. Frequency and percentage distribution of respondents according type of school attended

<i>Type of School</i>	<i>f</i>	<i>p</i>
Public General	133	54.51
Newly nationalized high school	15	6.15
Public Vocational	38	15.57
Private High school	58	23.77
Total	244	100.00

Table 4 reveals that out of the 244 respondents, more than one-half, that is, 133 or 54.51 percent graduated in public general high school. This trend is due to the fact that the majority of the parents of the students do not have a fixed income, thus they seek enrolment in public high school because of free tuition fees.

B. Performance in Math, Chemistry, and English

Table 5. Frequency and percentage distribution of respondents according to performance in three subjects

<i>Academic Performance</i>	<i>Math</i>		<i>Chemistry</i>		<i>English</i>	
	<i>f</i>	<i>p</i>	<i>f</i>	<i>P</i>	<i>F</i>	<i>P</i>
High	8	3.28	9	3.69	16	6.56
Average	110	45.08	125	51.23	161	65.98
Low	126	51.64	110	45.08	67	27.46
Total	244	100.00	244	100.00	244	100.00

As shown in Table 5, the frequency and percentage distribution of respondents differed according to their performance in Math, Chemistry, and English. It was discovered that the majority of respondents had poor math performance, with 126 (51.64 percent) of them receiving a poor grade in math. The bulk of them are doing at or above average in Chemistry and English, with 110 or 45.08 percent and 161 or 65.98 percent of the total respondents, respectively, in these subjects.

C. Cognitive Performance

Table 6. Frequency and percentage distribution of respondents according to scores in the cognitive test

<i>Achievement Interval</i>	<i>F</i>	<i>p</i>	<i>Level of Performance</i>
1 – 8	3	1.23	Poor
9 – 16	128	52.46	Fairly Satisfactory
17 -24	101	41.39	Satisfactory
25 – 32	9	3.69	Fairly Satisfactory
33 – 40	3	1.23	Excellent
Total	244	100.00	

Ideal mean = 25

Actual mean = 16.602

One hundred and twenty-eight (or 52.46 percent) of the respondents performed satisfactorily on the cognitive test in Chemistry, which was administered. One hundred one students, or 41.39 percent, received satisfactory results. Excellent and bad performance were both achieved by only three people (1.23 percent). According to the results, the respondents have trouble understanding basic chemical principles. When the ideal mean of 25 is compared to the actual mean of 16.602, it is clear that the ideal mean is significantly higher than the actual mean, indicating that the test is tough. The coefficient of variation for this test is 0.28, which indicates that it is a weak discriminator of differences. As a result, the respondents' poor retention of chemical concepts and skills is a contributing factor. The test was administered during the second semester, but they had taken the course during the first semester.

Relationship of Profile and Performance

Table 7. Relationship of respondents' profile variables and performance

<i>Group</i>	<i>Mean</i>	<i>SD</i>	<i>Computed t-value</i>
Fathers' Occupation			
Non-fixed income	16.59	4.70	0.44 ns
Fixed income	16.28	4.20	
Mothers' Occupation			
Non-fixed income	16.75	4.74	1.09 ns
Fixed income	15.98	4.19	
School Type			
Private	15.48	3.31	2.60 **
Public	16.95	4.93	

** = significant at .01

ns = not significant

Table 7 shows the results of the cognitive performance of the students in connection to the type of school from which they graduated in high school, as determined by the type of school they attended. In the cognitive test, respondents who attended public schools performed significantly better than those who graduated from private schools. As a result of the fact that instructors in public schools are eligible and have attended a variety of trainings and seminars in their particular fields of specialization, the situation has improved significantly. As a result, students in public schools received a better or higher-quality education than those in private schools. In a similar vein, the educational level of the respondents' parents is not found to be significantly connected to the respondents' performance on the cognitive test. This suggests that even if the students' parents are farmers or simple housewives, they will be able to achieve higher levels of performance in their chemistry classes. The outcomes of this study have significant implications for pupils who are economically disadvantaged. Students from poorer socio-economic backgrounds performed on par with those from middle and higher socio-economic backgrounds in terms of academic achievement. In this study, Madera's findings are identical to those of this study, which demonstrates that both investigated respondents' socio-economic position. Both studies discovered that having a high level of educational achievement among one's parents does not inevitably imply having a high level of cognitive ability.

CONCLUSION

From the findings, the type of school from which the respondents graduated has a significant impact on their cognitive performance. Respondents who attended public high schools outperformed those who attended private high schools.

RECOMMENDATIONS

1. This study may serve as an eye-opener to the public schools where significant experiences especially in learning Chemistry and other science subjects may seem lacking or limited. Creative activities that could enhance learning (in Chemistry) should be a regular part of the curriculum.
2. Teachers may be sent to seminars to acquire knowledge and best practices in teaching Chemistry.
3. The school administration should initiate the recommendation to purchase important equipment and materials for the teaching of chemistry and other science subjects.
4. Future researchers may consider correlating K-12 profile variables to their performance in Chemistry or their related science courses.

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