

Predictors of Science Performance of Senior High School Students

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ABSTRACT

Given the worldwide interest in improving students' academic performance, it is important to inspect the variables that influence student performance. Based on this premise, the study examined the effect of sex, academic strand, goal orientation, and self-efficacy on science achievement. To achieve this aim, the researcher used the descriptive causal methodology of research, and the selected sample size was 193 senior high school students from three academic strands different by using a stratified random sampling technique. The researcher used (SPSS) to analyze the collected data, statistical tests such as: mean, SD, multiple regression, analysis of variance, and T-test. Study findings indicated that the goal orientation of both the male and female senior high school students in all academic strands considered was Mastery Oriented., both the male and female students have a neutral science self-efficacy in general, male students tend to have a higher mean score in the science achievement test than the female student and sex and academic strand is a predictor of science achievement.

Keywords: Academic strand, Goal orientation, Predictors, Science achievement, Self-efficacy, Sex

INTRODUCTION

The academic performance of students plays a crucial role in developing the best quality of graduates who will become virtuous leaders and workforce for the country as well as for the country's economic and social growth. Science is considered to be one of the most important subjects because of its links to technology and industry. From the national perspective, this may be one area of high priority for development in the academe. Even though Science becomes an essential part of the educational system, several studies show that many Filipino learners are not performing well. (Pardo, 2017; Refugio, et. al, 2020). Moreover, difficulties in science are also reflected in the surveys as shown in the Trends in International Mathematics and Science Study (TIMSS) results in 2018. Filipino students garnered 357 points which indicated a low performance in science, such results place the Philippines' average scale score significantly lower than the international average. (DEPED, 2019).

This national situation reflects what is happening in smaller units of the educational system, such as divisions or even districts. Teachers, school administrators, and supervisors are concerned about high school pupils' declining performance, particularly in science. The same problem exists at the University of Northern Philippines. However, in order to achieve the goals of Philippine education, educational specialists in our country have continued to

work on revision and enrichment. As a result, the K-12 Basic Education Curriculum has been implemented.

Students' academic performance, in general, can be determined by various factors. Biological factor such as sex is significantly related to academic performance (Almazan, et. al, 2020; Kisigot, et al, 2021; Dania (2014); Agbaje & Alake, (2014). Furthermore, psychological factors such as goal orientation, self-efficacy, anxiety, and self-esteem affect significantly the academic achievements of students (Neroni, J. et. al, 2015). M N Suprayogi et al (2019) stressed the importance of psychological factors such as motivation, beliefs, self-concept, and self-efficacy towards academic achievement. Likewise, students' academic performance is significantly correlated with their general education subjects (Bañez et al. 2016).

Additionally, research shows that self-efficacy is related to student performance, and can predict student achievement (Jiang Y. et al, 2014). Klassen (2010) as cited in M N Suprayogi et al (2019) also found that self-efficacy has a significant impact on improving academic achievement in many schools' subject areas, such as math, science, and writing.

Meanwhile, as cited by Findikoglu and Gurol (2021), goal orientation can help students attain their instructional goals which can result in better learning. Student goal orientations give information to instructors as to why the students would or not perform the learning tasks at hand. Also, higher levels of goal orientation result in better performance and learning (Giota and Bergh, 2020; Moghimi, 2020)

On the other hand, academic achievement can also be attributed to student's demographic profile. Sex is one of such factors mentioned in many literatures to have considerable effects on students' academic performances (Adeyemi & Ajibade (2011); Kyei et al, 2011; Awofala, Adeneye & Nneji (2011) & Amosun (2011), Apata (2011) Dania (2014); Agbaje & Alake, (2014).

Goal orientation, sex, and self-efficacy have widely been examined to have a great influence on students' academic performance; however, few studies considered to determine the effect of academic strand in combination with these factors on academic performance specially to science performance. With the difficulties of students in science and with the implementation of K to 12, the researchers believe that there is a need to guise into the different factors encircling the learners that might influence their performances in science. It is for this reason that the current study has been conceptualized to determine the predictors of science performance of senior high school students of the University of Northern Philippines. Also, the researchers opted to pursue this study to find out the predictors of senior high school students' science performance. Particularly, following the trend set by previous studies that science achievement is assumed to be influenced by students' sex, academic strand, goal orientation, and self-efficacy. This study then intends to examine the significant differences in goal orientation and self-efficacy of Grade 12 senior high school students when grouped by sex and academic strand and the predictive influence of sex, academic strand, goal orientation, and self-efficacy, to science performance of Grade 12 Senior High School students.

METHODOLOGY

This study used the descriptive–correlational method and predictive analytics to determine the relationship between the dependent and independent variables. This design was considered suitable since the researchers sought the cause-and-effect relationships that exist between gender, academic strand, goal orientation, self-efficacy and science achievement. This design has been used by Gana et al. (2020), Ugwuanyi & Okeke (2020b) and Ugwuanyi, Okeke and Asomugha (2020) in similar studies. The predictors (independent variables) included (1) sex (2) academic strand, (3) goal orientation and (4) self-efficacy were correlated to students' science performance (dependent variable). The relationship is expressed as an equation that predicts the response variable as a linear function of the parameters. The respondents of this study were 193 Grade 12 Senior students that were enrolled during the academic Year 2019-2020. The students were taken from two tracks – Stem and NON-Stem. There were 74 students from STEM and for the Non-stem, 47 from were from ABM and 72 from HUMMS. The respondents were selected through stratified random sampling. Goal Orientation Scale, Science Self-efficacy Questionnaire and Science Achievement Test were used in gathering the information needed. The goal orientation scale was adopted from the Study of Was, 2006. It is a 34 items Likert scale-type questionnaire to elicit the goal orientation of the students. Meanwhile, the Science Learning Self-Efficacy Questionnaire (SLSE) was adopted from the study of Lin and Tsai (2012) to determine the self-efficacy of the students in Science. Lastly, the Science Achievement test was used to determine the achievement of the Grade 12 Senior high school students. The test covers topics on earth and life sciences and Physical Science and consisted of 75 items. The instruments were properly faced validated and trial-tested. The reliability indices estimated for the goal orientation, and self-efficacy scale using Cronbach alpha were 0.74 and 0.743 respectively. Meanwhile, the science achievement test reliability is .845 using KR 20. Permission to conduct the study was requested from the university president and the Laboratory school's principal. Data gathering was administered to the respondents through google forms. Links to the instruments were sent through Messenger Group Chat created. Data were analyzed using frequency and percentages, weighted mean, and multiple linear regression analysis through SPSS 20. The hypothesis was tested at 5% probability level using the t-test of independent samples.

RESULTS AND DISCUSSION

The current study aimed to examine the influence of sex, goal orientation, self-efficacy, and academic strand on science achievement. In particular, this section contains the descriptive analysis of the goal orientation, self-efficacy, and the science achievement of the participants and predictors of science achievement.

Goal Orientation of the Senior High School Students

Students are engaged in different academic tasks to realize their own various goals. Thus, some students strive to earn better grades in the course, and some other students are motivated not to expose their inability in academic tasks.

Table 1*Goal Orientation of the Senior High School students by Sex*

Goal Orientation	Sex	
	Male (n=72)	Female (n=121)
Mastery Oriented	65	82
Performance Approach Oriented	16	16
Performance-Avoidant	8	6

Table 1 is the goal orientation of the SHS students when grouped according to sex which shows that most of the male (65) and the female (82) senior high school were mastery-oriented learners. This means that both of female and male students were focused on learning and improvement. Students who are mastery-oriented are motivated to learn and master skills, which results in them being much more likely to attempt harder tasks and invest more effort to achieve a higher level of knowledge (Hall et al., 2015). Since these students are willing to put more effort into improving their ability and mastering their knowledge, they are more likely to study the learned materials and embrace mistakes as an opportunity to improve (Kayis & Ceyhan, 2015). This result contradicts the finding of Boyd (2017), and Kayis & Ceyhan (2015) that female students are mastery goal-orientated learners while male students are performance goal-oriented learners.

Table 2*Goal Orientation of the Senior High School students by Academic Strand*

Goal Orientation	Academic Strand		
	STEM n=74	ABM n=47	HUMMS n=68
Mastery Oriented	58	40	59
Performance Approach Oriented	9	5	4
Performance-Avoidant	7	2	5

Table 2 shows the number of participants classified under the goal orientation by academic strand. Most of the senior high school students across all the academic strands were mastery goal-oriented learners as indicated by the frequency of 58 for STEM, 40 for ABM, and 59 for HUMSS. This implies that the students are mastering their tasks according to self-set standards. They are more focused on developing new skills and acquiring new knowledge. This result adheres with the result of the study of Koo, et al (2016) that science major students are mastery-oriented learners. However, the results contradict the study of Janke and Dickhauser (2019) that social science majors are performance-oriented learners.

Self- Efficacy of the Senior High School Students

Table 3

Comparison of Self-efficacy of the Senior High School Students by Sex

Variable	Sex	n	\bar{x}	SD	t	df
Self-Efficacy	M	72	3.37	0.58	0.283	191
	F	121	3.35	0.52		

Table 3 shows sex differences in self-efficacy of the respondents in terms of sex. Male senior high school student has a slightly higher self-efficacy (\bar{x} = 3.37) than female high school student (\bar{x} = 3.35). However, the t-test result shows no significant difference between the self-efficacy between male and female participants. This emphasizes that both sexes are equally confident to perform academic related tasks. This result contradicts the study of Fallan (2016) that female students have significantly lower self-efficacy level than their male peers.

Table 4

Comparison of Self-efficacy of the Respondents by Academic Strand

Variable	Academic Strand	n	\bar{x}	SD	F
Self-Efficacy	ABM	47	3.20	.5577	8.865*
	STEM	74	3.25	.4586	
	HUMMS	72	3.56	.5542	

Table 4 shows the comparison of the self-efficacy of the participants according to the academic strand. HUMMS students tend to have a higher self-efficacy (\bar{x} = 3.56) compared to ABM students (\bar{x} = 3.20) and STEM students (\bar{x} = 3.25). Moreover, the F-test shows that there is a significant difference between and among the participants per strand ($F=8.865$, $p<0.05$). This implies that HUMMS students tend to have higher self-confidence in their course choice compared to ABM and STEM students.

This result opposes the findings of Villas (2019) that no significant differences in Grade 11 student's self-efficacy across/tracks.

Science Performance of the Senior High School Students

Table 5

Science Performance of the Grade 12 Senior High School Students

Variable	Sex	n	\bar{x}	Level	SD	t	df
Science	M	72	31.14	Satisfactory	12.2	.684	191
Achievement	F	121	29.86	Poor	12.7		

Table 5 shows the comparison of the science performance of the participants according to sex. Male senior high school students have a satisfactory performance in science (\bar{x} = 31.14) while female high school students have poor performance (\bar{x} = 29.86). However, the t-test value of .684 shows insignificant differences in science performance of male and female high school students. The results show that even though male students perform satisfactorily compared to female high school students, statistically both of the students equally perform in their science subjects. This result contradicts with the study of Akpotor & Egbule (2022) that male perform statistically better in science subjects compared to female students.

Table 6*Academic Science Performance of the Grade 12 Senior High School Students*

Variable	Academic Strand	n	\bar{x}	Level	F
Science Performance	ABM	47	27.83	Poor	2.547
	STEM	74	29.51	Poor	
	HUMMS	72	32.82	Satisfactory	

Table 6 shows the comparison of science achievement of the participants according to academic strand. Results, as indicated in the tables, shows that HUMMS students tend to have a satisfactory level of science achievement (\bar{x} = 33.82) compared to poor performance of ABM students (\bar{x} = 27.83) and STEM students (\bar{x} = 29.51). However, the F-test shows that there is no significant differences between and among the participants' science achievement when grouped according to strand ($F=2.547$, $p<0.05$). This implies that STEM students and Non-stem students tend to have the same level of performance in senior high school science subjects.

Effect of Sex, Academic Strand, Goal Orientation and Self-efficacy to Science Achievement**Table 7***Multiple Regression Analysis on the Influence of Sex, Academic Strand, Goal Orientation and Self-Efficacy to Science Achievement*

Factors	Beta	t-value	t-prob
Sex	.39	1.49	.041*
Academic Strand	.159	2.219	.028*
Goal Orientation	.062	.862	.390
Self-Efficacy	.070	.940	.348
Constant	24.881		

Mult R = .187

 R^2 = .135

F-ratio = 4.925

F-prob : $p < .05$

Table 7 shows the Multiple Regression Analysis on the Influence of Sex, Academic Strand, Goal Orientation and Self-Efficacy to Science Achievement. The F value of 4.925 indicate that all the predictor variables such as sex, academic strand, goal orientation, and self-efficacy combined have a statistically significant contribution to students' science achievement that accounts for 13.5% of the variation in science achievement.

Moreover, when the predictors are taken singly, sex and academic strand significantly contribute to students' science achievement as indicated by the t-value of 1.49 and 2.219, respectively. However, when taken singly, goal orientation and self-efficacy have no significant contribution to the prediction of students' science achievement.

CONCLUSION

The Senior High School students of the University of Northern Philippines in general were female-dominated and are enrolled in Science, Technology, Mathematics and Engineering strand. In general, senior high school students wanted to pursue STEM-related courses in college. In addition, the senior high school students were Mastery-oriented learners. These students are focused on learning and improving themselves based on the quality standard. Moreover, the students have a neutral self-efficacy. Senior high school students' belief in their ability depends on the situation they are in. Further, students from the STEM, ABM and HUMMS have no significant differences in Science their science performance. Lastly, students' academic strand and sex are predictors to science performance among senior high school students.

RECOMMENDATIONS

Based on the findings and conclusions, it is recommended that Students should find ways to improve their competencies in science subjects. They are advised to review the prerequisite lessons as well as advance to new topics by reading and doing some research. Educators must devise learning activities that can improve student mastery of the subject as well as how they perform in class. Self-efficacy training must be encouraged to improve student's self-outlook. Future study which considers more factors is needed to find out the different predictors of science achievement as well as academic achievement as a whole and larger sample for more robust result must be considered.

ETHICAL STATEMENT

The researchers sought ethical clearance from the University Ethics Committee. The researchers prepared informed consent letters and presented them to the participants for their approval through the appendage of their signatures. Contact details of the researchers were left with the participants in case there is a need to contact. Privacy of the participants and confidentiality of the research data was ensured. Anonymity of the respondents was maintained. Transparency and honesty were sustained throughout the study.

ACKNOWLEDGMENT

They would like to thank all of the Senior High School students of UNP for the academic year 2019-2020 who participated in this study and the University of Northern Philippines for funding this research

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