RESEARCH ARTICLE

DETERMINANTS OF STUDENTS' ACHIEVEMENT IN HIGH SCHOOL GEOMETRY.

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Manuscript Info	Abstract
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One of the biggest challenges that the nation faces today is the problem on how to improve the performance of Filipino students in mathematics and science. The steep downfall of the science and mathematics competencies that Filipino students demonstrate in standards-based tests as measured against international levels has belittled the nation's capacity to compete globally in academic competitions. And the Philippine Educational System can only put the blame on the subject teachers who have a direct contact with learners.

But to educators, instruction may not be the sole factor that brings about the problem. Surely, there is more to determinants of students' performance in mathematics than teacher-factor. For one, attitude that is observed in different directions – student towards the subject, student towards the teacher, teacher toward the subject, teacher toward the student – may also be considered non-intellective factors that may bring about an effect on student performance in mathematics, not to mention environment, support from family, and the like which may also influence such. Some of these may be even traced back to a learner's remotest experiences, and reading difficulties can be one of them.

The general problem of the study is to determine factors influencing the performance of LCUP BED students in High School Geometry. Specifically, this study sought to answer the following: (1) how can the demographic profile of the respondents be described in terms of gender, age, IQ, GPA, parental educational attainment and reading proficiency; (2) What is the respondents' level of achievement in Geometry; (3) Which of these factors are significant determinants of achievement in mathematics; and, (4) what pedagogical implications may be drawn from the study?

To realize this aim, a descriptive correlational method was employed. Performance in Geometry was measured using the Geometry California Mathematics Standards Test. This is one of the California Standards Test administered as part of the Standardized Testing and Reporting (STAR) program under policies set by the California State Board of Education. The reading proficiency level of the respondents, on the other hand, was identified using the Gates-MacGinitie Reading Test, a standardized test which was developed by Walter H. MacGinitie, Ph. D. The other factors considered were the demographic profile variables

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which included age, gender, IQ, GPA, and Parental Educational Attainment.

The respondents of the study were the one hundred sixty-eight (168) Grade 9 high school students of the Basic Education Department of La Consolacion University Philippines who were enrolled in the school year 2011-2012.

At the end of the study, the following were concluded: (1) the respondents of the study were almost equally distributed in terms of gender, were learners of normal schooling age, possessed average capacity to accept knowledge and obtained average GPA in the previous school year. Majority of the respondents' parents were non-bachelor's degree holders; (2) almost half of the respondents were diagnosed to have achieved at least the high school level of proficiency in reading while the other half of the respondents were not able to cultivate desirable reading proficiency level; (3) Majority of the respondents demonstrated poor achievement in High School Geometry; and, (4) GPA, IQ and reading proficiency are good determinants of achievement in Geometry while age, gender and parental educational attainment were found not to be significant determinants of achievement in the subject.

Pedagogical implications and recommendations of the study were thoroughly discussed.

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Introduction:-

The improvement of education in our country is the biggest problem confronting our people. Linag (2012) cited Manning (1993) who declares that everything in our life as a nation depends on education: our socio-economic progress, the improvement and performance of our democratic institutions, our standing prestige in the world and among our fellow nations in Southeast Asia; our potentialities for personal development, and the quality of our individuality as well as national life.

Education is a very important key element in nation building. If we want to improve the country, we must improve the educational system (Aquino 2010). The educational system, particularly science and mathematics programs in the secondary and tertiary levels has been beset by insurmountable problems for a long time. Foremost among these include the great variation in academic standards that exist between the best and the worst in the Philippine educational system. The Philippines underwent a lot of transitions in terms of its educational system but the truth is, not much was really changed at all (Valisno 2012).

Grouws & Cebulla (2000) stated that the number of research studies conducted in mathematics education over the past three decades has increased dramatically. The resulting research base spans a broad range of content, grade levels and research methodologies. The results from these studies, together with relevant findings from research in other domains, such as cognitive psychology, are used to identify the successful teaching strategies and practices.

But to educators, instruction may not be the sole factor that brings about the problem. Surely, there is more to determinants of students' performance in mathematics than teacher-factor. For one, attitude that is observed in different directions – student towards the subject, student towards the teacher, teacher toward the subject, teacher toward the student – may also be considered non-intellective factors that may bring about an effect on student performance in mathematics, not to mention environment, support from family, and the like which may also influence such.

Mathematics is one discipline students find difficult to understand and evade. This hatred and lack of interest for the subject may be due to early frustrations or lack of proper psychological approaches or perhaps the reflection of the behavior and attitudes of the teachers handling the subject.

In the setting of basic education where foundation of mathematics is honed, difficulties may not be as complicated yet when not properly addressed, difficulties can be carried on to tertiary education where students meet all complexities of the problem which may lead them to failure.

This concept prompts many basic education teachers to zero in to draw the attention to the specific root cause of their students' difficulty. Minimizing their effects if not to eliminate them is a quantum leap among students at risk from low achievers to, at least, average achievers. So that these future college students may be equipped with the fundamentals of mathematics before they enter the multifaceted world of tertiary education.

Several studies have been conducted to address these issues as far as mathematics learning difficulties whose root causes may be traced to output, organizational, language and attention, visual-spatial, and multiple-tasking difficulties (Lauren, Lee & Adam, 2011) to specific problems in mathematics like mastering basic number facts, arithmetic weakness, recognizing written symbol system and concrete materials, and, the language and visual-spatial aspects of the discipline.

Further, studies lead math teachers to the discovery of more and more factors –outside the classroom and outside the discipline – which may be influencing students' performance in the mathematics.

It is this premise that the researcher is inspired to pursue this study.

Methodology of the Study:-
This study used the descriptive correlational method in its aim to establish the relationship between achievement in Geometry and the variables age, gender, age, IQ, GPA, parental educational attainment, and reading proficiency. Correlation research was considered suited to the study because the research endeavor sought to determine relationships among two or more variables. Correlation research helps make more intelligent predictions and seeks to investigate whether one or more relationships of some type exist.

The study was conducted at La Consolacion University Philippines Basic Education Department which is located in the City of Malolos, Bulacan. The respondents were students belonging to the Grade 9 level and who were enrolled in the School Year 2011 -2012.

Respondents of the Study

Respondents	Total	Percentage
Grade 9 – Diligence	43	25.60 %
Grade 9 – Fortitude	43	25.60 %
Grade 9 – Gentleness	39	23.20 %
Grade 9 – Reverence	43	25.60 %
Total	**168**	100.00 %

Instruments one of which measured the reading proficiency of the respondents and the other, the achievement in Geometry.

The Gates-MacGinitie Reading Test, a standardized test, was developed by Walter H. MacGinitie, Ph.D. and was used in this study to measure the reading comprehension of the respondents. The indicators in this test are speed and accuracy, vocabulary, and reading comprehension.

The Geometry California Mathematics Standards Test, which is one of the California Standards Test administered as part of the Standardized Testing and Reporting (STAR) program under policies set by the California State Board of Education, was used to measure the respondents' performance in Geometry. The instrument covered the following topics: (a) Logic and Geometric Proofs, (b) Volume and Area Formulas, (c) Angle Relationships, Constructions and Lines, and, (d) Trigonometry. This instrument was utilized instead of a local standardized test because of the reason that the coverage of the study is limited only to topics for 1 semester. A cross analysis was made to ensure that all the topics in the syllabus were covered by the test. A table of specification was also constructed as a proof of such cross analysis.

The researcher sought permission from the BED Principal as soon as conduct of the study was approved by the panel of oral examiners. A letter of approval to pursue data collection was obtained from the abovementioned office. This gave the researcher the go signal to initiate the study.

Data on age and gender were obtained from the respondents' advisers, specifically from the School Register (Form 1).

Data on the respondent's IQ were obtained from the BED Guidance office with permission from the head of Student Services Program, Mrs. Maria Isabel Guevara.

Data on the respondents' GPA were obtained with permission from the University Registrar's Office. The researcher reclassified and organized these data.

Data on reading proficiency were gathered using a validated instrument. The instrument was administered by the English III teacher under time pressure. Data on the achievement in Geometry were collected using a validated achievement test. This examination was administered by the grade 9 Mathematics teacher.

Data on parent educational attainment were gathered by raise of hands. This was conducted during their Geometry class.

Data were tallied and organized for analysis and interpretation.

Statistical Treatment of Data
The following were used in the descriptive approach of data analysis: tallying frequencies, frequency distribution and percentage reporting.

Tallying of Frequencies. Tallying of frequencies is used to determine the distribution of respondents based on some observed characteristics.

Percentage. Percentage was used to determine the demographic profile of the respondents. Generally, the formula for percentage is

Percentage = . Part   x 100

$$Whole$$

To identify the variables which qualify as strong determinants of students' performance in geometry, the regression analysis was used.

Regression Analysis. Analysis of regression was used to establish the power of the factors as determinants of mathematics achievement. To compute for the Regression, the SSPS was used.

Results:-
This section established some relationships between and among the variables that pertain to the demographic profile of the respondents, their reading proficiency level and their achievement in Geometry. Table 9 provided the gist of the analysis of these relationships, followed by a thorough discussion of the results.
Analysis of Regression

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12018.034	7	1716.862	328.489	.000[a]
	Residual	836.246	160	5.227		
	Total	12854.280	167			

a. Predictors: (Constant), Dad, Age, Sex, IQ, Mom, GPA, RL*

b. Dependent Variable: Star*

Looking at the ANOVA table above, the variables, collectively, was found to be significant with a p-value < .05. This means that all the independent variables working together made a good predictor of students' performance in geometry.

Data in table showed the results of the analysis of regression. Variables sex, age, mom (maternal educational attainment) and dad (paternal educational attainment) obtained Beta coefficients equal to -.004, -.013, -.008 and .023 all with p-values >.05 were found to be non-significant determinants of the respondents' achievement in Geometry. This study held strongly that age and gender are not strong determinants of one's achievement in Geometry. Nevertheless, the paper resolutely forwarded that an individual's IQ, GPA, parental educational attainment, and reading proficiency are determinants of an individual's performance in Geometry. Simply put, the greater an individual's IQ is, the higher his GPA is, and the more elevated his level of reading proficiency is, then the better will his performance be in Geometry. In plain words, IQ, GPA and reading proficiency are determinants of an individual's performance in Geometry. Moreover, PISA (2004) reported that there is a positive relationship between the educational level of parents and student performance in mathematics. The foundation explained this in that parents play an important role in their children's education. This study therefore held on the notion that the level of the educational attainment of the respondents' parents could somehow cast an influence on their achievement.

Determinants of the Respondents' Achievement in Geometry

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-23.299	7.250		-3.214	.002
	Sex	-.069	.383	-.004	-.181	.857
	Age	-.209	.328	-.013	-.638	.524
	GPA	.311	.072	.144	4.310	.000
	RL*	1.152	.327	.191	3.523	.001
	IQ	.502	.032	.695	15.617	.000
	Mom	-.167	.451	-.008	-.371	.711
	Dad	.396	.371	.023	1.066	.288

a. Dependent Variable: Star*

These findings verify the position of the study that age and gender are not strong determinants of achievement in Geometry.

However, these figures contradict what PISA reported as there exists positive relationship between the educational level of parents and student performance in mathematics. This could be explained by observations that students are pushed by parents to be diligent in their studies whether or not the parents hold bachelor's degree. It is remarkable among Filipino families to put premium on their children's education whatever their economic status is or regardless of the general educational attainment of the older generations in the clan. Perhaps, findings of PISA may be conclusive to the American culture where their studies are based. Truly, values, perceptions and attitudes of parents that pertain to their children's education remain to be anchored on their cultural orientations.

In the light of the findings of the study is the confirmation that GPA, reading proficiency (RL) and IQ are highly significant determinants of achievement in Geometry, with Beta coefficients equal to .144, .191 and .695 all with p-values<.05. These Beta coefficients mean that GPA, reading proficiency (RL) and IQ influence achievement in mathematics by 14.4%, 19.1% and 69.5%, respectively. These results agreed with the common notion that GPA affects students' achievement in mathematics and verified more than what the findings say that reading (Barton, Heidema & Jordan, 2002; and Geary, 2004), and IQ (Blair, Gamson, Thorne & Baker, 2005) are significantly related to students' achievement in mathematics.

This study therefore declared that GPA, IQ and reading proficiency are good determinants of achievement in Geometry while age, gender and parental educational attainment are not significant factors in determining achievement in the subject.

The study attempted to identify factors that determine achievement in Geometry through the use of survey, document analysis and testing with 168 grade 9 students at LCUP Basic Education Department who were enrolled in the school year 2011 – 2012. The study found that among the variables involved, GPA, IQ and reading proficiency are good determinants of achievement in Geometry while age, gender and parental educational attainment are not.

Summary:-

The major concern of the study is to determine factors influencing the performance of LCUP BED students in High School Geometry. To realize this aim, a descriptive correlational method was used. Performance in Geometry was measured using the Geometry California Mathematics Standards Test. The reading proficiency level of the respondents, on the other hand, was identified using the Gates-MacGinitie Reading Test. The other factors considered were the profile variables of the respondents which included age, gender, IQ, GPA and parental educational attainment.

The respondents of the study were the third year high school students of the Basic Education Department of La Consolacion University Philippines who were enrolled in the school year 2011-2012.

Analysis of regression was used to establish the power of the factors as determinants of mathematics achievement.

Findings of the Study:-

Problem 1:- Profile of the respondents in terms of gender, age, IQ, GPA, parental educational attainment and reading proficiency

GENDER	Male	74	(44%)		
	Female	94	(56%)		
AGE	13	1	(1%)		
	14	60	(36%)		
	15	102	(60%)		
	16	5	(3%)		
IQ	Below Ave	38	(22%)		
	Average			99	(59%)
	Above Ave	30	(18%)		
	Superior	1	(1%)		
GPA	75 – 79.9	55	(33%)		
	80 – 84.9	64	(38%)		
	85 – 89.9	43	(26%)		
	90 – 94.9	6	(3%)		
Parental Educational Attainment	Father				
	College graduate	57	(34%)		
	College Undergrad	108	(64%)		
	No Response	3	(2%)		
	Mother				
	College graduate	36	(21%)		
	College Undergrad	132	(79%)		
	No Response	0			
Reading Proficiency	Level 1	0			
	Level 2	1	(1%)		
	Level 3	0			
	Level 4	18	(10%)		
	Level 5	34	(20%)		
	Level 6	33	(20%)		
	Level 7	50	(30%)		
	Level 8	22	(13%)		
	Level 9	7	(4%)		
	Level 10	3	(2%)		

Problem 2:- Respondents' level of achievement in Geometry

Section	Class Mean	No. of Items: 64
Diligence	36.93	Passing score: 32
Fortitude	28.09	
Gentleness	26.00	
Reverence	24.95	

Grand mean: 29.07 —————

Only one section passed the exam as a class. The grand mean is below the passing score which means the performance of the students in geometry is poor.

Problem 3. Significant determinants of achievement in mathematics
This study therefore declared that GPA, IQ and reading proficiency are strong determinants of achievement in Geometry while age, gender and parental educational attainment were found to be non-significant determinants of achievement in the subject.

Problem 4. Pedagogical implications may be drawn from the study
Based on the results of the study, the following pedagogical implications were derived:

- Instructive strategies may improve reading proficiency of the respondents, hence, their mathematical achievement, in particular, Geometry.
- Teaching-learning activities in Geometry may be harbored and governed by the students' prior knowledge and experience, situation and environment.
- Learning goals set by the teachers will be achieved when there is collaboration with the learners.
- Outcomes-based teaching and learning principles and practices when applied may address the present learning difficulties of the students before such difficulties would mount in the students' future endeavors along the disciplines of mathematics.
- Results on the diagnosis of prior knowledge and entry level skills of the students, regardless of area of discipline, may help the teachers in planning their lessons and activities for classroom instruction.
- A standardized diagnostic test administered in the beginning of the school year guides the teachers to assess the knowledge and skills of the students at entry level and provide those with learning difficulties the necessary intervention to minimize their effects on their overall achievement.
- Professional sharing on expertise and best practices may improve students' learning situations as well as raise their learning faculties to prevent academic failure.

Conclusions:-
At the end of the study, the following were concluded:
1. The respondents of the study were almost equally distributed in terms of gender, were learners of normal schooling age, possessed average capacity to accept knowledge and obtained average GPA in the previous school year. Majority of the respondents' parents were non-bachelor's degree holders.
2. Almost half of the respondents were diagnosed to have achieved at least the high school level of proficiency in reading while the other half of the respondents were not able to cultivate desirable reading proficiency level.
3. Majority of the respondents demonstrated poor achievement in High School Geometry.
4. GPA, IQ and reading proficiency are good determinants of achievement in Geometry while age, gender and parental educational attainment are not significant determinants of achievement in the subject.

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