Meta-analysis on the Role of Mathematics Background in the Performance of BSCS Freshmen in Computer Programming Subjects

Dr. Isidro L. Duran

Abstract - This study examined the relationship between the mathematics background and the performance of BSCS freshmen in computer programming subjects. Descriptive research design was utilized in the course of the study. Slovin's formula was applied to determine the sample size of the study which comprises 132 freshmen. Furthermore, stratified random sampling was applied for particular distribution of respondents taken from each stratum. Data collected were analyzed using descriptive statistics such as mean, standard deviation, skewness and kurtosis.In addition, partial correlation was used to determine the impact and significance of mathematics background in the performance of students in computer programming subjects. IQ was identified as the moderating variable which was controlled in the study. Results revealed that mathematics background of students is significantly correlated with the performance of freshmen in computer programming subjects. Hence, student who is good in mathematics is expectedly to perform better in programming subjects. The researcher then urges that mathematics background may be the basis of admission for Bachelor of Science in Computer Science freshmen.

Index Terms - Meta-analysis, Mathematics, Performance, BSCS Freshmen, Computer Programming

1 INTRODUCTION

The prevalent "computer science" is generally attributed to George Forsythe, who along with figures of establishing computer science as a stand-alone academic discipline Forsythe (1965). He also stresses that diverse application of computing recognizes the birth of a coherent body of technique, which he called "computer science." The name of Computer Sciences is being attached to the discipline as it emerges." Notably, Forsythe used the plural *sciences*. Like the British "math," it acknowledges that the field has many distinct branches, which Forsythe defined as "the theory of programming, numerical analysis, data processing, and the design of computer systems," (Knuth, 1961).

IQ (intelligence quotient) is a measure of person's general intelligence combined by two factors fluid and crystallized intelligence. According to Catrell (1971), it is the ratio of person's mental age to their chronological. Furthermore, Jensen (1998) explains that the best single predictor of academic achievement, years of schooling completed, and many other important outcomes. Gottfredson (1997) on the other hand defines that intelligence represents the ease with which individuals can acquire novel and complex material, where the content of the material is social academic or employment related. Lynn (2010) added that IQ is relative with mathematics and science achievement. Bennedsen (2006), pointed out that IQ (abstraction ability) has a positive impact on programming ability. Similarly, Jensen &Sherly (2010) considered that, students' intelligence quotient (IQ), emotion quotient (EQ), and creativity quotient (CQ) into teaching and learning activities has impacted student productivity in programming, specifically on web design and development .

According to Williams, Computer Science in most university campuses grew out of mathematics or engineering departments, not from accounting or business departments. Bryan (2012) reasoned out that "A lot of it was identifying that there was a core subject matter that didn't fit anywhere else". Schnabel (2012) stressed out that "Calculus and differential equation that underlie engineering are not what underlies computer science butit's really discrete mathematics.

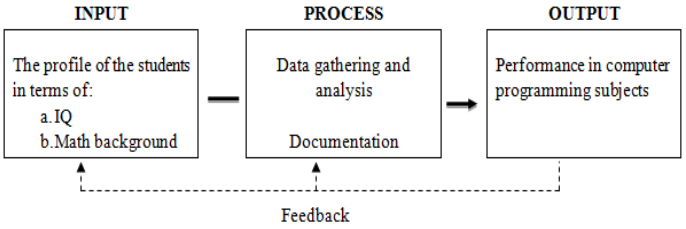
In addition, Dijkstra, (1975) pointed out that programming is one of the most difficult branches of applied mathematics; the poorer mathematicians had better remain pure mathematicians. Besides a mathematical inclination, an exceptionally good mastery of one's native tongue is the most vital asset of a competent programmer.

On the other hand, Alspaugh, 1970; Ricardo, 1983 &Ignatuk, 1986 collaboratively agree that a strong mathematics background predicts success in procedural programming. Studies of Renk 1987 & 1989 have shown that math scores on the Scholastic Aptitude Test (SAT-M) and the American College Testing program (ACT) correlate with procedural programming course grades. But, Taylor and Mounfield (1991) found that relationship between mathematics proficiency and success in procedural programming, exist in their study. Ralston, 1984; Saiedian, 1992 also agrees that these studies support the practice of mathematics prerequisites for computer courses. Correspondingly, Yegge 2006, stresses that people still advocate the idea that math alone has the power to make you a better programmer.

With these, the researcher was challenged to conduct further study to prove that mathematics background plays a great role in the performance of freshmen in computer programming subjects considering IQ as the moderating variable.

- *Dr. Isidro L. Duran is a professor at Don Mariano Marcos Memorial State University, Philippines, CP-072-09151339678, E-mail: duran_sid@yahoo. com*

1.1 Paradigm



1.2 Statement of Objectives

The study aimed to find the relationship between mathematics background and programming subjects with the following objectives:

1. To determine the profile of the students in terms of:
   a. IQ;
   b. Mathematics background (CAT math scores); and
   c. Performance in computer programming subjects (grades).
2. To assess the relationship between mathematics background and performance of students in computer programming subjects.

1.3 Hypothesis

H_o: There is no significant relationship between Mathematics background and performance in Programming subjects.

2 METHOD

Descriptive research design was utilized in this study. Slovin's formula was applied to determine the sample size of the study which comprises 132 freshmen of BSCS from the College of Computer Science, Don Mariano Marcos Memorial State University – South La Union Campus, Agoo, La Union. Furthermore, stratified random sampling was applied for the distribution of respondents taken from each stratum. Data collected were analyzed using descriptive statistics such as mean, standard deviation, skewness and kurtosis.In addition, partial correlation was used to determine the impact and significance of mathematics background in the performance of students in computer programming subjects.Moreover, IQ was considered as the moderating variable which was controlled in the study.

3 RESULT AND DISCUSSION

3.1 To determine the profile of the students in terms of: IQ; Mathematics background (CAT math scores); and performance in computer programming subjects (grades).

The IQ of the respondents extremely varied as revealed by the standard deviation and kurtosis which was platykurtic. But, skewness showed that most of the respondents' IQ was found below the mean which was positively skewed. Likewise, Mathematics background of the respondents is also tremendously varied and most of them were found above the mean which was negatively skewed.

Table 1: Profile of the students in terms of: IQ; Mathematics background (CAT math scores); and performance in computer programming subjects (grades).

	N	Mean	Std. Deviation	Skewness	Kurtosis
Performance in Programming 2	132	80.75	3.931	.041	-0.939
Performance in Programming 1	132	78.89	4.884	- 0.267	0.817
Intelligent Quotient	132	20.97	6.326	.679	.248
Mathematics Background	132	42.42	9.819	- 0.853	2.139

Respondents perform better in Programming 2 as bestowed by the means of the two subjects. But then, the distribution of scores were similar and both were positively skewed and platykurtic which was concisely radical.

3.2 To assess the relationship between mathematics background and performance of students in computer programming subjects.

As stated in the study of Shute 1991, it is disclosed that mathematical ability of students is insignificantly correlated with their programming skills. In the same way, one of the Bloggers, Jerz 2009, who is a programmer for almost 30 year but not mathematically inclined, who believe that mathematics background has no bearing to be a good programmer. Similarly, Lobo 2009 points-out "not all programming involves mathematics but knowing the basics is just right." In addition, Atwood (2009) there is no practice that programmers need to be mathematically inclined to become great software developers.

Table 2: The correlation between mathematics background and performance of students in computer programming subjects

Control Variables			Performance in Programming 2	Performance in Programming 1	Mathematics Background
Intelligent Quotient	Performance in Programming 2	Correlation	1.000	0.323	0.461
		Sig (2-tailed)	.	.000**	.000**
	Performance in Programming 1	Correlation	0.323	1.000	0.397
		Sig (2-tailed)	.000**	.	.000**
	Mathematics Background	Correlation	0.461	0.397	1.000
		Sig (2-tailed)	.000**	.000**	.

Nonetheless, nobody knows all of math, not even the best mathematicians. The field is constantly expanding, as people invent new formalisms to solve their own problems. And with any given math problem, just like in programming, there's more than one way to do it. As Yegge (2006) suggest that one can pick the one you like best. Kurland et al, 1986 found that mathematical ability of students is positively high and significantly correlated with the programming skills of students. Moreover, table 2 divulged that Mathematics background is positively, moderately and significantly correlated with the performance of students in Programming subjects at 0.01, level of significance.

4 CONCLUSION

Student who is good in mathematics will perform better in programming subjects.

5 References

[1] Bennedsen&Capersen. 2006. Abstraction ability as a indicator of success for learning object-oriented programing. ACM SIGCSE Bulletin Homepage archive.Vol 38 Issue 2, June 2006, pp 39-43. ACM New York, NY USA

[2] Bryant, R.E. (2012).Randy Bryant's Home.Retrieved from http://www.cs.cmu.edu/~bryant/

[3] Gottfredson, L. (1997a). Mainstream science on intelligence: An editorial with 52 signatories, history, and bibliography. Intelligence, 24, 13-23.

[4] Gottfredson, L. (1997b). Why g matters: The complexity of everyday life. Intelligence, 24, 79-132.

[5] Hamming R.W.(2012). Numerical Analysis vs. Mathematics: Modern mathematics often does not deal with the practical problems which face numerical analysis. American Association for the Advancement of Science. Retrieved from http://www.sciencemag. org/ content/148/3669/473.abstract

[6] Jerz, 2009.Should Competent Programmers be "Mathematically Inclined"?. Coding Horror: Programming and Human Factor

[7] Jensen & Sherry, 2010.The Impact of IQ+EQ+CQ Integration on Student Productivity in Web Design and Development. Journal of Information System 21.1 (Spring 2010):43-53.

[8] Jensen, A.R. (1998). The g factor: The science of mental ability. Westport: Praeger.

[9] Knuth, 1961, D.E. George Forsythe and the Development of Computer Science

[10] Kurland et al, 1986. A study of the development of programming ability and thinking skills in high school students.Educational computing research, Vol. 2(4), 1986.Bank Street College of Education.

[11] Lynn, R. 2010. High IQ is Sufficient to Explain the High Achievements in Math and Science of the Asian People. University of Ulster, Coleraine, Northern Ireland, United Kingdom

[12] Lobo, 2009.Should Competent Programmers be "Mathematically Inclined"?. Coding Horror: Programming and Human Factor.

[13] Schnabel, R. B.(2012). The trustees of Indiana University.School of Informatics and Computing.Indiana University.Blomington, USA. Retrieved from http://www.soic.indiana.edu/people/profiles/schnabel-robert.shtml

[14] Shute, 1991. Who is Likely to Acquire Programming Skills.J.Educational Computing Research, vol. 7(1) 1-24, 1991.Air Force Human Resources Laboratory.

[15] Williams, M.I. Board of Governors. The Community for Technology Leaders.IEEE Computer Society. Retrieved from http://www.computer.org/portal/web/ volunteercenter/excomwilliams