FACTORS THAT AFFECT THE LEARNING OF PROGRAMMING CONCEPTS

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Abstract

Understanding the fundamentals of computer programming is considered a difficult task for students. This paper aims to identify the programming topics that are difficult for the students to learn and determine the factors that affect their learning the concepts. Results revealed that regardless of gender, students have difficulty in learning programming fundamental concepts. Furthermore, the grade in Algebra determines the difficulty level of students in learning the concepts.

Keywords: programming, cognitive, program codes

I. INTRODUCTION

Computer programming is a process that leads from an original formulation of a computing problem to executable programs. It involves activities such as analysis, understanding, and solving problems. Students taking up computer related fields of study must understand the programming fundamentals concepts in order to develop their skills in programming. Learning computer programming is very complicated for most of the students. Thus, this study asserts that the students have difficulty in learning programming fundamentals regardless of gender and the grade in Algebra is not a significant predictor of difficulties in learning these concepts.

Computer programming learning is very complicated for many novice students at university level (Evans & Simkin, 1989). Moreover, the dropout and failure rates in introductory programming courses at the university level are evidence to the fact that learning to program is a difficult task. One source suggests that the dropout and failure rate is as high as 30 percent (Guzdial & Soloway, 2002).

Previous studies prove that students have difficulty in learning programming fundamental concepts. However, there is no study that investigates the impact of year level and grade in both Algebra and Trigonometry in learning programming fundamental concepts as well as their interaction with one another.

The difficulties have to be recognized to be able to aid learning and teaching in an effective way. The result of this study will be a benchmark of the instructors in enhancing their teaching strategies and to support in developing learning materials for basic programming courses.

II. CONCEPTUAL FRAMEWORK

Table 1. Programming Fundamental Topics and its corresponding Cognitive Domain Level

Blooms Taxonomy Cognitive Domain Levels	Topic Code	Programming Fundamental Topics
Knowledge		
Comprehension	T1	Basic Data Types
Application	T4	Loop Control
	T8	String Methods
Analysis	T2	Variable Types
	T5	Decision Making
	T6	Number Methods
	T12	Exception Handling
Synthesis		
Evaluation	T3	Basic Operations
	T7	Character Methods
	T9	Arrays
	T10	Creating Methods
	T11	Input and Output Handling

This study is anchored in Bloom's Taxonomy and can be viewed as a pedagogical instrument in the design of instruction. The anatomy is organized into three domains: Cognitive, Affective, and Psychomotor. This study primarily focused on the Cognitive model, which includes six different classification levels: Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation and place more emphasis on the cognitive nature of the framework, asserting that the first three elements—Knowledge, Comprehension, and Application represent lower levels of cognition and learning, while Analysis, Synthesis, and Evaluation are considered higher-order skills.

III. RESEARCH DESIGN AND METHODS

Research Design

To know the students level of difficulty, a test is conducted. The test consists of 12 program codes where every program code corresponds to a topic in programming fundamentals. Students will predict the output of the given source code of the program.

Research Methods

The respondents of the study are 40 randomly chosen first year students of Bachelor of Science in Computer Science of SDSSU-Tagbina Campus. These students have already finished taking the programming fundamental concepts and were not reviewed prior to the conduct of the test. The test is conducted twice with the second administration coming two weeks after the first. After the test has been administered, every item of the test is analyzed.

IV. RESULTS AND DISCUSSION

Table 2. Difficulty in learning programming concepts

Topic Code	TOPICS	AVERAGE
T1	Basic Data Types	1.2
T2	Variable Types	1.5
T3	Basic Operations	3.5
T4	Loop Control	2.5
T5	Decision making	2.6
T6	Number Methods	3.8
T7	Character methods	2.8
T8	String methods	2.8
T9	Arrays	3.3
T10	Creating methods	3.0
T11	Input and Output	1.6
T12	Exception Handling	2.8

Table 3. Description of the average responses

Average	Description
4.0 – 3.0	Most Difficult
2.9 – 2.0	Difficult
1.9 – 1.0	Easy

Table 1 shows that the most difficult topic for the students to learn is the number methods (T6). Since T6 belongs to the skills that require higher-order thinking, students find it difficult to learn due to their inability to comprehend the higher order thinking programming environment as well as the language used in programming.

This difficulty could be attributed to their poor background in mathematical operations and basic computer concepts. A clearer approach in teaching these topics should be made to make it beneficial to students.

Table 4. Analysis of variance of difficulty between Gender

Year Level	Mean	P-value	F-value
Male	2.40	0.039	4.77
Female	2.73		

Table 2 shows that there is a significant difference between male and female students in the difficulty of learning programming fundamental concepts. Furthermore, the mean value revealed that female students have more difficulty in learning programming fundamental concepts than male students.

This implies that in this group of students, the males possess higher order thinking skills compared to female students.

Table 4. Relationship of grade in Algebra and Programming Fundamentals

Coefficient	Estimate	Std. Error	t-value	p-value
Constant	-11.528	1.280	-9.01	0.00
Algebra	0.034019	0.003093	11.00	0.00
Grade				
R-Squared: 81.8%				

Results in Table 4 revealed that the hypothesis is rejected at .01 level of significance which means that the positive relationship between grade in Algebra and Programming Fundamentals is highly significant and this relationship implies that grade in algebra is an important predictor of grade in programming fundamentals. The r-squared value implies that most of the values fit in the regression line which means that there is a strong relationship between algebra and programming grades and they measure almost the same thing.

There is a strong relationship between algebra and programming fundamentals since some of the basic features of programming are similar in algebra. In addition, knowledge in algebra honed the students to develop their analytical skills and general ability to think in a logical manner in solving problems.

V. CONCLUSION

Computer programming skills belongs to the discipline with hierarchical nature where prior knowledge in applied mathematics is an advantage. The greater prior knowledge in applied mathematics, the higher the possibility to understand programming concepts since computer programming requires higher order mathematical thinking skills in order solve problems to translate mathematical representation into programming terms.

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