Factors Affecting Poor Performance in Programming Coursesin Nigerian Universities: ACase Study of Students in Ambrose Alli University, Ekpoma,Edo State, Nigeria

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ABSTRACT

This study examined the obvious factors considered to affect the students' academic performance in programming courses in Tertiary institutions. Questionnaire methods of data collection was adopted to solicit for responses from undergraduate students of Computer Science Department, Ambrose Alli University, Ekpoma. A working sample size of 200 was adopted from Taro Yamani sample size determination Techniques. SPSS was used to run the descriptive Statistics and coefficient of Variation (C.V) was further used to determine which of the obvious factors affected the students most. The analysis revealed that among all the obvious factors considered, lack of Quality teaching methodology and shortage of professional Lecturer accounts more for the poor performance of students in programming courses in Tertiary Institutions. Based on this premise, it is recommended that quality and qualified professionals should be employed to adopt a modern and flexible teaching Techniques to educate the students our future leaders (students).
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Keywords: Tertiary Institutions, Programming Languages, Students, Teaching Methodology.

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1. Introduction

Computer programming courses are among the main requirements of study plans in higher institution not only in the field of Computer Science and Information Technology, but also in Science, Mathematics, and Engineering [2]. Computer programming is used in terms of solving problem, the problem which is first formulated and transformed into an algorithm, then programmed using a particular Computer programming language that most satisfies the need of the problem.

Computer programming is the process of designing and building an executable computer program to accomplish a specific computing result or to perform a particular task[6]. Computer Programming involves generating and analysis algorithms to accomplish a given task and implementing the algorithms in a chosen programming language by coding[1].The purpose of programming is to find a sequence of instructions that will automate the performance of a task on a computer, often for solving a given problem. Writing a computer program is not an easy task. According to [3], Students must understand the problem, formulate the solution using standard problem solving techniques, and write down the solution to solve the problem using a programming language in such a way that a computer can follow the instructions.

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2. Literature Review

Psycharis and Kallia [7][10] conducted an experimental study on 66 high school students in order to investigate the influence of computer programming on students problem solving and reasoning skills. It was found that a lack of problem solving and reasoning skill affect the high rate of failure in computer programming, similarly, the research of [9] also revealed that shortage and lack of qualified professional lecturers in education institution also demotivate the students to see the connection of their studies with future careers. Lack of guidance from the lecturers especially on the teaching and learning style influence the interest of students in the programming class [15].

Another factor that influences the difficulties of students in learning programming subjects is the method of teaching and poor learning style. Each student has a distinct learning style. Some of the students prefer group discussion, while others favour independent study [20]. A study by [19]discovered that most students find it easier to learn a certain subject that they are familiar with rather than learning a new subject. This is because the learning process is usually built on previous knowledge as well as experiences, and since computer programming subjects are not related to any former subjects in their primary and secondary schools, many students feel that this new subject is difficult to learn[11].

One of the issue discussed by [5] regarding the effectiveness of students mastering a programming language is the nature of programming, which plays an important role in determining the effectiveness of students ability to master a programming language and [17] reported that most institutions use an object-oriented language like Java, C, , and C^{++} languages to teach procedural programming, whereas less than 15% of the institutions teach functional programming that are not suitable for educational purposes, these languages are difficult to understand by the students. The languages designed for education like Python, Logo, Eiffel, are not caught in schools [21]. [6] outlined five problems faced by students relating to programming nature, namely: developing an algorithm, transforming an algorithm to a program using a programming language, programming structures, modularization, and testing and debugging. These five issues were discussed based on the study on previous work as well as observations of more than 15 years in the world of programming education [18].

A study by [8] revealed the correlation between programming subject grades and student motivation. Due to the negative perception of students on programming, most students put little effort to learning programming with open mind. This attitude by students always reduce problem solving skills which has resulted in low grades in programming courses. Students perception on programming as reported by [13] also affect students performance. Due to this factor, students face difficulties in learning programming not only because of their limited problem-solving skills and having surface knowledge but their inability to write programming code, and figure out the problem when their program does not turn out the way they want.

Finally, Other researchers like [12], [8] also identified Real Programming Environment and student's inability to deal with source code errors also contribute to high rate of failure in programming in the early years of studies in Universities and this has been the trend over the years, making programming courses look difficult as observed in Ambrose University, Ekpoma. Also, from the errors, defects or unexpected things in program code during the development process, the best way to advance is through debugging. Learning how to debug is an important skill that many students lack when writing programming

3. Statement of problem

Research work of [22] [14] show that Students difficulty in computer programming is not peculiar to the students of Ambrose Ali University Ekpoma, but span across most Polytechnics and Universities in Nigeria and other parts of the world. It has also been observed that over the years there has been a high rate of failure or poor performance in computer programming courses in the Nigeria Polytechnic and Universities. Several problems were identified by many authors [16], [10], [20] in their findings. These problem are categorized as follows:

i). Method adopted by lecturers in teaching computer programming.

ii). Lack of problem solving skill and developing algorithm.

iii). Lack of programming planning and transforms an algorithm to program using a programming language.

iv). Lack of practical class to teach programming courses.

v). The lecturers lack of Instructional materials, competence and teaching strategies.

vi). Difficulties in using notation for representation of a program.

vii). Unable to transform the problem into programming instruction.

viii). Lack of understanding of the scope of variables and why it is necessary to pass and return parameters

4.   Aims and Objectives

Based on the above highlighted problems by different Authorities, the following aim and objectives were formulated i.e to identify the factors that influence the high rate of failure and challenges in learning computer programming courses by students and suggest way for addressing these issues.

(i). To determine if Teaching methodology contributed to the poor understanding of programming Languages among students in Tertiary institutions.

(ii). To examine the lack of problem solving skills as a factor to poor understanding of programming Languages.

(iii) .To examine if shortage of professional lecturers in educational institution affect the teaching of programming Languages.

(iv) .To examine the Programming environment as a contributing factor to poor understanding of programming Languages.

(v). To determine if Lack of good instructional materials affects the teaching of Programming Languages

5.   Research questions

Six research questions were formulated for the study:

i). Does shortage of professional lecturer in education institutions affect student high rate of failure in computer programming?

ii). Does learning environment have any effect on students performance in computer programming?

iii). Does the use of instructional materials affect students in learning computer programming?

iv). Does lack of problem-solving skill affect students in computer programming abilities?

v). Does the method adopted by lecturers affect the teaching of students in computer programming?

vi). Does the nature of programming language affect students' performance in computer programming?

6.   Methodology

6.1 Participants

The survey carried out using the students in the Department of Computer science, Ambrose Alli University, Ekpoma. Data were collected from the students taking programming courses with the use of questionnaires. This method helped in soliciting their views regarding the teaching methods and strategies lecturers adopted in teaching programming courses. To enhance both internal and external validity, we collected data from students who major in computer science, familiar with programming languages, have written code in both high and low level languages and who have taken C^{++}, Java, Visual Basic, and Pascal languages. The number of students in the Department of Computer science was over 400 and this form the population of the study. The sample size of 200 was adopted using the Taro Yamane formula as follows:

$$n = \frac{N}{(1+N(e)2)}$$

where n = Sample size

N = Population = 400

e = margin error = 0.05 (5% significant level)

$$n = \frac{400}{(1+400(0.0025)}$$

$$n = \frac{400}{2}$$

n = 200

6.2 Materials and Procedures.

The researcher administered the questionnaire to the respondents at various levels. The questionnaire was divided into two sections. The first section was demographic data which contain the background information of the respondents. The second section comprises of 40 items categorized into six dimensions so as to ascertain the level of difficulties that students faced while learning programming languages. The dimensions are:

Dimensions	Items
Teaching methodology	6
Lack of problem solving skill,	10
Shortage of professional lecturers	8
Programming environment,	5
Lack of good instructional materials	7
Nature of programming language	4

Nature of programming language	4

These questions were adopted with the aim of collecting data and finding out the difficulties that the students faced while learning programming language based on the factors. These responses rated based on a 5-point likert scale from " Strongly Agree" with a value of 5, "Agree" which has a value of 4,

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"Disagree "which has a value of 3, "Strongly Disagree" which has a value of 2 and undecided with a value of 1.

Responses to the different variables under study were collected and analyzed to examine which of the factors under consideration affected students more or contributing more to failure rate of students in programming Languages. The mean, which is the average and the respective standard deviation were determined using the SPSS to run the descriptive statistics and Coefficient of variation (C.V) was further used to examine the most contributing factors to poor performance of students in Programming Languages.

Given that: C.V $= \frac{S}{\bar{X}}$ x 100

Where**:**

Coefficient of Variation. (C.V)

$\bar{X}$ = Sample mean.

SD = Sample Standard Deviation.

6.3   Data Presentation.

Table 2:   The summary table shows the responses of various means of factors Consideredas obtained from the returned questionnaire administered.

Scale Responses / Factors Considered.	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6
Strongly Agree. (5)	66	60	57	52	55	49
Agree. (4)	54	50	49	49	48	35
Disagree (3)	25	28	32	35	30	45
Strongly Disagree.(2)	30	32	36	40	34	41
Undecided (1)	25	30	26	24	33	30
Total	200	200	200	200	200	200

Sources : Field Survey, (2021).

Where :

Y_1 - Quality Teaching Methodology.

Y_2 - Shortage of Professional Lecturers ..

Y_3 - Lack of Problem Skill.

Y_4 - The Nature of programming Language..

Y_5 - Lack of good instructional materials for Teaching.

Y_6 - Programming Environment

6.4Summary Analysis of Results.

Table 3. Descriptive analysis of results:

Coefficient of variations (C.V) was further adopted to ascertain the most obvious factors that contributed to the poor performance in programming courses taught in Nigerian Universities

7. Discussion

Factors Considered	Sum	Mean	Standard Dev.	C.V
Y_1	701	3.51	1.44	41.03
Y_2	678	3.39	1.45	42.80
Y_3	659	3.29	1.48	44.98
Y_4	638	3.18	1.49	46.71
Y_5	660	3.30	1.46	48.18
Y_6	606	3.03	1.49	49.17

From the findings six different factors were provided for the participants to rank in order of appropriateness. The analysis in Table 6.3 revealed that quality teaching methodology and shortage of professional lecturers' accounts most for the poor performance of students in computer programming course in Ambrose Alli University Ekpoma. The shortage of professional lecturers in computer programming courses especially from the industries is quite critical. The lack of qualified professional lecturers in educational institution demotivates the students to see the connection of their studies with future careers [2]. The main problems identified by the experts who were interviewed and the survey conducted, it has been realized that aside the numerous causes of failure by students in computer programming courses discussed above, we cannot overlook the teaching methodology, shortage of professional lectures and learning Environment; since this factors are major contributing factors to the high rate of poor performance in programming courses. Computer programming is among the most challenging subjects in Computer Science curriculum and the one that many students find difficult to grasp, hence it is very important to appropriate teaching methodology strategy that will provide students with most efficient learning Environment.

Quality and qualified lecturers should be Employed and to adopt a modern and flexible teaching Techniques to educate our future leaders. The roles of lecturers are very important to guide the students and slowly train them to work independtly; nevertheless, continuous supervision is needed to ensure that the students are on the right track. The lecturers are encouraged to create innovative courseware as teaching aid tools. Nowadays, there are a lot of software and e-learning tools available on the internet or mobile application. These applications can be downloaded , modified and customized according to the nature of the course or subject.

8. Conclusion

The analysis in Table 6.3 and 6.4 revealed that quality teaching methodology and shortage of professional Lecturers accounts most for the poor performance of students in programming Languages in Tertiary institutions. This was closely following by Lack of problem Skills and Lack of good instructional materials for Teaching. Because the lower the

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Coefficient of variation (C.V) the more relevant of the variables or factors being considered .But generally all the factors considered contributed immensely to poor performance of students in Programming Languages in Tertiary Institutions

9. Recommendations

(i). Quality and qualified professionals should be employed and to adopt a modern and flexible teaching Techniques to educate our future Leaders (Students).

(ii). Learning environment should be conducive and convenient as this allow reasonable thinking and deductive abilities in the reading and learning process.

(iii). Our Computer Laboratory should be up to global standard as this will really help to equipped our students to understand modern programming Languages and to be able to compete with other students of the rest of the world.

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Table 1: Responses on poor performance in programming Language courses in Nigerian Universities.

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Descriptive Statistics was employed to examine and to understand the level of difficulties experienced by students in programming Courses based on all the dimensions. The mean and standard deviations of each questions and responses are showed in the table below:

S/No	Questions	Strongly Agree (5)	Agree (4)	Disagree (3)	Strongly disagree (2)	Undecided (1)	$\overline{X}$	SD
	Teaching methodology							
1.	Does Presentation and organization of materials affect students performance in computer programming	11	9	4	4	5	6.6	3.2
2.	Lack of practical class to teach programming courses affect students performance in programming	12	9	5	5	6	7.7	3.0
3.	Students usually tend to memorize the whole coding whenever they cannot understand the flow of the algorithm	10	8	4	4	4	6.0	2.8
4	Does lack of sharing relevant example or real applications by lecturers to the students affect their performance	11	10	5	5	4	7.0	3.2
5	Method adopted by lecturer in teaching computer programming affect the rate of performance in programming courses.	12	10	4	4	6	7.2	3.6
6	Will increase in the number of assessments and selecting suitable exercises we increase the students performance in programming course	10	8	3	3	5	5.8	3.1
	Lack of problem solving skill,							
7	Limited surface knowledge of programs is among the main factor that lead to difficulties in learning computer programming.	6	5	3	5	2	4.2	1.6
8	Novice students often approach programming line by line instead of using structured program	5	5	3	4	2	3.8	1.3
9	Students do not understand the programming syntax and construct	7	6	4	4	3	4.8	1.6
10	Students lack experience with programming syntax	5	4	3	3	2	3.4	1.1
11	Students lack the basic skill in mastering various processes such as planning, editing, designing, compiling and debugging program code	4	4	3	3	3	3.4	0.6
12	Most students start writing computer program without analyzing, designing and understand the problem thoroughly	7	5	4	4	4	4.8	1.3
13	Some students just expect marks out of sympathy from their programming subject lecturers	5	4	3	3	2	3.4	1.4
14	Computer programming subjects are not related to any former subjects in their primary or secondary schools, many student feel that this new subject is difficult and complicated.	7	6	3	4	3	4.6	1.8
15	Many students find it easier to learn a certain subject that they are familiar with rather than learning new subject.	5	5	3	3	3	3.8	1.1
16	Learning to programming involves a different way of thinking	6	5	3	3	2	3.8	1.6
	Shortage of professional lecturers							
17	Shortage of professional programmers in the department of computer science also contribute to poor performance of students	9	6	4	4	4	5.4	1.7
18	Lack of guidance from instructors affect teaching and learning style in influence students performance	8	7	3	4	4	5.5	2.2
19	The lecturers are not happy with the quality of feedback from the government and the students, thereby making it difficult for them to put in their best.	6	6	3	3	3	4.2	1.6
20	Lack of sharing relevant examples or real applications by the lecturer to the students also contribute to poor	8	7	4	5	4	5.6	1.8

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	performance in programming							
21	The lecturer lack Instructional materials, competence and teaching strategies	7	6	4	3	4	4.8	1.6
22	Ability to deliver effective instructions to students and poor content knowledge in programming skill leads to difficulties in making the novice students attracted to programming class.	8	7	3	4	4	5.2	2.2
23	The contents in the lecture note that are very brief, examples given are not provided with answer.	6	6	3	5	3	4.6	1.6
24	Exercises that are given by the lecturers are not provided with answers for students to cross – check with their answers.	8	6	4	4	4	5.2	1.8
	Programming environment,							
25	Does lack of conducive classroom for teaching lead to poor performance in programming subjects	10	5	9	8	5	7.4	2.3
26	Student dislike programming courses in the school because there are no facilities to carry out the pratical class	9	7	9	7	7	8.2	11
27	Is Lack of instructional technologies a cause of lack of understanding of computer course	9	8	8	8	6	7.8	1.1
28	Does representing source code in a form of text based causes confusion among students	10	7	9	7	5	7.6	1.9
29	Most students have a negative perception about the difficulty of programming subjects from their seniors, which makes them lose interest and have less motivation even before learning it.	11	8	10	9	7	9.0	1.6
	Lack of good instructional materials							
30	Do you recommend laboratory practices as key factor when it comes to teaching programming courses	14	12	7	8	9	10.0	2.9
31	Do you agree that if right tools are adapted for the teaching of programming courses, both lecturers and the students will enjoy the course and high performance rate will be achieved.	15	13	8	9	0	10.8	3.0
32	Does performance based category, assessment such as laboratory exercise, programming assignment and examination help to test students ability to write good program	13	11	8	9	7	9.6	2.4
33	Teaching strategy adapted due to the long years teaching programming also can improve students performance in programming.	13	12	7	8	8	9.6	2.7
	Nature of programming language							
34	It is difficult in using notation for representation of a program.	7	7	5	6	4	5.8	1.3
35	It is difficult to understand programming structures	8	7	5	5	3	5.6	1.9
36	It is difficult in using language liberies such as searching in language libraries, finding the appropriate function, and using it correctly in a program	9	7	5	5	4	6.0	2.0
37	It is difficult to develop a program that solves a given task	7	6	5	6	3	5.4	1.5
38	It is difficult to remember all the programming language syntax	8	8	5	6	3	6.0	2.1
39	It is difficult to write algorithm and flowchart for a given problem	6	6	5	6	3	5.8	1.9
40	It is difficult to transform a given problem into mathematical formula that can solves using computer program	7	8	5	6	3	5.8	1.9