Programming Skills Needs of Computer Science Education Students for Effective Web Designing in Higher Institutions

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ABSTRACT

The purpose of this study was to determine the influence of programming skills on computer science education students' effectiveness in web design. In higher institution. The study was guided by four specific objectives, four research questions and four null hypotheses which were tested at 0.05 level of significance. Descriptive research design was adopted in the study. The population consisted of 155 computer science education students of University of Uyo, Calabar, Port Harcourt, AKSU and CRUTECH final year 0f 2018/2019 academic session. A total of 80 respondents constituted the sample size for the study. A 20 item questionnaire developed by the researcher tagged "programming skills needs of computer science education students for effective web designing questionnaire (PSNCESEWDQ)" was validated by three experts in the department of vocational education, University of Uyo. The reliability coefficient was 0.78. Mean and standard deviation was used in answering the research questions while t-test analysis was used in answering the research hypotheses. The finding of the study indicated that there is significant influence of programming skills on computer science education students' effectiveness in web designing in higher institution. Based on these findings, it was concluded that there is significant influence of programming language, algorithm; analytical thinking and mathematics skills in computer science education students' effectiveness in web design. It was recommended among others that students should be encouraged to take their programming courses seriously in order to acquire programming skills that can facilitate their effectiveness in web design.

KEYWORDS: Skills, Computer science education, Web design

Introduction

With the widespread development of computer technology in the era of open world and globalization, the needs for the use of computer are increasing. This requires the need of experts in the field of information and communications technology (ICT) such as software programming, database, software engineering, computer networking and the creative

multimedia (Rashid, 2004). Findings show that the industry's need for software engineers is high and this indicates that the programming personnel's are critical requirement for the industries (Medar, 2007). Therefore, to meet industries needs, programming course such as web programming is an essential component of the curriculum to be studied, not only in the field of information technology, but also in research Science, Mathematics, and Engineering at tertiary levels (McCrackenet, Medar and Rashid 2001).

Programming is an art and it requires the individuals' ability to interpret challenges into solutions. Computer Education students are required to take several programming courses as structured in their four-year program. In their early years of studies, they are required to study programming. The art of programming includes knowledge of programming tool and languages, problem-solving skills, effective strategy for programming design and implementation (Ala-Mutka, 2006).

A program is a set of instruction which computer uses in processing data or solving problem. This instruction are statement or command use in programming such as BASIC, JAVA, C++, HTML, CSS, PHP, PYTHON among others (Ekpenyong, 2014). Programming is the process of developing and implementing various sets of instructions that would enable computer to do certain task (Steve, 2015). It is also the act of creating and writing instructions which guides the computer to carry out the specific task or job. Programming also means coding of program or instruction or command, (Daniel, 2015). A programmer uses computer language to code or write a program, the languages are called programming language, (Harold, 2003). The knowledge of coding or programming enhances effective web development.

Web development refers to the act of building, creating and maintaining a website. It includes aspects such as web design, web publishing, web programming and database management, (Banker, Davis, and Slaughter, 2009). While the term "web designer "and "web developer" are often used synonymously, they do not mean the same thing. Technically, web designers only design website interface using Hypertext Markup language (HTML) and Cascading Style Sheet (CSS). A web developer may be involved in designing a website, but may also write a web scripts in languages such as Hypertext pre-processor(PHP) And Active server page (ASP.Net), (Davis, 2009). Additionally, web developer may help maintain and update a database used by dynamic website. Web development includes many types of web content creation. Some examples include; hand coding of web pages in the text editor, building a website in a program like Dreamweaver, and updating a blog via a blogging website. In recent years, content management system like Word Press, Drupal, and Joomla have also become popular means of web development. These tools make it easy for anyone to create and edit their own website using web-based interface.

According to Daniel (2015), algorithm is the step by step procedure which defines a set of instructions to be executed by the computer in order to get the desired or required outputs. Algorithm skill tells the programmer how to code the program and has never been written to support a particular programming code (Barret, 2008). Computer educators or web designers

should note that programming languages share basic code construct such as if-else, while loop statements and flow control. These common constructs are used to write algorithm.

According to Inyang (2014), without strong mathematics skills, a programmer is likely to write inefficient code that has bugs, takes a long time to execute wastes device battery power. Math skills are needed to analyze the data structures and algorithms in a program, and though computers process numbers in discrete units, continuous math skills are extremely helpful when analyzing the time and space complexity of a program (Inyang, 2014). Mathematics classes such as statistics, linear algebra, calculus and discrete mathematics are all valuable when studying to become a software developer (Ayan, 2016).

Web programming is a real challenge and should be treated as one. Many of the computer education students seem to find programming to be very difficult and disheartening especially when there are beginners. Considering the challenges that lack of programming skills presents to computer education students, the researcher decided to carry out this study on programming skills needs of computer education students for effective web designing.

Statement of the Problem

The aim of including programming into computer science curriculum in Nigerian tertiary institutions is to develop in the students the capabilities required of a professional software developer. McCrackenet, (2001), reported that computer science education students are struggling with the first steps of learning to program. Also, Vandegrift (2005), reported poor performance of students in programming and web designing. It was against this background that it becomes imperative for the researcher to embark on the study.

Purpose of the Study

The main purpose of the study was to determine the extent of programming skills needs on computer science education students for effective web designing in higher institutions. Specifically, the study sought to:

1. Determine the extent to which programming language skills influence computer science education students for effective web design.
2. Determine the extent to which algorithm skills influence computer science education students for effective web design.
3. Determine the extent to which analytical thinking skills influence computer science education students for effective web design.
4. Determine the extent to which mathematics skills influence computer science education students for effective web design.

Research Questions

The Following research questions were answered in the course of this study:

1. To what extent do programming language skills influence Computer Science Education Students' effectiveness in web design?

2. To what extent do algorithm skills influence computer education students' effectiveness in web design?
3. To what extent do analytical thinking skills influence Computer Science Education students' effectiveness in web design?
4. To what extent do mathematics skills influence computer education students' effectiveness in web design?

Research Hypotheses

The following null hypotheses guided the study:

Ho$_1$: There is no significant influence of programming language skills on Computer Science Education students' effectiveness in web design.

Ho$_2$: There is no significant influence of algorithm skills on Computer Science Education students' effectiveness in web design.

Ho$_3$: There is no significant influence of analytical thinking skills on Computer Science Education students' effectiveness in web design.

Ho$_4$: There is no significant influence of mathematics skills on Computer Science Education students' effectiveness in web design.

Research Design

Causal comparative research design was adopted for the study. This design is a systematic approach model for comparing causal independent variable (programming language skills) in relation to the dependent variable (effective web design). The design allows for proportional selection of sample that would represent a large population without bias.

Population of the Study

The population of the study consist 155 computer science education students in final year 2018/2019 academic programme at the University of Calabar (35), University of Uyo (35), University of Port Harcourt (35), Akwa Ibom State University (25) and Cross River State University (25).

Sample and Sampling Technique

A sample size of 85 students was purposively selected from the 155 students that make up the population. The sample were, University of Calabar (20), University of Uyo (20), University of Port Harcourt (20), Akwa Ibom State University (15) and Cross River State University (10).

The reason for the choice of purposive sampling technique was because the studied population was not a large one.

Instrument for Data Collection

A researcher developed a 20 items structured programming skills needs of computer education students and effective web designing questionnaire (PSNCESEWDQ) and used for data collection. The Instruments was divided into five sections, A-F. Section A requests for students' personal data, such as gender, types of program and level. Section B was used to collect information from the respondents on programming language skills. Section C was used to elicit information on algorithm skills. Section D sought to obtain information from the students on analytical thinking skills; section E was used to collect information on mathematics skills while Section F was used to collect information on programming skills for effective web designing. The response options for these sections are 4-points rating scale as follows; Strongly Agreed-4 points, Agree-3 Points, Disagree-2 points, and Strongly disagree-1 point,

Validation of the Instrument

The Instrument (PSNCESEWDQ) was subjected to face Validation by two experts in the Department of Vocational Education and one expert in the department of Educational Foundation, Guidance and Counseling making it the total of three (3) experts. They were requested to access the content coverage; the suitability of the items, language used and item arrangement in logical sequence. The experts' comments and input were incorporated and used for modification of the final copy of the instrument.

Reliability of the Instrument

Before the instrument was administered, it was pretested on a small group of the population who would not take part in the study. The set of scores obtained were analyzed using Cronbach Alpha Procedures. A reliability coefficient of 0.78 was obtained. On the basis of its reliability index, the instrument was considered reliable for measuring the variables in the study.

Method of Data Collection

The researcher visited computer science department and units of the Universities from which the sample was drawn. The researcher personally with the help of research assistant administered the questionnaire to the respondents. The respondents were given instructions on how to complete the questionnaire. Completed copies of the questionnaire were collected back by the researcher on the spot after their final year examination to ensure a high return rate of the Instrument.

Method of Data Analysis

Research questions were answered using mean score rating while independent **t**-test was used in testing the hypotheses formulated for the study at .05 level of significance.

Results and Discussion

Research Question 1

To what extent do programming language skills influence computer science education students' effectiveness in web design?

Table 1: Mean analysis of influence of programming language skill on computer science education student's effectiveness in web design.

S/N	ITEM	$\overline{X}$	SD	REMARK
1.	Adequate knowledge in programming syntax can help in effective web design	4.03	.91	Agree
2.	Adequate knowledge of programming procedures can help in effective web design	3.98	.86	Agree
3.	Acquisition of adequate knowledge in hypertext markup language (HTML) can help in effective web design	3.74	.84	Agree
4.	Acquisition of adequate knowledge in Hypertext pre-processor (PHP) can aid in Effective web design.	4.12	.94	Agree
5.	Processing sufficient skills in cascading spreadsheet (CSS) can help in effective web design	3.88	.85	Agree
	Average score	**3.95**	**.88**	**Agree**

Data analysis in table 1 shows that the mean score for items 1-5 are 4.03, 3.98, 3.74, 4.12 and 3.88 respectively. The average scores for mean were 3.95 and that of standard deviation is .88. The result indicates that the mean value for each item and the average mean score are greater than the average rating point of 2.50. This implies that acquisition of programming language has a significant influence on Computer science education students' effectiveness in web design

Research Question 2

To what extent do algorithm skills influence computer science education students' effectiveness in web design?

Table 2: **Mean analysis of the influence of algorithm skills on computer science education students' effectiveness in web design**.

S/N	ITEM	$\overline{X}$	SD	REMARK
1.	Possessing algorithm logic skills can help in effective web design	3.76	.84	Agree
2.	Logic comprehension of web base development can help in effective web design	4.06	.90	Agree
3.	Ability to module a web base domain can help in effective web design	3.75	.83	Agree
4.	Ability to decompose the domain into web base subsystem can help in effective web design	3.68	.79	Agree
5.	Ability to link the decompose web subsystem using HTML can help in effective web design	3.92	.89	Agree
	Average score	**3.83**	**.85**	**Agree**

Data analysis in table 2 shows that the mean scores for items 6-10 are; 3.76, 4.06, 3.75, 3.68 and 3.92 respectively. The average score for the mean is 3.83 and that of standard deviation is .85. The result indicates that the mean value for each item and the average mean score are greater than the average mean score and greater than average rating point of 2.50. This implies that algorithm skills have a significant influence on computer science education students' effectiveness in web design.

Research Question 3

To what extent do analytical thinking skills influence computer science education students' effectiveness in web design?

Table 3: **Mean analysis of the influence of analytical thinking skills on computer science education students' effectiveness in web design.**

S/N	ITEM	$\overline{X}$	SD	REMARK
1.	Possessing critical thinking skills can help in effective web design	2.92	.71	Agree
2.	Expressing critical thinking skills in mathematical formula can help in effective web design	3.00	.74	Agree
3.	Possessing sufficient analytical thinking skills can help in effective web design	2.87	.69	Agree
4.	Acquisition of problem solving skill can help in effective web design	2.88	.70	Agree
5.	Translating mathematical expression into coding can help in effective web design	3.43	.78	Agree
	Average score	**3.02**	**.72**	**Agree**

Data analysis in table 3 shows that the mean scores for items 11-15 are; 2.92, 3.00, 2.87, 2.88, 3.43, 3.02 respectively. The average score for the mean is 3.02 and that of standard deviation is .72. The result indicates that the mean value for each item and the average rating point of 2.50. This implies that analytical thinking skills has a significant influence on computer science education students' effectiveness in web design.

Research Question 4

To what extent do mathematical skills influence computer science education students' effectiveness in web design?

Table 4: Mean analysis of the influence of mathematics skills on computer science education students' effectiveness in web design

S/N	ITEM	$\overline{\text{X}}$	SD	REMARK
1.	Possession of mathematical skills can help in effective web design	4.21	.92	Agree
2.	Ability to translate Boolean expression into a program can help in effective web design	3.71	.83	Agree
3.	Adequate knowledge of algebraic expression can help in effective web design	4.20	.91	Agree
4.	Possessing a sound knowledge in binary expression can help in effective web design	3.84	.87	Agree
5.	Translating mathematical equation into coding can help in effective web design	3.49	.78	Agree
	Average score	**3.88**	**.86**	**Agree**

Data analysis in table 4 shows that the mean scores for items 16-20 are; 4.21, 3.71, 4.20, 3.84, 3.49 respectively. The average score for the mean is 3.88 and that of standard deviation is .86. The results indicate that the mean value for each item and the average mean score are greater than the average rating point of 2.50. This implies that mathematical skills has a significant influence on computer science education students' effectiveness in web design.

Hypothesis 1

There is no significant influence of programming language skill on computer science education students' effectiveness in web design

Table 5: t-test analysis of the influence of programming language skill on computer science education students' effectiveness in web design N=80

Variables	$\overline{X}$	SD	df	t-Cal	t-crit
Programming language	3.95	.88			
			80	3.17*	1.99
Effectiveness in web design	2.14	1.04			

*Significant at 0.05 alpha level

Result of data analysis in table 5 revealed that the calculated t-value of 3.17 is greater than the critical t-value of 1.99 at df of 80 and 0.05 level of significance. Hence the null hypothesis is rejected. Therefore, there is a significant influence of programming skills on computer science education effectiveness in web design.

Hypothesis 2

There is no significant influence of algorithm skills on computer education students' effectiveness in web design.

Table 6: t-test analysis of the influence of algorithm skills on computer science education students' effectiveness in web design N=80

Variables	$\overline{X}$	SD	Df	t-Cal	t-crit
Algorithm skills	3.83	.85			
			80	3.09*	1.99
Effectiveness in web design	2.14	1.04			

*Significant at 0.05 alpha level

Result of data analysis in table 6 reveal that the calculated t-value of 3.09 is greater than the critical t-value of 1.99 at df of 80 and 0.05 level of significance. Hence the null hypothesis is rejected. Therefore, there is significant influence of algorithm skills on computer science education students' effectiveness in web design.

Hypothesis 3

There is no significant influence of analytical thinking skills on computer science education students' effectiveness in web design.

Table 7: t-test analysis of the influence of analytical thinking skills on computer science education students' effectiveness in web designing N=80

Variables	$\overline{X}$	SD	df	t-Cal	t-crit
Programming language	3.02	.72			
			80	2.98*	1.99
Effectiveness in web design	2.14	1.06			

*Significant at 0.05 alpha level

Result of data analysis in table 7 reveal that the calculated t-value of 2.98 is greater than the critical t-value of 1.99 at df of 80 and 0.05 level of significance. Hence the null hypothesis is rejected. Therefore, there is a significant influence of analytical thinking skills on computer science education students' effectiveness in web design.

Hypothesis 4

There is no significant influence of mathematical skills on computer science education students' effectiveness in web design.

Table 8: t-test analysis of the influence of mathematical skills on computer science education students' effectiveness in web design N=80

Variables	$\overline{\text{X}}$	SD	df	t-Cal	t-crit
Programming language	3.88	.86			
			80	3.11*	1.99
Effectiveness in web design	2.14	1.06			

*Significant at 0.05 alpha level

Results of data analysis in table 8 reveal that the calculated t-value 3.11 is greater than the critical t-value of 1.99 at df of 80 and 0.05 level of significance. Hence the null hypothesis is rejected. Therefore, there is a significant influence of mathematical skills on computer science education students' effectiveness in web design.

Findings

The findings of the study are that:

1. There is a significant influence of programming language skills on computer science education students' effectiveness in web design.
2. There is a significant influence of algorithm skills on computer science education students' effectiveness in web design.
3. There is a significant influence of analytical thinking skills on computer science education students' effectiveness in web design.
4. There is a significant influence of mathematical skills on computer science education students' effectiveness in web design.

Discussion of the Findings

Findings of the study are discussed based on the specific objectives of the study.

Programming Language Skills and Effectiveness in Web Design

Findings of the study revealed that there is a significant influence of acquisition of programming language skills on computer science education students' effectiveness in web design. The study revealed that for computer science education students to effectively design

websites, they need to acquire programming language skills. The knowledge of web development is becoming an essential skill for computer science education students and this cannot be achieved without the understanding of the construct and syntax of programming languages.

The findings of this study does not differ from the findings of Rosmah and Zamzuri (2014), who studied difficulties in understanding programming languages among computer science students. The findings of that study reported that using visualization tool to learn programming can help in being effective in web design.

Algorithm Skills and Effectiveness in Web Design

Findings of this study revealed that there is a significant influence of acquisition of algorithm skills on computer education students' effectiveness in web design. The study revealed that for computer science education students to effectively design a website, they need to acquire algorithm skills. Algorithm skills are required to write a good program that can facilitate website development.

The findings agree with the findings of Etokebe (2015), who conducted a study on the relationship between algorithm skills and students' ability to develop websites for companies. The findings of his study reported that there is a significant relationship between possession of algorithm skills and website design.

Analytical Thinking Skills and Effectiveness in Web Design

Findings of this study revealed that there is a significant influence of acquisition of analytical thinking skills on computer science education students' effectiveness in web design. The study revealed that for computer science education students to effectively design a website, they need to acquire analytical thinking skills. Analytical thinking skills which encompass problem solving and critical thinking is required in effective web design.

The findings of this study is in line with the findings of Ismail and Umar (2010), who studies the effect of analytical thinking on web development in Malaysia. The findings of their study revealed that programmers' deficiency in analytical thinking skills is directly related to inability to design effective website.

Mathematics Skills and Effectiveness in Web Design

Findings of this study revealed that there is a significant influence of acquisition of mathematics skills on computer education students' effectiveness in web design. The study revealed that for computer science education students to effectively design a website, they need to acquire mathematical skills, without adequate mathematical skills; a web designer is likely to write inefficient codes that has bugs and takes a long time to executes

The findings of this study does not differ from the findings of Owolabi, Olanipekun and Iwerima (2014), who studied mathematical ability and anxiety as determinants of achievement in programming for effective web design. The findings of their study revealed that the

correlation between mathematics ability or skill and achievement in basic programming are positive and significant.

Conclusion

Based on the findings of the study, the following conclusions were drawn.

1. It can be observed that the level of programming language skill required by computer education students have a positive influence on the students' effectiveness in designing a website.

2. A careful consideration of the influence of algorithm, analytical thinking skills and student's effectiveness in web designing based on the data gathered showed that there is a positive influence between the three variables. This implies that there is tendency for computer education students to improve on their algorithm and analytical thinking skills to facilitate their effective coding thereby enhancing their effectiveness in web design.

Recommendations

Based on the research findings and the conclusion drawn, the following recommendations were made:

1. Computer science education students should take their programming classes seriously in order to acquire programming skills that facilitate their effectiveness in web design.

2. Programming teachers should adopt pedagogical approaches to tackle the problems students encountered while learning web programming and also inculcate in the students adequate programming skills that will enable them to design websites effectively.

3. Industries, companies and organization should provide grant to computer education students to aid them acquire necessary facilities they will need in learning programming courses.

4. Government should provide adequate facilities required for the teaching and learning of web programming to computer education departments to enable the students learn and acquire relevant programming skills for effective web design.

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