DEVELOPMENT SKILLS IN SOFTWARE CODING AND TESTING NEEDED FOR RE-TRAINING OF COMPUTER EDUCATION GRADUATES IN SOUTH-SOUTH, NIGERIA

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Abstract
The study sought to determine quality software development skills in Coding and Testing needed for re-training of computer education graduates in South-South, Nigeria. Two specific objectives and two research questions were postulated to guide the study and two research hypotheses were formulated and tested at 0.05 level of significance. The study adopted descriptive survey research, the area of the study was Federal Universities in the South-South, Nigeria. The population of this study consisted of 692 final year Computer Education students and experts in five federal universities in South-South, Nigeria. The sample for the study consist of 253 respondents comprising 182 final year Computer Education students and 71 experts drawn from the total population of 692 students and experts in five Federal Universities offering Computer Education in South-South, Nigeria. Taro Yamane formula was employed to obtain the sample for the study. The researcher developed instrument titled "Quality Software Development Skills Need" (QSDSN). Questionnaire was used in collecting data both from Computer Education students and the software experts (the Computer Education lecturers). The instrument was face validated by three experts: one from the Department of Educational Foundations, Measurement and Evaluation, one from Computer Science Department and one from Industrial Technology Education. The corrections, suggestions and recommendations of these validates were incorporated into the final copy of the instrument. The instrument was subjected

to Cronbach Alpha Reliability Test to determine the internal consistency of the instrument and reliability coefficient of .92 was achieved. The data collected were analysed using mean ($\bar{X}$) and Improvement Need Index (INI) to answer the research questions while independent t-test was used to test all the research hypotheses at .05 level of significance. The findings revealed that computer education graduates need re-training in the Software Development Life Cycle (SDLC) of software coding and testing. It was recommended that the Federal Government of Nigeria should as a matter of urgency ensure training facilities and infrastructures are provided in the computer education units/Departments and lecturers should intensify effort to guide the computer education students to improve their skills in software coding and testing.

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Introduction

Increasing demand for digital technologies at work is raising the demand for new skills in software development. The rapid growth of new segments of the ICT sector, such as the Internet, e-commerce and IT services, has created new types of jobs requiring new skills (Organisation for Economic Cooperation and Development (OECD), 2015). The Bureau of Labour Statistics (2018) predicts that jobs in this field will grow by a significant 21% from 2018 to 2028. Jobs for software applications developers are expected to grow even faster, at 26% and employment of systems developers however, is projected to grow by 10%. This implies that there will be more job openings than there will be applicants. This gap is explained loosely to mean that there is widespread shortage of software developers. Lopez-Bassols (2002) opinioned that the concern is not just about the perceived shortage of workers, but the mismatch between current skills possessed by workers and the future skills demanded by software development companies

Software developers require the necessary technical skills to coding and testing. Kowalski (2019) commented that the software engineering talent shortage is that of quality, not just quantity**.** While software engineering is raising the demand for new skills, it also creates new horizons for education and training. This implies opportunities for graduates to be trained in the area of quality software development for determining types of software trending in industries, establishing skills gap between industries and graduates and advocacy for digital skills integration. One area of concern for education is skill needs for quality software development. Quality software development skills entails, coding and testing.

After designing the new system, the whole system is required to be converted into computer language. This phase is called coding. Coding is the conversion of data into computer language. Coding is an important stage where the defined procedures are transformed into control specifications by the help of a computer language (Bashiru, 2009). This is also called the programming phase in which the programmer converts the program specifications into new system. Programmers start building the entire system by writing code using the chosen programming language. In the coding phase, tasks are divided into units or modules. This helps in fast development, maintenance and future change if required. It is the longest phase of the Software Development Life Cycle process. As such, programmers must have skills and competencies in different high level programming languages such as C, C++, Pascal, Java, fortran and

PHP used for coding and others. The programming language is chosen with respect to the type of software being developed (Mendling, *et al.*, 2010). The next process after coding is software testing

The purpose of software testing analysis is either to assess software qualities or else to make it possible to improve the software by finding defects. Testing can reveal a fault only when the execution of the corresponding faulty element causes a failure. Although some primitive software development processes concentrate testing analysis at the end of the development cycle, today it is widely understood that execution of tests is a small part of the verification and validation process required to assess and maintain the quality of a software product. Testing analysis activities during development according to Mauro and Michal (2008) are intended primarily to reveal faults so that they could be removed. Level of testing to ensure fault free must encapsulate unit, integral and overall system testing. Identifying and removing as many faults as possible is a useful objective during development, but finding all faults is nearly impossible and seldom a cost-effective objective for a nontrivial software product. Testing analysis cannot go on forever: Products must be delivered when they meet an adequate level of functionality and quality.

Before actually implementing the new system into operations, a test run of the system is done to remove all the bugs if any. It is an important phase of a successful system. After coding the whole programs of the system, a test plan should be developed and run on a given set of test data and the output of the test

run should match the expected results (Bashiru, 2009). Using the test data, the unit test and the system test are carried out. The unit test is done when the programs have been coded and compiled and brought to working conditions, the individual unit is tested with the prepared test data and any undesirable happening is noted and debugged (error corrections). The system test is carried out after successful unit test. At this stage the test is done on actual data. The complete system is executed on the actual data. At each stage of the execution, the result or output of the system is analysed. During the result analysis, it may be found that the outputs are not matching the expected output of the system. In such case, the errors in the particular programs are identified and are debugged and further tested for the expected output. When the output is ensured as asserted by Bashiru (2009) the system is running error-free, then the users are called with their own actual data so that the system could be shown running the document as per their requirements. This has necessitated this study, to establish the software development skills coding and testing needed for re-training of Computer Education graduates for quality software development.

Statement of the Problem

The skills gap leads to less preference for Computer Education graduates who possess less software development skills. It also leads to widening skills gap between industries and educational training institutions and consequently, higher unemployment rate among Computer Education graduates. Universities

on their own part have tried to bridge this deficiency gap by reviewing their curricular and tilting towards practical-oriented courses.

There is increasing skill deficiency in quality software development among Computer Education graduates (Nwadiana, 2011). The most disturbing for educators has been the widening mismatch between skills possessed by Computer Education graduates and the skills demanded by software development and servicing companies. The skills mismatch accounts for most of the lack of opportunities in software development for Computer Education graduates. The knowledge of Computer Education graduates is good enough for the development of software, but it seems they are still deficient in skills needed for the development of quality software despite human potentials. The consequences of skills gap then result in companies or organizations failing to meet up with demand for quality software, create shortages in man power, cause unemployment and can also lead to loss of revenue as a result of lack of customer satisfaction on the software.

Expectations of a software developer should be centered on their drive to learn and develop trending skills continuously. This is essential to keep pace with changing skills set. Failure to adapt by developing new software skills will see Computer Education graduates being bumped out of software development jobs. Bridging the knowledge and skills gap requires an in-depth analysis of current software industry skills trend and a proactive approach by computer educators in capacity building of graduates in quality software development.

Purpose of the Study

The main purpose of the study was to determine the quality software development skills needed for re-training of computer education graduates in South-South, Nigeria. Specifically, the study sought to:

i. Determine the software coding needs skills needed for re-training graduates of Computer Education graduates in South-South Nigeria.
ii. Determine the software testing analysis skills needed for re-training graduates of Computer Education graduates in South-South Nigeria.

Research Questions

The following research questions were stated to guide the study

i. What are the software coding needs of Computer Education graduates for quality software development in South-South Nigeria?
ii. What are the software testing needs of Computer Education graduates for quality software development in South-South Nigeria?

Research Hypotheses

The following null hypotheses were tested at .05 level of significance

i. There is no significant difference in the mean responses of Computer Education graduates and experts in software coding needs for quality software development in South-South Nigeria.

ii. There is no significant difference in the mean responses of Computer Education graduates and experts in software testing needs for quality software development in South-South Nigeria.

Research Method

This study is a descriptive survey because the researcher collected data from a large sample of final year Computer Education students (respondents) in federal universities and experts in South-South Nigeria on quality software skill needed for re-training of Computer Education graduates in South-South Nigeria. The design therefore was appropriate for this study as it intended to obtain opinion from experts (lecturers) and final year Computer Education students in South-South on quality software development skills needed.

The study was conducted in South-South Zone of Nigeria. South-South Nigeria comprises six states, namely Akwa Ibom, Bayelsa, Cross River, Delta, Edo and Rivers States located within latitude 6.2059^{o}N and longitude 6.6959^{o}E of the Greenwich meridian. There are five federal Universities within the South – South that offer Computer Education programme namely: University of Uyo, Uyo; University of Port Harcourt, Port Harcourt; University of Calabar, Calabar; University of Benin, Benin and Federal University, Otuoke. The Zone has a lot of natural resources such as arable lands, solid minerals, oil and gas. Natural resources spur growth and encourage development, as the inhabitants take to different occupations. The rational for selecting this area for the study is hinged on the premise that the zone is opening up to industrialization and with a

growing youth population, technical training will be essential for filling the skills gap. Presently, the Zone is being promoted as investors' world. Several developmental and industrial activities are opening up new employment opportunities in software development, particularly in industries and project companies that require digital technology.

The population of this study consisted of 692 final year students and experts in five federal universities in South-South, Nigeria offering Computer Education discipline, between the period of 2019/2020 academic session. These states are Akwa Ibom, Cross River, Bayelsa, Rivers and Edo. The population was 692 final year students in the six Federal Universities and experts in South-South, Nigeria. The students' population in this study is considered as trainees in quality software development while the experts are adjudged to be quality software developers and practitioners. For the purpose of this study, the experts are the bench makers while the students are to attend to the benchmark set by the bench makers in this study.

The sample of the study consisted of 253 persons comprising 182 final year Computer Education students and 71 experts drawn from the total population of 692 students in the five states and experts in South-South Nigeria. Taro Yamane formula was employed to obtain the sample size of the study as presented in Appendix III. The computation yielded 253 which was converted to percentage (37%). This 37% of students and experts respectively from each state was finally selected by random sampling. A multi-stage sampling method was used

to select the sample of the study. This was done by stratifying the students and experts population into five clusters representing the five states in the south-south. The decision by the researcher to adopt 253 as a sample is supported by Akpomi and Ordu (2009) who presented a table for various levels of population with their corresponding.

The researcher developed instrument titled "Quality Software Development Skills Need Questionnaire" (QSDSNQ). This questionnaire was used in collecting data for the study. The instrument was meant for both final year Computer Education students and the software experts. The questionnaire was divided into two parts (A and B). Part "A" elicited information on software coding skills need and "B" solicited information from respondents on software testing skills need. The instrument contained a total of 42 items on quality software development coding and testing skills need.

The instrument was subjected to face validation in order to ensure that the research instrument is capable of soliciting for the required information from the respondents. The pool of items in the instrument was first given to English specialist to ensure that there are no grammatical errors. The research instrument was then face validated by three educational experts. Two experts were from the Department of Industrial Technology Education and one from the Department of Curriculum Studies, Educational Management and Planning, all in the University of Uyo. These experts were requested to go through the draft copies of the instrument and make necessary corrections. The corrections,

suggestions and recommendations of these validates were incorporated into the final version of the instrument.

The reliability of the instrument was determined through a trial-testing of the instrument on 20 randomly selected respondents of which 10 were experts and 10 were final year Computer Education students in the states studied who were part of the population but not part of the main study. Trial testing is a method that involves people performance in each item (Udoh, 2014). Cronbach alpha reliability formula was used to determine the internal consistency of the instrument which stood at 0.92. This coefficient justified the instrument reliable for the study.

The copies of the research instrument were administered by the researcher on the sample of 253 experts and final year students of the Computer Education in the five Federal Universities in South-South, Nigeria with the help of five research assistants from those five states. The research assistants were properly briefed on how to help the researcher to administer and collect the completed copies of the questionnaire within a space of two weeks. The experts' questionnaire was administered individually while the students' questionnaire was in a group. Out of 253 copies of questionnaire administered, 253 copies were successfully collected which represented 100% return rate. Data from the copies collected were used for analyses.

The data collected was analysed using the mean ($\bar{X}$) and Improvement Need Index (INI) to answer the research questions. Asukwo and Usip (2017), mean

and Improvement Need Index (INI) is suitable when a gap between needed level and performance level is to be established. The mean for each skill need of software experts was represented by standard ($\bar{X}N$) while the mean of performance of Computer Education students was represented by ($\bar{X}P$). The difference between the two mean ($\bar{X}N$ - $\bar{X}P$) were determined to indicate the performance gap (PG) which yielded a positive or a negative value. This method of data analysis was adopted for answering the research questions. The independent t-test was used to test the seven null hypotheses at 0.05 level of significance.

Results and Discussion

Research Question 1

What are the software skill coding needs of Computer Education graduates for quality software development in south-south Nigeria?

Table 1: Summary of Performance Gap Analysis of Mean Responses on Software Coding Skill Needs of Computer Education Graduates

S/N	Items	$\bar{X}N$ (Experts)	$\bar{X}P$ (Students)	GAP $\bar{X}N$-$\bar{X}P$	Remark
1	Skills in deciphering design specifications	3.53	2.56	0.79	Needed
2	Creativity skills	3.60	2.60	1.0	Needed
3	General Language skills proficiency	3.54	2.54	1.0	Needed
4	Java	3.56	2.60	0.96	Needed
5	Python	3.60	2.54	1.06	Needed
6	R	3.80	2.56	1.24	Needed

7	JavaScript	3.23	2.53	0.7	Needed
8	Swift	3.18	2.56	0.62	Needed
9	C++	3.54	2.60	0.94	Needed
10	C#	3.49	2.54	0.95	Needed
11	PHP	3.61	2.60	1.01	Needed
12	SQL	3.47	2.54	0.93	Needed
13	Go.	3.53	2.56	0.97	Needed
14	Logic skills	3.56	2.53	1.03	Needed
15	Code writing skills	3.60	2.62	0.98	Needed
16	Cultivating debugging skills	3.54	2.62	0.92	Needed
17	Modularization skills	3.49	2.56	0.93	Needed
18	Source Control	3.56	2.60	0.96	Needed
19	Adaptability skills	3.60	2.58	1.02	Needed
20	Data structures and algorithms skills	3.45	2.50	0.95	Needed

Source: Field Work, 2019

Data presented in Table 1reveal the mean rating of the opinion of the respondents on software coding skill needs of Computer Education graduates for quality software development in south-south Nigeria. The result showed that all the items have performance gap between 0.62 and 1.24 with positive values indicating that students' performance level is below what is needed as indicated by the experts. Therefore, software system coding skills are needed by Computer Education graduates for quality software development in south-south Nigeria.

Research Question 2

What are the software testing needs of Computer Education graduates for quality software development in south-south Nigeria?

Table 2: Summary of Performance Gap Analysis of Mean Responses on Software Testing Skill Needs of Computer Education Graduates

S/N	Items	$\bar{X}$N (Experts)	$\bar{X}$P (Students)	GAP $\bar{X}$N-$\bar{X}$P	REMARK
1	Control flow testing skills	3.54	2.54	1.0	Needed
2	Specification-based testing skills	3.59	2.60	0.99	Needed
3	Test verification skills	3.56	2.54	1.02	Needed
4	Test validations skills	3.56	2.56	1.0	Needed
5	Missing path fault testing	3.57	2.53	1.04	Needed
6	Statement testing skills	3.56	2.62	0.94	Needed
7	Branch testing skills	3.50	2.62	0.88	Needed
8	Condition testing skills	3.59	2.56	1.03	Needed
9	Path testing skills	3.50	2.60	0.9	Needed
10	Structural testing skills	3.83	2.54	1.29	Needed
11	Test specification plan development skills	3.23	2.60	0.63	Needed
12	Unit testing	3.61	2.54	1.07	Needed
13	Component testing	3.47	2.56	0.91	Needed
14	System testing	3.53	2.53	1.0	Needed
15	Performance testing	3.56	2.62	0.94	Needed
16	Load/stress testing	3.54	2.62	0.92	Needed
17	Browser compatibility	3.53	2.56	0.97	Needed
18	Usability testing	3.76	2.60	1.16	Needed
19	Security testing	3.71	2.60	1.11	Needed
20	Regression testing	3.25	2.54	0.71	Needed

21	Test simulation	3.66	2.60	1.60	Needed
22	Acceptance testing	3.59	2.54	1.05	Needed

Source: Field Work, 2019

Data presented in Table 2 revealed the mean rating of the opinion of the respondents on software testing skill needs of Computer Education graduates for quality software development in south-south Nigeria. The result show that all the items have performance gap to be between 0.63 and 1.60 with positive values indicating that students' performance level is below what is needed as indicated by the experts. Therefore, software system testing skills are needed by Computer Education graduates for quality software development in south-south Nigeria.

Research Hypothesis 1

There is no significant difference in the mean responses of Computer Education graduates and experts in software coding needs for quality software development in South-South Nigeria.

Table 3: Summary of t-test analysis of the difference in the mean responses experts expected performance rating and students performance rating in software coding skill needs for quality software development in south-south Nigeria, $n_1=71$, $n_2= 182$

S/N	Items	GROUP	$\bar{X}_1$ $\bar{X}_2$	t-cal	p-value	Remark
1	Skills in deciphering design specifications	Experts	3.53			
		Graduates	2.56	12.09	.000	Sig.
2	Creativity skills	Experts	3.60			
		Graduates	2.60	12.96	.000	Sig.
3	General Language skills proficiency	Experts	3.54			
		Graduates	2.54	13.94	.000	Sig.
4	Java	Experts	3.56			
		Graduates	2.60	12.38	.000	Sig.
5	Python	Experts	3.60			
		Graduates	2.54	15.01	.000	Sig.

6	R	Experts	3.80			
		Graduates	2.56	16.99	.000	Sig.
7	JavaScript	Experts	3.23			
		Graduates	2.53	10.14	.000	Sig.
8	Swift	Experts	3.18			
		Graduates	2.56	8.52	.000	Sig.
9	C++	Experts	3.54			
		Graduates	2.60	12.19	.000	Sig.
10	C#	Experts	3.49			
		Graduates	2.54	13.14	.000	Sig.
11	PHP	Experts	3.61			
		Graduates	2.60	13.17	.000	Sig.
12	SQL	Experts	3.47			
		Graduates	2.54	12.76	.000	Sig.
13	Go.	Experts	3.53			
		Graduates	2.56	12.09	.000	Sig.
14	Logic skills	Experts	3.56			
		Graduates	2.53	14.28	.000	Sig.
15	Code writing skills	Experts	3.60			
		Graduates	2.62	12.43	.000	Sig.
16	Cultivating debugging skills	Experts	3.54			
		Graduates	2.62	11.58	.000	Sig.
17	Modularization skills	Experts	3.49			
		Graduates	2.56	12.09	.000	Sig.
18	Source Control	Experts	3.56			
		Graduates	2.60	12.96	.000	Sig.
19	Adaptability skills	Experts	3.60			
		Graduates	2.58	13.94	.000	Sig.
20	Data structures and algorithms skills	Experts	3.45			
		Graduates	2.50	12.38	.000	Sig.

Source: Field Work, 2019

Table 3 gives the summary of the t-test analysis in the mean responses of Computer Education graduates and experts in software coding needs for quality software development in South-South Nigeria.

The result shows that all the items have p-values less than the 0.05 level of significance. Since all the calculated p-values were less than 0.05 level of significance, the null hypothesis which stated that there is no significant

difference in the mean responses of Computer Education graduates and experts in software coding needs for quality software development in South-South Nigeria is rejected. This implies that there is a significant difference in the opinion of experts and graduates in quality software development in South-South Nigeria.

Research Hypothesis 2

There is no significant difference in the mean responses of Computer Education graduates and experts in software testing needs for quality software development in South-South Nigeria.

Table 4: Summary of t-test analysis of the difference in the mean responses experts expected performance rating and students performance rating in software testing skill needs for quality software development in south-south Nigeria, $n_1=71$, $n_2= 182$

S/N	Items	Group	$\bar{X}_1$ $\bar{X}_2$	t-cal	p-value	Remark
1	Control flow testing skills	Experts Graduates	3.54 2.54	13.17	.000	Sig.
2	Specification-based testing skills	Experts Graduates	3.59 2.60	12.77	.000	Sig.
3	Test verification skills	Experts Graduates	3.56 2.54	14.36	.000	Sig.
4	Test validations skills	Experts Graduates	3.56 2.56	13.11	.000	Sig.
5	Missing path fault testing	Experts Graduates	3.57 2.53	14.49	.000	Sig.
6	Statement testing skills	Experts Graduates	3.56 2.62	11.86	.000	Sig.
7	Branch testing skills	Experts Graduates	3.50 2.62	11.04	.000	Sig.
8	Condition testing skills	Experts Graduates	3.59 2.56	13.57	.000	Sig.
9	Path testing skills	Experts Graduates	3.50 2.60	11.48	.000	Sig.

		Experts	3.83			
10	Structural testing skills	Graduates	2.54	18.95	.000	Sig.
		Experts	3.23			
11	Test specification plan development skills	Graduates	2.60	8.45	.000	Sig.
		Experts	3.61			
12	Unit testing	Graduates	2.54	15.24	.000	Sig.
		Experts	3.47			
13	Component testing	Graduates	2.56	11.67	.000	Sig.
		Experts	3.53			
14	System testing	Graduates	2.53	13.10	.000	Sig.
		Experts	3.56			
15	Performance testing	Graduates	2.62	11.86	.000	Sig.
		Experts	3.54			
16	Load/stress testing	Graduates	2.62	11.58	.000	Sig.
		Experts	3.53			
17	Browser compatibility	Graduates	2.56	12.79	.000	Sig.
		Experts	3.76			
18	Usability testing	Graduates	2.60	15.17	.000	Sig.
		Experts	3.71			
19	Security testing	Graduates	2.60	14.67	.000	Sig.
		Experts	3.25			
20	Regression testing	Graduates	2.54	10.16	.000	Sig.
		Experts	3.66			
21	Test simulation	Graduates	2.60	13.79	.000	Sig.
22	Acceptance testing	Experts	3.59			
		Graduates	2.54	14.79	.000	Sig.

Source: Field Work, 2019

Table 4 gives the summary of the t-test analysis in the mean responses of Computer Education graduates and experts in software testing needs for quality software development in South-South Nigeria.

The result shows that all the items have values less than the 0.05 level of significance. Since all the calculated p-values were less than 0.05 level of significance, the null hypothesis which stated that there is no significant difference in the mean responses of Computer Education graduates and experts

in software testing needs for quality software development in South-South Nigeria is rejected. This implies that there is a significant difference in the opinion of experts and graduates in quality software development in South-South Nigeria.

Discussion of Findings

The result of the findings revealed that there is a gap in the performance level of Computer Education graduates in software coding skills compared with the basic level of expected performance. Also, the t-test analysis indicated that there is a significant difference in the mean responses of experts expected performance rating and Computer Education graduates' performance in software coding for quality software development in South-South Nigeria. The possible reason for the performance gaps could be that the graduates might not have been exposed to every aspect of software coding skills in the curriculum. Perhaps for Computer Education graduates to succeed in software development, they require adequate exposure to software coding skills to enable them put up code that will implement software design.

The result of the findings of this study is buttressed by Mărășoiu, *et al.* (2013) who opined that learning to code is generally considered hard and coding courses often have high dropout rates. In the same vein, Todd (2014) also reported that graduates are attending a university not out of a driving curiosity about a particular subject or a burning ambition to excel in a particular profession but to obtain qualification for a job. The performance gap in

software coding revealed in this study is also in support of the finding of Sami and Tarja (2002) Who found that most students choose to seek their computer education through concentrating on the softer, less technical aspect (coding), which is a combination of computer engineering and computer science. The findings of this study implies that for Computer Education graduates to bridge the performance gap created by their lack of skills in software coding, the experts will need to re-train them in the environment which is a replica of the environment they would subsequently work.

The result of the findings revealed that there is a gap in the performance level of Computer Education graduates in software testing skills compared with the basic level of expected performance. Also, the t-test analysis indicated that there is a significant difference in the mean responses of experts expected performance rating and Computer Education graduates' performance in software testing for quality software development in South-South Nigeria. The difference in responses could be as a result of the fact that the students are not yet exposed to the expected skills or the level of exposure is not adequate enough to enable them be at the same level with experts. Inability of Computer Education graduates to acquire the expected level of software testing skills will significantly affect their ability to develop quality software.

The result of this findings is in line with the assertion by Davide, *et al.* (2014) who identified the following skills for testing a software product as entering and editing data, searching records, condition testing etc. Computer Education

graduates need these skills to develop quality software for organizations in need of software. This then follows that Computer Education graduates need to build their skills in various software testing skills such as condition testing to enhance their capacity to develop quality software.

Conclusion

Based on the findings of the study, it was concluded that the computer experts in the industry and the University lecturers identified and agreed to the identified skill as being a software cycle that the student of Computer Education should possess in order to develop quality software in South-South States of Nigeria.

Recommendations

On the bases of the findings and the conclusion, the following recommendations were made:

i. Expert/lecturers should guide the Computer Education students to improve their skills in quality software development.
ii. The University management should organize workshop and invite experts in software development to sensitize Computer Education students on quality software development.

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