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QUALITY SOFTWARE DEVELOPMENT REQUIREMENT ELICITATION, SYSTEM ANALYSIS AND SYSTEM DESIGN SKILLS 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 needed for re-training of computer education graduates in South-South, Nigeria. Three specific objectives and three research questions were postulated to guide the study and three 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 ($\overline{X}$) 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 elicitation needs, analysis needs and system design needs. 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 quality software development.
Keywords: software development, requirement elicitation, system analysis, system design, skills

Introduction

Digital technologies are electronic tools, systems, devices and resources that accept, store and process data. Well known examples include social media, online games, multimedia and mobile phones. The pervasive of digital technologies in daily life is fundamentally changing the lifestyle of industries and individuals alike. Digital technologies are fuelling new models of businesses like online shopping, learning, business models and service delivery channels, virtual businesses, personal lifestyle, communication services and virtually all aspects of modern business and living. As digital technologies reshape competition, Tobias, *et al.* (2016) found that products and services increasingly depend on software for differentiation and performance. It is computer software that drives digital technologies such as smartphones and other interfaces that guide consumer interactions.

Quality software development skills entails, requirement elicitation, system analysis and system design. Software development process according to Geoffrey (2004) is the process of dividing software development work into distinct phases to improve design, product management, and project management. It is also known as a Software Development Life Cycle (SDLC). The main idea of the SDLC has been to pursue the development of information systems in a very deliberate, structured and methodical way, requiring each stage of the life cycle from inception of the idea to delivery of the final system to be carried out rigidly and sequentially within the context of the framework being applied. There are numerous system models, but their variations tend to be more superficial than real. Various models as asserted by Kowalski (2019) may carry different names, the system pie may be cut at different points and in different shapes, but the phases and components are identical in most essential ways; software requirement, elicitation needs, software analysis/planning needs and system design needs.

Software requirement elicitation is the process of defining user expectations for new software being built or modified. In software engineering, it is sometimes referred requirements elicitation or requirements capturing. Richard and Edward (2000), requirements elicitation encompasses those tasks that go into determining the needs or conditions to meet for a new or altered product or project, taking account of the possibly conflicting requirements of the various stakeholders, analyzing, documenting, validating and managing software or system requirements. The process to gather the software requirements from client, analyze and document them is known as requirement engineering. This process require certain skills for its success. Skills such as interview skills, survey skills, task analysis, domain analysis, prototyping as well as identification of the functional and non-Functional software requirements. This study adopted the waterfall model of quality software development by Shadi (2018).

The adopted steps are preceded by the software analysis phase with its own underpinning set of skills. The purpose of software analysis/planning is to establish reasonable plans for performing the

software engineering and for managing the software project. Software analysis involves developing estimates for the work to be performed, establishing the necessary commitments and defining the plan to perform the work.

The software analysis process in the view of Gurcan and Kose (2017) involves a set of interrelated activities followed in an orderly manner to implement user requirements in software and includes the description of a series of software planning activities and individual(s) responsible for performing these activities. Software planning skills include skills in creating work break down structure, scheduling skills, skills in developing the risk management plan, gantt charts, dashboards and reporting skills. Beyond the analysis needs, is the system design needs.

Software design is a phase in software engineering, in which a blueprint is developed to serve as a base for constructing the software system (Ralph and Wand, 2009). In the design phase, many critical and strategic decisions are made to achieve the desired functionality and quality of the system. Software design is the most important phase of the software development cycle. Once the requirements proposal document for the software to be developed is available, the software design phase begins. While the requirement specification activity deals entirely with the problem domain, design is the first phase of transforming the problem into a solution. In the design phase, the customer and business requirements and technical considerations come together to formulate a product or a system.

The design model provides details about software data structures, architecture, interfaces and components which are required to implement the system. Some of the skills in system design are logical design skills, Physical Design skills, Architectural Design skills and Detailed Design skills. As the process of system design is completed, the next phase is the software coding stage with its own defined set of skills (Ralph and Wand, 2009).

The need for better matching of the content of higher education courses to employers' needs and improving higher education/ industry relationships have been highlighted as needed by several studies on the IT industries. This has necessitated this study, to establish the skills needed for re-training of Computer Education graduates for quality software development.

Statement of the Problem

The national benchmark and minimum standard for Computer Science Education in the University is geared towards the acquisition of Computer Science skills so that graduates will be robust at solving industrial problems relating to information and communication technology. There are graduates who are sound in knowledge but lack capacity for utilising practical skills to solve problems. As such, graduates are involved more in memorisation of concepts; this has made them to be found wanting in performing practical oriented jobs. 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.

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 requirement elicitation skills needed for re-training graduates of Computer Education graduates in South-South Nigeria.

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

iii. Determine the software system design 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 requirement elicitation needs of Computer Education graduates for quality software development in South-South Nigeria?

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

iii. What are the software system design 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 on software requirement elicitation 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 analysis needs for quality software development in South-South Nigeria.

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

Research Design

The study employed the descriptive survey research design. A descriptive survey is that in which the researcher collects data from a large sample drawn from a given population and describes certain characteristics of the sample as they are at the time of the study (Nwankwo, 2016). According to Ukwuije and Obowu-Adutchay (2012), descriptive survey employ the use of sample to represent the entire population and it uses data collection techniques such as questionnaire, tests and interview.

Area of the Study

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.

Population of the Study

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.

Sample and Sampling Technique

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. 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 sample.

Instrumentation

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" contained the personal data of the respondents. Part "B" contained the statements on the independent sub-variables which were grouped into eight sections (A – C). Section "A" solicited information from the respondents on software requirement elicitation skills need. Section "B" sought information on software analysis skills need and Section "C" elicited information from respondents on software design skills need. The instrument contained a total of 23 items on quality software development skills need.

Validation of the Instrument

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.

Reliability 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). This method of reliability is associated with the use of Cronbach alpha formula. According to Udoh (2014), when the options in the items are on scale such as Strongly Agree, Agree, Disagree and Strongly Disagree, Cronbach alpha coefficient is applied. 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 use of Cronbach alpha formula is suitable in determining internal consistency of instrument.

Method of Data Collection

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.

Method of Data Analysis

The data collected was analysed using the mean ($\bar{X}$) and Improvement Need Index (INI) to answer the research questions. According to Madu and Iyiela (2013) in 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 requirement elicitation needs of Computer Education graduates for quality software development in South-South Nigeria?

Table 1: Quality Software Requirement Elicitation Skills needed by Computer Education Graduates

S/N	Items	$\bar{X}$N (Experts)	$\bar{X}$P (Students)	GAP $\bar{X}$N-$\bar{X}$P	REMARK
1	Requirements elicitation skills	3.56	2.56	1.0	Needed
2	Business requirements specification skills	3.60	2.60	1.0	Needed
3	Software requirements specification skills	3.54	2.54	1.0	Needed
4	Skills in identifying functional Requirements	3.49	2.60	0.8	Needed
5	Skills in planning for non-functional requirements	3.61	2.54	1.07	Needed
6	Diagnostics and fault management requirement skills	3.47	2.56	0.91	Needed
7	Skills in identifying safety requirements	3.53	2.53	1.0	Needed
8	Requirements verification skills	3.60	2.56	1.04	Needed
9	Requirements validation skills	3.54	2.53	1.01	Needed
10	Requirement modeling skills	3.56	2.65	0.91	Needed
11	Requirements management skills	3.60	2.57	1.03	Needed

Source: Field Work, 2019

Data presented in Table 1 revealed the mean response of the respondents on software requirement elicitation needs of Computer Education graduates for quality software development in south-south Nigeria. The result showed that all the items have performance gap between 0.8 and 1.07 with positive values indicating that students' performance level is below what is needed as indicated by the experts. Therefore, software requirement elicitation skills are needed by Computer Education graduates for quality software development in South-South Nigeria.

Research Question 2

What are the software analysis 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 Analysis 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	Time management skills	3.56	2.56	1.0	Needed
2	Cost estimation skills	3.60	2.53	1.07	Needed
3	Survey skills	3.54	2.56	0.98	Needed
4	Task analysis skills	3.49	2.53	0.96	Needed
5	Domain analysis skills	3.84	2.87	0.97	Needed
6	work breakdown structure (WBS) skills	3.23	2.54	0.69	Needed
7	Resource/project Scheduling skills	3.46	2.56	0.9	Needed
8	Risk management skills	3.46	2.52	0.94	Needed
9	Gantt Chart construction skills	3.46	2.49	0.97	Needed
10	Project evaluation and monitoring skills	3.80	2.49	1.31	Needed

11	Project Communication Management skills	3.23	2.56	0.67	Needed
12	Project Reporting skills	3.18	2.53	0.65	Needed

Source: Field Work, 2019

Data presented in Table 2 shows the mean rating of the opinion of the respondents on software analysis needs of Computer Education graduates for quality software development in south-south Nigeria. The result showed that all the items have performance gap between 0.65 and 1.31 with positive values indicating that students' performance level is below what is needed as indicated by the experts. Therefore, software analysis skills are needed by Computer Education graduates for quality software development in south-south Nigeria.

Research Question 3

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

Table 3: Summary of Performance Gap Analysis of Mean Responses on Software Design 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	Flow chart skills	3.54	2.56	0.98	Needed
2	Data design skills	3.49	2.60	0.89	Needed
3	Architectural design skills	3.61	2.54	1.07	Needed
4	Conceptual-level design skill	3.47	2.60	0.87	Needed
5	Interphase design skills	3.53	2.54	0.99	Needed
6	Modularity skills	3.60	2.56	1.04	Needed
7	Functional abstraction skills	3.49	2.53	0.96	Needed
8	Control abstraction skills	3.84	2.62	1.22	Needed
9	Data abstraction skills	3.23	2.62	0.61	Needed
10	Structural partitioning skills	3.46	2.56	0.9	Needed
11	Information hiding skills	3.46	2.60	0.86	Needed
12	Refinement skills	3.46	2.58	0.88	Needed
13	Testing skills	3.53	2.50	1.03	Needed
14	Debugging skills	3.40	2.59	0.81	Needed

Source: Field Work, 2019

Data presented in Table 3 revealed the mean rating of the opinion of the respondents on software design skills needs of Computer Education graduates for quality software development in south-south Nigeria. The result showed that all the items have positive performance gap between 0.81 and 1.22 indicating that students' performance level is below what is needed as indicated by the experts. Therefore, software system design 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 requirement elicitation 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 requirement elicitations skill needs for quality software development in south-south Nigeria, $n_1=71$, $n_2= 182$

S/N	Items	Group	n	$\bar{X}_1$ $\bar{X}_2$	t-cal	p-value	Remark
1	Requirements elicitation skills	Experts Graduates	71 182	3.56 2.56	13.11	.000	Sig.
2	Business requirements specification skills	Experts Graduates	71 182	3.60 2.60	12.96	.000	Sig.
3	Software requirements specification skills	Experts Graduates	71 182	3.54 2.54	13.94	.000	Sig.
4	Skills in identifying functional requirements	Experts Graduates	71 182	3.49 2.60	11.45	.000	Sig.
5	Skills in planning for non-functional requirements	Experts Graduates	71 182	3.61 2.54	15.24	.000	Sig.
6	Diagnostics and fault management requirement skills	Experts Graduates	71 182	3.47 2.56	11.67	.000	Sig.
7	Skills in identifying safety requirements	Experts Graduates	71 182	3.53 2.53	13.11	.000	Sig.
8	Requirements verification skills	Experts Graduates	71 182	3.60 2.56	13.72	.000	Sig.
9	Requirements validation skills	Experts Graduates	71 182	3.54 2.53	14.44	.000	Sig.
10	Requirement modeling skills	Experts Graduates	71 182	3.56 2.65	10.82	.000	Sig.
11	Requirements management skills	Experts Graduates	71 182	3.60 2.57	14.04	.000	Sig.

- Significant at 0.05 level

Source: Field Work, 2019

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

Table 5: Summary of t-test analysis of the difference in the mean responses experts expected performance rating and students performance rating in software system analysis skill needs for quality software development in south-south Nigeria, $n_1=71$, $n_2= 182$

S/N	Items	Group	$\overline{X}_1$ $\overline{X}_2$	t-cal	p-value	Remark
1	Time management skills	Experts	3.56		.000	
		Graduates	2.56	13.11		Sig.
2	Cost estimation skills	Experts	3.60		.000	
		Graduates	2.53	14.92		Sig.
3	Survey skills	Experts	3.54		.000	
		Graduates	2.56	12.92		Sig.
4	Task analysis skills	Experts	3.49		.000	
		Graduates	2.53	13.62		Sig.
5	Domain analysis skills	Experts	3.84		.000	
		Graduates	2.87	14.85		Sig.
6	work breakdown structure (WBS) skills	Experts	3.23		.000	
		Graduates	2.54	9.35		Sig.
7	Resource/project Scheduling skills	Experts	3.46		.000	
		Graduates	2.56	6.60		Sig.
8	Risk management skills	Experts	3.46		.000	
		Graduates	2.52	11.60		Sig.
9	Gantt Chart construction skills	Experts	3.46		.000	
		Graduates	2.49	11.71		Sig.
10	Project evaluation and monitoring skills	Experts	3.80		.000	
		Graduates	2.49	16.79		Sig.
11	Project Communication Management skills	Experts	3.23		.000	
		Graduates	2.56	10.05		Sig.
12	Project Reporting skills	Experts	3.18		.000	
		Graduates	2.53	10.41		Sig.

Source: Field Work, 2019

Table 5 gives the summary of the t-test analysis in the mean responses of Computer Education graduates and experts in software system analysis 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 system analysis 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 3

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

Table 6:Summary of t-test analysis of the difference in the mean responses experts expected performance rating and students performance rating in software design 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
		Experts	3.54		.000	
1	Flow chart skills	Graduates	2.56	12.92		Sig.
		Experts	3.49		.000	
2	Data design skills	Graduates	2.60	11.45		Sig
		Experts	3.61		.000	
3	Architectural design skills	Graduates	2.54	15.01		Sig
		Experts	3.47		.000	
4	Conceptual-level design skill	Graduates	2.60	10.99		Sig
		Experts	3.53		.000	
5	Interphase design skills	Graduates	2.54	13.15		Sig
		Experts	3.60		.000	
6	Modularity skills	Graduates	2.56	13.72		Sig
		Experts	3.49		.000	
7	Functional abstraction skills	Graduates	2.53	13.27		Sig
		Experts	3.84		.000	
8	Control abstraction skills	Graduates	2.62	16.27		Sig
		Experts	3.23		.000	
9	Data abstraction skills	Graduates	2.62	7.94		Sig
		Experts	3.46		.000	
10	Structural partitioning skills	Graduates	2.56	11.86		Sig
		Experts	3.46		.000	
11	Information hiding skills	Graduates	2.60	10.95		Sig
		Experts	3.46		.000	
12	Refinement skills	Graduates	2.58	11.47		Sig
		Experts	3.53		.000	
13	Testing skills	Graduates	2.50	13.27		Sig
		Experts	3.40		.000	
14	Debugging skills	Graduates	2.59	10.95		Sig

Source: Field Work, 2019

Table 6 gives the summary of the t-test analysis in the mean responses of Computer Education graduates and experts in software design 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 design 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.

Findings of the Study

The result of data analysed reveals the following findings based on research questions answered and null hypotheses tested.

i. Computer Education graduates need quality software development skills in all the listed items on software requirement elicitation for quality software development in South-South Nigeria.

ii. Computer Education graduates need quality software development skills in all the listed items on software system analysis for quality software development in South-South Nigeria.

iii. Computer Education graduates need quality software development skills in all the listed items on software design for quality software development in South-South Nigeria.

Discussion of Findings

The findings of this study are discussed based on the specific purposes of the study

Software Requirement Elicitation Skill Need for Quality Software Development of Computer Education Graduates

The findings of the study revealed that there is a gap in the performance level of Computer Education graduates in software requirement elicitation 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 requirement elicitation for quality software development in South-South Nigeria. This difference in response 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 the experts. Inability of Computer Education graduates to perform the expected level of software requirement elicitation will significantly affect the students' ability to collect required information in a system development related job since skills in software requirement elicitation are indispensable in any system development related job.

The result of this study is in line with the findings of Sami and Tarja (2002) who found out that there is a significant difference in the mean response of lecturers and graduates on all the null hypotheses

tested. This difference in responses may be because experts know what skills are needed to design database while students are not exposed nor have little exposure to software development find the skills as not necessary. This is because in the acquisition and development of skills, one needs to first be a novice and then practice through to become an expert. As such both the experts and the students are expected to differ in their opinion on software requirement elicitation skill needs for quality software development. When Computer Education graduates lack the basic software requirement elicitation skills, software that do not capture all the functionalities will be developed that do not meet the requirement of the client. It then follows that for quality software development, Computer Education graduates need more training to bridge the identified gaps on software requirement elicitation skills acquisition.

Software Analysis Skill Need for Quality Software Development of Computer Education Graduates

The findings of the study revealed that there is a gap in the performance level of Computer Education graduates in software analysis 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 analysis for quality software development in South-South Nigeria. Although, inculcation of system analysis skills is among the focus of system analysis and design as enshrined in the Computer Education curriculum, the result of the clearly shows that students are yet to attain the expected level of system analysis skill for quality software development. Hence, organization depending on system analyst could be frustrated in the near future if nothing is done. This is because software system analysis skills can help graduates of computer education to analyze a system; hence skills acquired could be employed for quality software development.

The result of the study is in support of Gurcan and Kose (2017) who maintained that graduates encountering the process of system analysis for the first time find it difficult to understand the concept of software system analysis and consequently are not able to analyse a given system. The findings of this study is also in corroboration with assertions by Suryanarayana (2014) who also maintained that software system analysis is always difficult to be presented by most lecturers to the graduates and that it is often difficult to motivate graduates to learn software system analysis because of dry and theoretical way in which it is presented in classes and textbooks. Ability to analyse a system would help students apply such skills to in the software development process. Lecturers should encourage graduates to practice system analysis through practical oriented lectures as this will reduce the much theoretical nature to practical based concept which would help graduates employ such in quality software development.

Software Design Skill Need for Quality Software Development of Computer Education Graduates

The findings of the study revealed that there is a gap in the performance level of Computer Education graduates in software design 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 design for quality software development in South-South Nigeria. Although, inculcation of system design skills is among the focus of system analysis and design as enshrined in the Computer Education curriculum, the result of the clearly shows that students are yet to attain the expected level of system design skill for quality software development. This is simply as a result of the fact that the graduates are yet to acquire the expected level of software design skill, which software analysis and design contents in Computer Education is designed to provide. Inability of Computer Education graduates to acquire the expected level of software design skill will significantly affect software design for quality software development in South-South Nigeria. This is because software design skills are essential for software development.

The result of this study is in agreement with the findings of Meristo, *et al.* (2002) which revealed that vocational education graduates ability to create quality products is influenced not just by a single vocational skill but by a combination of skills. This implies that for Computer Education graduates to be able to develop quality software, they require a combination of skills related to software development, one of such skills will be to design the logical flow of the software.

The main concern lies on the ability of Computer Education graduates to apply the appropriate software design skills based on the performance gap as identified in the study. Poor software design skills will lead to poor design of logical flows and this can cause the non achievement of quality software product development. The findings of this study implies that in order to acquire the expected level of software design skills for error-free quality software, Computer Education graduates need more training in software design skills to bridge the existing performance gaps.

Summary of the Findings

The findings revealed the following based on research questions answered and null hypotheses tested.

i. Computer Education graduates need quality software development skills in all identified items on software requirement elicitation for quality software development in South-South Nigeria.

ii. Computer Education graduates need quality software development skills in all identified items on software system analysis for quality software development in South-South Nigeria.

iii. Computer Education graduates need quality software development skills in all identified items on software design for quality software development in South-South Nigeria.

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. Graduates of Computer Education should be trained and retrained in the cycle of quality software development.

ii. Qualified lecturers in software development should be employed to teach Computer students on quality software development skills.

iii. The Federal Government should as a matter of urgency ensure that teaching facilities and infrastructures are provided in the universities in South-South for quality teaching of the students in software development.

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