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Confidence level and school experiences of final year undergraduates of computer science in South-West Nigerian universities

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Confidence level and school experiences of final year undergraduates of computer science in South-West Nigerian universities

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Abstract: This research explores the connection between the confidence level and university experiences of final year undergraduates of Computer Science across universities in the South-West region of Nigeria. A descriptive survey design was adopted for this study and 450 final year undergraduates were proportionately selected for the investigation. Computational task self-confidence questionnaire (CTSCQ) was used for data collection which demonstrated a high reliability with a Cronbach's alpha (α) of 0.89. Statistical analysis, including mean, standard deviations, frequencies, percentages, and linear regression, revealed that the final year undergraduates exhibited moderate confidence in computational tasks, indicating potential for growth in self-efficacy. Additionally, a notable correlation was found between the students' university experiences and their confidence level, suggesting that integrating positive learning experiences – aligned with Bandura's self-efficacy theory – could boost both satisfaction and confidence. The study recommends inviting industry experts as guest lecturers, increasing hands-on training, and prioritising student learning experiences in curriculum development.

Keywords: computer science; university experiences; undergraduates; confidence level.

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This paper is a revised and expanded version of a paper entitled 'Evaluation of the self-efficacy and learning experiences of final year students of computer science of Southwest Nigerian Universities' presented at the NigeriaLics International Conference held at the University of Lagos, Lagos, Nigeria, 9th-10th February 2023.

1 Introduction

Human resources in the form of computer professionals are critical to the nation's efforts to join the information society, and this cannot be achieved without a strong educational and research base. Self-efficacy is one of the most important topics in contemporary education. It provides an understanding of how students interpret their academic ability, and how this belief influences the manner in which they behave, feel, and think. Students

hold beliefs specific to academic achievement, and the concept of self-efficacy deals with self-judgement of capability to carry out a given level of performance (Zhang, 2021). Employers have voiced worries about the knowledge and abilities of graduates to operate successfully in evolving technological and commercial environments. It is believed that graduates do not show readiness to face the complexities and problems of the workplace due to their low level of skills and uncertainty of what they can do. Therefore, this study purposefully investigated the confidence level of final year computer science undergraduates in computational tasks. It also explores the relationship between computer science undergraduates' confidence levels and their school experiences. This is a critical group to study because they are on the verge of their career and are about to enter into a job market that is one of the most demanding and dynamic today.

Two research questions were raised and one hypothesis was formulated for this study. They are:

- 1 What is the level of confidence of the final year undergraduates of computer science?
- 2 What are the university experiences of the final year undergraduates of computer science?

Hypothesis (H0) There is no relationship between the confidence level and university experiences of the final year undergraduates in computer science.

2 Related literature

The dynamic and evolving nature of ICT demands a cadre of people who are well-prepared with adequate knowledge and skills to effectively carry out their tasks in the workplace. Research has identified self-efficacy/self-confidence as a key factor in how people approach their activities and overcome difficulties (Schunk and Dibenedetto, 2021). The learners' confidence in their capacity to succeed in school has been demonstrated to be a reliable indicator of motivation and performance.

2.1 *Self-confidence/self-efficacy/self-belief*

Self-efficacy/self-belief or self-confidence is a relatively stable belief that one has the necessary ability to achieve a specific task. Students who have high self-efficacy are confident people and they see tough jobs as challenges to overcome rather than dangers to avoid (Solfema et al., 2019). The level of confidence of people has a big impact on how well they learn and how well they do in and out of school (Dianito et al., 2021; Yapo et al., 2021). According to social cognitive theory, self-efficacy affects one's choice of activities, effort, and perseverance despite difficulties. Self-efficacy has been found to be related to a variety of factors and has been studied in different fields, although research in this area among computer science students is quite limited.

Studies shows varying confidence levels of students studying computer science, and that several factors influenced their self-confidence. The difference in their confidence level may affect their better academic performance and better coding comprehension (Chen et al., 2024). Long-term computer familiarity, majoring in computer science, and the growth of metacognitive abilities are all factors that leads to greater confidence

(Pirttinen et al., 2020; Napier, 2019). Students with higher computer self-efficacy were reported to have lower Computer-Based Test anxiety in Nigeria and psychological interventions could enhance computer self-efficacy of students (Balogun and Olanrewaju, 2016). A study by Awofala et al. (2015) found high computer self-efficacy among preservice science, technology and mathematics teachers, with gender significantly influencing self-efficacy. Irwanti et al. (2023) reported from a study of 307 final year students that the higher the self-efficacy of students, the lower quarter-life the students experienced and the other way round.

2.2 Learning experiences

The undergraduates' learning experiences and views about their efficacy are closely related (Kustyarini, 2020). They are more likely to approach learning as a joyful and gratifying experience when they have confidence in their talents. They have higher levels of motivation to establish difficult goals, persevere despite challenges, and use self-regulatory learning techniques. Students' university experiences can differ significantly based on the particular program or subject of study they choose to pursue and the school they attended. Some graduates may have participated in extracurricular activities including study abroad opportunities, internships, service learning, or research projects at the undergraduate level. Through hands-on activities outside of a standard academic framework, these encounters provide the chance to build knowledge, skills, and values (Sonetti et al., 2020). They give the chance to put their theoretical learning into practice and pick up common workplace abilities, which are frequently required for job preparedness. The choice of theoretical learning chosen by graduates is frequently overshadowed by the emphasis on graduate employability. Employers today place a lot of emphasis on hiring people who not only have the necessary technical knowledge and skills but also exhibit 'soft' skills (Munir, 2022). This is because the employment market is so competitive. The capacity to find a job overtakes academic merit as the primary motivation for earning a degree, and graduates strive to improve their employment prospects by integrating internships and career-related training into their degree programs. The emphasis on employability in higher education should drive institutions to offer more hands-on learning opportunities and practical training to help graduates find employment.

The experiences of final-year undergraduate computer science students have been examined in recent research. Studies have brought attention to differences in the experiences of underrepresented groups, such as female students, URM students, LGBTQ+ students, and students with disabilities, underscoring the need for focused assistance (Slougher et al., 2019). Although their real performance is on par with native speakers, non-native English speakers encounter particular difficulties, frequently needing higher grades and longer study time (Guzman et al., 2021). Even in large-scale group-based settings, early undergraduate research experiences have been found to have a favourable impact on students' self-esteem, feeling of community, and retention. Compared to control groups, participants in these programmes exhibit higher GPAs, more confidence, and a stronger interest in research (Alvarado et al., 2019). These results highlight the value of varied research opportunities and support networks in improving undergraduate computer science students' university experiences.

Despite, studies that examined and reported the confidence level of final year students of computer science and their learning experiences are scarce, hence, this study would show how students' learning experiences and their level of self-efficacy in computational tasks relate to one another. Additionally, it would include suggestions for how institutional activities and services should be improved to better support graduates as they transition from school to the workforce. It would also provide an answer to the query of how ready graduates of computer science are for gainful work.

3 Method

This study employed a descriptive survey research design. The population of the study comprises 4,500 final year undergraduates of computer science at Southwest Nigerian universities. Nine universities that were duly accredited by the computer professional (registration council) of Nigeria and the National University Commission (NUC) as of 2018 were purposely selected for the study. 50 final year students of computer science from each of the nine universities making 450 final year students were proportionately selected. This sample is considered to be the convenience sample as it is common in information systems research (McMurtrey et al., 2008).

The final year undergraduates were considered appropriate on the premise that they have present-day memory of the undergraduate computer science curriculum and have undergone the student industrial work experience scheme (SIWES). The students were at their final year as at year 2023 when the study was conducted. The instrument used for data collection, computational task self-confidence questionnaire (CTSCQ), was a structured questionnaire adapted from the Computer programming self-efficacy scale of Tsai et al. (2019) was adapted to form a 23-item scale which assessed the confidence level of the final year undergraduates in all courses covered in the undergraduate computer science curriculum. The items were measured using seven Likert's type rating scale options while the university experiences were measured with a 9-item scale using five points Likert's rating scale options adapted from Koppi et al. (2010). The undergraduate computer science curriculum was also consulted in the design process and experts in computer science education validated the instrument. CTSCQ was pilot tested among the undergraduates of computer science in two universities outside the main study area and a reliability coefficient of 0.5 was obtained and considered strong for the research instruments. Cronbach's alpha (α) was used to check the internal consistency of the instrument and values of 0.89 and 0.92 were obtained for the confidence level and the university experiences respectively. A total of 450 copies of CTSCQ was administered to the respondents, and 408 of the questionnaires were returned which implies that 90.6% of the returned questionnaire was used for the analysis. The responses were analysed using SPSS 23.0 for windows through mean, standard deviation, frequency, percentages, and linear regression.

4 Result

Research question 1 What is the confidence level of the final year undergraduates of computer science?

Table 1 Confidence level of Final year undergraduates of computer science in computational tasks given as frequency, percentage, mean and standard deviation (N = 408)

<i>Variable/scale</i>	<i>Not confident at all</i>	<i>Mostly not confident</i>	<i>Slightly confident</i>	<i>50/50</i>	<i>Fairly confident</i>	<i>Mostly confident</i>	<i>Absolutely confident</i>	<i>Mean</i>	<i>Standard deviation</i>
<i>Computer programming and database management</i>									
Programming in different languages	50 (14.2)	30 (7.4)	42 (10.3)	74 (18.1)	84 (20.6)	61 (15.0)	59 (14.5)	4.2623	1.92930
Designing the user interface	63 (15.4)	42 (10.3)	40 (9.8)	70 (17.2)	72 (17.6)	66 (16.2)	55 (13.5)	4.1373	1.98168
Developing web applications	68 (16.7)	31 (7.6)	51 (12.6)	69 (17.0)	76 (18.7)	61 (15.0)	50 (12.3)	4.0764	1.95923
Performing object-oriented design	74 (18.3)	45 (11.1)	48 (11.9)	62 (15.3)	67 (16.4)	64 (15.8)	45 (11.1)	3.9259	2.00234
Developing a software application	101 (24.9)	62 (15.3)	53 (13.1)	48 (11.9)	55 (13.6)	49 (12.1)	37 (9.1)	3.4667	2.03849
Database modelling development	87 (21.5)	50 (12.4)	43 (10.6)	66 (16.3)	68 (16.8)	44 (10.9)	46 (11.4)	3.7277	2.02592
Using the case tools	102 (26.5)	57 (14.8)	45 (11.7)	56 (14.5)	43 (11.2)	54 (14.0)	28 (7.3)	3.4026	2.01853
<i>Computer analysis</i>									
Hardware acquisition, evaluation, and selection	68 (17.0)	45 (11.3)	45 (11.3)	71 (17.8)	61 (15.3)	57 (14.3)	53 (13.3)	3.9875	2.00434
Gathering and documenting system requirements	48 (11.9)	41 (10.2)	47 (11.7)	66 (16.4)	86 (21.3)	75 (18.6)	40 (9.9)	4.2060	1.84735
System planning, management and, evaluation	52 (12.9)	43 (10.7)	54 (13.4)	72 (17.9)	67 (16.7)	74 (18.4)	40 (10.0)	4.0970	1.87729
Information access and security	60 (14.9)	45 (11.2)	51 (12.7)	83 (20.6)	66 (16.4)	59 (14.6)	39 (9.7)	3.9504	1.88144
Using software testing tools and strategies	63 (15.7)	55 (13.7)	52 (12.9)	75 (18.7)	64 (15.9)	57 (14.2)	35 (8.7)	3.9577	3.17655
Performing feasibility analysis	70 (17.4)	53 (13.2)	48 (11.9)	77 (19.1)	64 (15.9)	54 (13.4)	37 (9.2)	3.7990	1.92310
Creating effective documentation	67 (16.9)	46 (11.6)	44 (11.1)	75 (18.9)	62 (15.7)	56 (14.1)	46 (11.6)	3.9369	1.96773
<i>Networking (user support)</i>									
Configuring, and troubleshooting telecommunication networks	82 (20.6)	27 (6.8)	46 (11.5)	68 (17.0)	66 (16.5)	57 (14.3)	53 (13.3)	3.9825	2.04404
End user computing support	73 (18.2)	51 (12.7)	46 (11.3)	61 (15.2)	67 (16.4)	62 (15.5)	41 (10.2)	3.8678	1.98997
Designing system Architecture	82 (20.4)	41 (10.2)	66 (16.4)	48 (11.9)	80 (14.0)	52 (12.9)	33 (8.2)	3.7239	1.94843
Simulation and modelling of data	87 (21.8)	31 (12.8)	46 (11.5)	64 (16.0)	68 (17.0)	54 (13.5)	30 (7.5)	3.6425	1.96197
Computer appreciation services, e.g., use of word processing tools, spreadsheets, desktop publishing, etc.	54 (13.7)	19 (4.8)	36 (9.1)	44 (11.1)	79 (20.0)	78 (19.7)	85 (21.5)	4.6430	2.00929

Table 2 Descriptive analysis of the computer science final year university experiences

<i>Variable/scale</i>	<i>Strongly disagree</i>	<i>Somewhat disagree</i>	<i>Neutral</i>	<i>Somewhat agree</i>	<i>Strongly agree</i>	<i>Mean</i>	<i>Std. deviation</i>
My degree contains current technological content	54 (13.7)	47 (11.9)	141 (35.8)	90 (22.8)	62 (15.7)	3.1497	1.22751
My university courses provided a solid base for employment	51(13.0)	69 (17.6)	113 (28.8)	101 (25.7)	59 (15.0)	3.1221	1.24144
Possessing a computer science qualification will provide me with a competitive edge in securing employment compared to individuals with qualifications from other fields	29 (7.3)	55 (13.9)	107 (27.0)	138 (34.8)	67 (16.9)	3.4015	1.13980
Having a professional qualification will provide me with a competitive advantage when it comes to securing employment	16 (4.1)	37 (9.4)	91 (23.0)	133 (33.7)	118 (29.9)	3.7595	1.10163
My educational journey diverges from what I had anticipated	24 (6.1)	39 (9.9)	104 (26.3)	130 (32.9)	98 (24.8)	3.6051	1.14039
The course curriculum heavily lean towards theoretical content, providing minimal provision for hands-on practical experiences	16 (4.1)	41 (10.4)	87 (22.1)	130 (33.0)	120 (30.5)	3.7538	1.11789
The practical exposure gained during my internship has effectively honed my abilities and equipped me with the necessary competencies to thrive in a professional setting	19 (4.9)	39 (10.0)	95 (24.4)	118 (28.9)	119 (30.5)	3.7154	1.14435
I would have opted for courses that provided regular lectures delivered by professionals working in the field	22 (5.6)	37 (9.4)	96 (24.4)	128 (32.6)	110 (28.0)	3.6794	1.14241
The skills and knowledge acquired during my previous computing training have effectively equipped me for the demands of the workplace	28 (7.1)	30 (7.6)	88 (22.3)	112 (28.4)	137 (34.7)	3.7595	1.20716

Table 1 demonstrates that the cohort of final year undergraduates of computer science generally exhibited moderate to high self-confidence in the areas of computer programming and database management, and computer analysis and networking. They showed the highest levels of self-belief in the aspects related to computer appreciation within the networking (user support) areas. Moreover, their confidence was notably high in tasks such as programming in various languages (4.26), designing user interfaces (4.13), and developing web applications (4.07) within the computer programming and database management categories, alongside the computer analysis category.

Their self-confidence was also particularly high in collating and documenting system requirements (4.21), as well as in system planning, management, and evaluation (4.09). In summary, the final year computer science undergraduates were found to possess an average level of confidence in performing computational tasks.

Research question 2 What are the university experiences of the final year undergraduates of computer science?

In Table 2, it is observed that 38.5% of the participants concurred that their degree programme contained modern technological elements, while 25.6% believed it was lacking in contemporary content. A further 35.8% might not be familiar with current industry standards or a curriculum encompassing a wide range of subjects. Regarding the preparedness for work provided by university courses, nearly half (40.7%) of the respondents felt that their courses had adequately prepared them for employment, whereas around 60% were not satisfied. When questioned on whether their Computer Science degree offered them a job market advantage, just over half (51.7%) agreed, whereas 48.2% disagreed. Concerning professional qualifications, a majority (63.6%) were of the view that having such qualifications would indeed offer them a better chance at securing a job, while 36.5% did not share this opinion. In terms of school experiences matching expectations, over half (57.7%) did not agree that there was a difference. A significant number (60.5%) agreed that their course content was overly theoretical with insufficient practical work, while 37.1% disagreed with this view. Regarding the compulsory internship programme, around 60% felt that their internship had adequately prepared them for the working environment, in contrast to 40% who disagreed. The preference for industry professionals as lecturers garnered agreement from approximately 61% of students, with the remainder not in favour. Lastly, in exploring the impact of previous computing knowledge on work readiness, those in agreement (64%) outnumbered those who were not.

5 Testing the hypothesis

H0 There is no relationship between the confidence level and learning experiences of the final year undergraduates of computer science

Table 3 illustrates the association between learning experiences and confidence level in computational tasks among final year computer science undergraduates through Pearson correlation analysis. The confidence level variable, along with its sub-indicators, exhibited a composite value. The learning experiences were found to be significantly correlated with both the confidence level composite score and the scores of its sub-indicators. The correlation coefficient (R) between learning experiences and

confidence was calculated to be 0.515** with a significance level of $p < 0.05$ (2-tailed). Furthermore, the correlation coefficients between learning experiences and each of the sub-indicators of confidence level were as follows: computer programming and database management (0.465), computer analysis (0.449), networking/user support (0.462), and personal attributes (0.382).

Table 3 Relationship between the confidence level and learning experiences of final year computer science undergraduates

S/N	Variables	1	2	3	4	5	6
1	Computer science learning experiences	1					
2	Self-efficacy	0.515**	1				
3	Computer programming and database management	0.465**	0.872**	1			
4	Computer analysis	0.449**	0.905**	0.722**	1		
5	Networking (user support)	0.462**	0.864**	0.693**	0.724**	1	
6	Personal attributes	0.382**	0.617**	0.386**	0.430**	0.416**	1

Note: **Correlation is significant at the 0.05 level (2-tailed).

6 Discussion

The readiness of final year undergraduates in computational tasks, as expected of them in the workplace after completing the computer science school curriculum, is closely linked to their confidence levels. The findings indicate that students exhibit below-average confidence levels in the use of CASE tools and software application development within the computer programming sub-scale. This suggests that not all undergraduates feel fully prepared to undertake these tasks with confidence. Possible reasons for this could be the complexity of computer programming and database development, which may require a high cognitive capacity to comprehend, or other factors that hinder the learning process of undergraduates. These factors may include inappropriate teaching methods, teacher quality, or insufficient teaching resources, among others. Improving the integration of these skills into the curriculum will ultimately boost the confidence of undergraduates.

Self-confidence plays a crucial role in achieving success in a computer programming career. By providing training and designing teaching approaches that focus on enhancing confidence, individuals can develop the necessary confidence and skills required for this field (Meinhardt-Injac and Skowronek, 2022). This, in turn, is expected to result in more confident and competent behaviour, as suggested by the research conducted by Hajovsky et al. (2020). In terms of specific subscales, such as computer analysis and networking (user support), undergraduate students displayed an average level of confidence in performing related tasks. These findings align with previous research that highlights the significance of self-confidence judgments as influential factors in determining perceived cognitive effort.

Durak et al. (2019) conducted a study that yielded similar results to this research. They also observed an increase in self-confidence among the same group of undergraduates on two different occasions. This finding aligns with the research conducted by Vogel and Human-Vogel (2016), who found that individuals with high self-efficacy tend to be more resilient and goal-driven than those with low self-efficacy. These findings suggest that the level of confidence among undergraduates has a significant positive impact on their performance in the workplace. Vorster De Wet (2020) further support this notion by emphasising the importance of self-confidence in determining the success of undergraduates in various tasks.

Contrary to these findings, Lopez et al. (2006) reported different results. They found that second, and third-year computer science undergraduates had higher confidence level than fourth-year undergraduates. However, their study acknowledged that the fourth-year undergraduates may have experienced self-doubt due to the upcoming challenge of undertaking their first major individual programming project after completing their university degree.

In line with these findings, Smith et al. (2018) highlighted the significance of self-confidence in information technology (IT). According to Smith, individuals who lack self-confidence in IT knowledge may face difficulties in their academic and professional development. Furthermore, their interest in pursuing a career in IT may be hindered.

The results obtained from the learning encounters of undergraduate students, as indicated by the mean score, demonstrated that, on average, students had a favourable view of their computer science education in universities, despite variations among the institutions. Feedback from stakeholders is crucial in ensuring that graduates, especially those in the field of computer science, have met their educational goals and are prepared for the workforce. This assessment of learning experiences helps in determining the effectiveness of the educational process. However, the frequency and percentage analysis indicated that students feel the curriculum may need frequent updates to address the evolving requirements of the IT industry. Students also expressed a preference for practical courses over theoretical ones and emphasised the importance of being taught by industry practitioners. This suggests a need for curriculum revision to include more hands-on classes and the involvement of industry professionals who are up-to-date with IT advancements, making the computer science education more engaging and relevant to both students and employers. Zynuddin et al. (2023) highlighted learning experiences as a key factor in predicting academic success and fostering the development of essential skills in students. Similarly, Peters and Pears (2012) reported positive outcomes from a study conducted in Sweden on the learning experiences of undergraduates following an introductory computer science course. Building on these findings, McGill et al. (2014) recommended that industry experts should play a role in curriculum development and contribute to the content of ICT courses offered in universities.

In contrast, Kurnia (2007) conducted an assessment of the effectiveness of the information system curriculum in developing the expected skills of professionals and the satisfaction levels of undergraduates in Australia. The research revealed that undergraduates expressed the least satisfaction with their technical skills; however, it laid the groundwork for future knowledge acquisition. The study recommended enhancements to the curriculum. Regarding the correlation between self-efficacy and learning experiences, the study established a significant link between students' learning experiences and their self-efficacy levels. This underscores the importance of incorporating students' learning experiences into the curriculum development process to

create a learner-centred and industry-relevant educational framework. This study aligns with the conclusions drawn by Chibisa et al. (2021) in their investigation of computer self-efficacy and its impact on learning outcomes in higher education.

7 Conclusions

The final year undergraduates of Southwest Nigeria universities as of year 2023, had an average level of confidence in completing the computational tasks that are expected of people like them in the workplace. This implies that while they are somewhat ready for workplace, their computational self-confidence could improve. Their positive learning experiences have concluded that these experiences should be incorporated into the self-efficacy theory to ensure learner satisfaction. Universities are to centre on making and keeping up positive learning situations that support students' certainty in their abilities. This may include hands-on ventures, real-world problem-solving errands, and steady input instruments. By doing so, undergraduates are more likely to feel competent and arranged for the computational requests of the work environment, driving to higher levels of self-efficacy and generally fulfillment with their learning encounters.

8 Recommendations

In light of these findings, several recommendations have been proposed. First, there is a need for further improvement in the computer science program offered by universities in order to meet the learning aspirations of the students. Second, efforts should be focused on enhancing the confidence level of computer science students. Additionally, prioritising practical sessions for hands-on training should be considered during the curriculum development process. Finally, involving industry experts in the curriculum design and teaching of certain courses can help bridge the gap between theory and practice. It is crucial to recognise the significance of students' learning experiences in shaping the computer science curriculum and to incorporate them as an integral component in the curriculum development process.

8 Area of further studies

This study did not consider other factors that could influence the relationship between university experiences and confidence levels. Also, the study did not consider the feasibility, the resource allocation, and administrative buy-in and other challenges required for the involvement of industry professionals for the enhancement of the curriculum. A comparative study could be conducted to determine if the findings from South West, Nigeria are similar to other parts of Nigeria or other countries. Models that integrate self-confidence to enhance learners satisfaction in computational tasks could be developed and tested. Furthermore, the study is limited to quantitative research method however, further study may consider mixed method for the study.

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