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IS A FIRST DEGREE IN COMPUTER SCIENCE FROM NIGERIA A PREREQUISITE FOR STARTING A CAREER IN SOFTWARE DEVELOPMENT?

Insights from Interviews and Questionnaires

Faculty of Information
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Msc Thesis
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ABSTRACT

Ayodeji Ilori: “Is a First Degree in Computer Science from Nigeria a Prerequisite for Starting a career in Software Development”? – Insights from Interviews and Questionnaires
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The evolving landscape of software development has sparked discussions regarding the importance of a traditional Computer Science (CS) degree versus alternative educational pathways. This study investigates whether a CS degree from Nigeria is necessary for aspiring software developers and examines the feasibility of alternative educational options such as coding bootcamps, online courses, and self-directed learning. Using a qualitative approach, we analysed employer expectations, educational experiences, and the career trajectories of software developers from different backgrounds. Findings indicate that while a CS degree offers foundational knowledge essential to the theoretical aspects of programming, it is not a prerequisite to achieving success in a career in software development. Alternative pathways offer practical, industry-relevant skills that meet the demands of employers who increasingly prioritize competence over formal qualifications. The findings provide implications for aspiring developers, educational institutions, employers, and policymakers, suggesting a shift towards inclusive, skills-focused educational models that caters for varied learning trajectories. Future research should investigate the long-term career outcomes of developers from alternative pathways and the impact of continual learning on skill retention and adaptability in a rapidly evolving technology sector.

Keywords: Computer Science, Recruitment, Technology, Nigeria

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PREFACE

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Tampere, 21 April 2025

Ayodeji Ilori Oluwaseun

CONTENTS

LIST OF FIGURES

LIST OF SYMBOLS AND ABBREVIATIONS

BVN	Bank Verification Number
CS	Computer Science
HR	Human Resources
ICT	Information and Communication Technology
IT	Information Technology
NCC	Nigeria Copyright Commission
NSD	New Software Developers
NIN	National Identification Number
NNIDB	Nigerian National Identity Database
STEM	Science, Technology, Engineering and Mathematics
UNDESA	United Nations Department of Economic and Social Affairs

1 INTRODUCTION

Technology plays a vital role in Nigeria transitioning from the sidelines of global economy into the mainstream of countries with a tech-based workforce. The country has in the past years adopted the use of technology especially in the finance sector to drive growth for example, the introduction of Bank Verification Number (BVN) and National Identification Number (NIN). The BVN uses biometric technology to register bank customers. It keeps track of distinguishing physical features, such as fingerprints and facial features [61]. The centralized application (NIN) was implemented to capture details of citizens into NNIDB for identification purposes. Nigeria also has a considerable number of indigenous software companies that build software aiming at addressing socio-economic challenges within and outside the country such as Remita [69], which was developed by SystemSpecs, [85] has assisted the Nigerian government to consolidate and monitor its account with Nigerian banks, contributing significantly to improved financial oversight and fraud reduction [24]. As a result, there is a rising demand for skilled software professionals who have the prerequisite knowledge and skill to build and maintain software applications.

1.1 Research Problem and Objectives

There are those [52] who believe that higher education institutions should play a crucial role in supplying the industry with professionals, others [39] are of the opinion that a university degree is certainly not the only pathway to such a career. Oguz and Oguz [60] stresses that while a degree in computer science was not always a strict requirement for entry-level positions, it often served as a differentiating factor in the hiring process.

Carolyne D.M [16] citing Yvone Agyei the Director of Talent and Outreach Programs in Google's People Operation Department asserts that

> "For our software engineering roles, we tend to look for people with a strong computer science background who have experience with programming. We need core programming skills, algorithm skills and quantitative analysis. We're looking for people who have majored in computer science…"(p.23) [16]

In a study carried out by Begel and Simon [13], 85 hours was dedicated to observing eight newly hired software developers during their first six months of employment at Microsoft Corporation. They observed that recent college graduates demonstrated proficiency in code-writing, design specifications, and resilience when confronted with challenging tasks as they onboard into the workforce.

According to Radermacher and Walia [67] , while students may demonstrate the ability to apply theoretical concepts to solve academic problems, additional hands-on experience is required to address complex requirements found in real-life software projects. Thus, researchers like Lehman et al. [41] emphasize on the importance of practical experience, industry certifications and continuous learning over a formal degree stating that

> "…a boot camp hire tends to have more current knowledge, whereas, the undergraduate hired may not have been exposed to newer software programs/hardware" (p.504) [41].

In the light of this, alternative educational paths such as coding bootcamps and online courses have gained attention as viable options for aspiring IT professionals [14].

Literature that has been written on pathways to computing careers majorly focuses on those who have taken the traditional university route, while paying less attention to alternative pathways. Understanding that there are alternative pathways may be particularly important to discussions about diversity and inclusion in the field (e.g. women & underrepresented minority students, and in this paper those who have no first degree in Computer Science).

1.2 Research Questions

This research aims to examine the relationship between formal education, particularly a degree in computer science and a career as a software developer.

This study undertakes to answer the following research questions:

- Is a degree in Computer Science a prerequisite for entry into career in software development in Nigeria?
- Are there other alternative educational pathways to be considered as viable options for aspiring software developers?

1.3 Research Methods

This research adopted a qualitative research method because it focuses on exploring participants' perspectives, experiences, and insights in depth, rather than measuring variables quantitatively. Qualitative research methods are valuable when studying complex, context-dependent phenomena, such as career entry requirements and educational pathways in Nigeria's software development industry.

Qualitative research methods are also ideal for capturing the viewpoints and motivations of participants such as, early-career developers, educators, and hiring managers providing rich, descriptive data [51]. This is important for understanding the perceived value of different educational backgrounds and pathways in the software development field.

The qualitative techniques used will be interviews and open-ended questionnaires which allowed for detailed, nuanced data collection. These methods would help gather first-hand insights into the skills, competencies, and qualifications valued by both tech professionals and employers in Nigeria [50], and investigate the outcomes, perceptions, experiences, challenges and trajectories of individuals with computer science degrees to those who pursued alternative paths such as coding bootcamps, online courses or self-study in Nigeria. This is crucial for identifying unique challenges or opportunities Nigerian software developers face compared to their counterparts in other regions.

1.4 Significance of the Study

This study aims to guide aspiring software developers in Nigeria by outlining the essential steps needed to enter and succeed in the field, regardless of their formal educational background. By examining industry requirements and potential career paths, it seeks to provide clarity for individuals looking to break into software development.

Additionally, the study may help identify alternative learning pathways that can make software development careers more accessible. By exploring non-traditional education methods, such as self-learning, coding boot camps, and online courses, it could encourage a more inclusive and diverse technology sector in Nigeria.

Furthermore, the findings may offer valuable insights for educational institutions and policymakers regarding the evolving demands of the tech industry. As skills become increasingly prioritized over conventional credentials, the study could help shape policies and curricula that better align with industry needs, ultimately fostering a more skilled and adaptable workforce.

1.5 Scope and Limitations

The study is focused on examining the specific educational and employment landscape for software developers in Nigeria. It will consider the relevance of a Nigerian Computer Science degree in the local tech industry and target aspiring and early-career software developers, hiring managers, and HR professionals in tech companies. However, accessing a representative sample of employers, developers, and educational institutions across Nigeria was not feasible. The findings will therefore not fully represent the diversity of perspectives across the country or across all tech sectors. While formal education data was readily available, gathering comprehensive information on alternative pathways (e.g., bootcamps, online courses) and their long-term effectiveness was more difficult. Many such programs lack tracking on their graduates' career progress in Nigeria. Finally, participants in the study, particularly those who have taken non-traditional pathways have a stronger inclination to succeed creating a possible bias in favor of alternative education routes.

1.6 Structure of the Thesis

This thesis will be outlined into several chapters, each providing a comprehensive description of the research topic's methodology, objectives and background motivation. The purpose of these chapters is to provide an answer to the research question discussed previously.

The evolution of software development, challenges and opportunities in the Nigerian Software Industry are presented and discussed in Chapter 2. Chapter 3 details the several aspects of the research process and research method used to gather data from participants (via surveys). Chapter 4 discusses the results of the survey conducted also analysing different viewpoints on the research question. To conclude, Chapter 5 summarises the main findings and offers suggestions for aspiring software developers.

2 LITERATURE REVIEW

Nigeria, a Federal Republic in West Africa consists of 36 states and a Federal Capital Territory. It is the most populous country in Africa (with about 200 million people), constitutes about 15% of the continent's population, while the balance is shared among more than 50 other countries [59]. As reported in the most recent World Population Prospects 2019 from the Population Division of UNDESA [87], the population of the country is expected to surpass 440 million people by 2050 [2] .

The country also has a growing youthful population (between 15 – 34 years old) comprising more than one-third of the population [66] who fall within the potentially ICT savvy age, therefore Nigeria potentially remains an ICT hub; not yet for production, but for utilization. According to Soriyan and Heeks [78], despite recent strong growth rates, the penetration rates for digital technologies remains relatively small.

Prior to the current period, the IT industry in Nigeria was marked by inadequate infrastructure, limited internet access, and a dearth of proficient personnel. The Nigerian government, nevertheless, has acknowledged the IT sector's capacity to stimulate economic expansion and has undertaken numerous initiatives to bolster its progress. Initiatives such as the establishment of innovation (Tech) hubs, investment in technology infrastructure, and the promotion of STEM (Science, Technology, Engineering and Mathematics) education are being implemented to nurture software engineering talent and foster a conducive environment for innovation [33]. Other initiatives include setting up of agencies to assists towards efforts in technology innovation and entrepreneurship such as National Board for Technology Incubation Centre (NBTI) [55], Nigeria Information Technology Development Agency (NITDA) [57] to name a few.

On the global front, Nigeria has also been a beneficiary of funding for establishment of Tech hubs in Africa. In 2016, African technology firms attracted $366.8 million in investments, with Nigeria, South Africa, and Kenya cumulatively securing 80% of the total funds, as reported by Partech Ventures. Nigeria obtained $109 million (29.8%), South Africa obtained $96 million (26.4%), and Kenya obtained $92 million (25.3%) [23]. The financing led to an increase in the number of innovation centers from 117 in the previous year to 310 in 2016, including 173 accelerators and incubators, according to the World Bank [23].

2.1 Essential Skills and Competence of a Software Developer

Competence according to Frezza et al. [28] is “the personal qualities causally related to effective performance in an area of work, where individual competence integrates knowledge, skills, and dispositions in a professional context”. Competence involves the capacity to apply the required knowledge and skill to execute tasks in an efficient way not merely possessing knowledge and skill in isolation [48]. From this point of view, the competence of a software professional is defined as the “knowledge, skills, and attitudes for exceptional performance in a software project” [86], Furthermore, software development can be considered as a human-centered and socio-technical endeavor [17] that relies on professionals; who in addition to formal education and technical proficiency, demonstrate practical ability to identify and solve complex problems [73] .

Typically, job descriptions for software development (whether online or offline) categorize the required skills needed for the job into two main groups: technical requirements and non-technical requirements. Technical skills, usually referred to as hard skills," encompass the specific knowledge and abilities that are learned, acquired mostly through structured training and formal education, that one needs to do the duties connected with a particular employment or work setting” [7]. Non-technical skills also called soft skills originated from the field of psychology and connotes an individual’s belief systems which influence or determine one’s behavior or actions [70]. The term encompasses a wide array of attributes related to personality traits, social aptitude, communication, and personal behaviors [7]. Other classical sets of soft skills are active listening, negotiating, conflict resolution, problem solving, critical thinking, ethics, and leadership skills [22]. It is worth noting that the term "soft skills" is sometimes used interchangeably with terms such as "people skills," "non-technical skills," "emotional intelligence," or "social skills" in literature.

Several studies have been conducted to ascertain the required skills (hard & soft skills) required of IT experts. Koong et al. [37] conducted a study using Monster.com and HotJob.com to categorize various jobs into seven categories. They found that programming languages and web development abilities accounted for around 51% of the skills needed for IT related jobs. Prabhakar et al. [65] also conducted a study in collaboration with Monster.com for a duration of three years. Their findings once again emphasized the importance of web-related skills. The findings of Bee and Hie [12] aligns with this conclusion, indicating that many skills mentioned in IT related job advertisements were of a technical nature.

The conclusion above is rather incongruous with organizational assertions that soft skills hold significance for entry-level professionals. Academics in the software development community predominantly focus on the "engineering" elements of the process, which essentially need technical expertise. Moreno et al. [54] however asserts that there is a discrepancy between the skills obtained by graduates in information technology (IT) and the abilities required by the industry. Studt et al. [82] conducted interviews with 23 managers and hiring personnel from the USA and Europe to examine the challenges faced by recent graduates when they enter the workforce and the factors that hinder their employment prospects. Their analysis indicated that these graduates face difficulties in several soft and hard skills, such as proficient communication, utilization of configuration management systems and other tools, and conducting product unit testing. Nevertheless, the primary hindrance to their employment is mostly attributed to their limited project experience and deficient problem-solving skills [68].

In a study conducted by Stalhane et al. [80], outlined a mandatory project in a software engineering course where students conducted interviews with representatives from the IT industry to determine the necessary skills and qualifications for employment in their organization. After conducting interviews with 120 firms, they discovered that the most cited attributes were proficiency in programming, a strong desire to acquire new knowledge, and effective communication abilities. In a study conducted by Lewis et al. [43], a total of 11 American firms were interviewed to determine the key technical and soft qualities they prioritize when recruiting recent graduates. The most often cited soft skills were proficiency in effective communication, capacity for collaboration, and desire for continuous learning and curiosity.

In their systematic literature analysis on computer science and software engineering students, Radermacher and Walia [67] define inconsistencies between graduate candidates and the requirements of the industry as the "discrepancy between industry expectations and the skills possessed by graduates." Their findings indicate that there is a disparity observed in various domains, including technical competencies, interpersonal talents, and professional attributes. The top five knowledge inadequacies that were identified are written communication, oral communication, project management, software tools and testing.

In a survey carried out by Hamilton et al. [31], 11 ICT reps in Australia to determine the specific talents they need in potential candidates. The two most prominent talents were communication and teamwork. The subsequent three competencies encompassed problem-solving, business acumen, and technological proficiency. Stevens and Norman [81] examined the industry's anticipations regarding soft skills and their conclusion was that

the employer prioritizes soft skills over technical skills. Lundberg et al. [45] conducted a study in an IT network administration program, where they interviewed 10 recruitment managers. The study revealed that personal traits were the primary factor that the managers considered when evaluating graduates.

In an alternative scenario, Lundberg et al. [46] conducted interviews with six representatives from organizations that had employed graduates from the Master program in IT. They cite problem-solving ability, teamwork skills, and communication skills as coveted attributes. Additionally, they stress the importance of possessing the ability to adapt and acclimatize to the swift transformations within the field. Koppi et al. [38] conducted a survey on IT graduates from renowned Australian universities, specifically examining the extent to which the content of their curriculum was applicable to the industry. A significant discrepancy was identified in the proficiency of soft skills, including teamwork, problem solving, communication, information organization, project management, and client interactions.

From the foregoing, employers in the IT industry prioritize personal attributes and soft talents. Nevertheless, it is still unclear if this implies that technical abilities are of lesser significance or merely presumed to be satisfactory. However, to effectively carry out the job, an employee must not only acquire specialized technical expertise, but also demonstrate essential soft skills such as teamwork, a strong work ethic, and effective communication abilities [71]. Soft skills are therefore meant to complement the technical skills of a job [44] .

2.2 Education and Career Paths in Software Engineering

In the global economy, systems that rely on software are now a necessary component of daily life and business which requires enough skilled and modern software developers to maintain software quality and functionality. Currently, software developers are educated in the traditional ways which typically involves a four-year undergraduate program in a tertiary institution comprising of core coursework, participating in an internship, and a capstone project to demonstrate their capabilities [41].

Some in the software education sector have suggested that undergraduate software engineering degrees should be separated from computer science for over a decade. Such programs, according to Shaw [77] are intended to provide a better base for a software development career than would a traditional computer science program. She went on to explain that

> most universities now offer undergraduate degrees in computer science, and most provide an extensive selection of software-related courses. These programs typically allow a student to study software design and implementation topics, and they provide a common educational base for entry-level programming positions (p.374) [77] .

Upon entering the workforce, graduates often perceive a gap between what was taught during their academic training and requirements of software projects in the industry. Unlike the theoretical focus of academic programs, the software industry is practical oriented, adaptable to business demands and open to innovations. This, in turn, results to higher standards in skill requirements, which many graduates are not adequately prepared for. This disparity highlights the divide between the software industry and academic curriculum taught in schools.

Existing research on careers in computing has focused on students who enroll in a CS major at an educational institution to obtain a computing degree that will lead to a career in computing, however other routes do exist outside of the university system that have received less attention [41]. Examples includes vocational schools, in-house courses, or short courses which offer flexibility in choosing specialized courses, duration of program and varied program fees.

According to Lehman et al. [41]

> a “new breed of intensive training ground for software development dubbed “coding boot camps” has blossomed”. These camps (Lehman 2018) asserts teach coding to novices between 8 to 104 weeks at a price tag of $11,400 on average, and ... are established to help diversify the computing workforce.

2.3 Challenges and Opportunities in Nigeria’s Software Industry

Today, technology and innovation play crucial roles in determining growth and ensuring long-term development. Nigeria's awareness of this is evident via several government-led technology and innovation expos, specifically focusing on software items. Regrettably, to this day, a meager proportion of less than 20% of software products implemented in critical sectors of the Nigerian economy are domestically created, while an average of $1 billion dollars is expended yearly on the importation of software and the renewal of licenses [79] which could have been used to develop the economy.

The use of foreign software also comes with its own challenges as most of the solutions are designed in line with the internationally recognized standards and a global perspective, often overlooking distinct features of their target market. This however present opportunities for indigenous companies to provide add-on services to close the gap e.g. Trade-X (a trade finance and Treasury Software) built by Union Systems Limited (an indigenous company) [88] integrates with any International Trade application or the Trade Module of a Bank's core banking application to conform with the finance institutions' regulations stipulated by Central Bank of Nigeria (apex body that regulates the Banking Institutions in Nigeria) [18].

In a series of interviews led by Ogbonna [59], participants ranging from CEOs of software companies in Nigeria to Middle and Senior Level managers, junior Software Engineers, recently unemployed computer science graduates, and Heads of Computer Science Departments in Nigerian Universities were engaged. The interviews were centered around exploring the challenges faced by the Software Industry in Nigeria and identifying potential solutions. Some of the CEO's lamented that most graduates lack practical familiarity with the contemporary programming languages utilized in the industry, One CEO said

> Computer science as a degree is almost, is not good enough. There's a disconnect between academia and practice in the industry. The industry moves too fast for the academia to catch up. I studied computer science … but everything that I needed, that I use, I learned at work. So, I got the foundation, right? I got the foundation in school, like I could program, but I didn't learn the right languages and all that (p.9) [59]

This disconnect between academia and industry practice was highlighted by several alumni who mentioned that they learned programming through traditional methods like chalkboard and paper rather than practical computer-based exercises. others reported restricted or nonexistent access to university-owned computers throughout their academic pursuits, impeding their capacity to implement acquired knowledge though they successfully passed the written exams.

Roland et al. [72] also highlighted a rise in software piracy, intellectual property theft and other sharp practices in the IT Industry despite resources put in place by the Nigerian government through the establishment of NCC (Nigeria Copyright Commission) [58] in 1990 to curb its practices. Piracy is a global cankerworm that affects both developed and developing countries in the world [43] in which Nigeria is ranked amongst countries where piracy is prevalent. Its existence becomes frustrating to both the author of the

work and the economy because it generally reduces the real profit margin a particular product or invention is anticipated to earn [12].

In addition, the migration of IT professionals presents a challenge to the growth of the software industry. This is exemplified by the "brain drain" phenomenon, which results in a depletion of technical proficiency in Nigeria as proficient individuals opt to pursue more favorable prospects and increased remuneration overseas and in exchange contribute their quota to the development of the host country. Nevertheless, this does not mean that every instance of such migration leads to a "brain drain"; rather, it can occasionally be advantageous for both the migrant and the communities of origin and destination. In 2012, two Nigerian alumni of the esteemed Harvard Business School established Jumia [36], one of the earliest internet-based startups in Nigeria. Numerous diasporas reintegrate have founded enterprises that provide employment for tens of thousands of individuals. Several tech firms, including Iroko TV, Flutterwave, and Bamboo were founded by diaspora returnees [5].

3 RESEARCH METHODOLOGY

This research study aims to examine the significance of obtaining a bachelor's degree in computer science from a Nigerian University for pursuing a career in software development. This chapter will present a thorough examination of the several aspects of the research process, which encompasses the research design, criteria for selecting participants, methods for collecting data, and techniques for analyzing data. This chapter establishes a strong and methodical investigation into the perceptions and experiences of stakeholders regarding the alignment between computer science education in Nigerian universities and the demands of the software development industry. Through the careful selection of research methods and procedures, this study aims to provide valuable insights that contribute to the ongoing discourse on the relevance of computer science education in Nigeria for a successful career in software development.

3.1 Research Design

Given the inquiry and the goal of this study, a qualitative approach was employed. According to Creswell [19], qualitative research is

> "an inquiry process of understanding based on distinct methodological traditions of inquiry that explore a social or human problem" (p.15). [19]

In conducting qualitative research, the goal is to model the description of a natural setting by capturing the authentic voices of its participants [19]. Since we were particularly interested in the rich details and the genuine perspectives of those with careers as software developers in an exploratory study, we chose to employ qualitative inquiry.

Also, research on pathways to computing careers have grown over the years, the major focus has been on those who have taken the traditional university route to careers in the software industry. There have therefore been few attempts according to Lehman et al. [41] at exploring individuals who pursue alternative pathways (e.g. bootcamps) into software development. Creswell [20] asserts that a qualitative approach is well suited for situations where a topic has not been previously examined from a certain perspective, thus the researcher is able to approach the study without a previous bias. Since this study falls into Creswell's category, a qualitative research approach is therefore the most appropriate strategy to follow.

Finally, the qualitative approach places a strong emphasis on people's subjective experiences and attitudes that other approaches might overlook [63]– by enabling representation of aspects that are beyond the scope of numbers and statistical evaluation. This aligns well with the research objectives as it becomes possible to clarify if a degree in computer science is a prerequisite for entry into a career in software development in Nigeria. The nature of a qualitative study therefore allowed me to prioritize aspects of meaning and expression that may otherwise be ignored in a quantitative study using interviews and questionnaires to gather data. These methods were chosen to capture detailed narratives and diverse experiences from individuals at different stages of the software development career path, providing deeper insight into industry expectations and alternative routes to entry.

3.2 Research Participants

Participants for this study included software developers, job seekers and HR managers responsible for recruiting software designers. Each of these groups contributed unique insights into the necessity of a CS degree, the impact of alternative learning pathways, and employer preferences in hiring practices.

Participants who were software developers (employees) included both formally trained CS graduates and self-taught developers. They shared their career trajectories, highlighting whether formal education played a critical role in their success and identifying the skills most valued in the industry. They also discussed the effectiveness of coding bootcamps, internships, and mentorship programs as alternative learning paths.

Participants who were job seekers are those actively searching for roles in software development field. They provided insights into the challenges faced when applying for jobs without a CS degree. They detailed their experiences with job application processes, employer expectations, and the role of portfolio-building in enhancing employability.

Both participants were willing to reflect on their careers as software developers, especially as it relates to the path (whether university degree in computer science or through an alternative route like a bootcamp) they took to arrive at their respective careers. This group of participants are important because they possess firsthand experience with the realities of working in the software development industry. Their perspectives, insights, and experiences provide valuable information about the skills, knowledge, and competencies required to succeed in software development roles [42]. They can reflect on their educational experiences and assess the relevance of their computer science degree to their current roles and responsibilities which provides insights into the strengths and

weaknesses of their educational preparation, the applicability of theoretical knowledge in practical settings, and the adequacy of skill development during their degree program. By participating in the research, they can therefore offer nuanced insights into the relevance or lack of the computer science degree to their current or desired career path.

The last set of research participants include HR managers and Employers in the software industry. Human Resource professionals are responsible for recruitment, selection, and talent management within organizations, and thus can provide insights from the perspective of employers and industry stakeholders [76]. Their insights into the skills, competencies, and qualifications sought by employers in the software development industry are therefore invaluable for understanding the alignment between computer science education and industry expectations. Their involvement not only provide firsthand insights into the specific requirements and preferences of employers when hiring software developers but also fosters a holistic understanding of the dynamics shaping the relationship between education and employment in the software development field. Additionally, HR managers provided insights into the challenges of assessing self-taught developers, including verifying the credibility of their skills and experience without traditional academic credentials. The discussed the importance of portfolios and industry certifications as alternative proof of competence. Moreover, they highlighted the evolving hiring criteria within Nigeria’s tech sector, noting that companies are increasingly adopting a more flexible and inclusive approach to recruitment to tap into a wider talent pool.

3.3 Method of Data Collection

Questionnaires were chosen to gather insights and distributed to allow participants to express their thoughts freely. This method facilitated the collection of qualitative data on the effectiveness of bootcamps, online courses, self-learning, and mentorship programs in preparing individuals for software development roles. The questionnaire had both open-ended and closed-ended questions; the open-ended questions enabled respondents to provide detailed and personalized accounts of their experiences, perspectives, and challenges while closed-ended questions had limited responses to predefined choices since it’s easier to quantify and analyze the data obtained using statistical methods. The questions were particularly valuable for gathering insights from a larger sample of participants who might not have been available for interviews.

These questionnaires included exploratory questions about participants' educational backgrounds, learning paths, job-seeking experiences, and employer expectations. Respondents were encouraged to elaborate on their opinions about the relevance of a CS degree, the role of technical skills, and the industry's openness to self-taught developers.

The research was divided into 2 separate instances of surveys running concurrently online using LimeSurvey [83][84] from May 2024 – January 2025.

No	Participants in Nigeria	No of Contacts reached out to.
1	LinkedIn Search with Job Titles – Hiring Managers, Tech recruiters, Human Resource Personnel	55
2	LinkedIn Search with Job Titles – Software Developers, Backend Developer, Frontend Developer.	60
3	Other sources e.g. WhatsApp contacts, previous colleagues in the workplace	23

Table 1. *Table showing the number of contacts invited to participate in the survey*

In Table 1; A total of 138 contacts were invited to participate in this survey. Participants were searched for on LinkedIn using job titles and industry filters, based on location i.e. Nigeria using keywords such as “Hiring Manager”, “Tech Recruiters”, “Human Resource Personnel”, “Software Developer”, “Backend Developer”, “Frontend Developer”. Participants were also invited from different social media platforms including sharing links on WhatsApp, previous colleagues at work etc.

The survey [84] for the first group consists of 4 sections, 15 questions which had different question types and could be completed within 5 to 10 minutes. The questions include

- Demographic Information: This section consists of five questions regarding years of experience in the software development field, gender, highest level of education, current employment status, and age bracket. These questions help to categorize respondents based on their backgrounds which would provide useful information on how different groups embark on a career in software development. The questions in this section were all closed-ended questions with participants selecting responses from predefined options which were all compulsory.
- Educational Background: This section consists of two questions on whether a participant completed a first degree in computer science, or which course was studied from a Nigerian University. These questions evaluate if respondents have

an undergraduate degree in computer science or another discipline that is relevant to the purpose of the research. The responses will help to determine how many software engineers have a CS degree against those who do not, as well as whether their subject of study had any impact on professional growth. Responses can be contrasted with career development statistics to see whether a CS degree provides an advantage and identify patterns among alternate educational courses leading to software development professions. This section had one closed ended (compulsory) question regarding participants first degree and an open-ended question (optional) where the participant can state his or her first degree.

- Relevance of Degree: This section consists of two questions on whether a First degree in Computer science is required to kickstart a career in Software Development in Nigeria and what are the reasons. These inquiries investigate whether a degree in computer science is thought to be necessary in Nigeria to begin a profession in software development. The answers will provide a direct response to the thesis question by expressing the views of the industry regarding the value of a computer science degree. Responses might be influenced by respondents' educational backgrounds; individuals without a computer science degree might view things differently from those who do. Furthermore, we can assess whether alternate educational pathways—such as self-learning or boot camps—are suitable alternatives. This section had one closed ended (compulsory) question on relevance of the degree in Computer science and an open-ended question (optional) where the participant could choose to state his reasons.
- Personal Experience: This section consists of two questions on whether a participant's educational background played any impact in career advancement and what are the reasons. These questions aim to ascertain whether a person's professional advancement was impacted by their degree-or lack thereof and determine if a CS degree offers real benefit in terms of professional growth. Responses will also provide insight into whether industry demand prioritizes skills over formal education. This section had one closed ended (compulsory) and one open-ended question (optional) where the participant can elaborate on earlier response.

The survey [83] for the Second Group consists of 2 sections, 8 Questions in all. The questions include

- Details: This section consists of three questions relating to Employer Name, Role at the Organization and Employment status. These questions aid in gathering

critical background information about the employer, the respondent's role and employment status, thus establishing the trustworthiness of responses and providing context for examining employer perspectives. Understanding the responses allows more accurate interpretation of comments on hiring patterns and degree relevance as perspectives may vary depending on respondent role within the company. Only questions related to “Employer Name” and “Role at the Organization” were open-ended questions, however all questions were compulsory.

- Employer Perspectives: This section consists of five questions relating to feedback on performance of individuals with or without computer science backgrounds in their careers and applicability of the curriculum taught in computer science programs in Nigerian Universities in relation to the demands of the software development industry. Based on responses, if employers indicate not much difference in performance between people with and without computer science degrees, it will imply other paths- such as boot camps or self-learning may also be effective. Furthermore, if employers question the relevance of university courses, this may imply a disconnect between academic training and industry requirements. The questions in this section were a mix of closed and open-ended questions.

3.4 Interviews

Interviewing is a key technique in qualitative research because data is obtained directly from respondents in their own words, furthermore researchers have the opportunity to explore further, seek clarity, and ask follow up questions along a line of inquiry [49] . Questions used in the interviews were the same as the survey questions, so this provided the flexibility to explore participants' responses in depth while ensuring consistency across interviews. It also ensured that the responses were not confined to predefined options, allowing for a richer and more comprehensive dataset.

Eight people participated in the interview; 4 were job seekers and 4 were software developers (2 of whom had moved into other positions as Product Lead and Business Analyst). All the interviewees had already completed the survey. I purposively selected 2 software developers, and 1 job seeker based on convenience, and the rest were engaged via the Snowball Sampling technique where developers and job seekers who agree to participate referred colleagues or fellow job seekers thereby, expanding the participant pool [66].

Interviewee	Group	Participant Id	Status	Occupation
1	1	Participant 7	Employed	Senior Business Analyst.
2	1	Participant 21	Employed	Product Lead.
3	1	Participant 19	Employed	Senior Faculty
4	1	Participant 25	Job Seeker	Graphic Designer
5	2	Participant 82	Job Seeker	Software Developer
6	2	Participant 75	Employed	Software Developer
7	2	Participant 66	Job Seeker	IT Support
8	2	Participant 18	Job Seeker	IT Support

Table 2. *Table showing participants who were invited for the interviews*

Table 2 gives a summary of the employment status and occupation of the interviewees.

The interviews were conducted remotely via zoom based on the availability of participants and lasted approximately 20-30 minutes, transcribed, and analyzed to identify recurring themes. The interview sessions focused on participants' educational backgrounds, their experiences in the software development industry, the skills deemed most valuable by employers, and challenges encountered in hiring and job-seeking processes.

Each interview session was recorded with the consent of the participants to ensure that accurate data was captured. All participants were required to be present in at least two separate interview sessions; the first session was to gather responses, and a second session to clarify prior remarks, ask further questions and provide participants the opportunity to approve or disapprove earlier statements.

Before conducting any interview, participants were informed about the purpose of my research and the interview process, and allowed to ask any questions they might have

about the study. What participants were most concerned about was their anonymity, and I allayed their fears by explaining that I would not ask for their names during the interview and would employ pseudonyms during my analysis to ensure confidentiality thereby preventing any possibility of identification. Participants that chose to proceed with the interview were provided with an informed consent form and notified of their right to withdraw at any point during the study without facing any repercussions. However, none of the participants opted for this option.

During the interview process, I observed common professional backgrounds between participants and me, especially those without a university degree in Computer Science and now currently working as a software developer though not in Nigeria, which facilitated better conversation with the participants and got me information that would otherwise be challenging to acquire. Furthermore, I had a deeper and more accurate understanding of participants experiences so I needed to exhibit caution not to allow my prior background influence data interpretation. Therefore, in a bid to uphold the credibility of the research process and prevent influencing participants' responses, I ensured that I did not steer participants responses to align towards my perspective and frequently asked participants to review and verify their responses for correctness.

3.5 Data Analysis

The main survey was conducted online and received 121 responses from 138 invited for the survey, with 34 responses in the first group (HR Managers and Employers of Labor) and 87 responses in the second group (currently employed or seeking employment in the software industry).

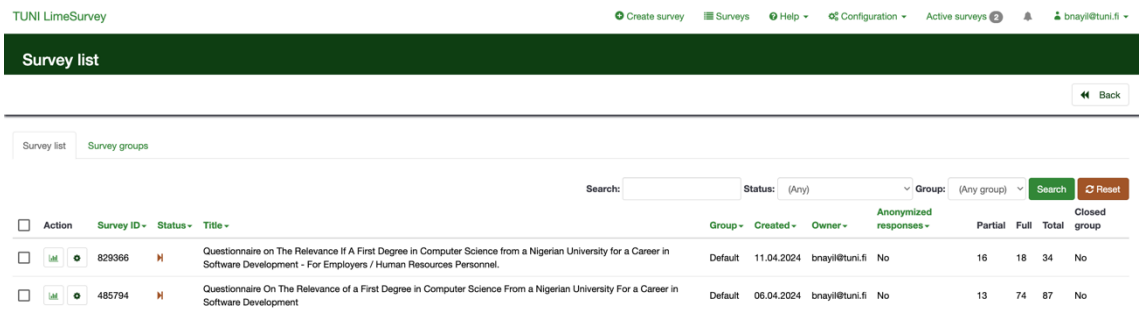

Figure 1. *Breakdown of Responses from the Survey.*

Figure 1 shows a summary of the number of responses (partial and full) in different groups on the questionnaire.

In Group 1, only 18 out of 34 responses were analyzed while in Group 2, only 74 out of 87 responses were analyzed. Both reports omitted responses which did not answer all the compulsory questions as shown in Figure 1.

Responses from the questionnaires were analyzed thematically, identifying common trends and patterns in hiring preferences, skill acquisition methods, and industry perceptions. The flexibility of this data collection method allowed researchers to capture a wide range of viewpoints, ensuring a more comprehensive understanding of the topic. Moreover, the anonymity provided by questionnaires encouraged honest feedback, particularly from job seekers and employers who might not have been comfortable sharing their experiences in a face-to-face interview.

By employing both interviews and questionnaires, the study ensured a diverse range of perspectives, capturing detailed responses that reflect the complexities of entering the Nigeria software development industry. The qualitative data collected from these techniques provided an in-depth understanding of the skills and qualifications valued by employers, the experiences of job seekers, and the alternative pathways available for aspiring developers [4].

3.6 Ethical Consideration

Research involving human participants poses inherent ethical challenges as the researcher undertakes to [53] respect and safeguard participants' interest and well-being. Participants' identities were replaced with pseudonyms to ensure anonymity and data obtained was stored in a secure place. Prior to the interviews, participants were informed about the research objectives and permission obtained through signed consent forms. Given that no monetary compensation was provided, the briefing highlighted that this interview would create an opportunity for them to have a deeper understanding of their identities and experiences as software developers.

4 RESULTS

The results of the survey conducted online are reported in this chapter. It discusses some insightful metadata collected about the participants and the details of the analysis examined. The survey consisted of 2 groups of participants

- Group 1 - Participants include HR managers/ Employers in the software industry.
- Group 2 – Participants include individuals who are currently employed in the software development industry (Employees) or actively seeking employment in this field (Job Seekers). They may or may not have completed a first degree in computer science from a Nigerian University.

The survey conducted for participants in Group 1 recorded a total of 18 analyzed responses while participants in Group 2 had a total of 74 responses analyzed.

4.1 Respondents Metadata – Group 1

Survey participants mostly worked as Human Resource Manager (5), Senior Business Analyst (1), Deputy Manager & CEO (2), while others had related roles etc. Most of the respondents indicated that they had employed individuals from fields other than Computer Science background and they met their expectations as regards to job requirements despite the transition. Furthermore, the participants expressed strong opinion that the curriculum taught in Computer Science program in Nigerian universities was below expectations. Below is a table showing the breakdown of responses

Question	Answered	Not Answered	Not Completed or Not Displayed
Employer Name	21	3	10
Do you Still work there?	21	3	10
Role At the Organization	21	3	10
From your experience or understanding, do employers in the Nigerian Software Development Industry prioritize candidates with a First degree in Computer science over those with alternative educational backgrounds or certifications?	18	0	16
Please provide any insights or examples to support your answer	8	10	16
Have you employed individuals who have graduated in fields other than Computer Science but have effectively transitioned into Software Development roles ?	18	0	16
If you answered YES to the above question, what was the feedback on the extent of their achievement?	16	2	16
Have you observed any significant differences in the performance or competencies of Software Developers based on their educational background, specifically in terms of obtaining their first degree from universities compared to those who went through alternate pathways such as self-study, coding bootcamps, online courses, and so forth?	18	0	16
If you answered YES to the previous question, who performed better?	9	9	16
How do you perceive the applicability of the curriculum taught in Computer Science program in Nigerian Universities in relation to the demands of the Software Development Industry?	18	0	16
Please provide any insights or examples to support your previous answer	8	10	16

Table 3. *Table showing responses to survey from Group 1 respondents.*

The table above summarizes responses from HR managers and Employers to the survey. It can be observed that most respondents provided direct answers to core questions though fewer respondents supported their responses with examples especially on performance differences and curriculum relevance.

Figure 2. *Bar chart showing Responses from Group 1 Respondents.*

Fig 2 shows the distribution of responses as a Bar chart from the participants in Group 1 that responded to the survey, breaking down the “Answered” column in Table 3 into its constituent values for deeper insight into the responses. The findings indicate that most respondents provided their employer’s name and role, with a majority still employed at their companies. Many respondents recognized self-study and boot camps as feasible options but there were varied responses regarding giving preference to CS graduates over other educational backgrounds during interviews. Opinions varied on how non-CS graduates adapted to the work environment since a sizeable portion of businesses attested to employing developers with non-CS backgrounds, many of whom received positive feedback regarding their performance. Most respondents disagreed with the relevance of the CS curriculum taught in Nigerian universities with only a few respondents providing detailed insights.

4.2 Respondents Metadata – Group 2

Survey participants had a high overall level of education (35 respondents with Bachelor’s degree, 33 Respondents with a Master’s Degree, 5 respondents with a Diploma, and 1 with a Doctoral degree) .Of the survey participants , 29 respondents had less than 5 years work experience, 15 respondents had spent 6-10 years, 15 respondents had 11-15 years, while the rest had worked for more than 15 years. Nearly half of the participants had completed their first degree in Computer Science whilst the others had a degree in related Engineering fields and science-based courses such as Electronics Engineering, Chemical Engineering, Biochemistry, Geology etc.

Question	Answered	No Answer	Not Completed or Not Displayed
Age	78	1	8
Gender	78	1	8
Highest Educational Qualification	78	1	8
Current Employment Status	78	1	8
Years of Experience in the Field of Software Development	78	1	8
Have you completed your First degree in Computer Science from a Nigerian University?	76	0	11
If NO, what course did you study in your Undergraduate?	36	40	11
Do you think that having a First degree in Computer Science from a Nigerian University is a requirement to kickstart a career in Software Development in Nigeria?	75	0	12
Please explain your answer?	53	22	12
If Your First Degree was in Computer Science and you are currently employed in a Software Related Field, Do you think the degree significantly contributed to your career advancement?	74	0	13
Please Elaborate on how this Educational Background influenced your career in Software Development.	41	33	13

Table 4. *Table showing responses to survey from Group 2 respondents.*

Table 4 shows the distribution of responses from the participants in Group 2 that responded to the survey. It will be observed that most respondents answered direct questions, but fewer provided more in-depth explanations, however the analysis provided a foundation for understanding the perceived value of a CS degree in Nigeria's software industry.

Figure 3. *Bar chart showing Responses from Group 2 Respondents.*

Fig 3 shows the distribution of responses as a Bar chart from the participants in Group 2 that responded to the survey, breaking down the “Answered” column in Table 4 into its constituent values for deeper insight into the responses. The survey provides valuable

insights into software development career path and education. Most respondents hold a Bachelor's degree and mostly been employed between 1-10 years in the field of software development despite lacking a CS degree. While some believe a CS degree is essential, others argue that alternative paths such as bootcamps can lead to success.

4.3 Analysis

The discourse about the necessity of a Computer Science (CS) degree for a successful career in software development has been ongoing for years. Given the increasing popularity of alternative education options like coding bootcamps, online courses, and self-directed learning in programming [14], these questions have become more significant.

- Is a degree in Computer Science a prerequisite for a successful career in software development?
- Are there other alternative educational pathways to be considered as viable options for aspiring software developers?

The objective of this chapter is to analyze different viewpoints on this issue by assessing the conventional advantages of a computer science degree, the significance of other educational routes, and concrete instances of accomplished software developers who lack a formal computer science education.

4.4 Is a degree in Computer Science necessary for a successful career in Software Development?

In respect of the ongoing debate over the necessity of a CS degree for a successful career in software development, analysis of the data collected split the answers into participants in favor of a formal education and participants not in favor of a formal education.

4.4.1 Participants in favor of Formal Education

Participants in favor of formal education being important for a career in software development are those with an undergraduate certificate in computer science [Participant 1] or computer engineering [Participant 2]. Their argument is that the degree provides a comprehensive understanding of fundamental concepts such as algorithms, data structures, and computer architecture, which are essential for solving complex problems and writing efficient code.

> ...I was taught a range of Software concepts including Data structures and Algorithms, Discrete structures, Logic, low level

> languages and Principles of programming and these planted the seed and laid the foundation for what is today my career.... [Participant 7, Group 2]

> the first degree gives us the foundation for doing any course in the world .. [Participant 5, Group 2]

> ...It helped as it put me in position to apply and improve on some courses like Operations Research, Algorithm, Optimization Theory, Machine learning and the likes [Participant 15, Group 2]

This response reflects the participants acknowledgment of how their education in various fundamental software concepts e.g. "...Data structures and Algorithms, Discrete structures, Logic, Operations Research, Low Level Languages and Principles of programming..." provided the foundational knowledge that facilitated their career development.

Other participants also acknowledged the impact of a formal education in computer science on their career in software development. Hence the statements

> Most of the tools I am using today, I had the knowledge about it while I was in school but after graduating, I become versatile while using it and it makes more sense because I can genuinely see what they are really meant to do in solving real life scenario
> [Participant 16, Group 2]

> Taking a computer science in the university kindled my interest in software development and was the foundation upon which I built my career. Computer science also give me a beginner exposure in computing in general. [Participant 63, Group 2]

> ...my career in software started early and the base of this was fundamentally provided by my school education... [Participant 52, Group 2]

These statements are the reason a respondent asserted that

> …. Certain fundamentals of programming that provide depth and coverage are typically thought in the universities and from my experience, people who do not study computer science usually lack such depth [Participant 52, Group 2].

Stalhane and Sindre [80] explained a situation whereby software engineering students did a compulsory project that involved interviewing representatives from the IT industry in Norway on the required competence level for graduates to be employed in their organization. They found that part of the most frequently mentioned characteristics after interviewing 120 companies, were programming knowledge... which further pinpoints the fact that mastery of some courses like Operations Research, Algorithm, Optimization Theory, Machine learning and the likes according to Kravtsov and Kobets [39] is crucial as they underpin almost every aspect of software development.

Hence, Mardis et al. [47] asserts that

> ...In general, Computing degrees, such as Computer Science (CS), Software Engineering (SE), Information Technology (IT), Information Systems (IS) and Management of Information Systems (MIS), prepare future professionals to get ready for the job market and to remain competent in industry. Graduates from these degrees are required to have a wide range of constantly updated technical (hard) skills and knowledge in various computing and IT fields (p.1550).[47]

There are participants who believe that individuals with a CS degree are less likely to face skepticism from employers and colleagues regarding their ability, as the degree enhances an individual's credibility in the field of software development.

> It gives an edge to study computer science because you don't get to hear discriminatory comments from people about your capability to advance in software development [Interviewee 1]

This degree offers a structured learning path covering essential theoretical concepts as mentioned above. This foundational knowledge is very important in understanding how software works at a fundamental level as this will enable developers to write efficient and optimized code. It is no wonder then that some employers would prefer candidates especially those with

> ... good grades from a reputable university with minimum of second class lower... [Participant 1, Group 1]

as better equipped to handle complex problems thereby contributing to a bias against those without such degrees.

Burke et al. [14] conducted research on the kinds of graduate industry managers and directors prefer to hire: those from coding Boot Camp or 4-year degrees. They asserted that most companies indicated hiring graduates with a 4-year degree or higher because

> some of the practice areas, especially in a data science area, require a pretty heavy mathematical background, so they need an education in statistical math that's deeper than you would get through a boot camp. Three companies recognized university graduates for having more theoretical knowledge and knowing the best algorithm to make something work. Some companies do not even bother to interview boot camp graduates due to either having enough college candidates to choose from or not view[ing] it as much of an asset to the company (p.505) [14].

As a result, a CS degree can provide professional validation, reassuring colleagues and employers of the individual's technical prowess. Having a CS degree can provide concrete evidence of one's capabilities, potentially reducing the frequency of discriminatory comments based on perceived technical inadequacies.

> It also gives you confidence ... because many people already assume you are coming from a place of experience, so that paves way for you... [Participant 20, Group 2]

> We have had to reject candidates based on their first degree not being computer related [Participant 32, Group 1]

The CS degree not only offers a robust certification that verifies an individual's proficiency to the industry, but it also functions as a potent instrument in building credibility and demonstrating one's qualifications. Traditional measures of programmers' competencies which include training, transcripts, and academic references for novice programmers according to Hawk et al. [32] therefore serves as important indicators of an individual's competency. This can therefore lead to fewer doubts about a person's skills and knowledge, helping to create a more positive perception of their abilities.

> This confidence is essential for career advancement thus a good understanding of fundamentals of computing greatly contributes to success as a software engineer [Interviewee 4]

4.4.2 Participants not in favor of Formal Education

Majority of the participants who disagree on the importance of not having a formal degree in computer science as necessary for a successful career in the software industry are

those with degrees in Public Administration [Participant 69], Chemical Engineering [Participant 3], Physics [Participant 30], Mechanical Engineering [Participant 45], Mathematics [Participant 32], Electrical Engineering [Participant 29] etc. while those who studied computer science are in the minority. This is in line with Burke et al. [15] explanation that

> Many ... companies did not list a specific preference for CS university degrees. In fact, some indicated that hires with alternative degrees, such as music, physics, or education degrees were successful due to similar problem-solving traits as CS graduates ... (p.505) [14].

Thus, when asked if they think their degree significantly contributed to their career advancement, participants without a first degree in CS answered in the negative stating that

> I did not study Computer Science but learned on the job and took some courses online. I don't think it is necessary really. A lot of Computer Science graduates are not even in the tech line at all ... [Participant 69, Group 2].

> We have countless evidence to debunk that in the case of electrical engineers and medical doctors being successful in this field. [Participant 65, Group 2]

> I don't think so, besides I didn't have a first degree in computer science or any related field [Interviewee 6].

> Continuous learning is what leads to career advancement and not a degree. The principles from CS classes can be learnt from books or short courses nowadays [Participant 19, Group 2]

This statement corroborates with the HR managers' claims that employers in the Nigerian Software Development Industry do not prioritize candidates with a First degree in Computer science over those with alternative educational backgrounds or certifications.

> I have done a couple of Tech recruitment, and their first degree wasn't a selection criterion [Participant 14, Group 1].

In the tech recruitment processes observed, the specific field of the applicant's first degree was not a critical selection criterion. This suggests that some tech companies may

be more flexible regarding the educational background of applicants. Rather than focusing on whether the candidate studied computer science, engineering, or a related field, the emphasis might be on the skills and experiences that the candidate brings to the table.

> Software development is a skill that can be easily verified during interview. This does not necessarily mean you must be a graduate of computer science to demonstrate this skill.... There are interview questions that require candidates to write a piece of code or debug a code to confirm if that candidate has the necessary skills required to function on the job [Participant 7, Group 1]

This is particularly relevant in the tech industry, where skills can be self-taught or acquired through non-traditional educational paths, such as coding boot camps or online courses [15].

Also, the tech industry is rapidly evolving, and the demand for specific skills can change quickly.

> Over a period, the engineering of software has become an interdisciplinary concept, which means that the skills necessary to successfully work in this area thirty years ago may no longer be applicable in today's workplace. For instance, software design has become much more than manipulating formal or semi-formal notations, but rather revolves around the interaction between designers and users: namely, the designer's perception of what the user wants, and the user's perception of what he/she really needs (p.172) [7]

As a result, companies might prioritize candidates who can demonstrate practical knowledge, problem-solving abilities, and adaptability over those who simply have a degree in a particular field.

> Computer Science is not all about Software Development ... I have discovered that grit and individuals teachability skill has made a significant difference beyond having first degree in CS [Participant 13, Group 1]

> A lot of jobs or opportunities in software development in Nigeria are usually based on the individual's experience and not their background. Some jobs are fine with the individual having a background in engineering. [Participant 42, Group 2]

Research indicates that many successful software developers are self-taught or have acquired their skills through non-traditional route [37]. According to [15], organizations like Apple and Google adjusted their hiring practices to lean more on practical skills and problem-solving abilities rather than formal qualifications. This shift reveals an industry trend that values real-world experience and continuous learning over formal education. This approach allows companies to tap into a broader talent pool and find individuals who can contribute effectively, regardless of their academic background.

Although the specific degree field was not a key factor, academic performance still played a significant role in the selection process.

> An applicant must have good grade from a reputable university with Minimum of second class lower [Participant 16, Group 1]

> It doesn't matter what their undergrad degree is, anyone can learn how to code on the internet. At the same time, I'm not downplaying the importance of learning algorithms and data structures in a structured manner which a degree might provide or introduce students to... [Participant 3, Group 1]

A good grade often shows that the candidate possesses a good work ethic, intellectual capability, and the ability to meet deadlines and take on challenges—qualities that are valuable in any professional setting. Setting a minimum standard like Second Class Lower indicates that companies are looking for a baseline level of academic competence. This criterion helps weed out candidates who may not have demonstrated sufficient academic success, ensuring that those who advance in the recruitment process have met a certain threshold of achievement. The data suggests a shift in recruitment practices within the tech industry. The usual measures of qualification, such as a candidate's specific field of study may be becoming less relevant as companies focus more on what candidates can do rather than what they studied. So, it is safe to conclude that while a degree in CS provides specific technical and theoretical knowledge, it is not an absolute prerequisite for a successful career in software development.

In fact, students and employers recognize that computer science graduates are often not fully equipped with required skills for effective performance, especially in large software development companies. This might be because

> The curriculum in Nigerian universities are outdated and not in-line with global trend for software development. I studied Computer Engineering and I can recall been thought old software development language and methodologies [Participant 2, Group 1]

> The curriculums during my period of study does not prepare you sufficiently for the job market, most things I know I learnt of my own volition [Participant 5, Group 2]

> While Computer science undergraduates in Nigeria are taught a range of Software development languages and concepts, the curriculum most often is not enough to kickstart a career in software development without some personal effort [Participant 7, Group 2]

> Most of our Nigerian universities are theory based, the software industry demands more. [Participant 32, Group 1]

Nigerian universities often struggle with outdated curricula that do not keep pace with global trends, particularly in fields like software development. This issue is partly due to how slow the curriculum is reviewed [*outdated* [Interviewee 5] and *insufficient* [Interviewee 8]], little or no industry collaboration, and more emphasis placed on theoretical knowledge over practical, industry-relevant skills, leading to a gap between academic training and real-world job requirements. As a result, Idoko N. [33] after reviewing the ICT content of advertised jobs assert that

> "...Universities should ... re-engineer the curriculum to meet the need of the Nigerian Software Industry" (p.3) [33].

This disconnect between academic training and industry requirements means that graduates often need to upskill independently, that is take the initiative to learn key software development skills, modern programming languages, and industry practices on their own

In line with the above statement, Burke et al. [14] explained using the data collected from a large automobile technology company that CS graduates are

> generally not so much taught to code. They don't come out as the best developers, and they may be able to analyze a problem very well... They can think about the theory really well and explain the theory of things really well, but then when they actually sit down to code, their habits aren't great. Their naming conventions aren't great. They generally are unfamiliar with just basic development tools (p.506) [14]

Based on the aforementioned, it is safe to assert that

> ... the first degree gives us the foundation for doing any course in the world ... [Participant 5, Group 2]

> Anyone with any grade should be employable as long as they can deliver value and are teachable. [Participant 8, Group 1]

suggesting that obtaining a first degree equips individuals with the basic skills, knowledge, and competencies necessary to pursue further education or career opportunities in various fields. In the context of a career in software development, this foundational argument raised by those without a formal degree in CS is often used to deemphasize the perceived importance of a CS degree.

4.5 Are there other alternative educational pathway to be considered as viable options for aspiring software developers?

Deciding to embark on a CS major at the start of tertiary institution and subsequently earning a computing degree may not only be the most direct pathway to a successful career in computing.

> One can acquire the necessary skills and proficiency needed in software development through self-paced learning or training bootcamps. While a computer science degree might be helpful, it is not the only pathway to software development [Participant 30, Group 2]

> Based on my experience and interaction with others, people who have no background in CS have been able to start a career by attending a bootcamp or taking the self-taught path [Participant 19, Group 2]

> So graduates from the university tends to further learn more on their area of study outside, like boot camps and the likes so as to be proficient in their chosen field [Interviewee 5]

> There are a lot of bootcamp training platform to help you kickstart your journey [Participant 14, Group 2]

The increase in alternative education paths—such as coding bootcamps, online courses, and self-directed learning—has challenged the traditional notion of a CS degree as a prerequisite for a successful career in software development. Bootcamps are typically short-term, intensive programs designed to teach specific programming skills and technologies that are in high demand in the industry, while platforms like Coursera, Udemy, and edX offer courses on a wide range of online software development topics. These courses often focus on specific tools, languages, or frameworks, enabling learners to tailor their education to their career goals. These programs emphasize practical coding skills that often include project-based learning, which can be more immediately applicable to software development roles than traditional academic coursework [41]. Therefore, unlike CS degrees, which cover a broad range of theoretical topics, bootcamps focus on practical, hands-on experience. This allows students to quickly acquire the skills needed for entry-level developer positions.

However, Lehman et al. [41] argued that while bootcamps offer an alternative for a career path into the software industry, and an opportunity for those who missed computing education earlier, students entering the industry ... are still faced with personal challenges, which often include spending a lot of time, money and effort before, during, and after their bootcamps. Despite this challenge, they still concluded that

> "Coding bootcamps are a new and understudied way of training new software developers" (p.245). [41]

> it is possible to have no educational background in computer Science and have a career in software development by taking courses, certifications and showing that you have the skills required to perform the job [Participant 66, Group 2]

Increasingly, employers are recognizing that a degree is not the only indicator of a candidate's abilities. Many companies now prioritize practical skills, experience, and problem-solving ability over formal education hence,

> ...experience in software development will always be better than degrees [Interviewee 5].

As a result, candidates who have completed bootcamps, online courses, or who have built a strong portfolio through self-directed learning can compete with, or even outperform, those with traditional CS degrees.

> I would have strongly agreed some years ago but the landscape has changed in recent years and a lot more companies are open to the idea of non CS degree holders venturing into their software engineering departments [Participant 25]

There has been a significant shift in recent years. As the demand for software engineers continues to grow, more companies are recognizing that skills and experience can be just as valuable, if not more so, than a formal degree in computer science. So as more individuals from non-traditional backgrounds successfully transition into software engineering roles, they serve as proof that formal CS education is not a prerequisite for success. Their achievements have encouraged more companies to be open-minded about hiring candidates with alternative educational backgrounds. In fact, Carolyn [16] noted

> ….that in certain cases, they actually prefer their boot camp hires. These participants praised their coding boot camp hires based on the fact that they were often older and had more experience with hands-on projects as well as more efficient problem-solving skills based on their work and educational experiences. Furthermore, software development companies prefer candidates with up-to-date knowledge. Four of the managers interviewed noted that a boot camp hire tends to have more current knowledge; whereas, the undergraduate hire may not have been exposed to newer software programs/hardware...

This fast pace of technological change has highlighted the importance of continuous learning,

> … thus continuous learning is what leads to career advancement and not a degree [Participant 19, Group 2]

> As a graduate of mechanical engineering, my I had my first programming experience in my third year where I did Fortran 90. I think that made me learn how to think about writing code. After school, I had to learn web development on my own. [Participant 45, Group 2]

because it allows one to demonstrate competence by applying new knowledge to real-life scenarios. This practical application of skills is often more impactful than a degree when it comes to career growth. Thus, employers are increasingly valuing candidates who can quickly learn new skills and adapt to evolving technologies. This has levelled the playing field for self-taught developers and those who have upskilled through bootcamps or online courses.

Software development is thus a field where success is driven more by personal qualities like interest, determination, and focus than by having a formal background in CS.

> Software development requires interest, determination and focus ... [Participant 10, Group 2]

> Your background does not matter, but your motivation and interest matters a lot [Participant 70, Group 2]

> A degree is not required but the knowledge is necessary. You have to study the same concepts to do the job, whether in school or on your own. Without the degree, and the schooling, there is a bigger mountain to climb, one that requires you to be self motivated and really want to work in tech... [Participant 55, Group 2]

> Unless a graduate goes extra miles outside the four walls of the university in getting the required expertise, he or she will not be able to perform as expected [Participant 19, Group 1]

> Drive and desire (passion) can launch anyone into that field. There are many software developers who didn't even go to college, let alone study Computer Science. [Participant 38, Group 2]

Many successful software developers have entered the field without a college degree, let alone a degree in computer science. These self-taught developers have relied on their interest motivation determination and focus to build their careers. Learning to code involves tackling complex problems and debugging errors, which can be frustrating, hence the need for self-motivation which helps you push through these challenges and continue improving.

5 CONCLUSIONS

The question of whether a CS degree is essential for success in software development is complex. While formal education provides a structured foundation, the technology industry has evolved to value practical skills over formal credentials in many cases.

From the data analyzed, a CS degree equips students with core technical skills in programming, algorithms, and software engineering principles. It shows that these skills are important in building a deep understanding of computer systems, which can help with problem-solving and technical challenges [9]. Although, the degree might not provide exposure to the latest technologies and tools, as university curricula may be outdated, and project management and collaboration skills often gained through real-world experience might be lacking, employers still see graduates with a CS degree as candidates with a baseline competency in these critical areas [26].

On the other hand, companies are shifting away from degree-focused hiring practices. Practical skills, project experience, and technical proficiency are more significant than a specific degree. Therefore, self-learners and bootcamp graduates are seen as good options if they can demonstrate the right competencies. The Nigerian tech sector mirrors this global trend, particularly in fast-growing tech hubs like Lagos, where start-ups prioritize practical coding skills and portfolio work over formal credentials [62]. In summary, while a CS degree can provide a solid foundation, it is not necessary for a career in software development. Employers value skills, experience, and the ability to learn and adapt, which can also be achieved through alternative education pathways like bootcamps, online courses and certifications, self-directed learning and internships. These findings underscore the importance of practical skills, adaptability, and continual learning in the field, which can be obtained through diverse educational routes.

5.1 Contribution to knowledge and Implication for further research

This study contributes to understanding how industry demands, and education requirements are changing, emphasizing skills over traditional academic credentials. By exploring whether a Computer Science degree is necessary, the study highlights a shift towards skills-based hiring and raises questions about the role of universities in preparing students for careers in fields like software development.

This shift has implications for curriculum development in higher education, suggesting a need for academic institutions to consider industry demands when designing Computer Science programs. By providing evidence that a formal CS degree is not always necessary, the study encourages a re-evaluation of how technical education is structured. The results could support initiatives that integrate more practical, hands-on training into degree programs and bridge the gap between academic knowledge and industry requirements.

Additionally, the study's findings could motivate policymakers to develop funding programs for alternative educational pathways, supporting coding bootcamps, and online learning platforms as viable educational options. This diversification could help address the demand for software development skills and provide more Nigerians from diverse socioeconomic backgrounds with accessible pathways to tech careers.

Finally, this study opens avenues for further research on the long-term career progression and job satisfaction of individuals from traditional versus non-traditional educational backgrounds. While the current study provides valuable initial findings, further research could examine how these different educational pathways impact career longevity, professional growth, and skill adaptability in the tech industry. Longitudinal studies could also build on these findings by tracking the career trajectories of bootcamp graduates, self-taught developers, and Computer Science degree holders.

5.2 Limitations of the Study

It is crucial to recognize various shortcoming in the study. First, the research concentrated on persons with a first degree in computer science from Nigerian universities. As a result, the findings may not fully show experiences of self-taught developers, those with diploma qualifications or graduates from international universities who are also contributing to the growth of software industry in Nigeria.

Secondly, the rapidly evolving nature of the tech industry presents another challenge as hiring practices, skill demands and career pathways in software development are continually changing, therefore the findings of this study may not remain valid over time without periodic review to maintain their importance.

Thirdly, the fast adoption of AI-powered tools (GitHub Copilot, ChatGPT) that simplify programming tasks and offer real-time coding assistance may lead to less reliance on a first degree in CS as a prerequisite for entry. As AI advances, future studies may need to re-assess the value and relevance of formal qualifications as opposed to skill-based entry roles.

Lastly, the study didn't consider likely variations in the quality of education across different universities. While participants had similar qualifications in title; the curriculum, exposure to practical skills and overall instructional quality likely varied significantly, this distinction could have a profound impact on how graduates are able to embark on a career in software development.

5.3 Recommendations

Based on the study's findings, aspiring Software Developers should focus on hands-on learning and practical experience (e.g. build portfolios by working on personal projects, contributing to open-source projects, and freelancing etc.) as these are highly valued by employers and will demonstrate their skills beyond formal qualifications. They can take advantage of online courses, coding bootcamps, and self-learning resources on platforms like Coursera, Udemy etc. to acquire essential technical skills, especially if a formal Computer Science degree is not an option. Finally, the tech field is constantly evolving, so it is essential to that aspiring developers stay up to date with emerging tools, languages, and trends.

Institutions should update their curricula to cover current industry practices and technologies, aligning with the skills that are most in-demand in the workforce. They should offer more opportunities for students to engage in real-world projects, internships, and experiential learning to prepare them for industry demands. Providing students with career counselling, workshops, and networking events with industry professionals can help them understand job market expectations and create connections within the tech community.

Employers should consider considering hiring practices that are skills-based, that is emphasizing a candidate's technical skills, portfolios, and project experience rather than the formal degrees. This can help identify competent candidates from diverse educational backgrounds. Companies should establish entry-level programs such as internships or apprenticeships, especially for candidates from non-traditional educational backgrounds. These programs can help bridge skill gaps while giving the company access to new talent. Employers should foster diversity by hiring individuals from various educational pathways, including self-taught developers and bootcamp graduates. This approach not only promotes inclusivity but also brings different viewpoints to problem-solving.

Government bodies should recognize and support alternative education models, such as bootcamps and online learning platforms, as feasible routes to employment. Providing, scholarships or low-interest loans for individuals pursuing these paths can increase

accessibility, especially for aspiring software developers who cannot afford a formal CS degree.

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APPENDICES

Appendix A : LinkedIn Questions sent to Employers or Human Resource Personnel In Software Development Companies in Nigeria.

Good day Sir/Ma and Thanks for accepting my request. I hope this message finds you well. My name is Ayodeji Ilori, and I'm a master's Student studying Software, Web and Cloud at Tampere University Finland . I am reaching out to you because I'm conducting research to determine "if a First Degree in Computer Science from a Nigerian University is required for a career in Software Development in Nigeria from the perspective of an employer or Human Resources Personnel" .

I understand that your time is valuable, and I would sincerely appreciate your assistance in filling out this survey https://survey.tuni.fi/lime/829366?lang=en . The survey should take approximately 5 - 10 minutes to complete, and is targeted at Employers or Human resource personnel in Software Development Companies in Nigeria.

Please feel free also to share with anyone within your reach and Your responses will remain confidential and will only be used for research purposes. I'm happy to provide any additional information you may need or address any concerns you might have. Thank you very much for considering my request. I truly appreciate your time and support. Please feel free to reach out if you have any questions or require further clarification via this chat or linkedIn (https://www.linkedin.com/in/ayodeji-ilori/).

Appendix B : LinkedIn Questions sent to those working in Software Development who studied in Nigeria.

Hi , I am a Master's Student in Software, Web and Cloud at Tampere University Finland , currently working on my thesis. The purpose of my research is to find out if having a First degree in Computer science from a Nigerian university is required for a career in Software Development.

To this effect , I have created a survey https://survey.tuni.fi/lime/485794?lang=en which will only take about 5 – 10 minutes of your time. This survey is targeted at those working in Software Development who studied in Nigeria and I would be very delighted if anyone eligible can help in filling this out. Please feel free also to share with anyone within your reach.
I assure you completely of the survey's anonymity and upon completion, your answers will only be reported in an aggregated form and individual responses are not shared.
Thank you

Appendix C: Questionnaires For Employees / Job Seekers

LimeSurvey

Section A: Demographic Information (For Employees Only)

A1. Age :

- 20 - 25 Years ☐
- 26 - 30 Years ☐
- 31 - 35 Years ☐
- Above 35 Years ☐

A2. Gender :

- Male ☐
- Female ☐

A3. Highest Educational Qualification :

- National Diploma (OND / HND) ☐
- Bachelor's Degree ☐
- Master's Degree ☐
- Doctoral Degree ☐

A4. Current Employment Status :

- Job Seeker ☐
- Employed ☐
- Retired ☐

A5. Years of Experience In The Field of Software Development :

- 0 - 5 Years ☐
- 6 - 10 Years ☐
- 11 - 15 Years ☐
- Above 15 years ☐

Section B: Educational Background (For Employees Only)

B1. Have you completed your First degree in Computer Science from a Nigerian University ?

- Yes ☐
- No ☐

LimeSurvey

B2. If NO , What course did you study in your Undergraduate ?

Section C: Relevance of Degree (For Employees Only)

C1. Do you think that having a First degree in Computer Science from a Nigerian University is a requirement to kickstart a career in Software Development in Nigeria ?

- ☐ Strongly Agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly Disagree

C2. Please explain your answer ?

Section D: Personal Experience (For Employees Only)

D1. If Your First Degree was in Computer Science and you are currently employed in a Software Related Field , Do you think the degree significantly contributed to your career advancement?

- ☐ Yes
- ☐ No

D2. Please Elaborate on how this Educational Background influenced your career in Software Development.

Appendix D: Questionnaires for HR Managers / Employers

LimeSurvey

Section A: Details

A1. **Employer Name (Company)**

A2. **Do You Still Work There :**

- Yes ☐
- No ☐

A3. **Role At The Organisation**

Section B: Employer Perspectives

B1. **From your experience or understanding , do employers in the Nigerian Software Development Industry prioritize candidates with a First degree in Computer science over those with alternative educational backgrounds or certifications ?**

- Yes ☐
- No ☐
- Depends ☐

B2. **Please provide any insights or examples to support your answer**

LimeSurvey

B3. **Have you employed individuals who have graduated in fields other than Computer Science but have effectively transitioned into Software Development roles ?**

- ☐ Yes
- ☐ No

B4. **If you answered YES to the above question, what was the feedback on the extent of their achievement and how did they adapt to the demands of the job ?**

- ☐ Far Below Expectations
- ☐ Below Expectations
- ☐ Meets Expectations
- ☐ Exceeds Expectations

B5. **Have you observed any significant differences in the performance or competencies of Software Developers based on their educational background, specifically in terms of obtaining their first degree from Universitites compared to those who went through alternate pathways such as self-study , coding bootcamps, online courses, and so forth ?**

- ☐ Yes
- ☐ No

B6. **If you answered YES to the previous question , who performed better ?**

- ☐ Software developers from University Background
- ☐ Software Developers From Alternate Pathways

B7. **How do you perceive the applicability of the curriculum taught in Computer Science program in Nigerian Universities in relation to the demands of the Software Development Industry ?**

- ☐ Far Below Expectations
- ☐ Below Expectations
- ☐ Meets Expectations
- ☐ Exceeds Expectations

B8. **Please provide any insights or examples to support your previous answer**

Appendix E : Participant Responses

Table showing outline of Participant Responses in Group 1

Participant ID	Status of Questionnaire
1	Not Completed
2	Not Completed
3	Completed
4	Not Completed
5	Not Completed
6	Not Completed
7	Completed
8	Completed
9	Completed
10	Completed
11	Completed
12	Not Completed
13	Completed
14	Completed
15	Completed
16	Completed
17	Completed
18	Not Completed
19	Completed
20	Not Completed
21	Completed

22	Not Completed
23	Completed
24	Completed
25	Completed
26	Not Completed
27	Not Completed
28	Not Completed
29	Completed
30	Not Completed
31	Not Completed
32	Completed
33	Not Completed
34	Not Completed

Table showing outline of Participant Responses in Group 2

Participant ID	Status Of Questionnaire
1	Completed
2	Not Completed
3	Completed
4	Completed
5	Completed
6	Not Completed
7	Completed
8	Completed
9	Completed
10	Completed
11	Not Completed
12	Completed
13	Completed
14	Completed
15	Completed
16	Completed
17	Completed
18	Completed
19	Completed
20	Completed
21	Completed
22	Not Completed

23	Completed
24	Completed
25	Completed
26	Completed
27	Not Completed
28	Completed
29	Completed
30	Completed
31	Completed
32	Completed
33	Completed
34	Completed
35	Completed
36	Completed
37	Completed
38	Completed
39	Completed
40	Completed
41	Completed
42	Completed
43	Completed
44	Completed
45	Completed
46	Completed
47	Completed

48	Completed
49	Completed
50	Completed
51	Completed
52	Completed
53	Completed
54	Completed
55	Completed
56	Completed
57	Completed
58	Completed
59	Completed
60	Not Completed
61	Completed
62	Completed
63	Completed
64	Completed
65	Completed
66	Completed
67	Completed
68	Completed
69	Completed
70	Completed
71	Completed
72	Not Completed

73	Not Completed
74	Completed
75	Completed
76	Completed
77	Not Completed
78	Completed
79	Not Completed
80	Completed
81	Not Completed
82	Completed
83	Completed
84	Completed
85	Not Completed
86	Completed
87	Not Completed