Age and Gender as a Demographic Factors that Correlates Students' Performance in Computer Programming in Colleges of Education in Enugu State, Nigeria

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Abstract— *The aim of this study was to investigate age and gender as a demographic factors that correlates students' performance in computer programming in Colleges of Education. The study was carried out in Colleges of Education. Two objectives, two research questions and two hypotheses were formulated to guide the study. The study adopted correlational survey research design. The study was carried out using government owned Colleges of Education. The population for the study was forty nine (49) computer education students (final year) from the two (2) government owned Colleges of Education in Enugu State, Nigeria. The entire population was studied due to the fact that it is manageable. Hence, total population sampling technique was adopted. The instrument that was used for the study was student's result scores and a structured questionnaire titled "Age and Gender as a Demographic Factors that Correlates of Student's Performance in Computer Programming (AGDFCSPCP) questionnaire". The research instrument was subjected to face validation by three experts, two experts in the Department of Computer & Robotics Education and one from Measurement and Evaluation unit, all from University of Nigeria, Nsukka. The internal consistency of the questionnaire was determined using Cronbach's Alpha reliability test which yielded co-efficient of 0.98 and 0.97 for clusters 1 and 2 respectively and 0.98 for the entire instrument. The instrument for data collection were administered by the researcher and two research assistants. The data collected was analyzed using Pearson Product Moment Correlation Coefficient to answer the research questions. The null hypotheses were tested using One Way Analysis of Variance (ANOVA) at .05 level of significance. The findings from the study revealed a very weak relationship among age, gender, and performance of computer education students' in computer programming. In addition, the findings on hypothesis tested revealed that there was no statistically significant relationship among computer education students' age, gender and their performances in computer programming course. It was therefore, recommended among others that since demographic factors don't differentiate performance, the*

effectiveness of teaching methods and curriculum content becomes paramount. The researcher suggested that the study should be replicated in other states of our country to investigate demographic factors as correlate students' performance in computer programming in Colleges of Education. It is recommend that, invest in training for computer programming instructors on effective pedagogical approaches, such as problem-based learning, project-based learning, collaborative coding, and active learning strategies. Regularly review and update the computer programming curriculum to ensure it is relevant, engaging, and aligned with industry needs.

I. INTRODUCTION

Since computer programming remains a continually changing profession, teaching students about it effectively requires creative ways. [130], Computer programming is the process that professionals use to write code that instructs how a computer application or software program performs. Computer programming is a set of instructions to facilitate specific actions. Computer programming is the process of performing a particular computation (or more generally, accomplishing a specific computing result), usually by designing/building an executable computer program. Programming entails duties including analysis, algorithm generation, resource use and accuracy profiling, and algorithm implementation (typically in a chosen programming language, also known as coding). [138], discovered that programming performance was significantly impacted by computer programming. Similarly, [84], quoted [136], who claimed that computer programming directly affects pupils' overall programming proficiency.

The foundational knowledge and abilities needed to develop the software, applications, and systems that power the contemporary digital world are taught in computer programming courses [67]. These courses are designed to equip students with a solid understanding of programming languages, algorithms, data structures, software development methodologies, and problem-solving techniques [67]. In the rapidly evolving field of technology, computer programming is a critical skill sought after by employers across various industries. It enables individuals to translate ideas into functional, interactive, and efficient software solutions.

The practice of writing a set of commands that guide a computer on how to work or carry out a task is known as programming. Numerous computer programming languages, including JavaScript, Python, and C++, can be used for programming. Computer programming, [67], is the process of creating and implementing computer programs. [68], furthermore defined a computer program as codes executed on a computer to perform particular tasks. This code is written by programmers. The process of providing machines with a set of instructions that specify how a program should be executed is known as computer programming. In the subject of computers, computer programming, as taught in higher education institutions in the fields of computer science and education is crucial. Among the most important computer science courses offered by educational institutions is programming.

According to research, the numeral of undergraduate students selecting computer science and computer education courses has been steadily declining for more than ten years [58]. Since there is a lack of skilled experts in the sector due to the growing demand for trained computer scientists and programmers, it is necessary to advance the performance of students in computer science programs [61]. Among the causes for students not choosing computer science may be the perception of undergraduate computer science students that computing, especially programming is difficult and boring [48]. The instruction and acquisition of computer science education is very important when the teachers know the essence of using practical's to teach their students.

Computer science education teachers and students should appreciate the importance of the school laboratory in transferring theory gained in the classroom into practice. The computer laboratory is the most convenient avenue for solving problems through practice, by test-running and debugging learnt through observation and demonstration. Learning to solve real life problem through computer programming provides good ground for practical demonstration since success in programming is heavily dependent on problem solving abilities. Computer programming activities in Colleges of Education would be interesting, relevant and effective on the part of the students, if there is a relationship between the content of the computer curriculum and the practical carried out in the computer laboratory. Computer programming is one of the courses taught in Computer Education Department in educational institutions.

In Nigeria, the College of Education is the tertiary educational institution tasked with preparing teachers to earn a professional certificate in education that is not a

degree. In Nigeria, Colleges of Education first appeared in the 1950s. It is clear from the 1959 Ashby Commission report that middle-level personnel were required to meet Nigeria's demands for teaching personnel [17]. Numerous teachers were found to be untrained and uncertified. In order to improve the current teaching workforce, a proposal for a larger extension of intermediate education for intermediate instructors was made in response to this observation [64] referenced in [96]. The Commission recommended the establishment of Advanced Teacher Training Colleges (A.T.T.C's) in Nigeria. The recommendation led to the establishment of ATTC'S at Owerri, Ondo, Lagos and Zaria between 1961 and 1962; Kano in 1964 and Abrakain 1968, with both institutions named Colleges of Education [64] in [96]. The Advanced Teachers Colleges (ATCs) [64]) cited in [96] turned out graduates who were holders regarding the Nigerian Certificate of Education (NCE), a non-degree but qualitative professional certificate in education.

The philosophy underpinning teacher education at the Colleges of Education as pointed out by [64] as cited in [96], included the desire of the Nigerian Government to ensure uniformity of content and educational standard. It also aimed on creating educators by highly individual then expert correction then honesty, educators who are dedicated, and possessing the knowledge and abilities necessary to easily accomplish the national aim. The government's decision that the NCE will eventually be the minimal prerequisite for entering the teaching profession in Nigeria makes this even more crucial.

According to the NCE curriculum revision, computer instruction is now required for all 100 levels (100L). All College of Education students must meet minimal technology criteria as part of their pre-service training under the new curriculum, which was introduced in October 2010. Nonetheless, the National Commission for Colleges of Education acknowledges that instructors at educational institutions play a crucial role in helping students acquire computer programming abilities. Therefore, all instructors at Nigerian Colleges of Education are required to be literate and computer literate. The public is concerned about the student's poor performance in computer education classes, such as computer programming courses in educational institutions.

[62], defined academic performance as students' reports of their anticipated Grade Point Average (GPA) for the current semester and their Cumulative Grade Point Average (CGPA)/GPA from the previous semester. Nowadays, the majority of postsecondary educational institutions employ the grade point average, or GPA, as a handy way to summarize their students' academic performance. Because it gives more information about the

relative performance levels of individuals and other student groups, the GPA is a more accurate metric [89].The academic performance involves factors such as the intellectual level, personality, motivation, skills, interests, study habits, self-esteem or the teacher-student relationship. When a gap between the academic performance and the student's expected performance occurs, it refers to a diverging performance.

[60], Students' performance describes how students handle their coursework and how they manage or complete various assignments that are assigned by their teachers. Academic performance, or how effectively a student satisfies requirements specified by the school administration, is the yardstick by which success in an educational institution is evaluated. Specifically, a student's performance is the consequence or result of their education, the point to which they have encountered their education objectives, which include their capacity to learn and retain information and to express that knowledge either orally or in writing. Performance is frequently evaluated through testing or ongoing evaluation.

Performance of students is the yardstick for testing educational quality of a nation [130]. Hence, it is expedient to maintain a high performance in internal and mostly external examinations. The result of education is performance, which measures how well a student, instructor, or institution has met their learning objectives [130]. The performance of the students is crucial in generating the highest caliber of graduates who will serve as the nation's future leaders and workforce, ultimately driving its social and economic advancement. Science student performance is impacted through social, psychological, economic, environmental, and personal issues, and student performance measurement has drawn a lot of attention in the past. It is also one of the more difficult topics in academic literature. Demographic variables have been identified as common variables that influence the students' achievement in computer programming. More so, the influence has been more particularly pronounced among the students of College of Education in Enugu State of Nigeria. There may be some factors including demographic factors of the students that may affect their performance in programming for computers. One of the greatest important elements influencing students' poor academic performance is their demographic factors [18].

Demographic factors are the characteristics of a person or a population such as age, gender. Students' demographic factors are the sum total of the characteristics that differentiates students, or the stability of a student's behaviour across different situations [44]. These attributes may help the individual accomplish tasks that are beneficial to him or the society. Reviewed research suggests that

academic performance has a relationship with some demographic characteristics [105]. [69], focused on elements that can affect students' performance in an effort to identify the aspects that contribute to their academic achievement. In addition to other academic and demographic factors, the writers focused on gender, age, and ethnicity. They discovered a considerable correlation between demographics and student performance. Specifically the study will investigate the demographic variables (factors) of age and gender of the students and how they impact computer programming. This study looks at age and gender as demographic characteristics.

Age is among the demographic variables that most likely have an effect on students' academic performance. Age is the duration of a person's or object's existence. Numerous research has looked at the effects of age on academic achievement. "Age of the individual student, as it increases, usually affects the various development changes," claims [41]. [43], [111] looked into the variables that can impact students' academic performance and discovered that a student's age has little bearing on their total academic performance. According to the [1] study referenced [43] concluded that the negative relationship between age and performance remains constant over time. [43], quote [71] as saying that a favorable relationship exists between academic achievement and age. However, [70], discovered that student's' academic performance is not greatly impacted by their age.

[25] Pointed out that there is a general decline in active programming with increasing age. The survey further submitted that some home based activities such as gardening, art, and craftwork among others are most popular among the middle aged. He contended that age has important influence on students' performance in programming but the effects according to him depend on the individual and the type of activities. Activities differ in strength and specialized skills they require. [124], discovered that young students are more active when cumulative activity of less stringent intensity threshold is incorporated into their programme. The desire for new activity varies within age group. People in their mid-adult years and the baby boomers have different programming experiences and skills than what their parents did at that age. [25], found out that students who are currently quite active are often additional likely to desire a new activity than young students with lower level of activity. Regardless of the kind of programming activity, this is true. Age and gender were discovered to possess a strong relationship concerning the academic achievement of students in a study conducted by [9] to investigate the demographic and academic features of students that are linked to their academic performance. In his research, {87] discovered that

gender and age had a combined influence on students' academic achievement.

The social and/or physical state of being male or female is known as gender. According to [3] gender is a collection of traits that, especially when comparing men and women, differentiate between male/masculinity and female/femininity. The issue of gender in computer programming has generated a lot of controversy and misconception. [59], maintained that the pattern of women's participation in programming has all along been punctuated by a lot of cultural practice, false assumption, prejudice and even myth. According to him, right from time, male superiority over the female has been part of the culture of the society. He also added that students, both male and female shift orientation on the range of value depending on the activity structure and reported that college girls see themselves as less able in programming while boys recognize them as channel of acquiring popularity. [31], credence to the earlier claim with a submission that gender differences in variety of behavioural preference and style of living is the outcome of socialization pattern of the society. The interest and activity level of college girls decline at greater rate than the boys. Despite the persistent male dominance, [31] observed that Nigerian women including college girls have steadily continued to make an impact in computer programming skills.

It was discovered that many students in the colleges do not participate very well in most computer programming training. What are the factors that are responsible for the poor participation in computer programming among the students? [86], opined that the success of some programme significantly relies on identification of the factors that are vulnerable to its interference. In Nigerian educational institutions (Colleges of Education), computer programming is taught as a course in the computing field. Every college or school has its facilities and also operates under different conditions, but all the students are expected to write the same assessment at the completion of the education. Students' performance in computer programming is expected to be high across schools since the same computer programming contents are taught across the schools or colleges in Nigeria. But in most cases, some students' performance in computer programming is today better compared to other students across the colleges in Nigeria. However, studies by different researchers revealed that generally, students achieved poorly in programming.

In addition, many research findings also indicate that students' poor performance in computer programming may have resulted from absence of enthusiasm on the part of the students. This disregard for computer programming has been attributed to some factors such as students'

perception that programming is difficult. Several efforts have been made by researchers and computer programmers but much of these efforts seem to pay less attention on demographic factors of students in the Colleges of Education. It could be that the poor performance of students has a relationship, or can be attributed to some students' demographic factors including among other things, age and gender? Hence, this study therefore investigated the demographic variables as predictors of students' computer programming performance.

Research Objective

The major purpose of the study is to determine the age and gender as a demographic factors as correlates of students' performance in computer programming in Colleges of Education in Nigeria. Specifically, the study sought to establish;

1. the relationship between age and students' performance in computer programming in Colleges of Education.
2. the relationship between gender and students' performance in computer programming in Colleges of Education

Research Questions

The study was guided by the following research questions;

1. What is the relationship between age and students' performance in computer programming in Colleges of Education?
2. What is the relationship between gender and students' performance in computer programming in Colleges of Education?

Research Hypotheses

This study was guided by the following null hypotheses, all of which were tested at the.05 level of significance.

1. There is no statistically significant relationship between students' age and students' performance in computer programming in Colleges of Education.
2. There is no statistically significant relationship between student's gender and students' performance in computer programming in Colleges of Education.

Significance of the Study

This study would be of great significance to the following ministries both Education, Labour and productivity; school administrators; students; college authorities; curriculum planner and researchers

The ministries of Education, Labour and Productivity will find this study useful as the strategies that may be generated from this study will help policy makers in making necessary review and further contribution in the policy formulation process that may encourage employers in hiring NCE computer students. Besides, it may also help to erase the erroneous impression of the society on gender and computer programming in Colleges of Education.

Information gathered from this study will assist the school administrator and computer programmer to ensure that equal attention is given to all the students in computer education participation irrespective of their years of study in the college. The outcome of this study would concretize abstractions associated with age, educational level and gender for the students. It would expose students to have interest in the use of computer programming to being job creators rather than job seekers. This happens when the students are exposed to computer programming through the publication of this study online and use of it by lecturers to lecture when exposed through training. The study's conclusions might also be useful to school officials on suggestion of strategy on change of educational structure of computer science education so that the rightful candidates who are really interested in learning computer programming are truly admitted.

The information from this study would be a strong indicator of student's gender performance in computer programming. It will inspite of some few activities that are mainly dominated by female, the male students generally, show more interest and participated more in computer programming than the female students.

The information from this study will task the college authorities, gender bodies and physical educators to find a mean of removing those prejudices and misconceptions that constitute barrier to female participation in computer programming. The study will assist the college authorities and service providers to select and modify the activities that will suite the various ages of the students. Also, offering programming opportunities that have carry-over values will ensure continuous participation and development of life-long programming skills. This finding will guide the college authority to design programme of action that integrate computer into family chores in a meaner that will further preserve the family values and responsibilities.

In information from this study will task the curriculum planner in designing the programme of activities that will suite not only the individual gender needs but ensure balance co-computer programming. Researchers will gain from this research as well, since the results will be useful resources, which will add to existing body of literature, and help to unravel further investigations.

II. LITERATURE REVIEW

Overview of Colleges of Education in Nigeria

The foundation of Colleges of Education in Nigeria is traceable to the [17] called, Investment in Education [49]. The Commission recommended the establishment of Teachers' Grade One Colleges, which would offer a two-year teacher programme based on a school certificate. As a result of the modification of the Report, five Advanced Teachers" Training Colleges were established in 1962 by the Federal and Regional governments with the aid of UNESCO. The programme is a three-year course open to candidates who had completed a Grade II Teachers" course or secondary education with required credit passes. The report was modified and five Advanced Teachers' Training Colleges were established at Lagos. Ibadan and Zaria in 1962. That of Ibadan was later transferred to Ondo in 1964. The College is now known as Adeyemi College of Education. Other Advanced Teachers Training Colleges were established at Owerri in 1963, Kano in 1964 and Abraka in 1968. All the Advanced Teachers' Training Colleges were co-educational with sponsorship from either the Federal or Regional governments. Because of their excellent reputations and high standards, a few of the Advanced Teachers' Training Colleges were promoted to the rank of Colleges of Education. In 1973, there were thirteen Colleges of Education and advanced teachers' training colleges in Nigeria [93] as referenced in [109].

All 43 or so Advanced Teachers' Training Colleges and Colleges of Education in Nigeria were affiliated with educational institutions or faculties of Nigerian universities until 1989, when the National Commission for Colleges of Education (NCCE) was established. [88], there are currently 219 Colleges of Education in Nigeria that meet consistent basic criteria. The setting up of the uniform minimum standards by the commission was necessitated, among other things, by the discriminatory admission policies of the universities in favour of the candidates from ATTCs/Colleges of Education that were affiliated to them. The commission argues further that: The necessity for harmonization of the different standards becomes even more compelling with the recognition that is producing for the same market [97] cited in [109].

Since the establishment of the National Commission for Colleges of Education in Nigeria, the Academic Programmes of all the Colleges of Education in Nigeria have been accredited from time to time as stipulated in section 5 (c) and (d) of Decree 3 of 1989 that set up the Commission. The Decree states that; the Commission shall: (c) Lay down minimum standards for all programmes of teacher education and accredit their certificates and other academic awards, (d) Approve guidelines setting out criteria for accreditation of all Colleges of Education in Nigeria. The purpose of accreditation and re-accreditation exercise is to ensure the maintenance of minimum standards in all the Colleges of Education in Nigeria [88].

[96], Isiyaku outlined the concept guiding teacher education at the Colleges of Education, which included the Nigerian government's aim to guarantee consistency in curriculum and academic standards. It also sought to produce teachers who are committed, with the necessary abilities and depth of knowledge to easily accomplish the national goal, and have a high degree of professional and personal discipline and honesty. The government's decision that the NCE will eventually be the minimal prerequisite for entering the teaching profession in Nigeria makes this even more important.

According to the NCE curriculum review, computer instruction is now required. All College of Education students must meet minimal technology standards as a requirement of pre-service programs under the new curriculum, which was introduced in October 2010. However, the National Commission for Colleges of Education recognizes lecturers in the Colleges of Education as key players in developing ICT skills in students. Hence, literacy and proficiency in ICT have been made compulsory for all lecturers in Nigerian Colleges of Education since 2004/2005 academic session. Lecturers in these colleges are required to integrate ICT into their classroom activities. ICT proficiency is the ability of lecturer to use ICT appropriately to access, manage, integrate and evaluate information, develop new understanding, and communicates with others in order to participate effectively in the society Ministerial Council on Education, Employment, Development, and Youth Affairs, Mceecdya as cited in [96].

Following primary and secondary education, the College of Education (COE) is the third level of Nigeria's higher education system. Together, Colleges of Education, universities, and mono/polytechnics make up higher education, or tertiary education [133]. An institution of higher learning authorized by law to grant the Nigerian Certificate in Education (NCE), a professional teacher's credential, is the College of Education. The Nigerian Certificate in Education (NCE) is a professional teacher's certificate awarded by a college of education (or its equivalent). It is the minimum certificate that qualifies one to teach in the country. Some of these colleges are also accredited to award bachelor's degree in education and education based courses [133]. There are bodies recognized by law and charged with the responsibilities of issuing approvals for the commencement of academic programs offered by higher education institutions, as well as for the accreditation and re-accreditation of those institutions. Colleges of Education are governed and accredited by the National Commission for Colleges of Education (NCCE).

Colleges of Education are among institutions of learning formally designated to provide teacher education. In Nigeria, every educational planning places a high priority on teacher education because of its importance. Colleges of Education will only carry out effective teacher education upon successful implementation of relevant programmes [94]. [88], among several other responsibilities usually carry out a resource visit to any new College of Education whether public or private to ascertain the extent of availability of facilities for its programmes.

Computer Programming as a Course of Study

Studying computer programming calls for both metacognitive and cognitive abilities. The apprentice must use their creativity and understand the syntax and semantics of a selected programming language in order to solve problems. It combines imagination with reason. Generally speaking, it takes around ten (10) years to turn a beginner in computer programming into an expert; this process is time-consuming and mostly relies on internal [100]. Learning a new language initially, figuring out what and how to begin coding, correcting thoughtless mistakes, sitting for hours on end doing nothing, not understanding what the user needs from you, and many other challenges were all part of the programming process [120]. However, with the correct drive and consistent practice, these difficulties can be reduced or even eliminated. Developing countries face additional unique hurdles in addition to the general difficulties that come with learning programming. Tanzania is a developing nation with unique learning programming challenges, primarily socioeconomic and environmental issues like inadequate facilities, outdated materials, undertrained staff, ineffective teaching strategies, learners' low educational backgrounds, low income, cultural variety, poor living conditions, limited and erratic electricity, and the inability to buy personal computers and home use [100]. The following general issues with education in emerging nations have been noted by other academics: Inadequate educational value, parental opportunity cost, financial setbacks, insufficient infrastructure, insufficient quality and efficiency, challenges with equity and gender [24], [32].

In an effort to effectively assist students in learning programming which, according to the typical class scores in the educational institutions they have attended, have demonstrated efficacy in igniting interest and enhancing learning [117], [78], [19], [40]. Despite all of these developments and achievements, it is indisputable that students in developing nations have made significant programming progress. This is partially because the instructional strategies used haven't changed all that much. According to the study, this constraint results from a lack of infrastructure available to higher institutions in underdeveloped nations, rather than just the instructor's incapacity to adopt new teaching techniques [100].

The field of computer programming is evolving rapidly, necessitating innovative approaches to effectively educate students in this discipline. Computer programming courses provide individuals possessing the essential abilities and expertise needed to develop systems, software, and applications that power the modern digital world. These courses are designed to equip students with a solid understanding of programming languages, algorithms, data structures, software development methodologies, and problem-solving techniques [67]. In the rapidly evolving field of technology, computer programming is a critical skill sought after by employers across various industries. It enables individuals to translate ideas into functional, interactive, and efficient software solutions. Whether one is interested in developing video games, mobile apps, web applications, artificial intelligence, or software for businesses, a foundation in programming is essential. Despite the essential role of computer programming as a cornerstone in creating software, which powers a wide range of applications and systems, from mobile apps to operating systems to web platforms, the consistent under performance of tertiary institutions students has been a longstanding issue of concern [81].

Computer programming or coding is the composition of sequences of instructions, called programs that computers can follow to perform tasks. It involves designing and implementing algorithms, step-by-step specifications of procedures, by writing code in one or more programming languages. Computer programming is defined as telling a computer what to do through a special set of instructions which are then interpreted by the computer to perform some task(s). These instructions can be specified in one or more programming languages including Java, C, and C^{++}. Computer programming is the process that professionals use to write code that instructs how a computer, application or software program performs. At its most basic, computer programming is a set of instructions to facilitate specific actions (Cheryl, 2021). Writing computer programs, which are a series of instructions created using a computer programming language to carry out a certain task by the computer, is known as computer programming. Computer Programming is also fun and easy to learn provided you adopt a proper approach. This tutorial attempts to cover the basics of computer programming using a simple and practical approach for the benefit of novice learners.

Any language capable of communicating a collection of high-level or low-level computer instructions, is considered computer programming. [35], computer programming languages are used to create computer

programs that are intended to address particular issues. The author went on to explain that computer programming languages can be constructed so that they can be used to identify, initialize, and control all of the computer's external devices. [34], computer programming language is a collection of grammatical rules used to send commands to a computer so that it can perform particular tasks. The writer went on to say that computer programming language is a formal, clearly written set of instructions used to connect with digital technology, specifically computers. David added that computer programming languages are used to create programs that transmit algorithms and regulate the operation of digital computers.

A computer program, on the other hand, is a set of commands and codes which is executed to perform a definite task. Thousands of distinct programming languages have been developed, mostly in the computer area, and thousands more are developed every year. Programming language is a set of functions that tells a computer to accomplish particular functions [33]. A structured language used to transmit commands to a computer is called a programming language machine, most commonly a computer. Programming languages can be used to program computer activities. Many programming languages require computation to be stated in imperative form (that is, as a series of actions to be performed), whereas others use the declarative form (that is, the desired output is specified rather than how to obtain it). Therefore, computer programming is considered to be a part of digital literacy and one of the subjects taught in schools especially to students in computing discipline at universities. However, since lecturers facilitate knowledge to students, it is important that the computer programming language instructions are effectively and efficiently delivered to computer education students.

Computer programming is an actively highlighted area in education worldwide [42]. This has spurred researchers, policymakers, and educators to see programming as an important skill and form the basis of its inclusion in the curriculum of younger learners. This implies that pupils would acquire digital competence as a result of their engagement in programming activities [110], [113]. While a computer programming language has traditionally being taught at that level for decades and studied mostly in higher education, nothing has been done to support the learning of younger students. [112], programming is a crucial skill that all learner and worker categories across a wide range of businesses and professions must master in order to survive in modern society. Needless to say that the role of programming in shaping learners' minds and building their competence is beyond mere coding and arithmetic but also entails the rudiments of computational thinking and logical reasoning which represents one of the core skills of today often regarded as "21st-century skills".

Computer programming consists of step-by-step instructions for the computer. It is regarded as a must-have skill in the 21st century. In the digital age, programming is a necessary sort of literacy [73]. It is a branch of computer science that entails the development and coding of procedures that enable a computer to solve a problem [65]. Programming has been an increasingly important part of education in recent years. Research indicates that it fosters students' cognitive development [20] [139]. The current topic of discussion is the importance of incorporating programming into primary school curricula. Computer programming, according to [80], tends to support the acquisition of a range of abilities, making it equally as significant as traditional reading and writing [131]. According to recent research, students develop other abilities including self-management, social skills, problem-solving, and critical thinking while learning to code [107], [22], [119], preparing them to use these skills in an information society.

[42], [7] programming language is a collection of instructions that the computer follows in order to carry out a certain activity. Therefore, designing a program that a computer may run to achieve the intended or desired outcome is another way to define a computer programming language. Computer programming known for its complexity and difficulty has in recent years been adopted in elementary schools in many countries but has yet to be fully immersed in the Nigerian primary school curriculum. According to recent studies, computer studies are compulsory and have become an important part of the educational process in Nigeria [122], [98]. This would support students in developing their capacity to traverse or engage with digital technology as well as their ability to construct, recreate, and innovate some of the contemporary applications.

From the foregoing, it can be seen that programming fosters creativity in kids and increases their self-esteem. As a result, programming is one of the most crucial talents that must be mastered, [79]. Programming provides numerous advantages, such as helping to learn some mathematical abilities for offering a solution to issues, which can be utilized in many industries. It certain that programming languages facilitate the quick and fun teaching of programming concepts to students in lower grades. They also make it easy for students to create engaging games and interactive stories, as well as aid in the visualization of abstract ideas for their comprehension [134], [132]. Despite this, there are few research reports on computing and coding practices in earlier years in schools,

this is because it is believed that these practices are less important for students.

Experts and educators also acknowledge the advantages of programming for students of all ages. They held the opinion that programming has a significant role in driving innovations and success in other spheres of life [114]. It is considered that computer programming is a potent learning tool, particularly for young learners. As a result, they thought that students who program would apply their programming skills to other fields. Consequently, Dan Shapiro, Robot Turtles inventor in [53] opined that:

> "Being able to program will make children better at whatever they do... irrespective of what they do, programming unlocks their potentials, helps them express themselves, and helps them become more successful in anything they decide to do in the future" page 65

Learning computer programming is essential to creating computer applications [21]. It has also been demonstrated to improve students' creativity, planning skills, reasoning, and teamwork, making it an essential ability in today's technologically advanced society [2]. [47], learning programming has several advantages, including increasing motivation, encouraging creativity, enhancing cognitive learning and higher-order thinking skills, and cultivating problem-solving ability. [106], computer programming also fosters the development of concepts such as algorithms and the understanding of the syntax, semantics, and complexity of various languages. Computer science majors and non-majors alike must, however, comprehend computer programming despite its importance still find it hard and frustrating.

Performance of Students in Computer Programming

The concept of students' performance in computer programming in school has been divergently captured by different scholars. Some see it as academic performance; some also captured it as academic performance, while others envisaged it as students' school performance-making it to become a source of concern to researchers, especially as the performance of students in schools is declining. However, the concept has been professionally captured; the main concern of this work is geared towards students' performance. Nevertheless, the views of other scholars were captured as they are in this work, though, paraphrased ([85]. Student performance in computer programming refers to the degree of expertise, proficiency, and aptitude that a student acquires in this field of study. It typically involves understanding programming languages, algorithms, data structures, and problem-solving

techniques, and applying them to create software and applications. Student performance can be assessed through various methods, such as quizzes, exams, assignments, and projects. The ultimate goal is to develop proficiency and expertise in computer programming, which can lead to career opportunities in software development, data science, and related fields.

Exams, assignments, and quizzes are typically used to gauge students' academic performance or progress. Academic performance in the context of this study is defined as a student's academic success after completing a course or subject through the use of a web-based learning environment or platform. By lowering fear and humiliation for students of all genders and shifting the facilitators' role to be more guiding, equal educational chances for students using the same platform would boost their enthusiasm in learning, claim [15]. However, [23] defines interest as the state in which a learner is absorbed, involved, focused, or gives their full attention to a task, item, or subject. Furthermore, according to [5], when a student is engaged with a subject, the psychological resource will improve learning, which will guarantee improved academic achievement. The author further supported the idea that the purpose of any organization or academic institution should be to assist students in identifying their interests and to design curricula that will appeal to them, regardless of gender.

[90], exam results at the conclusion of a term, semester, or program are used to define or evaluate a student's performance. It might also be interpreted as the degree of achievement in a certain field of study. According to him, students that receive higher marks perform better [90]. Furthermore, according to [75], referenced in [13], student performance is determined by how well students perform on coursework-related tests as well as other kinds of exams. However, according to IGI Global Disseminator of Knowledge (2019), student performance is the final grade received in the course, which is determined by the students' reports of their previous semester's CGPA or GPA and their anticipated GPA for the current semester [13].

The above submissions are good but they did not capture what this work viewed students' performance to be. All the submissions observed performance within the circumference of CGPA or GPA grade, test and examinations cores at the conclusion of the semester, term, or program. The performance of the students has clearly gone above these. [137], supported this claim by stating that when people hear the term "student performance," they frequently consider a student's GPA or CGPA. When determining a student's performance, they start by looking at their grades. A student's knowledge and intelligence are not always reflected in their grades. According to him, some

students are highly clever and score highly on IQ tests, standardized tests, or college entrance exams even when they don't perform well in the classroom. Having submitted the above fact therefore, we would say that students' performance refers to the total results or outcome of observable positive involvement of students' ability to use his or her cognitive, affective and psychomotor domain effectively and efficiently in learning and or in academic activities. In spite of these values attached to performance, [90], indicated a decline in student performance. This can be as a result of the numerous basic demands and obligations they have, both linked to an unrelated to education. Given that student performance has an impact on the caliber of human resources in society, this issue appears to be one that needs an immediate and serious remedy and the world at large [90].

Academic performance and students' motivation are related [108]. [115], assert that in order to promote successful learning, student motivation is crucial. Given how crucial motivation is to students' academic success, the literature offers several instances of computer science education programs that try to improve students' motivation and understanding of computer programming. [46], for instance, studied university students who were taught robotics programming and discovered that it improved their motivation and academic performance. In a computer programming course, [104] discovered that using App Inventor programming and game development as an alternate method improved students' motivation and performance in fundamental programming abilities. [115], found that students who did not major in computer programming were more motivated when they used a variety of languages and tools.

Demographic Factors

[59], described demography as the changing numbers of birth, death, disease etc in a community over a period of time. [126], viewed demography as the study of human population and the ways in which they change [135], explained that demography is concerned with virtually everything that influences or can be influenced by population size. He further justified the study of demography on the basis of population growth and its attendant socio-cultural, political and economic implication on the population. [129], added that a population survey in recreation will help to identify the concentration and specific section of the society that require special consideration in service provision.

Demographic is a word used to describe an element of a group within a society e.g. the average age of a population, average education. Demographics are the quantifiable statistics of a given population while demographic factors are those relating to personal characteristics such as age ,gender, social class, level of education, family, race and ethnicity [45] the demographic factor of students to be measured in this study includes age range, gender, level and marital status of students. Demographic factors of the students influence performance of students in computer programming. Demographic factors could include marital status, educational status, religious status, age etc.

Demographic variables have been described as major factors that may influence or predict the use of computer programming by individuals. The following demographic characteristics are frequently mentioned as influencing the use of programming: age, gender, income, and degree of education and skill [63]. Demographic factors like age, gender, teaching experience, subjects taught, computer use experience, and educational background were taken into account for this study. Students must therefore have simple access to a variety of programming languages in order to utilize computer programming in the classroom [12]. Access refers to the degree of accessibility of specific resources as well as how simple it is for a given user to find them for usage. One element that may affect how science students use computer programming is access. The ease of location would determine whether a student would use computer programming for learning or not. It is expected that if students finds it easy locating computer programming the tendency to use such resources is high and vice versa.

The demographic factor like residential background has become an unavoidable part in the present-day world [16]. Demographic factors are the characteristics of a person or a population such as age, gender, ethnicity, socioeconomic measures, and group membership. Students' demographic factors are the sum total of the characteristics that differentiates students, or the stability of a student's behaviour across different situations. These attributes may help the individual accomplish tasks that are beneficial to him or the society. Reviewed research suggests that academic performance has a relationship with some demographic [105], [18], [9]. [69], focused on elements that can affect students' performance in an effort to identify the aspects that contribute to their academic achievement. They focused on demographic and intellectual factors such as gender, age, and ethnicity. They discovered a considerable correlation between demographics and student performance. The demographic factors examined in this study are age, gender, year of study and marital status.

Age and Performance of Students in Computer Programming

Age is one of the most studied demographic factors in relation to computer programming among students. [56], in their studies also confirmed that age is one of the factors that correlate students' performance in computer

programming. [28], were of the opinion that people who quickly adopt new programme tend to be younger than those who are later or non-adopters of the new programme. [27], in their study of age, computer experience and computer attitudes among teenagers found that there was positive attitude in younger group of ages eleven to twelve years than the older group of fifteen to sixteen years.

According to a study, there was no discernible difference in the use of computer programming between two teacher classes according to age or experience [77]. Another study demonstrated that staff age significantly affects how programming tools are used for teaching, research, and record-keeping in higher education; younger instructors in higher education used the tools more than older lecturers [92]. Younger lecturers may have little or no obligation to connect with the family and are less concerned with academic work, which could account for the age variations in computer programming usage [92]. The researchers hypothesized that young people are more eager to learn computer programming because they are more inquisitive. This is in line with the assertion that computer program utilization depreciates with age and that programs faithfully adhere to the law of declining returns [36]. In contrast, a number of research show that age has no discernible impact on programming usage [8] [14]. In fact, a study by [66] indicated that age had no effect on how much time Nigerian college of education instructors spent on computer programming. The differences in conclusions reached by different researchers might be ascribed to factors such as the presence of respondents, actual structures analyzed, techniques employed, or regions where these investigations were conducted.

Regarding the demographic traits considered, the first, age, half of the current computer programming, of which nearly 90% falls within the range of 18-40 years, identify themselves as members of the Millennial generation (those born after approximately 1980), and over one-third identify as being of Generation X (those born after Baby Boomers, yet earlier than the Millennials). The significance of this distribution is that differences between ages often occur within groups, with each generation maintaining distinct attitudes and behaviours about life [38]. For example, Gen-X-ers prefer to face a challenge with minimal assistance from others [118]. Millennials, on the other hand, generally welcome oversight and guidance [38].

Age is the duration of a person's or object's existence. Numerous studies have examined the impact of age on academic achievement. "The age of the individual student, as it increases, usually affects the various development changes," claims [41]. [111], analysis of the variables that potentially impact students' academic performance, a student's age has little bearing on their total academic performance. [1], research, younger pupils outperform older ones. [54], however, concluded that age and performance are consistently negatively correlated. [71], age and academic success are positively correlated. However, [70], found that age has little bearing on students' academic achievement in computer programming.

Gender and Performance of Students in Computer Programming

Another significant demographic component that has been examined in computer programming research is gender. Numerous studies indicate that women are underrepresented in computer science majors and computer-related [39]. This could be as a result of environmental and cultural elements that influence women's choices and preferences. Therefore, it is necessary to examine gender within this framework as one of the possible aspects that may have correlated with students' programming skill. However, women's underrepresentation may be due to their somewhat less positive computer programming [125]. Males have more positive programming than females, comparable findings are presented by [74] and [103]. It has been demonstrated that, despite these studies highlighting gender disparities in programming domains, these discrepancies have generally decreased in computer programming usage [10] & [128].

Gender is determined by attributes such as tasks, functions and roles of women and men in the society rather than the biological characteristic of women and men. However, gender gap is one of the variables in the educational system that tends to influence the academic adjustment of students owning to some societal steer kindly types [4]. As gender roles in the society are being rapidly redefined, female students today are showing outstanding academic prowess and pursuing higher education. Girls are better adjusted than boys, according to research on gender variations in school adjustment. They acknowledges the gender role in the computer programming is still a "thorny problem". Males and females often see things differently. For example, a young woman may attribute failure in the training classroom to not being smart enough [55]. A young man in a similar situation may interpret perceived lack of support as the culprit, and it is viewed as the supervisor's fault. Gender refers to the socially traits and duties that are culturally produced and assigned to men and women in each given society. Gender is a major factor that influences the adaptation of students to academics [96].

[92], the roles have been connected to the gender gap that African women play at home and, more significantly, in school. Therefore, the time needed for women to receive computer programming instruction may conflict with the time needed for childcare, home

responsibilities, and other academic work. While there is ongoing debate on the connection between students' performance in different courses and their gender, research has also demonstrated that it has no bearing on students' performance [72], [101]; [102]. These research on gender and performance are indirectly related to the current study because student performance is influenced by things like study habits, tool use, and programming. Consequently, if gender influences performance, it assumes that other mediating factors, including performance in the relevant course, may have produced this effect.

One such element that could influence students' programming performance is gender, should also be investigated. It has been argued that females are not adequately represented in computer-related work and computer science [123], for some cultural and environmental reasons. Moreover, it was reported that males have higher attitudes towards computer programming than females [103]. Contrary to these results, some studies show that female students have higher programming success than male students. For example, [138], concluded that female students' computer programming success was significantly higher than male students. Similarly, [84], stated that female students had higher success in computer programming than male students. [76], reported that in computer programming, secondary school female students perform slightly higher than male students. Gender gaps in information and communication technology (ICT) use have typically been demonstrated to decline, despite such studies highlighting such disparities [10]. According to a study on computer literacy and academic achievement in Enugu State, Nigeria, among other things, computer-literate female students outperformed their computer-literate male counterparts [6]. Conversely, there were no discernible gender disparities in [84] the way students performed on computer programming courses [127]. [37], female students reported using programming less frequently than male students. This is consistent with the findings of those studies. This implies that there is a continuous debate on the impact of gender on computers and students' programming abilities. Their computer self-efficacy was not significantly impacted by the interaction of gender and age [116].

[3], gender, especially when referring to men and women, is a collection of traits that differentiate between male/masculinity and female/femininity. Numerous investigations have been carried out to determine how gender affects students' performance [26]. According to a study by [52], female students outperformed male pupils. Male students do better than female students in computer programming classes, according to [30]. [121], looked on the connection between pupils' performance and their gender. Both research discovered a correlation between students' gender and performance. According to the research, there is no gender difference in students' aptitude for learning computer programming and related subjects like robotics [11]. However, even though they score better in some computer science topics, women are known to undervalue their skills and rank themselves worse than men in several nations [51]. Female students frequently lose confidence and competence due to the perceived difficulties of programming [57]. Therefore, it is necessary to investigate gender roles and their impact on students' perceptions of motivation and computer programming performance, in addition to studying how students perceive motivation.

III. THEORETICAL FRAMEWORK

Performance Motivation or Need Theory [82]

Performance Motivation or Need Theory was propounded by McClelland in the year 1961. McClelland's theory posits that needs are acquired or learned through experiences in one's environment and culture, closely linking it with learning theory. He observed that individuals who acquire a specific need exhibit distinct behaviors compared to those who do not possess it. McClelland focused on three primary needs outlined by Murray: the Need for Performance (n Ach), characterized by a drive to excel surpass set standards, and strive for success; the Need for Power (n Pow), which involves influencing others, changing people, and making a difference in life; and the Need for Affiliation (n Aff), referring to a desire to build and preserve cordial relationships with other people. McClelland found that individuals with a high need for performance tend to outperform those with moderate or low levels, and noted variations in performance motivation across regions and nations. Conversely, individuals with a high need for power seek control over people and events, finding satisfaction in such influence. The need for affiliation, akin to Maslow's social needs, reflects a desire for interpersonal connections and warmth.

[82], suggests that individuals are motivated by their need for performance, affiliation, and power, which are acquired during their lifetime. These situations enable them to achieve success through their own efforts and skills, with moderate levels of difficulty and risk. Clear feedback on results is crucial for satisfaction. However, McClelland's focus on performance, affiliation, and power is limited to the Achieving Society.
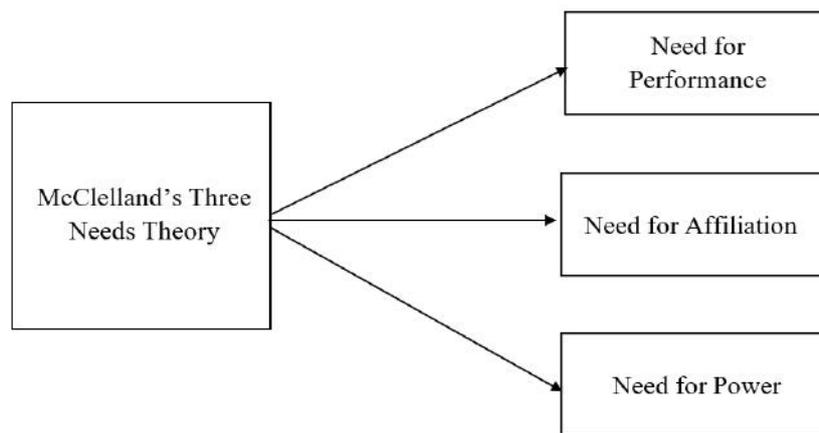
Fig. 1: Diagram of Performance or Needs Theory
Source: Researcher (2025)

In other words, most people possess and will exhibit a combination of three needs such as:

1. **Need for Performance:** [82], defined the need for performance as success in competition with a standard of excellence. This generic definition identifies an individual's goal as a performance goal, even if they fail to achieve it. Competition with a standard of excellence is most noticeable when in direct competition, but can also be evident in task performance.

2. **Need for Affiliation:** [82], defines the need for affiliation as the unconscious concern for developing, maintaining, and restoring close personal relationships, primarily referring to friendship.

3. **Need for Power:** [82], defined the need for Power as a "concern 'with the control of the means of influencing a person'". The Need for Power as "the unconscious concern for influencing others and seeking positions of authority".

Performance Motivation in computer programming is influenced by stereotypes, societal expectations, and cultural beliefs. Girls may face societal pressures to conform to traditional gender roles, but supportive environments and encouragement can help them excel. Access to resources and opportunities, cultural beliefs, and prior academic experiences also impact motivation. Intrinsic motivation, driven by personal interest and satisfaction, is more likely to achieve, while extrinsic motivation is driven by external factors like grades or rewards. Goal setting and expectancy are also influenced by demographic factors, with disadvantaged students setting lower goals due to societal expectations or lack of resources. Attribution theory explains how individuals attribute their successes and failures, with success attributed to internal factors and failures attributed to external factors. Performance Motivation Theory offers a framework for understanding student performance in computer programming, promoting a supportive learning environment and addressing demographic implications.

IV.   METHODOLOGY

Design of the Study

The study adopted correlational survey research design. Correlational survey according to [29], seeks to precisely and methodically explain a population, circumstance, or phenomena. It involves gathering and examining data from a collection of individuals or objects, only a few things thought to be typical of the group as a whole. The design is used to elicit different opinions of people on an issue of wide concern. The design is deemed appropriate given that this study solicited information from students of computer science education department on demographic factors as correlates of performance of computer programming students in Colleges of Education utilizing a standardized, structured questionnaire.

Area of the Study

The research was carried out in all the public Colleges of Education in Enugu State, one of the five States in the South East geographical zone of Nigeria. It was created on August 27th, 1991 with Enugu city as the capital. The choice of Enugu State as area of the study's foundation is its central location in terms of the old Eastern states in Nigeria. Enugu State is also endowed with a large number of educational institutions.

Population for the Study

The study population is forty nine 49 year three (final) computer science education students in public Colleges of Education in Enugu State (2023/2024 session).

The population is made up of 17 year three students at Federal College of Education, Eha-Amufu (FCEE) and 32 year three students at Enugu State College of Education (Technical), Enugu (ESCET), (Computer Education Department, FCEE, 2023; Computer Education Department, ESCET, 2023).

Sample and Sampling Technique

Forty-nine (49) third-year computer education students from Enugu State's two public Colleges of Education make up the study's sample size. The complete study population was chosen using the total sample technique. This is due to the research population's controllable size.

Instrument for Data Collection

The instrument developed for data collection is a student's result scores and structured questionnaire titled: "Age and Gender as a Demographic Factors that Correlates of Student's Performance in Computer Programming in Colleges of Education Questionnaire" (AGDFCSPCPCEQ). AGDFCSPCPCE questionnaire has two sections; A and B. Section A seeks information on the demographic data of the respondents, while section B consisted of twenty (20) items questionnaire developed in two clusters. Each cluster covered one research question. Cluster A contained ten items which seeks to gather data regarding the relationship between age and students' performance in computer programming. Cluster B contained ten items which seeks to gather data regarding the relationship between gender and students' performance in computer programming. The 20 items were used, a 5-point rating scale with equivalent values of 5, 4, 3, 2, and 1 for Very Strong Relationship (VSR), Strong Relationship (SR), Moderate Relationship (MR), Weak Relationship (WR), and Very Weak Relationship (VWR) was used to collect data from the 49 respondents.

Validation of the Instrument

Three professionals were asked to face-validate the instrument in order to determine its validity. Two experts in Department of Computer and Robotics Education and one from the Measurement and Evaluation unit, all from the University of Nigeria, Nsukka, who were requested to comment and make corrections on the instrument. The experts were given the freedom to include or exclude any item they thought acceptable or inappropriate. The instrument's final draft was updated in response to their constructive criticisms and suggestions.

Reliability of the Instrument

Twenty (20) copies of the survey (questionnaire) were sent to computer science education students at Ebonyi State College of Education, which is outside the study's

purview, in order to assess the instrument's reliability. The reason for using the above state is that the respondents share the same characteristics with those that were used for the study but in another state. The reliability of the instrument was calculated as 0.98 and 0.97 for Clusters 1 and 2 respectively and 0.98 for all the clusters using Cronbach's Alpha. [91], Cronbach's Alpha is primarily utilized for internal consistency reliability calculations when the test items are polytomously scored, which is why it was used to determine the instrument's reliability estimate. The overall reliability co-efficient is 0.98, **t**he result indicated that the instrument was reliable and therefore considered excellent or highly reliable for the study.

Method of Data Collection

The respondents were given the instrument in each school. This was done by two (2) research assistants (one each assistant from FCEE and ESCET) in Enugu State and the researcher. Only dully completed questionnaire returned were employed to examine and respond to the study's research objectives and hypotheses.

Method of Data Analysis

The information gathered for the research was analyzed to test the null hypotheses and respond to the research questions. Data from the study were analyzed using the mean and standard deviation. The correlation coefficient for the Pearson Product Moment was employed for analyzing the research questions. Interpretation criteria: Very Strong Relationship (VSR) is equal to 0.80 ± 1.00, Strong Relationship (SR) is equal to 0.60 ± 0.79, Moderate Relationship (MR) is equal to 0.40 ± 0.59, Weak Relationship (WR) is equal to 0.20 ± 0.39 and Very Weak Relationship (VWR) is equal to 0.00 ± 0.19. At the .05 level of significance, the null hypotheses were analysed using One-Way ANOVA Analysis of Variance (ANOVA). According to the decision rule, the null hypotheses were upheld if the significant value (p-value) was equal to or greater than the α-value (0.05); if not, they were discarded. SPSS, 27 was used for the analysis.

V.   RESULTS AND DISCUSSION

Research Question One

What is the relationship between age and the students' performance in computer programming in Colleges of Education?

Table 1: Correlation of the relationship between age and the students' performance in computer programming in Colleges of Education.

	Age	Average Students' Scores	N	Remark
Age	1	-0.119		
Average Students' Scores	-0.119	1	49	**Very Weak Relationship**

Researcher's Field Work (2025)

Data analyzed in Table 1 showed that there is very weak negative relationship (rpb = -0.119) between age and the students' performance in computer programming. Inference drawn from the result is that age does not affect students' performance in computer programming in Colleges of Education.

Hypothesis One

Ho$_1$: There is no statistically significant relationship between age and the students' performance in computer programming in Colleges of Education.

Table 2: ANOVA analysis of no statistically significant relationship between age and the students' performance of computer programming in Colleges of Education.

	Sum of Squares	Df	Mean Square	F	Sig.	Decision
Between Groups	1.872	3				
Within Groups	64.822	45				
Total	66.694	48				

Key words: Sig. = Significant level/exact probability value, NS = Not Significant, Df = Degree of Freedom, and F = ANOVA test statistic.

Researcher's Field Work (2025)

The outcome in Table 2 displays the Analysis of Variance (ANOVA) of the statistically significant correlation between students' computer programming performance and age. Additionally, the table showed that the F-value (0.433) above the significance level of 0.05, reaching a significance of 0.730. As a result, there is no statistically significant correlation between age and students' performance in computer programming courses, according to the mean replies of computer education students in Nigerian institutes of education. Because the relevant probability value (0.730) is greater than the 0.05 threshold set as the level of significance for testing the hypothesis, the null hypothesis (Ho$_1$) is thus maintained.

Research Question Two

What is the relationship between gender and the students' performance in computer programming in Colleges of Education?

Table 3: Correlation of the relationship between gender and the students' performance in computer programming in Colleges of Education

	Gender	Average Students' Scores	N	Remark
Gender	1	-0.127		
Average Students' Scores	-0.127	1	49	**Very Weak Relationship**

Researcher's Field Work (2025)

Data analyzed in Table 3 showed that there is very weak negative relationship (rpb = -0.127) between gender and students' performance in computer programming. Inference drawn from the result is that gender has no effect on students' performance in computer programming in Colleges of Education.

Hypothesis Two

Ho$_2$: There is no statistically significant relationship between gender and the students' performance in computer programming in Colleges of Education.

Table 4: ANOVA analysis of no statistically significant relationship between gender and the students' performance in computer programming in Colleges of Education.

	Sum of Squares	Df	Mean Square	F	Sig.	Decision
Between Groups	1.080	1	1.080			
Within Groups	65.614	47	1.396	0.773	0.384	**NS**
Total	66.694	48				

Key words: Sig. = Significant level/exact probability value, NS = Not Significant, Df = Degree of Freedom, and F = ANOVA test statistic.

Researcher's Field Work (2025)

The Analysis of Variance (ANOVA) of the Table 4 shows a statistically significant relationship between the students' gender and computer programming skills. The table shows that the F-value (0.773) attained a significance level of 0.384, which is greater than the 0.05 level of significance. As a result, there is no statistically significant correlation between students' performance in computer programming courses and their gender, according to the mean responses of computer education students Nigerian educational institutions. As a result, the null hypothesis (Ho$_2$) is upheld because the associated probability value (0.384) is greater than the 0.05 threshold for testing the hypothesis.

VI.   DISCUSSION OF FINDINGS

The data presented in Table 1, provided answers to research question 1. The findings revealed that the age of students does not affect their performance in computer programming courses in Colleges of Education. The finding that age has a very weak relationship with computer programming courses of computer education students negates the findings of [95] who stated that age contributed significantly to the prediction of students' academic achievement as regards in Integrated Science, that, age is a good predictor of academic achievement. This present study also disagrees with the findings of [50], who found a moderate favorable correlation between age and students' performance. Though, the finding affirms the assertion of [83], who stated that age was largely unrelated to performance.

[41], "a student's age typically influences the different developmental changes as it increases." [43], who looked at the variables that potentially impact students' academic performance, a student's age has little bearing on their total academic performance. According to the [1] study referenced by [43], younger pupils outperform older ones. On the other hand, [43] concluded that the negative relationship between age and performance remains constant over time. [43], age and academic achievement have a positive correlation. However, [70], discovered that pupils' academic performance is not greatly impacted by their age. The analysis of hypothesis one shown in Table 2 indicated the comparison of the respondents (computer students) on ANOVA analysis was used to examine the association between age and students' performance in computer programming courses at educational institutions at the 0.05 level of significance and with 48 degrees of freedom. The determined p-value exceeded the significance level of 0.05. Consequently, the null hypothesis was maintained at the 0.05 level of significance, demonstrating that there was no statistically significant correlation between the age of the students and their computer programming proficiency in Enugu State's Colleges of Education.

The data presented in Table 3 provided answers to research question two. The findings revealed the relationship between gender and the students' performance in computer programming in Colleges of Education. The finding that gender has a very weak negative relationship between gender and students' performance in computer programming affirms the results of [3] who believed that gender is a range of traits that discriminate between male/masculinity and female/femininity, especially in the circumstances of men and women, are supported by students' performance in computer programming. Issue of gender in computer programming has generated a lot of controversy and misconception. [59], maintained that the

pattern of women's participation in programming has all along been punctuated by a lot of cultural practice, false assumption, prejudice and even myth. [59], right from time, male superiority over the female has been part of the culture of the society. The author also added that students, both male and female shift orientation on the range of value depending on the activity structure and reported that college girls see themselves as less able in programming while boys recognize them as channel of acquiring popularity. [31], gives credence to the earlier claim with a submission that gender differences in variety of behavioural preference and style of living is the outcome of socialization pattern of the society, increasing that the interest and activity level of college girls decline at greater rate than the boys.

It is acknowledges that gender role in the computer programming is still a "thorny problem". Males and females often see things differently. For example, a young woman may attribute failure in the training classroom to not being smart enough [55]. A young man in a similar situation may interpret perceived lack of support as the culprit, and it is viewed as the supervisor's fault. [92], the gender gap has been linked to the roles that African women play at home and, more significantly, in school. Therefore, the time needed for women to receive computer programming instruction may conflict with the time needed for childcare, home responsibilities, and other academic work. While there is ongoing debate on the relationship between gender and students' performance in various courses, research has also demonstrated that it has little bearing on students' performance [72], [101], [102]. These research on gender and performance are indirectly related to the current study because student performance is influenced by things like study habits, tool use, and programming. Consequently, if gender influences performance, it assumes that other mediating factors, including performance in the relevant course, may have produced this effect. The analysis of hypothesis two shown in Table 4 indicated the comparison of the respondents (computer students) on ANOVA analysis was used to examine the link between students' performance in computer programming courses at educational institutions and their gender, using 48 degrees of freedom and at the 0.05 level of significance. The calculated p-value was higher than the 0.05 threshold for significance. Consequently, the null hypothesis was maintained at the 0.05 level of significance, showing that there was no statistically significant correlation between the gender of the students and their computer programming proficiency in Enugu State's Colleges of Education.

VII.   CONCLUSION

This study highlights age and gender as a demographic factors that correlates of students'

performance in computer programming in Colleges of Education in Enugu State, Nigeria. According to the study, there was a very weak but significant relationship between the age of the students studying computer education and their proficiency with computer programming in Colleges of Education. Additionally, the study found a very minimal association between students' gender and their computer programming proficiency in Colleges of Education. It is therefore vital to note that as students, there is always the need to consult and use programming materials for academics and research needs irrespective of any demographic factors. Students' demographic factors like age and gender should not be a barrier to programming courses and as a result, students of all the demographics should endeavor to acquire knowledge required to enable them effective learning programming courses anytime and anywhere. So, if there are notable variations in the performance of students in computer programming at Colleges of Education level, it might not have happened because of things like their age and gender.

VIII.   RECOMMENDATIONS

The study's conclusions and their implications led to the following recommendations:

1. Since demographic factors don't differentiate performance, the effectiveness of teaching methods and curriculum content becomes paramount. It is recommend that, invest in training for computer programming instructors on effective pedagogical methods include collaborative coding, project-based learning, problem-based learning, and active learning techniques. Regularly review and update the computer programming curriculum to ensure it is relevant, engaging, and aligned with industry needs. Emphasize practical application and hands-on coding experience.

2. Adequate Resources and Infrastructure should be provided to all students to have equal access to the essential tools and environment for learning computer programming, ensuring well-equipped computer labs with up-to-date hardware and software.

3. Government and school authorizes should provide reliable internet access for all students, both on and off campus, to facilitate online learning resources and collaborative projects. Making sure that there are sufficient programming languages, compilers, and development environments available and accessible to students.

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