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Computing Education, Decent Work and Economic Growth in Nigeria

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Abstract:

This study examines the impact of computing education and decent work on economic growth in Nigeria, using Enugu state as a case study. 250 respondents were randomly selected using a structured questionnaire. The Ordinary Least Square (OLS) technique was employed in analyzing the data. Computing education is measured by household investment (enrolment) in ICT/computing education courses. Employment opportunities – employed household members-to-household size, remunerative employment, conditions of work and social security are used to measure decent work. Economic growth, on the other hand, is measured by per capita household income. The results of the study showed that computing education had a significant impact on economic growth. Employment opportunities and social security were also found to had a significant impact on economic growth. Conditions of work had a positive and insignificant impact on economic growth, while remunerative employment had a negative and insignificant impact on economic growth. Computing education and employment opportunities were complementary. Also, there was a complementary effect of computing education and remunerative employment, computing education and decent work, and computing education and social security on economic growth. Among the measures of decent work, conditions of work and social security were complimentary, while employment opportunities and remunerative employment, remunerative employment and conditions of work, and remunerative employment and social security were substitutes. Other variables such as the stock of human and physical capital played some diverse roles in enhancing economic growth. We, therefore, recommend the adoption of supportive policies to encourage computing education and decent work as well as physical and human capital development. In particular, policies to encourage computing education should include the incorporation of compulsory ICT/computing education courses in the nations one-year National Youth Service Corp (NYSC) scheme.

Keywords: *Keywords: Computing education, Decent work, Economic growth, Sustainable Development Goals*

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1. Introduction

Approximately half of the population of the world still lives in poverty – about US$2 a day. In most places, especially in developing countries, the ability to come output of poverty is not quarantined by having a job. There are decreasing decent work opportunities as a result of investment insufficiency leading to under-consumption. This leads to an erosion of the efficient economic growth process of most developing countries including Nigeria. A policy thrust of job creation in the development policy-making will in addition to generating decent work opportunities; bring about robust and inclusive poverty-reducing growth. This has been acknowledged by the United Nations and set the goal 8 of the 17 goals 2030 Agenda for Sustainable Development Goals (SDG) on January 1st, 2016 (Boluk, Cavaliere & Higgins-Desbiolles, 2019). The SDG 8 is to "promote decent work and economic growth" and contains a description of conditions that will permit a better understanding and promote knowledge (Musango, Currie, Smit, & Kovacic, 2020).

Goal 8 puts at the forefront, workers well-being through employment and decent work that respect the dignity of workers. Technology, economic growth and social changes revolutionize the world, people everywhere, especially in Nigeria, need to develop their skills and knowledge as fast as possible, as to work meaningfully and live in this contemporary knowledge-based society (Chijioke, 2013). Individuals' personal development is a function of education and training, which facilitate once activities in economic and social life and increase once income at work and productivity (Ruhose, Thomsen & Weilage, 2019). The importance of education and training cannot be overemphasized as it ranges from helping one to escape poverty by aiding one with skills and knowledge to generate income and increase their output (Rageth & Renold, 2019). Investment in future simply means investing in education and training as it helps one to acquire knowledge and skills which are the engine for economic growth (Yaeger, Munich, Byrne & Germano, 2020). In Nigeria, the effort is been made by Government at all levels to eradicate illiteracy for all children and adults through education (Pritchett & Sandefur, 2020), which will, in turn, support the social and economic development of the citizen to ensure access to decent work and employability skills.

The quality of education especially in technical and vocational education and training (TVET) which computer education is one of the core studies (Shereni, 2020), aid to enhance once knowledge of science and technology in a wide trade area requiring professional and technical skills in specific trade areas (McGrath, Ramsarup, Zeelen, Wedekind, Allais, Lotz-Sisitka & Russon, 2019). TVET system in Nigeria has a mandate of teaching and equipping students with relevant up to date skills and knowledge that aid the workforce and supply the needs of the labour market in the competitive global economy. Computer education is a course of study that equip students with the basic knowledge and skills in computing processing. This computing processing skill is used in all work of life ranging from banking,

hospitals, education and industry. These sectors have been effective will aid economic growth (Jayalath & Esichaikul, 2020).

Economic growth and improvement in human welfare is a key component of computer education, this is because it focuses on equipping the students will skill, creates jobs for the citizen and provides enabling environment for career development. Also, the key factor of lifelong earning appears to be in computer education, using a computer as a tool in doing the job makes the work faster and easier thereby tackling deprivation and reduce poverty. However, computer education is associated with indicators of human capital development 21st-century (Aldowah, Al-Samarraie & Fauzy, 2019). For some decades in Nigeria, economies have shown the importance of the use of computers both in private and public investment. In a developing country like Nigeria, computer education is a source of competitive advantage because it associated with economic growth and means for the country to attract investors and create decent work for the citizens (Khan, Jian, Zhang, Golpîra, Kumar & Sharif, 2019).

Decent work is given everyone equal opportunity to be productive through work and earn an income, have social protection, integration, security at the workplace and a better environment for personal development (Blustein, Kenny, Di Fabio & Guichard, 2019). Decent work is characterized by social dialogue, workers' rights, social security, and employment (Conigliaro, 2019). Employment discusses both the quantitative and qualitative dimensions of all kinds of work that is its focus on both formal, informal and casual work. When citizens are not given equal opportunity to decent work, it can lead to scarcity of investors, increase poverty and crime rates. Thus, decent work is not only for those in the formal economy but those informal, casual, home workers and self-employed among others (Cooke, Xu & Bian, 2019). In any economy where people involve themselves with decent work, there is a tendency that will be economic growth and development.

Economic growth is a rise in the technology, capital goods, human capital, services and economic goods over some time, is an important factor in the global economy (Zaidi, Wei, Gedikli, Zafar, Hou, & Iftikhar, 2019). It is commonly measured using some factors such as the value of goods and services produced in the market, using estimates like GDP among others. Notwithstanding the reproach in rate and level of growth, it is always difficult to measure the living standard of the population, but the importance cannot be overemphasized in measuring prosperity. Despite the importance of economic growth, it still has some drawbacks. It cannot record the informal market volume of production, which means that is not all the economic transaction is captured in the volume of the generated output (Plepys & Singh, 2019). Also, it does not measure the amount of time spent on work, environmental pollution among others which directly affect social welfare. in any country where this is no economic growth, there will be an increase in unemployment.

The unemployment rate in Nigeria is still at an alarming rate, according to the National Bureau of Statistics, Nigeria's unemployment rate in 2018 was about 23.1% in the third quarter, there is also, an increase of 4% in the second quarter of 2020. This resulted in 27.1% which shows that about 21.7 million (21,764,614) Nigerians are unemployed. The underemployment still increases to about 28.6% and unemployment summing them will result in 55.7% as the second quarter of 2020. This increase in unemployment is a result of lack of interest in agriculture, inadequate information about vocational education and training, increase in population, lack of foreign investors and political will, the outdated curriculum in school, inadequate manufacturing industry and low economic activities, lack of interest in computer education among others (Adesina, 2013; Salami, 2013; Nwanguma, et al. 2012; Adebayo, 1999; Alanana, 2003; Echebiri, 2005; Ayinde, 2008; Morphy, 2008; Awogbenle & Iwuamadi, 2010; Okeke, 2011; Njoku & Ihugba, 2011; Anyadike, et al. 2012). These factors have led to an increase in the number of drug abuse, school dropout, thuggery among others.

According to Verger, Fontdevila & Parcerisa, (2019) the importance of computer education cannot be overemphasized because it equips the student with skills that are will aid the students either become self-reliant or gainfully employed on graduation. Studies have confirmed that investing in computer education has a direct impact on economic growth. Besides, when one is working and once a fundamental human right is granted in respect to remuneration and work safety it will spur the individual to work hard (Blustein, Kenny, Di Fabio, & Guichard, 2019). When an individual is working in a conducive environment and earning a living that individual is already contributing the quota to the economic growth and development. Thus, the study seeks to examine if computer education has any impact on decent work and economic growth in Nigeria.

The study especially examines the impact of computing education on decent work, the impact of decent work and computing education on economic growth, an interaction effect of computing education and decent work on economic growth. This study will be of immense benefit to policymakers in computer education in Nigeria. Policymakers during curriculum review this work will aid them to identify the skill mismatch between the industry and university once a skill is not needed in the labour market and the skill will not contribute to economic development. The government will benefit from the study through her agency Ministry of Education it will help in decision making on improving the training of computer education teachers. This study will be conducted in Enugu state Nigeria.

2. Theoretical Background

2.1 Conceptual literature

The digital world is characterized by a lot of development such as computing; this equips all young people with knowledge and skills to function optimally and increase their output (National Research Council, 2012). These computing skills can be learnt through the learning of computer education (Popat & Starkey, 2019). Computer education has two major concepts computer and education; a computer is an electronic device that accepts input, process and produces output equally communicate it while education focuses on knowledge and skill transfer (Guillén-Nieto & Aleson-Carbonell, 2012). Computer education simply means teaching and learning computing knowledge and skills (Hsu, Chang & Hung, 2018; Durak, 2020). Computer education or computer sciences education is the art and science of teaching and learning computing skills (García-Peñalvo & Mendes, 2018). Computer education refers to learning the rudiment knowledge and skills to communicate, work and achieve a desired function or job. It focuses not on basic but computer education covers various fields and sectors because of its use in society (Lajoie, (Ed.). Computer science education according to Skalka, and Drlík, (2018) is coaching and training the students in programming knowledge and skills. This programing usually helps an individual to be gainfully or self-employed and contribute to economic growth.

Economic growth is usually measured in one year, upsurge in gross domestic product or increase in the amount of production of goods and services in a country (Ausloos, Eskandary, Kaur & Dhesi, 2019; Schandl, Fischer-Kowalski, West, Giljum, Dittrich, Eisenmenger & Krausmann, 2018). Economic growth refers to the process of growth in the size of macro-economics, national economics, per capita income mostly on GDP, in ascending order, in turn, has a positive impact on the socio-economic sector and improving the standard of leaving (Jean-Paul & Martine, 2018; Emere, 2018). Economic growth means an increase in the production of goods and services in the capacity of an economy, it is usually compared over a while (Kjaer, Pigosso, Niero, Bech & McAloone, 2019). It can be measured through gross domestic product and gross national product.

Decent Work thus compares the generation of been employed within a conducive environment with which workers' rights are observed and their voice in the community is respected (Blustein, Kenny, Di Fabio & Guichard, 2019). Decent work is understood to be a non-punishable activity, compliance with the rule of law, legal and acceptable with all necessary to legal norms (Pellegrino, 2019). It equally includes fair payment, safe and working conditions with a given time (Rahim, 2020; Farese, 2020). Decent work simply means the work right that is right to a fair wage, good standard of leaving, healthy and safe working environment, full employment,

strike, social security and freely chosen work among others (Cooke, Xu & Bian, 2019; Blustein, Kenny, Di Fabio & Guichard, 2019; Mansour, & Hassan, 2019). Decent work refers to enabling an equal playing ground for men and women to obtain decently and create work in an environment free from inequality, inequity, dependence and insecurity among others.

2.2 Empirical Literature Review

The director-general in the 87th meeting of the international conference of 1999 was when the concept of decent work was established. Decent work simply means working security, equity, employment and satisfactory working condition, freedom of working in a productive condition. It was established for adequate salary/wage, choice of a trade union, social security, conducive environment and right to strike action (ILO, 1999). Decent work was later expanded to cover the right to express, right in decision making, right to social contribution among others. The concept has four pillars workers rights, social dialogue. employment and security (ILO, 2015).

However, studies have been conducted on decent work (Anke, Paul & Graham, 2019; Pacheco et al., 2014; David & Kevin, 2017; Campbell, 2010; Vives et al., 2013; Kayode & Agboola,2019; Hussain & Endut, 2018 these studies have tried to explain decent work in the relation to the four pillars developed by ILO. Anker et al. (2002) the author defines decent work about the child labour, social dialogue, hours worked and working condition, moreover, Mondal (2010) add that it is based on the right to work progressively. Pacheco et al. (2014) contributed that collective voice and employment stability is the major component in decent work. Kinzil (2005) further clarified insecure work as work that threatens the freedom of workers, nature and freedom to collective bargaining also, working conduction and wages. Campbell (2010) opined that not all work is standard. The author spilt work into the category casual most insure, marginal that is self-employed and fixed-term wages. Vives et al (2013) also highlighted insecure work as follows, disempowerment such as low wage, right to sick leave, unjust and oppressive treatment, holiday among others.

There are limited researches on the impact of computer education, decent work and economic growth. Some of the early studies (Solow 1987; Baily 1986; Parsons, Gotlieb, and Denny 1990) their study reveals the impact of ICT on the economy. Solow (1987) maintained that the US economy in the mid-80s was seriously booming, as a result of the computer age but in the productivity, statistics is not the same. During this period national productivity has not seen the impact of ICT. In recent studies, Gruber and Koutroumpis (2010) in his study reveals a positive impact of ICT on productivity and GDP. The researcher collected data from 192 countries from 1990 to 2009 in the US.

In Singapore, Vu (2013) carried out a study using Econometrics and growth accounting on ICT use in the country. The study founds a positive effect on

economic growth, especially in the manufacturing industry. Bertschek, Briglauer, Hüschelrath, Kauf, and Niebel (2015) carried out survey research using the proxy of broadband internet in telecommunication users. The study equally shows positive growth in the economy as a result of ICT. In India and Brazil in a study conducted by Harrison, and Menezes Filho (2011) their study reveals a positive effect on productivity and ICT capital. Brynjolfsson and Hitt (2003) studies reveal that investing in computer education and technology produce more output against the input unit. The study focused on the industry use of ICT and productivity in the firm. Ebrahim, 2009; Bello & Johnson 2011; Akanni, 2015; Ismaila, 2017 Akinwale, Sanusi & Surujlal, 2019; these are authors that studied ICT and economic growth in Nigeria and beyond. They were able to establish that there is a positive relationship between ICT and economic in the country.

Farhadi, Ismail and Fooladi (2012); Paunov and Rollo (2016); Nath and Liu (2017) and Niebel (2018) observed from studying more than 220 countries from 2000 to 2015. Studying computer education through ICT the Impact on economic growth. The result reveals that computer education through ICT has a positive relationship to economic growth through per capital of the individual. The knowledge and skill of the computer are very important in today's world. Niebel (2018); Lee, Gholami and Tong (2005); Dewan and Kraemer (2000); Yousefi (2011) Opined that computer education should be given more attention in developing countries. Similarly, Stiroh (2002) carried out a study on ICT capital on US manufacturing industries' data for 1984 to 1999 using OLS and regressions as a statistical tool, the researcher found a negative output elasticity of ICT on productivity.

Empirical literature analyzed has shown, computer education enhances the use of ICT technologies this, in turn, increase economic growth in are far been establish, moreover in developing countries. Therefore, no known study available to the researcher at the time of this research in Nigeria has tried to examine the impact of computing education, decent work on economic development in Nigeria.

3. Methodology

3.1 The Population of the Study

The population of this study is public and private sector workers. They are non-agricultural sector workers. They include workers in the education sector, manufacturing, and services sectors in Enugu state. Enugu state is one of the states in Southeastern Nigeria. The state is created in 1991. The state capital is Enugu, which is the largest city in the state.

3.2 Sample and Sampling Technique

The purposive sampling technique was used in selecting 250 respondents for the study. 150 were selected from the public sector, while 100 respondents were chosen from the private sector. Five Local Government Areas (LGAs) were randomly selected. In each of the LGAs selected, 50 respondents were randomly selected. 30 were public sector workers while 20 were from the private sector. Therefore, making the total number of respondents for this study to be 250. Structured Questionnaires were used to collect data for the study. The designed instruments comprise multiple-choice close-ended questions.

3.3 Theoretical Framework and Model Specification

This study is anchored on the augmented Solow human-capital-growth theory by Mankiw, Romer & Weil (1992). The theory posits that investment in human capital instigates higher economic growth rates. It is based on the assumption that formal education improves productivity. The human capital theory emphasis the significance of education and training as a basis to take part in the new global economy as well as for productivity capacity improvement. The theory views a population that is educated as a productive population. Human capital (education – computing education) improves workers efficiency and increases productivity by enhancing the level of cognitive stock of human capability, which comes from innate abilities and investment in human capital (Almendarez, 2011). The ultimate basis of a nation's wealth is human resources. The theory offers a basic justification for investment in education at the micro and macroeconomic levels. Following Eigbiremolen & Anaduaka (2014), the model is specified as:

$$Y = AK^{\alpha}(hl)^{\beta} \quad . \quad . \quad . \quad (1)$$

Where Y is growth, K is the stock of physical capital and his level of human capital. L represents the labour force, (hl) is the total stock of human capital and A represents total factor productivity. α is capital input elasticity with respect to output, while β is labour input elasticity with respect to output. The total factor productivity (A) in equation (1) is influenced by technological progress as given in equation (2):

$$A = (TP) = TP^{\varphi} \quad . \quad . \quad . \quad (2)$$

Where TP is technological progress. For the purpose of this study, technological progress is taken to be an investment (enrolment) in ICT/computing education courses – ECEC (that is, TP = ECEC). The stock of physical capital (K) is represented by households accumulation of non-land fixed assets (NLFA) including productive and consumable assets like treadle pumps used for production as well as radio and television as consumable assets. The total stock of human capital (hl) in equation (1) is taken to be the product of household members with ICT/computing education certificates (h) and the total household size (L) – HKS. On this basis, we

proxy Y in equation (1) with per capita household income (PHHI) and rewrite equation (1) as:

$$\text{PHHI} = \text{ECEC}^{\varphi}\text{NLFA}^{\alpha}(\text{HKS})^{\beta} \quad . \quad . \quad . \quad (3)$$

The new expanded model, after taking the logs is specified as:

$$\text{PHHI} = \varphi ecec + \beta nlfa + \beta \text{hks} \quad . \quad . \quad . \quad (4)$$

Log transformed variables are presented in small case letters. PHHI is not logged because the variable is already in ratio. Again, for the purpose of this study, equation (4) is modified by incorporating measures of decent work, since this study is focused on computing education, decent work and economic growth. Equation (4), therefore, becomes:

$$\text{PHHI} = \varphi ecec + \beta nlfa + \omega \text{hks} + \gamma_1 EMPO + \gamma_2 REMEMP + \gamma_3 \text{WORKCON} + \gamma_4 \text{SOS} \quad \ldots (5)$$

Where EMPO is employment opportunities measured by the ratio of employment (employed household members)-to-household size, REMEMP is remunerative employment measured by the proportion of workers in a household earning an income less than half of the national (median) wage rate, WORKCON is conditions of work measured by paid leave, and SOS is social security measured by the adequacy of workers coverage in terms of contingencies like occupational injury, medical care, maternity, benefits in respect of sickness etc. The parameters, φ, ω, β, γ_1, γ_2, γ_3 and γ_4 measure the output elasticities of the variables respectively. The four measures of decent work are selected measures put forwarded by the International Labour Organization (ILO).

Again, in order to determine if the measures of decent work are complementary or substitutes, we interact with the measures of decent work. Also, to determine the complementarity and otherwise of computing education and decent work, we interact investment (enrolment) in ICT/computing education courses (ECEC) with the measures of decent work. On this basis, the model for estimation is specified as:

$$\text{PHHI} = \varphi ecec + \beta nlfa + \omega \text{hks} + \gamma_1 EMPO + \gamma_2 REMEMP + \gamma_3 \text{WORKCON} + \gamma_4 \text{SOS} + \gamma_5 EMPO\_REMEMP + \gamma_6 \text{WORKCON\_SOS} + \gamma_7 REMEMP\_\text{WORKCON} + \gamma_8 REMEMP\_\text{SOS} + \gamma_9 ECEC\_EMPO + \gamma_{10} ECEC\_REMEMP + \gamma_{11} ECEC\_\text{WORKCON} + \gamma_{12} ECEC\_\text{SOS} + u_1 \quad \ldots (6)$$

Where $EMPO\_REMEMP$ is the interaction of employment opportunities and remunerative employment. WORKCON_SOS measures the interaction of conditions of work and social security, while $REMEMP\_\text{WORKCON}$ is the interaction of

remunerative employment and conditions of work. *REMEMP_SOS* measures the interaction of remunerative employment and social security, *ECEC_EMPO* is the interaction of computing education and employment opportunities, *ECEC_REMEMP* represents the interaction of computing education and remunerative employment, *ECEC_WORKCON* is the interaction of computing education and conditions of work, while *ECEC_SOS* is the interaction of computing education and social security.

The signs and significance of the coefficients for the interaction terms determine the complementarity or otherwise of the variables. For example, if the coefficient for computing education is positive and the coefficient for the interaction term is negative, then, it means that the variables are substitutes. On the contrary, if the coefficient for computing education is negative and the interaction term is positive or if both are positive, then, it means that the variables are complementary.

Equation (6) will be estimated using the Ordinary Least Square (OLS) technique. The OLS technique is classified as the Best Linear and Unbiased Estimator (BLUE) among the class of estimators. The OLS estimator is BLUE in the class of all available estimators if it is: linear – a linear function of a random variable, such as the dependent variable, Y in a regression model; unbiased – if its average or expected value $E(\hat{a}_i)$ is equal to the true value a_i and has minimum variance in the class of all such linear unbiased estimators.

4. Empirical Findings/Result

4.1 Demographic Characteristics of the Respondents

The demographic characteristics of the respondents considered in this study are gender, age, marital status, education and household. Table 1 below presents the descriptive statistics of the respondents.

Table 1. Descriptive Statistics of the Respondents' Profiles

	Frequency	%
Gender		
Males	158	63.20
Females	92	36.80
Total	**250**	**100.00**
Age group		
Below 30 years	37	14.80
30 - 44 years	135	54.00
45 - 59 years	78	31.20
60 and above	-	-
Total	**250**	**100.00**
Marital status		
Single	78	31.20
Married	146	58.40

Divorced	18	7.20
Widow	8	3.20
Total	**250**	**100.00**
Education Level		
Primary	25	10.00
Secondary	61	24.40
Tertiary	109	43.60
Others Qualifications	55	22.00
Total	**250**	**100.00**
Household size		
Below 5 person	151	60.40
5-9 persons	88	35.20
10-14 persons	9	3.60
15 and above	2	0.80
Total	**250**	**100.00**
Years at work (work experience)		
Below 5	138	55.20
5-9	57	22.80
10-14	53	21.20
15 and above	2	0.80
Total	**250**	**100.00**

Source: Authors computation from field survey, 2020

Table 1 shows that the males are 158 representing 63.20 per cent of the respondents while the females are 92, representing 36.80 per cent of the respondents. This means that the respondents were more males. Concerning the age range of the respondents, 37 or 14.80 per cent were below 30 years, 135 or 54.00 per cent were between the age ranges 30 – 44 years, while 78 or 31.20 per cent were between the age ranges 45 – 59 years. None of the respondents was 60 years and above. The single respondents were 78 or 31.20 per cent, 146 or 58.40 per cent were married, while 18 or 7.20 per cent were divorced. 8 or 3.20 per cent were a widow. The respondents, therefore, were more married people. The respondents with a household size of below 5 people were 151 or 60.40 per cent, while those with 5-9 persons were 88 or 35.20 per cent. 9 or 3.60 per cent had a household size of 10-14 persons, and 2 or 0.80 had a household size of 15 persons and above. 25 or 10.00 per cent had primary education, 61 or 24.40 per cent had secondary education, 109 or 43.60 per cent had tertiary education, and 55 or 22.00 per cent had other forms of qualifications. Out of the total respondents, 138 or 55.20 per cent had below 5 years of work experience, while 57 or 22.80 per cent had 5 – 9 years at work. 53 or 21.20 per cent had worked for 10 – 14 years, and those that had worked for 15 years and above were 2 or 0.8 per cent.

4.2 Impact of Informal Sector Entrepreneurship and Employment on Inclusive Growth

Equation (6) was estimated to examine the growing impact of computing education and decent work using the OLS technique and the result is presented in Table 2 below.

Table 2. Estimates of the impact of computing education and decent work on economic growth

PHHI	Coefficients	Standard Errors	t-stat	P-value
ECEC	8.763	2.1637	4.05	0.000
NLFA	0.919	4.1764	0.22	0.829
HKS	9.536	3.0272	3.15	0.003
EMPO	6.623	2.2451	2.95	0.015
REMEMP	-9.239	16.4994	-0.56	0.573
WORKCON	8.552	171.0340	0.05	0.960
SOS	6.707	1.7558	3.82	0.000
EMPO_REMEMP	-3.257	6.6475	-0.49	0.623
WORKCON_SOS	2.123	0.6318	3.36	0.001
REMEMP_WORKCON	-6.712	12.9077	-0.52	0.605
REMEMP_SOS	-7.514	250.4823	-0.03	0.973
ECEC_EMPO	92.081	21.2658	4.33	0.000
ECEC_REMEMP	1.449	9.6622	0.15	0.878
ECEC_WORKCON	7.481	3.2109	2.33	0.025
ECEC_SOS	37.045	43.5824	0.85	0.398
Constant	67.81	17.9392	3.78	0.000
R-squared	0.7427			
Adj R-squared	0.7186			
F-statistics	20.70 (p = 0.0009)			
Ramsey RESET statistics	0.40 (p = 0.7499)			

Source: Computed by the authors

The coefficient for computing education is positive and statistically significant. This means that computing education brings about significant economic growth. Specifically, an increase in the level of computing education leads to an 8.76 per cent significant increase in economic growth. Computing education enhances human productivity and creativity and encourages entrepreneurship and advancements in technology. Computing education (such as education in ICT) enhances the productive potentials of a nation and improves the productivity of every factor input in the economy. This promotes social-economic progress and improves income distribution and, therefore, economic growth. As the number of better computing educated workers increase, as does national output (economic growth).

The stock of household physical capital (K) showed a positive and insignificant coefficient of 0.919 with a t-value of 0.22. This implies that the stock of household physical capital (households' accumulation of non-land fixed assets including productive and consumable assets) such as treadle pumps used for production as well as radio and television as consumable assets has a positive impact on economic growth. But the impact is not significant at the 5 per cent level. This finding conforms with the idea of the Solow growth theory, which posits that physical capital accumulation – building, factories, machines, etc constitute the key to economic growth.

The positive and significant coefficient of the human capital stock implies that an increase in the stock of human capital significantly leads to economic growth. Any additional development in the stock of human capital results in a 9.53 per cent significant increase in economic growth. In line with the postulates of the human capital development theory, the positive and significant coefficients indicate that the stock of human capital is a key growth enhancer. Human capital development brings about knowledge and skills expansion, which increases economic value through the increase in productivity.

Three aspects of employment that form an integral part of decent work are employment opportunities (EMPO), remunerative employment (REMEMP) and conditions of work (WORKCON). As shown in Table 2, employment opportunities showed a positive coefficient of 6.623, with a t-value of 2.95. This means that employment opportunities have a significant impact on economic growth. An increase in employment opportunities means an increase in economic growth. In specific terms, any additional employment will bring about a 6.62 per cent significant increase in economic growth.

As regards remunerative employment (measured by the proportion of workers in a household earning an income less than half of the national (median) wage rate), the result shows the negative coefficient of -9.239 and an insignificant t-value of -0.56. It means that an increase in the proportion of workers in a household earning an income of less than half of the national (median) wage rate leads to a 9.24 per cent reduction in economic growth. In other words, remunerative employment, though, not statistically significant, is a determinant of economic growth. Better remunerative employment is associated with improving economic growth rates and vice versa.

The coefficient for conditions of work is 8.552 with a t-value of 0.05. The positive and insignificant coefficient shows that the conditions of work positively affect economic growth, but the effect is not significant. Any improvement in the conditions of work will bring about an 8.55 per cent insignificant increase in economic growth. This means that conditions of work such as paid leave is a prerequisite for workers productivity that can translate to economic growth.

Another aspect of decent work is social security. Social security such as occupational injury, medical care, maternity, benefits in respect of sickness, and destitution in old age among others are usually designed for workers protection against contingencies. The result showed that social security positively affects economic growth. Any improvement in the social security of workers results in about a 6.71 per cent increase in economic growth. Social security, for the average and the low-income workers, facilitate progressive income redistribution, which can cause an increase in aggregate demand and economic growth. The positive and significant coefficient means that social security could indeed be conducive to economic growth.

The interaction terms in Table 2 enable us to determine the complementary and substitution effects of the variables on economic growth. The signs and significance of the coefficients of the interaction terms are used to determine the complementary and substitution effects. On this basis, the signs and t-values reported in Table (2) above are compared. Table 3 below provides a summary.

Table 3. Measurement of the complementary and substitution effects of the explanatory variables on economic growth (the signs and t-values of the regression coefficients)

Variable	Sign	t-value	Interaction Term	sign	t-value	
EMPO	+	2.95	EMPO_REMEMP	-	-0.49	Substitutes
WORKCON	+	0.05	WORKCON_SOS	+	0.03	Complementary
REMEMP	-	-0.56	REMEMP_WORKCON	-	-0.52	Substitutes
			REMEMP_SOS	-	-0.03	Substitutes
ECEC	+	4.05				
			ECEC_EMPO	+	4.33	Complementary
			ECEC_REMEMP	+	0.15	Complementary
			ECEC_WORKCON	+	2.33	Complementary
			ECEC_SOS	+	0.85	Complementary

Source: Authors' computation

The coefficient of employment opportunities is positive and statistically significant, while the interaction of employment opportunities and remunerative employment – the proportion of workers in a household earning an income less than half of the national (median) wage rate is negative and statistically insignificant. Since the coefficient of employment opportunities is positive and the interaction term coefficient is negative, it means that complementarity does not exist. Employment opportunities and remunerative employment – the proportion of workers in a household earning an income less than half of the national (median) wage rate are substitutes.

Conditions of work - paid leave showed a positive and insignificant coefficient, and the interaction of conditions of work and social security – adequacy of workers

coverage in terms of contingencies is also positive. This indicates complementarity. The two variables have a complementary effect on economic growth.

Remunerative employment has a negative and insignificant coefficient and the interaction of remunerative employment and conditions of work also have a negative and insignificant coefficient. This means that remunerative employment the proportion of workers in a household earning an income less than half of the national (median) wage rate and conditions of work–paid leave are substitutes.

Similarly, the interaction of remunerative employment and social security – adequacy of workers coverage in terms of contingencies is negative. The negative interaction term coefficients indicate that the two variables are substitutes.

The interactions of computing education – investment (enrolment) in ICT/computing education courses and employment opportunities, remunerative employment, conditions of work and social security have positive coefficients. This means that computing education and employment opportunities; remunerative employment; and conditions of work have a complementary effect on economic growth. The complementary effect of computing education and employment opportunities, and computing education and conditions of work are strongly significant. It means that they have a significant complementary effect on economic growth.

The coefficient of determination (R^2) of 0.7427 in Table 2 means that the variables explained about 74.27 per cent change in the dependent variables, while the remaining 25.73 per cent is explained by other variables that are not included in our model. The F-statistics of 20.70 with a p-value of 0.0009 shows that the variables jointly statistically significantly affect economic growth. The insignificant Ramsey RESET test statistics for model specification suggests the acceptance of the null hypothesis of the model having no omitted variables. The means that the regression model was properly specified.

5. Conclusions and Policy Recommendations

The impact of computing education and decent work on economic growth in Nigeria has been specifically examined. We directly examined the impact of computing education and other variables on economic growth using the OLS technique. The complementary or substitution effects of computing education and measures of decent work on economic growth was also examined. The study came up with several findings and based on the findings we conclude that computing education significantly promotes economic growth. Decent work, especially the availability of employment opportunities, good working conditions and social security are cure determinants of economic growth. With adequate computing education and decent work, significant economic growth rates will be instigated.

Computing education and employment opportunities are strongly complementary. Also, there is a complementary effect of computing education and remunerative employment, computing education and decent work, and computing education and social security on economic growth. Among the measures of decent work, conditions of work and social security are complimentary, while employment opportunities and remunerative employment (paid leave), remunerative employment and conditions of work, and remunerative employment and social security are substitutes – they have a substitution effect on economic growth.

Other variables such as physical capital and the stock of human capital also instigate economic growth. They are necessary for the economic growth process as explained by the augmented Solow human-capital-growth theory. It is a confirmation of the theory that physical capital and the stock of human capital are necessary conditions for the economic growth of Nigeria.

Based on the findings, the study recommends the adoption of supportive policies to encourage computing education and decent work as well as physical and human capital development. In particular, policies to encourage computing education should include the incorporation of compulsory ICT/computing education courses in the nation oneyear National Youth Service Corp (NYSC) scheme. In this way, there will be higher employment opportunities and the complementary effect of computing education and employment opportunities will be enhanced. Decent work has to be encouraged by improving the working conditions, paid leave and ensuring adequate security of workers. Human and physical capital is also important. Government has to invest meaningfully to ensure the development of human and physical capital.

References:

Aldowah, H., Al-Samarraie, H., & Fauzy, W. M. (2019). Educational data mining and learning analytics for 21st century higher education: A review and synthesis. *Telematics and Informatics* 37, 13-49.

Anke Winchenbach, Paul, H. & Graham, M. (2019): Rethinking decent work: the value of dignity in tourism employment. *Journal of Sustainable Tourism*, DOI: 10.1080/09669582.2019.1566346

Anker, R., Chernyshev, I., Egger, P. and Mehran, F. (2003). Measuring Decent Work with statistical indicators. *International Labour Review* 142(2), 147

Ausloos, M., Eskandary, A., Kaur, P., & Dhesi, G. (2019). Evidence for Gross Domestic Product growth time delay dependence over Foreign Direct Investment. A time-lag dependent correlation study. *Physica A: Statistical Mechanics and its Applications* 527, 121181.

Baily, M., (1986). What has happened to productivity growth? *Science* 234(4775), 443-451

Bertschek, I., Briglauer, W., Hüschelrath, K., Kauf, B., & Niebel, T. (2015). The economic impacts of broadband internet: A survey. *Review of Network Economics* 14(4), 201-227.

Blustein, D. L., Kenny, M. E., Di Fabio, A., & Guichard, J. (2019). Expanding the impact of the psychology of working: Engaging psychology in the struggle for decent work and human rights. *Journal of Career Assessment* 27(1), 3-28.

Boluk, K. A., Cavaliere, C. T., & Higgins-Desbiolles, F. (2019). A critical framework for interrogating the United Nations Sustainable Development Goals 2030 Agenda in tourism.

Brynjolfsson, E., and Hitt, L. 2003. Computing productivity: Firm-level evidence. *The Review of Economics and Statistics* 85, 93-808

Campbell, I. (2010). *The Rise in Precarious Employment and Union Responses in Australia*. Edward Elgar Publishing, Cheltenham, 114-132.

Chijioke, A. I. (2013). Computer technology in Nigerian secondary school education: Problems and prospects. *Journal of Resourcefulness and Distinction* 6(1).

Conigliaro, P. (2019). Decent Work Principles and Job Quality Criteria to Improve Sustainable and Equitable Well-Being. In Italian Studies on Quality of Life (pp. 333-347). Springer.

Cooke, F. L., Xu, J., & Bian, H. (2019). The prospect of decent work, decent industrial relations and decent social relations in China: towards a multi-level and multi-disciplinary approach. *The International Journal of Human Resource Management* 30(1), 122-155.

Durak, H. Y. (2020). The effects of using different tools in programming teaching of secondary school students on engagement, computational thinking and reflective thinking skills for problem-solving. *Technology, Knowledge and Learning* 25(1), 179-195

Emere, I. F. (2018). *Impact of Government Expenditure on Standard of Living of Nigerian People 1981-2015* (Doctoral dissertation, Federal University of Technology, Owerri).

Farese, G. (2020). Socio-economic rights. International Human Rights, Social Policy and Global Welfare: Critical Perspectives, 105.

Farhadi M, Ismail R, & Fooladi M (2012). Information and Communication Technology Use and Economic Growth. *PLoS ONE* 7(11): e48903.

Gallo, Ó., Gonzales–Miranda, D. R., Roman-Calderon, J. P., & García, G. A. (2020). Decent work and healthy employment: a qualitative case study about Colombian millennials. International Journal of Workplace Health Management.

García-Peñalvo, F. J., & Mendes, A. J. (2018). Exploring the computational thinking effects in pre-university education.

Gruber, H., & Koutroumpis, P. (2010). Mobile telecommunications and the impact on economic development. Paper presented at the 52nd Economic Policy Panel Meeting, Einaudi Institute for Economics and Finance (EIEF), October 22 –23, Rome, Italy

Guillén-Nieto, V., & Aleson-Carbonell, M. (2012). Serious games and learning effectiveness: The case of Its Deal! *Computers & Education* 58(1), 435-448.

Hsu, T. C., Chang, S. C., & Hung, Y. T. (2018). How to learn and how to teach computational thinking: Suggestions based on a review of the literature. *Computers & Education 126*, 296-310

Hussain, A.H.M., &Endut, N. (2018). Do Decent Working Conditions Contributes to Work-Life Balance: A Study of Small Enterprises in Bangladesh. *Asia Pacific Journal of Innovation and Entrepreneurship* 12(1), 90-104.

ILO (2015). Small and Medium-Sized Enterprises and Decent and Productive Employment Creation. Report 04, 104th session, Geneva

ILO. (1999). Report of the Director-General: Decent Work, International Labour Conference. 87th session, Geneva.

ILO. (2006). Decent Working Time. New Trend, New Issues. ILO, Geneva

ILO. (2012). The ILO and the EU, Partners for Decent Work and Social Justice; Impact of Ten Years of Cooperation. ILO, Brussels

Jayalath, J., & Esichaikul, V. (2020). Gamification to Enhance Motivation and Engagement in Blended eLearning for Technical and Vocational Education and Training. *Technology, Knowledge and Learning*, 1-28.

Jean-Paul, F., & Martine, D. (2018). Beyond GDP Measuring What Counts for Economic and Social Performance: Measuring What Counts for Economic and Social Performance. OECD Publishing.

Kayode, B. (2019). Decent Work and Social Security: A Myth or Reality in Nigerian Macro Communities? *Annals of Global History* 1(1)19-23

Khan, S. A. R., Jian, C., Zhang, Y., Golpîra, H., Kumar, A., & Sharif, A. (2019). Environmental, social and economic growth indicators spur logistics performance: from the perspective of the South Asian Association for Regional Cooperation countries. *Journal of Cleaner Production* 214, 1011-1023.

Kinzl, J. F., Knotzer, H., Traweger, C., Lederer, W., Heidegger, T., & Benzer, A. (2005). Influence of working conditions on job satisfaction in anaesthetists. *British Journal of Anaesthesia 94(2)*, 211-215.

Kjaer, L. L., Pigosso, D. C., Niero, M., Bech, N. M., & McAloone, T. C. (2019). Product/service-systems for a circular economy: the route to decoupling economic growth from resource consumption? *Journal of Industrial Ecology* 23(1), 22-35.

Lajoie, S. P. (Ed.). (2020). Computers As Cognitive Tools: Volume Ii, No More Walls. Routledge.

Lee S., Gholami R, & Tong, T. (2005). Time series analysis in the assessment of ICT impact at the aggregate level—Lessons and implications for the new economy. *Information and Managemen* 42, 1009–1022

Mansour, M. S., & Hassan, K. H. (2019). Job Security and Temporary Employment Contracts: A Theoretical Analysis. In Job Security and Temporary Employment Contracts (pp. 1-26). Springer, Cham.

McGrath, S., Ramsarup, P., Zeelen, J., Wedekind, V., Allais, S., Lotz-Sisitka, H., & Russon, J. A. (2019). Vocational education and training for African development: a literature review. *Journal of Vocational Education & Training*, 1-23.

Mondal, A.H. (2010). Monitoring and Assessing Progress on Decent Work in Bangladesh. ILO Dhaka and Geneva.

Musango, J. K., Currie, P., Smit, S., & Kovacic, Z. (2020). Urban metabolism of the informal city: Probing and measuring the 'unmeasurable' to monitor Sustainable Development Goal 11 indicators. *Ecological Indicators* 119, 10 – 25.

Nath, H. and Liu, L. (2017). Information and communications technology (ICT) and services trade. *Information Economics and Policy* 41, 81–87.

National Research Council. (2012). Education for life and work: Developing transferable knowledge and skills in the 21st century. National Academies Press.

Niebel, T. (2018). ICT and economic growth – Comparing developing, emerging and developed countries. *World Development* 104, 197–21

Pacheco, G., Morrison, P.S., Cochrane, B., Blumenfeld, S., Rosenberg, B. and Bouchard, I. (2014). Understanding Insecure Work, Centre for Labour, Employment and Work.

Parsons, D., Gotlieb, C., and Denny, M., 1990. Productivity and computers in Canadian banking, Working Paper No. 9012, University of Toronto Department of Economics.

Paunov, C., & Rollo, V. (2016). Has the internet fostered inclusive innovation in the developing world? *World Development* 78, 587–609.

Pellegrino, F. (2019). The Legal Definition of 'Just Culture' in Aviation. In The Just Culture Principles in Aviation Law (pp. 45-68). Springer, Cham.

Plepys, A., & Singh, J. (2019). Evaluating the sustainability impacts of the sharing economy using input-output analysis. A Research Agenda for Sustainable Consumption Governance. Edward Elgar Publishing

Pohjola, M. (2002). The new economy in growth and development. *Oxford Review of Economic Policy* 18(3), 380–396.

Popat, S., & Starkey, L. (2019). Learning to code or coding to learn? A systematic review. *Computers & Education* 128, 365-37

Pritchett, L., & Sandefur, J. (2020). Girls' schooling and women's literacy: schooling targets alone won't reach learning goals. *International Journal of Educational Development* 78, 102242.

Rageth, L., & Renold, U. (2019). The linkage between the education and employment systems: ideal types of vocational education and training programs. *Journal of Education Policy*, 1-26.

Rahim, M. M. (2020). Humanising the global supply chain: building a decent work environment in the readymade garments supply industry in Bangladesh. In Research Handbook on Human Rights and Business. Edward Elgar Publishing.

Ruhose, J., Thomsen, S. L., & Weilage, I. (2019). The benefits of adult learning: Work-related training, social capital, and earnings. *Economics of Education Review* 72, 166-186.

Schandl, H., Fischer-Kowalski, M., West, J., Giljum, S., Dittrich, M., Eisenmenger, N. & Krausmann, F. (2018). Global material flows and resource productivity: Forty years of evidence. *Journal of Industrial Ecology* 22(4), 827-838.

Shereni, N. C. (2020). The Role of Technical and Vocational Education and Training (TVET) in Restoring Hospitality Sector Specific Skills in Zimbabwe: A Students' Perspective. *Journal of Hospitality & Tourism Education* 32(3), 133-141.

Skalka, J., & Drlík, M. (2018, September). An educational model for improving programming skills based on conceptual microlearning framework. In International Conference on Interactive Collaborative Learning (pp. 923-934). Springer, Cham.

Solow, R., (1987). We'd better watch out. New York Times Book Review, Vol 36.

Stiroh, K. (2002). Are ICT spillovers driving the new economy? *Review of Income and Wealth* 48(1), 33–57.

Verger, A., Fontdevila, C., & Parcerisa, L. (2019). Reforming governance through policy instruments: How and to what extent standards, tests and accountability in education spread worldwide. *Discourse: Studies in the Cultural Politics of Education* 40(2), 248-270.

Vives, A., Amable, M., Ferrer, M., Moncada, S., Llorens, C., Muntaner, C. & Benach, J. (2013). Employment precariousness and poor mental health: evidence from Spain on a new social determinant of health. Journal of environmental and public health, 2013.

Vu, K., (2013). Information and Communication Technology (ICT) and Singapore's economic growth. *Information Economics and Policy* 25, 284-300

Yaeger, K. A., Munich, S. A., Byrne, R. W., & Germano, I. M. (2020). Trends in the United States neurosurgery residency education and training over the last decade (2009–2019). *Neurosurgical Focus* 48(3), E6.

Yousefi, A. (2011). The impact of information and communication technology on economic growth: Evidence from developed and developing countries. *Economics of Innovation and New Technology* 20(6), 581-596.

Zaidi, S. A. H., Wei, Z., Gedikli, A., Zafar, M. W., Hou, F., & Iftikhar, Y. (2019). The impact of globalization, natural resources abundance, and human capital on financial development: Evidence from thirty-one OECD countries. *Resources Policy,* 64, 101476