Modeling and Analysis of the Impact of Vocational Education on the Unemployment Rate in Nigeria

Abayomi Ayoade
University of Lagos

Opeyemi Odetunde
University of Ilorin

Bidemi Falodun
University of Ilorin

Recommended Citation

Modeling and Analysis of the Impact of Vocational Education on the Unemployment Rate in Nigeria

[1]Abayomi Ayoade, [2]Opeyemi Odetunde and [3]Bidemi Falodun

[1]Department of Mathematics
University of Lagos, Nigeria
ayoadeabbayomi@gmail.com

[2,3]Department of Mathematics
University of Ilorin, Nigeria
[2]opeyemiodetunde@yahoo.com; [3]falodunbidemi2014@gmail.com

Abstract

Unemployment is a major determinant of a weak economy and a good measure of living standard in a country. Nigeria is faced with the problem of unemployment at present. By that, a mathematical model is formulated to investigate the effect of vocational education on the unemployment challenges in Nigeria. The model is tested for the basic requirements of a good mathematical model. The equilibrium analysis of the model is conducted and both the unemployment-free and the unemployment endemic equilibria are obtained. The threshold for the implementation success of the vocational education program is also derived following the approach of epidemic models. Stability analysis of the unemployment-free equilibrium is performed via the stability theory of nonlinear differential equations. Numerical simulation is carried out using parameter values from published data as well as assumption. The result of the simulation shows that the current unemployment rate in Nigeria is going to the peak unless vocational education is revived and makes to function.

Applications and Applied Mathematics: An International Journal (AAM), Vol. 15 [], Iss. 1, Art. 32

AAM: Intern. J., Vol. 15, Issue 1 (June 2020)   551

1. Problem background

Nowadays, the world is facing a number of problems like climate change, pollution, corruption, inequality, illegal migration, kidnapping, terrorism, poverty, banditry, human and drug trafficking, smuggling, COVID-19 outbreak and so on. Unemployment is among the leading challenges facing the world (Sirghi et al. (2014)). It is a disturbing issue for the world because it influences other problems like poverty, banditry, inequality, and robbery directly or indirectly. Unemployment also affects the migration patterns of the world as people have to leave their territories and move to other territories in search of jobs, which more often than not aggravates the unemployment burden of the receiving countries. Inordinate migration also leads to an increase in the social and environmental pollution as well as pressure on the social amenities of the receiving countries.

According to the Nigerian National Bureau of Statistics (NBS), unemployment is the proportion of the labor force that was looking for jobs but who could not find them at least twenty hours during the time of reference (NBS (2015); (2016)). The unemployment rate is measured as the ratio of unemployed to the labor force. The ratio tends to rise during a recession. The unemployment situation in Nigeria can be discussed in terms of older unemployed and younger unemployed according to Oyebade (2003). While older unemployed are made up of individuals who lost their jobs due to redundancy and bankruptcy, younger unemployed comprises individuals who have never been gainfully employed.

The population of Nigeria is youthful with the percentage of the people whose ages fall within the labor force bracket standing at more than 50% of the total population (Awogbenla and Iwuamadi (2010)). The youth unemployment figure has been rising year by year in Nigeria with 64 million youth unemployed and 1.6 million youth underemployed in 2017 (Kazeem et al. (2018)). Youth unemployment in Nigeria is attributed to a number of factors among which are: rural-urban drift, rapid population growth, corruption, neglect of agricultural sector, unfavorable government reform, low standard of education, erratic power supply, infrastructural decay, poor management practices, poor system of education, etc. (Uddin and Uddin (2013); Asaju et al. (2014)).

In order to increase employability of graduates, the Chinese government took a major reform by converting about 600 universities into polytechnics so as to reduce too much academic theory that does not guarantee jobs (University World News (2014)). The Chinese government focuses on Engineering and Technology and Technical courses to the extent that graduates from vocational colleges have a slightly higher average starting salary compared to graduates from China's top 100 universities (University World News (2014)). Studies conducted by Yasin et al. (2013) and Langenkamp et al. (2018) have shown that the revival of technical and vocational

education and training (TVET) is the solution to the unemployment burden in developing countries.

The rates of unemployment in East Asian countries are low mainly because the population acquired employable technical and vocational skills (Famiwole et al. (2012); Jin (2008)). Technical and vocational education and training (TVET) is the education that highlights the application of skills, attitude and knowledge needed for employment in a given occupation or related occupations in any field of economic and social activities (Oranu (2010)). TVET emphasized the acquisition of knowledge and skills from the world of work. Olaitan (2010) regarded TVET as the education given to individuals in order to enable them to acquire the scheming and creative potentials for man's use. According to International Labor Organization ILO (2014), the population of individuals within the age bracket of 15 – 29 years in developing nations rose by 12.4% between 1993 and 2003, while the youth employment increased by just 0.6%. This is a precarious unemployment situation that can be remedied by encouraging job-seekers' opportunities in the informal labor markets through TVET (Oluwade et al. (2014)).

However, technical education and vocational education are two different concepts. Technical education is the theoretical vocational preparation of students for jobs involving applied science and modern technology. It highlights the knowledge of basic principles of mathematics and science and their practical applications; acquired (usually) at lower tertiary and upper secondary levels to prepare learners for carriers that are regarded above the skilled crafts and below the engineering or scientific professions (Tripney et al. (2012)). On the other hand, vocational education is planned actions intended to ensure learning as preparations for jobs in designated (practical or manual) occupations or trades usually, non-theoretical and concentrated on the real attainment of competency in manual skills (Oluwade et al. (2014)). Vocational education focuses on the actual attainment of proficiency in manual skills. It trains students for jobs that are connected with a specific occupation or trade (Tripney et al. (2012)).

2. Literature survey

The literature on the mathematical modeling of unemployment is well researched. Nikolopoulos and Tzanetis (2003) presented and analyzed a mathematical model for the allocation of housing for families who were rendered homeless by natural disaster. Based on this idea, Misra and Singh (2011); (2013) developed a model for unemployment. Pathan and Bhathawala (2015) designed a model for unemployment taken into account the effect of self-employment built on the concepts of the pioneer works on unemployment. Sirghi et al. (2014) presented a dynamical model with four compartments: Number of employed people, number of unemployed people, number of jobs in the labor market and number of vacancies that are newly created. Neamtu (2014) formulated a model for unemployment, adopting some concepts in Misra and Singh (2011); (2013) by adding a new compartment called immigrant. Inspired by the work of Munoli

Applications and Applied Mathematics: An International Journal (AAM), Vol. 15 [], Iss. 1, Art. 32

AAM: Intern. J., Vol. 15, Issue 1 (June 2020)   553

and Gani (2016), Galindro and Torres (2018) proposed an unemployment model and applied optimal control to investigate the appropriate policies for avoiding unemployment in Portugal. Pathan and Bhathawala (2017) formulated a mathematical model that captured the scenario of job competition between new migrant workers and the native unemployed using the method of dynamical differential equations. They also considered the impact of attempts made by the government and the private sectors in creating new vacancies without delay and with delay as well as the impacts of both the new migrant workers and the native unemployed to become self-employed. The authors carried out a numerical simulation of the analytical results and discovered that new vacancies must be created in proportion to the number of the native unemployed and the migrant workers if a territory allowed new migrant workers in order to keep the unemployment rate at bay.

Harding and Neamtu (2018) formulated a model for unemployment reduction by incorporating the importance of taking migration into consideration when designing policies to address unemployment. The model was made up of five variables: the number of employed, the number of the unemployed, the number of jobs, the number of migrants, and the total number of new vacancies created by the government intervention. The researchers conducted both the qualitative and the quantitative analyses of the model and the results of the analyses indicated a significant drop in the initial level of unemployment when migration was taken into consideration by the government policy. On the other hand, the unemployment rate jumped to a high value when migration was ignored in the government policy. Al-Maalwi et al. (2018) developed an unemployment model with reference to poor countries following the idea of Munoli and Gani (2016) where three dynamical variables were considered: the population of employees, the number of unemployed and the total number of available vacancies. The researchers discovered that the unemployment rate decayed and reached 7% when the basic reproductive ratio $R_0 \approx 15$. Kazeem et al. (2018) designed an unemployment model and derived a threshold quantity for the control of unemployment. They concluded that the unemployment solution in Nigeria was a function of self-employment as academic certificates are not enough to bring food on the table. More works on unemployment in relation to Africa in particular and other continents of the world in general can be found in (Aminu (2019); Adelowokan (2019); Yasin and Gachunga (2019); El Fadily and Kadder (2019); Teixeira et al. (2020); Ayoade et al. (2020)).

Low economy and high rate of unemployment in Nigeria have been attributed to low demand for vocational education. Table 1 shows the youth unemployment trend in Nigeria between 2006 and 2016.

Table 1. Nigeria's labor force, employment and unemployment statistics from 2006-2016

S/No.	Year	Labor Force	Employed (E)	E%	Unemployed (U)	U%
1	2006	57455701	50388650	87.7	7067051	12.3
2	2007	59294283	51763909	87.3	7530374	12.7
3	2008	61191700	52074137	85.1	9117563	14.9
4	2009	63149835	50709318	80.3	12440571	19.7
5	2010	61570629	57089471	78.6	8081158	21.4
6	2011	67256090	51181884	76.1	16074206	23.9
7	2012	69105775	50170793	72.6	18934982	27.4
8	2013	71105800	53542667	75.3	17563133	24.7
9	2014	72931608	55209227	75.7	17722381	24.3
10	2015	76957923	54486209	70.8	22471714	29.2
11	2016	81151885	52586421	64.8	28565464	35.2
12	Total	744771229	579202686	854.3	165568543	245.7
13	Av.	67706475	52654790	77.7	15051686	22.3

(NBS (2016)).

The study of unemployment with the method of mathematical modeling has received considerable attention but the use of mathematical modeling to study the impact of vocational education on the unemployment rate in Nigeria is rare in the literature. Since vocational education is non-theoretical and trains students for instant jobs after school life, this work is aimed at using a mathematical modeling approach to examine the impact of vocational education on the current unemployment trend in Nigeria.

3. Materials and Methods

In order to achieve the purpose of the study, a mathematical model is formulated. The model is compartmentalized into the theoretical class $T(t)$, vocational class $V(t)$, unemployed class $U(t)$ and the employed class $E(t)$. The theoretical class comprises every individual who does not participate in the vocational education program which might be attributed to unfavorable government policy or poor implementation of the program but are engaging in theoretical education. The vocational class is made up of students who are into vocational education and are expected to be self-employed after graduation. The unemployed class is made up of individuals who are unemployed either because they do not have vocational education background after graduation or they have vocational education background but there are no resources to set up businesses after graduation. The employed class comprises individuals who have been gainfully employed either by setting up themselves with businesses after graduation from vocational education or by getting recruited into the paid employment. While recruitment rate into the vocational class is $\alpha\pi$, recruitment rate into the theoretical class is $(1-\alpha)\pi$. β is the rate of

Applications and Applied Mathematics: An International Journal (AAM), Vol. 15 [], Iss. 1, Art. 32

AAM: Intern. J., Vol. 15, Issue 1 (June 2020)   555

employment creation in the economy while γ is the rate at which individuals in *V(t)* class lose interest in the program and move to *T(t)* class. The transfer diagram of the model is in Figure 1.
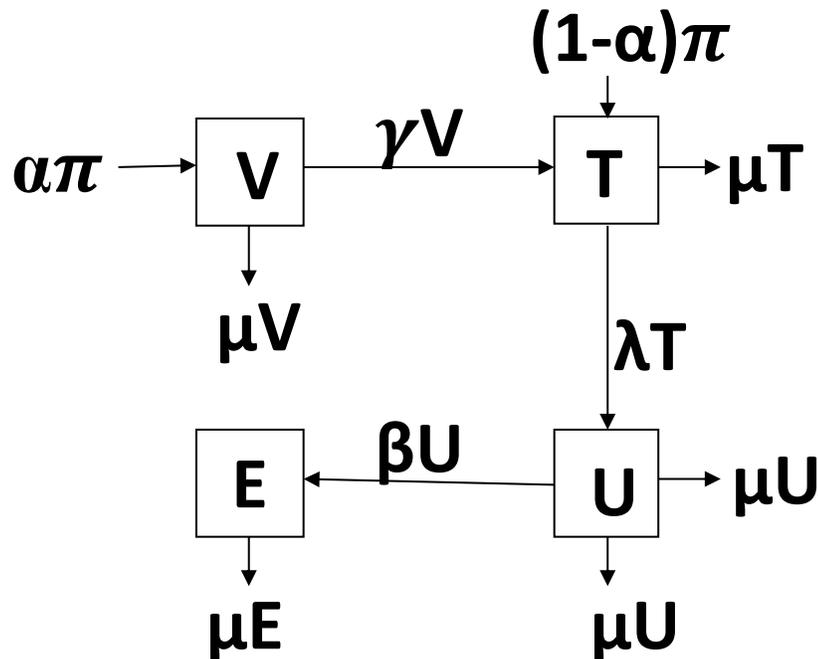
Figure 1. Transfer diagram of the model

In Figure 1, λ is the tendency of becoming unemployed and is defined as $\sigma\theta U$ where σ is the per capita probability of becoming unemployed after graduation due to negligence during training and θ is the rate of influence of individuals in the unemployed class who do not have vocational education background on individuals who are receiving theoretical education. Influence of the unemployed without vocational background on individuals receiving theoretical education will lead to unemployment as those in the unemployed class who do not have vocational orientation cannot influence others to be self-employed. If per capita probability of successful implementation of the vocational education program is ρ then the effective rate of the tendency of becoming unemployed, λ^v is $\sigma\theta(1-\rho)U$. It is assumed that the rate at which individuals disengage from vocational education, disengage from theoretical education, migrate to other countries in search of employment and disengage from the present employment in search of greener pastures is the same and is denoted by μ. It is also assumed that those that have been gainfully employed do not lose their jobs but remain employed unless they leave their present employment in search of greener pastures.

Bringing these assumptions together with the flow diagram, we come about the following set of first-order ordinary differential equations.

$$\frac{dV}{dt} = \alpha\pi - \gamma V - \mu V, \tag{1}$$

$$\frac{dT}{dt} = (1 - \alpha)\pi + \gamma V - \sigma\theta(1 - \rho)UT - \mu T, \tag{2}$$

$$\frac{dU}{dt} = \sigma\theta(1 - \rho)UT - \beta U - \mu U, \tag{3}$$

$$\frac{dE}{dt} = \beta U - \mu E. \tag{4}$$

The values assigned to the parameters to conduct the simulation are presented in Table 2.

Table 2. Parameters description and values

Parameter	Interpretation	Value	Source
π	Rate of recruitment	5000	Munoli and Gani (2016)
α	Proportion of individuals recruited into voc. ed.	0.001	Munoli and Gani (2016)
μ	Rate of Withdrawal	0.04	Munoli and Gani (2016)
γ	Rate of loss of interest in vocational education	0.0001	Assumed
β	Rate of creation of employment	0.007	Munoli and Gani (2016)
σ	Per capita probability of becoming unemployed	0.001	Assumed
θ	Rate of influence of individuals in U(t) on T(t)	0.0001	Assumed
ρ	Vocational program successful implementation rate	0.001	Assumed

Based on the assumptions on which the model is built, equation (4) is not needed in the analysis and shall be dropped.

$$\left.\begin{array}{c}\frac{dV}{dt} = \alpha\pi - \gamma V - \mu V, \\ \frac{dT}{dt} = (1 - \alpha)\pi + \gamma V - \sigma\theta(1 - \rho)UT - \mu T, \\ \frac{dU}{dt} = \sigma\theta(1 - \rho)UT - \beta U - \mu U.\end{array}\right\} \tag{5}$$

3.1. Basic features of a good model

3.1.1. The existence and uniqueness of solutions for a linear system

Theorem 3.1.

Given an *n*- dimensional system of first order ordinary differential equations

Applications and Applied Mathematics: An International Journal (AAM), Vol. 15 [], Iss. 1, Art. 32

AAM: Intern. J., Vol. 15, Issue 1 (June 2020)   557

$$\left. \begin{array}{l} \frac{dX_1}{dt} = f_1(t, \ x_1, \ x_2, \ \cdots, \ x_n) \\ \frac{dX_2}{dt} = f_2(t, \ x_1, \ x_2, \ \cdots, \ x_n) \\ \frac{dX_3}{dt} = f_3(t, \ x_1, \ x_2, \ \cdots, \ x_n) \end{array} \right\}, \qquad (6)$$

with initial conditions

$$x_1(t_0) = x_1^0, x_2(t_0) = x_2^0 \cdots x_n(t_0) = x_n^0. \ \text{If} \ f_1, f_2, \cdots, f_n$$

and

$$\left. \begin{array}{l} \frac{\partial f_1}{\partial x_1}, \frac{\partial f_2}{\partial x_1}, \cdots, \frac{\partial f_n}{\partial x_1} \\ \frac{\partial f_1}{\partial x_2}, \frac{\partial f_2}{\partial x_2}, \cdots, \frac{\partial f_n}{\partial x_2} \\ \vdots \\ \frac{\partial f_1}{\partial x_n}, \frac{\partial f_2}{\partial x_n}, \cdots, \frac{\partial f_n}{\partial x_n} \end{array} \right\}, \qquad (7)$$

are continuous in a region D of the space $(t, \ x_1, \ x_2, \ \cdots, \ x_n)$ containing the point $(t_0, \ x_1^0, \ x_2^0, \ \cdots, \ x_n^0)$, then there is an interval I containing t_0 in which there exists a unique solution $x_1 = y_1(t), x_2 = y_2(t), \cdots, x_n = y_n(t)$ of Initial Value Problem given above.

Proof:

See Ayoade et al. (2019) for the proof.

3.1.2. Positivity and boundedness of solutions.

Lemma 3.2.

The close $\Omega = \left\{ (V, T, U) \in \mathbf{R}_+^3 : V + T + U \leq \frac{\pi}{\mu} \right\}$ is positively invariant and positively attracting with respect to the system (5).

Proof:

From the system (5), we establish that $\frac{dN}{dx} \leq \pi - \mu N$ and deduce that $N(t) \leq N(0)e^{-\mu t} + \frac{\pi}{\mu}(1 - e^{-\mu t})$ by standard comparison theorem in (Lakshmikantham et al. (1994)). As $t \to \infty$, *N(t)* approaches $\frac{\pi}{\mu}$ and the system (5) is positively invariant and positively attracting in Ω. Hence, the model is mathematically well posed and the solutions for the model can be considered in Ω.

4. Model Analysis

4.1. Equilibria

The model system (5) has an unemployment-free equilibrium, U_0 which is derived by reducing all the unemployment terms and the RHS of the model to zero. The result is obtained as:

$$U_0 = (V^0, T^0, \; U^0) = \left(\frac{\alpha\pi}{(\mu+\gamma)}, \; \frac{\pi(1-\alpha)(\mu+\gamma)+\alpha\pi\gamma}{\mu(\mu+\gamma)}, \; 0 \right). \tag{8}$$

The model also has the unemployment endemic equilibrium, U_* denoted by $U_* = (V^*, T^*, U^*)$ which is obtained by reducing the RHS of the model system (5) to zero and solving for each state variable which gives:

$$U_* = (V^*, T^*, U^*) = \left(\frac{\alpha\pi}{c}, \; \frac{d}{a\sigma\theta}, \; \frac{a\sigma\theta[\pi bc + \alpha\pi\gamma] - \mu cd}{acd\sigma\theta} \right), \tag{9}$$

where

$$a = 1 - \rho, b = 1 - \alpha, c = \mu + \gamma, d = \mu + \beta.$$

4.2. Implementation success ratio of vocational education program (I_0)

The quantity I_0 is the quantity that measures the implementation success of the vocational education program in terms of reduction in the level of unemployment in the economy. Unlike in epidemic model, if $I_0 > 1$, the vocational education program is successfully implemented to the extent that more and more individuals are willing to enroll in the program and those that are already in the program are motivated to remain in the program. This eventually decreases the level of unemployment in the economy. On the other hand, If $I_0 < 1$, the vocational education program is poorly implemented to the degree that individuals are discouraged from enrolling in the program and those that are already in the program are withdrawing to the theoretical education compartment. The situation eventually leads to an upsurge in the level of unemployment in the economy. Since individuals in the theoretical education compartment are more liable to become unemployed after graduation due to the current prevailing economic situation, the compartment shall be used to derive I_0. Besides, for the endemic equilibrium U_* to exist in the feasible region Ω, $0 < T^* < T^0$ or $\frac{1}{T^*} . T^0 > 1$ is the necessary and sufficient condition. The inequality is true on the ground that at the unemployment endemic equilibrium, a good number of individuals in $T(t)$ compartment must have proceeded to $U(t)$ compartment after graduation. Therefore,

$$I_0 = \frac{1}{T^*}(T^0) = \frac{\sigma\theta(1-\rho)[\pi(1-\alpha)(\mu+\gamma)+\pi\alpha\gamma]}{\mu(\mu+\gamma)(\mu+\beta)} \; . \tag{10}$$

Applications and Applied Mathematics: An International Journal (AAM), Vol. 15 [], Iss. 1, Art. 32

AAM: Intern. J., Vol. 15, Issue 1 (June 2020) 559

4.3. Stability of the unemployment-free equilibrium

Theorem 4.1.

$I_0 < 1$ and the unemployment-free equilibrium of the model is locally asymptotically unstable if $\lambda_i < 0, i = 1,2,3, \cdots, \lambda$ is the eigenvalue of the variational matrix of the system (5). Theorem 4.1 is the reverse of what is obtainable in epidemic models.

Proof:

The variational matrix of the system (5) at the unemployment-free equilibrium is obtained as

$$J_{(U_0)} = \begin{pmatrix} -(\mu + \gamma) & 0 & 0 \\ \gamma & -\mu & -\sigma\theta(1-\rho)k \\ 0 & 0 & -[-\sigma\theta(1-\rho)k + \mu + \beta] \end{pmatrix}, \tag{11}$$

where

$$k = T^0 = \frac{\pi(1-\alpha)(\mu+\gamma)+\pi\alpha\gamma}{\mu(\mu+\gamma)}.$$

The characteristic equation of equation (11) is obtained as

$$-(\mu + \lambda)(\mu + \gamma + \lambda)[-\sigma\theta(1-\rho)k + \mu + \beta + \lambda] = 0. \tag{12}$$

In equation (12),

$$\lambda_1 = -\mu, \lambda_2 = -(\mu + \gamma) \text{ and } \lambda_3 = \sigma\theta(1-\rho)k - (\mu + \beta).$$

Obviously,

$$\lambda_1 < 0, \lambda_2 < 0 \text{ and } \lambda_3 < 0 ,$$

if

$$\sigma\theta(1-\rho)k - (\mu + \beta) < 0. \tag{13}$$

The unemployment-free equilibrium of the model is locally asymptotically unstable if inequality (13) is true otherwise it is stable.

5. Results and Discussion

The parameter values in Table 1 shall be used to evaluate M where $M = \sigma\theta(1-\rho)k - (\mu + \beta)$ in order to draw a conclusion on the stability nature of the model. The values of α, ρ, γ and μ are then varied while the values of other parameters are held constant to investigate their influence

on the stability behavior of the model. The reason for varying the values of these parameters is that they have a direct impact on the vocational education program. The result of the analysis is in Table 3 and the result is supported graphically in Figure 2 and Figure 3 using parameter values in Table 2. Figure 2 and Figure 3 display the trend of vocational and theoretical educations in Nigeria in the last ten years which is responsible for the present unemployment situation in the country.

Table 3. Effect of variations in the values of the key parameters on the stability of the model

S/No	α	ρ	γ	μ	θ	β	π	σ	M	Remark
1	0.001	0.001	0.0001	0.04	0.0001	0.007	5000	0.001	-0.0345	Unstable
2	0.005	0.005	0.0001	0.04	0.0001	0.007	5000	0.001	-0.0346	Unstable
3	0.009	0.009	0.0001	0.04	0.0001	0.007	5000	0.001	-0.0347	Unstable
4	0.01	0.01	0.0001	0.04	0.0001	0.007	5000	0.001	-0.0347	Unstable
5	0.005	0.005	0.00009	0.004	0.0001	0.007	5000	0.001	0.1128	Stable
6	0.006	0.006	0.00008	0.003	0.0001	0.007	5000	0.001	0.1547	Stable
7	0.007	0.007	0.00007	0.002	0.0001	0.007	5000	0.001	0.2376	Stable
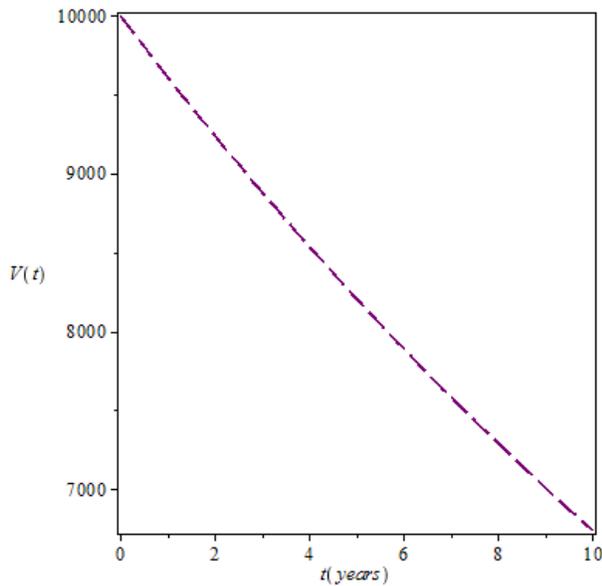
Figure 2. Trends of vocational education   **Figure 3.** Trends of theoretical education
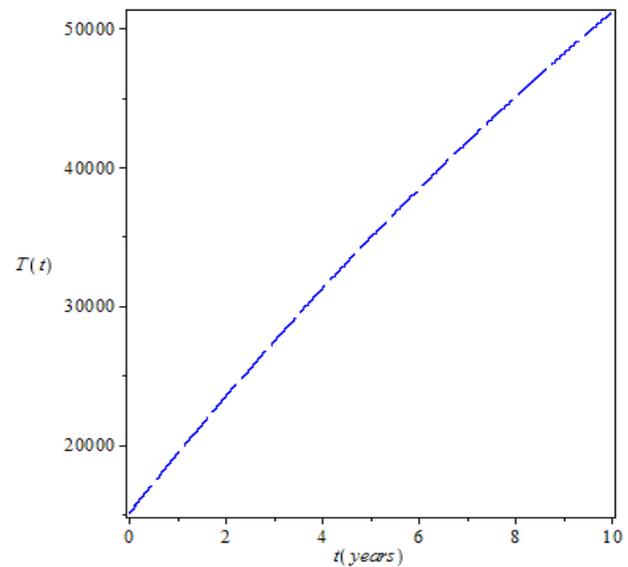
As the rates of motivation for vocational education and successful implementation of the program (α, ρ) increase without corresponding decrease in the rates of withdrawal from the program and loss of interest in the program (μ, γ) , the unemployment-free equilibrium of the model is unstable [S/No 2 – S/No 4]. On the other hand, as the increase in the rates of motivation for vocational education and successful implementation of the program is matched with the corresponding decrease in the rates of withdrawal from the program and loss of interest in the program, the unemployment-free equilibrium of the model is stable [S/No 5 – S/No 7]. The

Applications and Applied Mathematics: An International Journal (AAM), Vol. 15 [], Iss. 1, Art. 32

AAM: Intern. J., Vol. 15, Issue 1 (June 2020)   561

interpretation of the instability of unemployment-free equilibrium is that the educational system is vocational oriented and the economy is moving towards full employment (i.e., the unemployment rate is on the decline as $I_0 > 1$). Whereas, the implication of the stability of unemployment-free equilibrium is that the educational system is theoretical inclined and the unemployment rate is on the increase as $I_0 < 1$.

The 6-3-3-4 system of education as championed by the late Minister of Education in Nigeria, Professor Aliu Babatunde Fafunwa, was introduced in 1988 to replace the 6-5-4 with the primary focus of meeting the educational needs of its citizenry and equipping the youths with sellable skills that would make them self-reliant. The educational system, which had produced a good result in Japan, was job oriented and placed a premium on manual activities, technical proficiency, and respect for the dignity of labor and economic efficiency. The program was aimed at providing the child with the basic tools needed to prepare him for the local craft. However, the quest for technological advancement in Nigeria through the 6-3-3-4 system of education became a mirage because the program was poorly implemented. The outcome of poor implementation of the 6-3-3-4 system of education in 1988 is the current unemployment problem in Nigeria. The system, due to its inability to achieve a desirable result, is neglected and now replaced with the 9-3-4 system of education which was launched in 2011.

The current system of education (9-3-4) is theoretical in nature because of its emphasis on basic education at the expense of vocational education. Nigeria should prepare for doom as the current unemployment rate may reach the peak in the nearest future due to the neglect of technical and vocational education training (TVET). To avert the looming doom, vocational education must be revived and made to function in the region within S/No 5 – S/No 7 in Table 3.

6. Conclusion

In this work, the impact of vocational education on the unemployment rate in Nigeria had been analyzed via mathematical modeling approach. A deterministic compartmental model was formulated and the solutions of the model were proved to exist, unique and positive. Equilibrium analysis was conducted and the equilibria solutions were obtained. The threshold for the implementation success of the vocational education program was also derived and the stability analysis of the unemployment-free equilibrium was performed. Numerical simulation was carried out to verify the analytical result and the result of the simulation showed that the current high rate of unemployment in Nigeria was a result of neglect of vocational education. We also observed that the present system of education in Nigeria would not help the situation as the unemployment rate might reach the climax in the nearest future unless vocational education was revitalized and made to perform. However, while the work had provided an elegant background for the study of the impact of vocational education on the unemployment rate in Nigeria, the genuineness of the result was limited by the hypothetical values adopted for some parameters to handle the simulation. Future study can be designed towards a more realistic outcome when true values are available for the parameters whose values were assumed in this study. Future study can also be directed towards the estimation of the proportion of the Nigerian population needed to receive vocational education in order to overcome the unemployment problem.

REFERENCES

Adelowokan, O. A., Maku, O. E., Babasanya, A. O. and Adesoye, A. B. (2019). Unemployment, poverty and economic growth in Nigeria, J. of Economics and Management, Vol. 35, No. 1, pp. 4-11.

Al-Maalwi, R. M., Ashi, H. A. and Al-sheikh, S. (2018). Unemployment model, Applied Mathematical Sciences, Vol. 12, No. 21, pp. 989-1006.

Aminu, A. (2019). Characterizing graduate unemployment in Nigeria as education-job mismatch problem, African J. of Economics Review, Vol. 7, No. 2, pp. 113-130.

Asaju, K., Adagba, S. O. and Kajang, T. J. (2014). The efficacy of fiscal policy in promoting economic growth and poverty reduction in Nigeria, Research in World Economy, Vol. 5, No.1, pp. 33-40.

Awogbenla, A. C. and Iwuamadi, K. C. (2010). Youth unemployment: entrepreneurship development program as an intervention mechanism, African J. of Business Management, Vol. 4, pp. 831-835.

Ayoade, A. A., Ibrahim, M. O., Peter, O. J. and Amadiegwu, S. (2019). On validation of an epidemiological model, J. of Fundamental and Applied Sciences, Vol. 11, No. 2, pp. 578-586.

Ayoade, A., Folaranmi, R. and Latunde, T. (2020). Mathematical analysis of the implication of the proposed rise in the retirement age on the unemployment situation in Nigeria, Athens J. of Sciences, Vol.7, No.1, pp. 29-42. https://doi.org/10.30958/ajs.7-1-3

El Fadily, S., and Kaddar, A. (2019). Modeling and mathematical analysis of labor force evolution. Hindawi Modeling and Simulation in Engineering. http://doi.org/10.1155/2019/2562468

Famiwole, R. O., Oke, J. O. and Amadi, N. S. (2012). Potentials of vocational technical education: empowering youths and vulnerable adults for poverty reduction in Nigeria, J. of Science Management, Vol.1, No. 2, pp.157-162.

Galindro, A. and Torres, D. F. M. (2018). A simple mathematical model for unemployment: a case study of Portugal with optimal control, Statistics, Optimization and Information Computing, Vol. 6, pp. 116-129.

Harding, L. and Neamtu, M. (2018). A Dynamic model of unemployment with migration and delayed policy intervention, Computational Economics, Vol. 51, No. 3, pp. 427-462.

ILO (2014). Global employment trends for youth. http://www.ilo.org/wcsmsp5/groups/public. Retrieved 6/1/2019.

Jin, Y. (2008). General or vocational? The tough choice in the Chinese education policy, Int. J. of Education Development, Vol. 8, No. 4, pp. 289-304.

Kazeem, A. B., Alimi, S. A. and Ibrahim, M. O. (2018). Threshold parameter for the control of unemployment in the society: mathematical model and analysis, J. of Applied Mathematics and Physics, Vol.6, pp. 2563-2578. DOI: 10.4236/jamp.2018.612214.

Applications and Applied Mathematics: An International Journal (AAM), Vol. 15 [], Iss. 1, Art. 32

AAM: Intern. J., Vol. 15, Issue 1 (June 2020)   563

Lakshmikantham, V., Leela, S. and Kaul, S. (1994). Comparison principle for impulsive differential equations with variable times and stability theory, Nonlinear Analysis, Theory, Methods & Application, Vol. 22, No. 4, pp. 499 – 503.

Langenkamp, K., Rodel, B., Taufenbach, K. and Weiland, M. (2018). Open access in vocational education and training research, Publications, Vol. 6, No. 29, pp. 1-12. Doi:10.3390/publications6030029

Misra, A. K. and Singh, A. K. (2011). A mathematical model for unemployment, Nonlinear Analysis Real World Application, Vol. 12, No.1, pp. 128-136.

Misra, A. K. and Singh, A. K. (2013). A delay mathematical model for the control of unemployment, Differential Equation Dynamical System, Vol. 21, No. 3, pp. 291-307.

Munoli, S. B. and Gani, S. (2016). Optimal control analysis of a mathematical model for unemployment, Optimal Control Application Methods, Vol. 37, pp. 798-806.

Neamtu, M. (2014). A dynamical model for unemployment control with migration and distributed delay, Mathematical Methods in Finance and Business Administration, Proceeding of the International Business Administration Conference, Tenerife, Spain, Vol. 1, pp. 23-31.

NBS (2015). Presentation of labour statistics based on revised concept and methodology for computing labour statistics in Nigeria. Accessed from www.nigerianstat.gov.ng/pages/downloads/285 on 12/5/2019.

NBS (2016). Unemployment/underemployment. Watch-Q3. Accessed from www.nigeriastat.ng/report/481 on 10/2/2019.

Nikolopoulos, C. V. and Tzanetis, D. E. (2003). A model for housing allocation of a homeless population due to natural disaster, Nonlinear Analysis, Vol.4, pp. 561-579.

Olaitan, S. O. (2010). Vocational and technical education in Nigeria: issues and analysis, J. of Vocational Education, Vol. 1, No. 7, pp. 1-8.

Oluwale, B. A., Jegede, O. O. and Olamade, O. O. (2014). Technical and vocational skill depletion in Nigeria and the need for policy Intervention, Int. J. of Technical and Vocational Education, Vol. 5, No. 6, pp. 101-109.

Oranu, R. N. (2010). Vocational and technical education in Nigeria. http://www.ibe.unesco.org/curriculum/Africapdf/lago2orapdf, retrieved 3/2/ 2019

Oyebade, S. A. (2003). Education and unemployment of youth in Nigeria: causes, impacts and suggestion, National Economic Empowerment Development Strategy (NEEDS), pp. 45-65.

Pathan, G. N. and Bhathawala, P. H. (2015). A mathematical model of unemployment with effect of self-employment, IOSR-JM, Vol. 11, No. 6, pp. 37-43.

Pathan, G. N. and Bhathawala, P. H. (2017). Mathematical model for unemployment control a numerical study. Int. J. of Mathematics Trend and Technology, Vol. 49, No. 4, pp. 253- 259.

Sirghi, N., Neamtu, M. and Deac, D. S. (2014). A dynamic model for unemployment control with distributed delay, Mathematical Method in Finance and Business Administration, Vol. 12, pp. 42-48.

Teixeira, G. S., Neto, G. B. and Leivas, P. H. S. (2020). Evidence on rule manipulation and moral hazard in Brazilian unemployment insurance program, Int. J. of Social Science Studies, Vol. 8, No. 1, pp. 67-78.

Tripney, J., Newman, M., Hovish, K. and Brown, C. (2012). Post-basic technical and vocational education and training (TVET) interventions to improve employability and employment of TVET graduates in low and middle-income countries. www.cambellcollaboration.org. Accessed 3/12/2018.

Uddin, P. S. O. and Uddin, O. O. (2013). Causes, effect and solutions to youth unemployment problems in Nigeria, Journal of Emerging Trends in Economics and Management Sciences (JETEMS), Vol. 4, No. 4, pp. 397-402.

University World News (2014). Major reform as 600 universities became polytechnics. Universityworldnews.com/post.php?story=20140612080509913 Accessed 22/9/2019

Yasin, R. M., Nur, Y. F. A., Ridzwan, C. R, Ashikin, H. T. and Bekri, R. M. (2013). Current trends in technical and vocational education research: a meta-analysis, Asian Social Science, Vol. 9, No. 13, pp. 243-251.

Yasin, K. and Gachunga, M. J. (2019). An analysis of the impact of unemployment on economic growth in Kenya. Int. J. of Business Marketing and Management. Vol. 4, No. 4, pp. 52-57.