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Conceptual Model on the Implementation of Technical and Vocational Education in Nigeria

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Abstract

The purpose of this study is to develop a model that predicts the implementation of technical and vocational education (TVE) in Nigeria. It examines the relationships among the variables associated with barriers and issues of implementation of TVE towards the production of competent graduates for economic and national development. Hypothesized Multivariate model was tested using structural equation modeling (SEM) to statistically analyze the variables under the study. The result of the model was found to comply with a good statistical fit. Four factors out of five were found to predict the implementation of TVE in Nigeria, these comprises of teaching methods, learning skills, employability skills and technical skills.

Keywords: Implementation; technical education; vocational education; conceptual model; conceptual framework

1.0 INTRODUCTION

The implementation of Technical and Vocational Education implies change to many group of professionals including teachers, administrators, curriculum planners and other individual's charged with implementing educational policy [1]. The Nigeria's National Policy on Education was designed to train individuals to acquire knowledge and skills for self-reliant and national development. The policy further states that: "the trainees of Technical and Vocational program shall have three options: (1) secure employment either at the end of one or two modules of the whole course or after completing one or two modules of employable skills; (2) set-up their own business and become self- employed and be able to employ others; and (3) pursue further education in advance craft/technical program and in post – secondary (tertiary) technical institutions such as science and technical colleges, polytechnics or colleges of education (technical) and universities" [2].

Technical and vocational education system in Nigeria is designed to train competent personnel that will fit into the different sector of the economy. The graduates are expected to be able to diagnose, service, test and carryout repairs as designed by the national curriculum that is currently used by all technical colleges all over the country, accredited by National Board for Technical Education (NBTE) [3]. The rapid growing changes in the industries has brought a lot of competitions and challenges in the world today especially in the technology sector. Therefore, graduates in these areas are expected to be highly competent in terms of "hard "technical skills and "soft" generic skills for them to serve and remain in the industry [4]. It is obvious to recognize the importance of proper implementation of technical and vocational education in Nigeria towards technological development and self-reliant.

2.0 THEORETICAL FOUNDATION OF THE STUDY

Various researchers revealed that numerous factors affect the implementation of technical and vocational education in Nigeria which include poor foundation laid right from junior secondary school levels with non-flexible curricula, non-availability of equipment and facilities, over populated classrooms and lack of practical teaching tools as well as incompetent teachers [5] .The method of teaching in our institutions of learning is based on instinctive with emphasis on memorization and also with much more common features of theoretical approach [6].

The curriculum for basic science and technology which include vocational is basically practical oriented and should be implemented through various ways and methods that will enhance learners' active participation but stressed that the schools are lacking the facilities for the proper implementation of the subjects. Moreover, teachers with specialized skills who are the major players in the implementation are no longer adequate to teach such curriculum [7]. The major problem associated with the curriculum of secondary school curriculum in Nigeria is the implementation aspect. The ineffective implementation of curriculum in the Nigerian secondary schools is the major factor

that created the missing link between attaining the national goals and the goals of the Nigeria education. Technical and vocational education is facing a critical set-back in the area of the development of curriculum materials due to the nature and demands attached to the program [8]. In order to face the challenges of the world of work, well-equipped educated personnel with the ability of reasoning, problem-solving, communication skills and behavioral skills coupled with technical skills are expected to serve the schools and the industry [9].

Employability Skills

The International Labor Congress (ILC) at its 88th session in year 2000 defined employability skills as the combination of knowledge, skills and competence a worker should possess in order to obtain and retain job. The employability skills considered by the congress for worker to be employable are basic and portable high-level skills, broad-based education and training, teamwork, problem solving, communication and language skills Information and communication technology (ICT), [10].

Entrepreneurial Skills

Entrepreneurship as skills that enables individual creates employment or start up business. Entrepreneurship education provides a mix of experiential learning, skill building and most importantly, mindset shift. Certainly, the earlier and more widespread the exposure to entrepreneurship and innovation, the more likely it is that students will consider entrepreneurial careers at some point in the future [11].

Learning Skills

Learning skills is an ability of the learner to learn new process, access, manage, organize and ask questions in order to have productive study skills by using appropriate learning tools and strategies. This could also be related to the ability to learn independently and develop attitude to learn. It is also related to the skills on where and how to get information from available sources and also be able to manage and organize the information effectively [12]

Teaching Methods

Teaching method could be referred to as the adaptation of ways and means of guiding students through the activities of learning for the purpose of accomplishing the desired goals. The selection of good teaching method by the teacher in a particular situation enables the teacher to achieve specific goals towards the set activities [13]

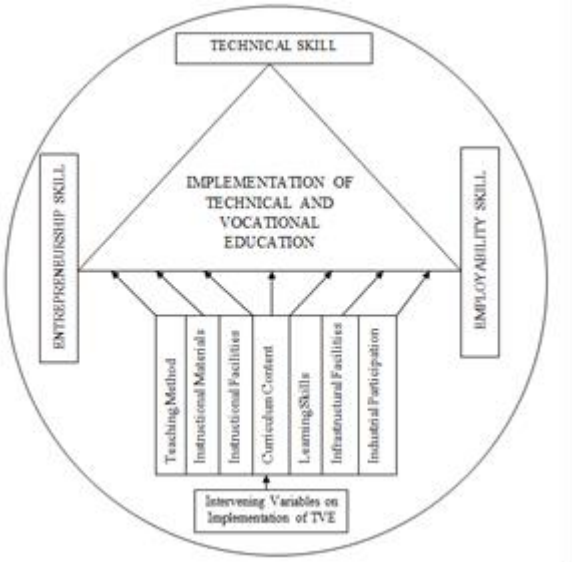
Technical Skills

These are the rudiments of hands on skills acquired through practically-oriented subjects that are designed to train individuals in various vocational fields and empower them with job and become self-reliant [14]. Students are expected to have competencies in these core skills in order to fit in to the industries and help to develop the society and nation at large.

■3.0 CONCEPTUAL FRAMEWORK

The major factor responsible for economic prosperity and national development rely basically on human capital stock. Researches have been conducted on human capital in the area of economic aspect, factors that affect the enhancement of skills and talents are continuously emerging in social and behavioral research. According to the studies conducted by Sakamota and Powers, Schultz, Psacharopoulos and Woodhall, human capital laid the assumption that, the major instrument that resulted in an improved and effective production capacity of individuals is education. It is argued by human capital theorists that an educated society is a productive society. The theory make emphasis on how education transformed the efficiency and productivity of the workers in a positive direction as a result of investment accorded to human beings. The proponents of human capital theory have considered the productive investment in human capital through formal education as equal or even worthwhile than the physical capital [15, 16, 17].

The conceptual framework in Figure 1.1 of the present study was developed by the researcher to establish the relationship between the human capital theory and the training of young generations towards the acquisition appropriate knowledge and skills for economic and national development. In the National Policy on Education [2], the national goals on education is aimed at providing citizens with appropriate skills and the development of mental, physical and social abilities and competencies as equipment for individual to live in and contribute to the development of the society. It also aimed at training of individuals for acquisition of competencies necessary for self-reliant. Therefore, the implementation of technical and vocational education in Nigeria is the main concept of this study towards investigating the methods and procedures employed by technical and vocational schools in the training of young generations in Nigeria. The focus is on the training of youths through various teaching methods, technical skills, employability skills, entrepreneurship skills, learning skills, curriculum content, infrastructural facilities, instructional facilities, instructional materials and industrial participation for the students to acquire skills for self-employment and become economically empowered leading to national development and economic growth. The framework shows the implementation of TVE as an independent variable, teaching methods, instructional and infrastructural facilities, teaching materials, machines and equipment, as well as learning skills as intervening variables while technical skills, entrepreneurship skills and employability skills are the dependent variables. The background study for the conceptual framework on skills for employment growth and development for this study examines the skill development in order to achieve greater productivity and employment growth. Quality technical and vocational education provides a strategic link to higher productivity, employment and development. What is particularly important to note for the purpose of this study is that productivity at individual level is affected by such factors as education, training, core skills and experience. Absence of relevant and affordable training programs impedes skills development and employability. Thus, the road to more productive employment is impaired.



■4.0 METHODOLOGY

Research Design

Structural Equation Modeling (SEM) analysis was used in order to identify the factors that influence the implementation of technical and vocational education in Nigeria. The analysis was used to identify the dominant and non-dominant factors on the implementation of TVE using Analysis of Moment Structures (AMOS) version 16. The researcher chose Measurement Model (MM) as part of the Structural Equation Model (SEM) approach which was employed as part of the statistical technique of analyzing the data for this study. The choice was due its effectiveness in model testing in behavioral and social sciences [18]. AMOS software is generally more concerned about the normality of data that has to be in multivariate normal distribution, therefore in using AMOS software, the researcher made sure that the data is normally distributed because the analysis is only valid for normal data.

AMOS is the most powerful and user friendly structural equation modeling (SEM) software that enables the user to support their research and theories by extending standard multivariate analysis methods, factor analysis, regression, correlation, as well as analysis of variance [19].

Some of the samples were deleted after been analyzed using AMOS software due to outlier symptoms that manifested from the result, therefore, two step modeling approach was adopted. At first, an initial measurement model was developed by allowing all the constructs to correlate freely and all the non-significant values were removed. In the second step, the propose model was also tested in order to show the relationship between the items. At the final stage, the researcher used AMOS to produce a model of each component of the constructs and the overall Implementation of technical and vocational education model. Based on the requirements as suggested by Gao, Mokhatarian and Johnson, the low contributory and problematic items were deleted [20]. According AMOS version 16, a model is a good fit when Chi Square (CS) is $\leq$ 2.00, Ratio (2 or less), Adjusted Goodness-of-Fit Index (AGFI) (more than 0.9), Root Mean Square of Approximation (RMSEA) (less than 0.05), (closer to 1), Confirmatory Factor Index (CFI) and Normal Fit Index (NFI) (more than 0.9).

Using SPSS version 17, all the constructs were subjected to reliability test in order to get the Cronbach's Alpha value for the new measurement model (MM). The researcher also tested the five factor independent clusters MM using confirmatory factor analysis (CFA) in order to determine whether the MM was valid or not.

Research Instrument and Participants

The questionnaire used for the study was adapted from Employability skills for Australian small and medium sized enterprises [21] which were administered on two hundred and twenty (220) technical teachers in Kano State-Nigeria. The questionnaire consists of two parts, Part I requires background information on respondents' age, gender, educational qualification, type of school etc. Part II contains questions items requesting the respondents to indicate the level of importance of each item on teaching approaches, technical skills, entrepreneurship skills, employability skills and learning skills. The 50 question items was designed to capture five (5) constructs using Very High (VH), High (H), Moderately Low (ML), Low (L), and Very Low (VL).

Cronbach's alphas were calculated for the five major variables in order to examine the reliability and internal consistencies. The result shows the alpha value for employability skills is 0.74, for entrepreneurship is 0.76, for learning skills is 0.76, for technical skills is 0.82 and for teaching methods is 0.73. According to Kline, reliability coefficient of 0.9 is excellent, 0.8 is very good and 0.7 is adequate [22].

■5.0 RESULTS AND DISCUSSION

In order to examine the influence of the five constructs used towards implementation of technical and vocational education in Nigeria. It is therefore imperative to use AMOS in order to identify the items that are not contributing positively and eliminated from the final model. In

considering the number of variable to be removed from the priori measurement model, it requires iterative sequences before the proper model that complied and fit well to the data at p>0.05. In this case, all the relevant indicators such as multivariate normality, modification indices, standardized residual covariance and outliers were properly treated and investigated in order to come up with proper measurement model.

Measurement Model for Employability Skills

Initial Model Employability Skills

Nine items from the main instrument constituted the sub-construct of employability skills that were presumably aimed at predicting the employability skills. The items included were: 1- (Listening and understanding communication), 2-(Speaking clearly and directly), 3-(Reading independently), 4-(Working well with peers and supporting staff), 5-(Transfer effectively between individual work and team work), 6-(Knowing own role as part of the team in the work situation), 7-(Developing creative solutions in practical problems), 8-(Showing independence and initiative in identifying problems and solving them) and 9-(Solving problems in team). The initial measurement model tested did not comply with a good fit Chi-square statistics where the standardize estimate shows Chi-square=-343.359, df=27, Ratio=12.717, AGFI=0.543, RMSEA=0.231, NFI=0.617, CFI=0.633, TLI=0.510 and IFI=0.465.

Modified Model for Employability Skills

From the analysis presented for the modified model, four (4) items were retained after eliminating five variables that were not fit to the data. Variables 1, 3, 6, 7, and 8 were excluded because the modification index indicated the items were problematic in developing a model. After a re-run of the model, the Chi-square statistics and quantitative indicators show a goodness of fit and the new trimmed model (modified measurement model) was within acceptable limit of model fit (Chi-square=2.587, df=2, p=0.274, Ratio=1.293, AGFI= 0.972, RMSEA= 0.037, NFI=0.991, CFI= 0.998, TLI= 0.994 and IFI= 0.998).

Measurement Model for Entrepreneurship Skills

Initial Model for Entrepreneurship Skills

An entrepreneurship skill is one of the sub-constructs examined towards implementation of technical and vocational education. From the original instrument designed for this study, eleven (11) items were constituted to presumably predict the capability of entrepreneurship skills. The items were: 10-(Making estimate and calculating well), 11-(Understanding tables, figures and interpretation of graphs), 12-(Understanding basic budgeting), 13-(Adapting to new situations), 14-(Developing strategic vision), 15-(Management of time), 16-(Managing self and work alone), 17-(Being resourceful), 18-(Making decisions), 19-(Understanding relationships amongst workplace processes and systems), 20-(Adapts resource allocation to cope with contingencies) and 21-(Allocates people and other resources to tasks). The initial model tested shows that the measurement model did not comply with a good Chi-square statistics (CS=490.958, df=54, p=.000, Ratio=9.092, AGFI=.629, RMSEA= .192, NFI=.531, CFI=.555, TLI=.456 and IFI=.678).

Modified Model for Entrepreneurship Skills

The entrepreneurship skills model was later re-modified by re-running the model and eliminating some items that were not fit to the model. The items excluded were items number 11, 13, 17, 19, 20 and 21 which were considered to be problematic items. The remaining new items were within the acceptable limits of good model fit, (CS=11.575, df=9, p=.238, Ratio= 1.286, AGFI= .963, RMSEA= .036, NFI= .963, CFI= .991, TLI= .985 and IFI= .991).

Measurement Model for Learning Skills

Initial Model for Learning Skills

Learning skills is one of the sub-constructs examined towards implementation of technical and vocational education. From the original instrument, it contained five (5) items that were presumably enough for prediction. The items were as follows: 22-(Have enthusiasm for ongoing learning), 23-(Willing to learn in any setting), 24-(Open to new ideas and techniques), 25-(Prepare to invest time and effort in learning new skills) and 26-(Acknowledge the need to learn in order to accommodate change). From the analysis of the initial measurement model, learning skills did not comply with a goodness model fit (CS =71.200, df=5, p=.000, Ratio= 14.240, AGFI= .657, RMSEA= .246, NFI= .698, CFI= .707, TLI= .414 and IFI= .564.

Modified Model for Learning Skills

After eliminating one item from the five items and re-running the model, the Chi-square statistics and other relevant quantitative indicators shows a good acceptable range of data. The acceptable limits of goodness of fit shows (CS=9.261, df=2, p=.010, Ratio= 4.630, AGFI= .930, RMSEA= .129, NFI= .933, CFI= .945, TLI= .936 and IFI= .998). Therefore, the analysis shows that items 22, 23, 24 and 25 are good model fit for learning skills.

Measurement Model for Technical Skills

Initial Model for Learning Skills

A technical skill is another sub-construct used by the researcher to examine the implementation of technical and vocational education in Nigeria. The construct consist of fifteen (15) items from the original instrument. The items were as follows: 27-(Able to relate the use of technology to work), 28-(Having basic computer skills), 29-(Upgrading technology skills), 30-(Using various range of technologies for various problems), 31-(Use technology to seek, process and present information), 32-(Use relevant and physical abilities for application of technology), 33-(Knowledge of Safety and Health Skills), 34-(Skills on the use of primary tools), 35-(Basic Machine Operation Skills), 36-(Advanced Machine Operation Skills), 37-(Sketching/Drawing Skills), 38-(Trade Specific Reading Skills), 39-(Technical Writing Skills), 40-(Trade Specific Math Skills) and 41-(Quality Assurance Skills). The initial model shows that, the Chi-square statistics and other quantitative analysis and indicated that the model is out of range, where (CS=845.285, df=90, p=.000, Ratio= 9.392, AGFI= .539, RMSEA= .196, NFI= .586, CFI= .610, TLI= .545 and IFI= .564).

Modified Model for Learning Skills

The modified model was developed after eliminating some items and re-running the model, the Chi-square analysis changed to a better range. The Chi-square statistics and other quantitative analysis complied with a good model fit as indicated (CS= 9.097, df=5, p=.105, Ratio= 1.819, AGFI= .953, RMSEA= .061, NFI= .975, CFI= .989, TLI= .977 and IFI= .989). Therefore, the analysis shows that items 29, 32, 35, 38 and 40 are good model fit for technical skills.

Measurement Model for Teaching Methods

Initial Model for Teaching Methods

Teaching methods is another variable that was used to examine the implementation of technical and vocational education in Nigeria. It consisted of Nine (9) items from the original instrument used for this study. The items were: 42-(Teaching Technical subjects using problem-based method), 43-(Teaching Technical subjects using context based method), 44-(Teaching Technical subjects using students centered method), 45-(Teaching Technical subjects using demonstration method), 46-(Teaching Technical subjects using project-based method), 47-(Teaching Technical subjects using lecture method), 48-(Teaching Technical subjects using tutorials and seminars), 49-(Teaching Technical subjects using field work) and 50-(Teaching Technical subjects using computer-based method). Generally, the model did not comply with good Chi-square statistics as can be seen from the initial model in Figure 4.12. (CS =368.547,df=27, p=.000, Ratio= 13.650, AGFI= .609, RMSEA= .240, NFI= .594, CFI= .608, TLI= .836 and IFI= .652).

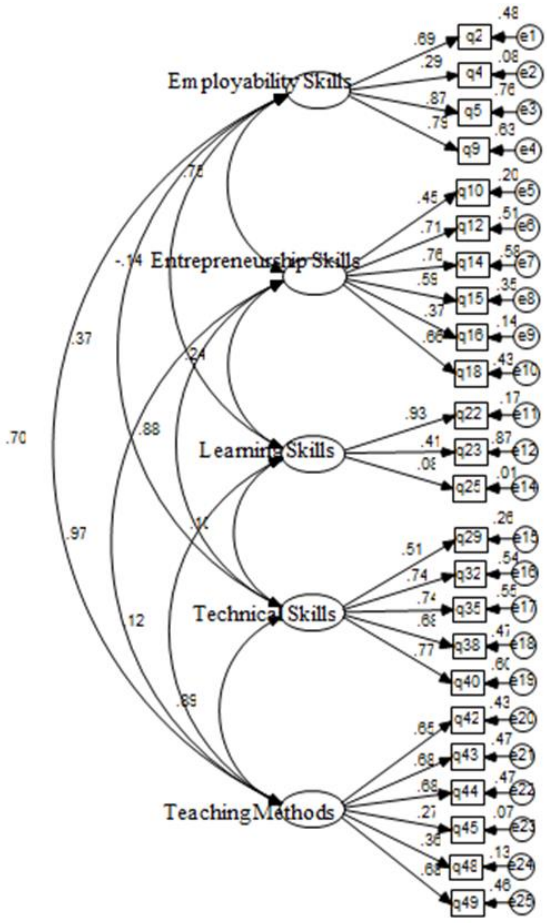
Modified Model for Teaching Methods

From the foregoing analysis, some elements were eliminated and the model was re-run in order to have a better range of Chi-square statistics. After eliminating the items, the Chi-square statistics and other quantitative analysis comply with a good model fit as can be seen (CS =7.800, df=5, p=.168, Ratio =1.560, AGFI= .9567, RMSEA= .051, NFI= .968, CFI= .988, TLI= .976 and IFI= .988). Therefore, the analysis shows that items 43,43,44,48 and 49 are good model fit for teaching methods.

Measurement Model for Implementation of Technical and Vocational Education.

The researcher has endeavored to use the same method using measurement model (MM) to disentangle complex casual linkages among the variables that were computed for the implementation of technical and vocational education. The researcher also used discriminant validity to analyze the relationships between the items and the core variables in order to come up with an acceptable model. Generally, the model does not comply with a good fit model with a good chi-square statistics (CS=1784.615, df=242, p=.000, Ratio= 7.374, AGFI= .572, RMSEA= .171, NFI=.497, CFI= .528, TLI= .462 and IFI= .463). Considerations on which and how many variables should be removed from the priori measurement model requires an iterative sequence before the proper model that complied and fit well to the data at p> .05.

The analysis was subjected to all the relevant indicators such as multivariate normality, modification indices, standardized residual covariance and outliers were properly investigated in order to have achieved proper measurement model. Since the study was trying to maximize the usage of good of fit indicators, most of the problematic items were removed in an appropriate manner. From the cases by cases analysis, sixteen (16) items from the samples have an outlier effect and were deleted in order to produce an acceptable model. The model in Figure 1.2 shows the values of correlation between the variables on the implementation of technical and vocational education skills to be between -.14 to .97 and the standardized regression weight (factor loading) between .27 to .93.



Note:
Standardized Estimates
Chi-square=1784.615
df=242
p=.000
Ratio (2 or less)= 7.374
AGFI (more than 0.9)= .572
RMSEA (less than 0.05)= .171
NFI(more than 0.9)= .497
CFI(more than 0.9)= .528
TLI(more than 0.9)= .462
IFI(more than 0.9)= .463

Figure 1.2 Initial model for the implementation of technical and vocational education

Modified Model for Implementation of Technical and Vocational Education

By deleting some outlier samples and a particular variable, the fit of a new trimmed model (modified measurement model) was within acceptable limits for goodness of fit. (Chi-square=27.159, df=14, p=.018, Ratio= 1.940, AGFI= .923, RMSEA= .066, NFI= .939, CFI= .969, TLI= .937 and IFI= .970. The final model was developed with four constructs namely: Employability skills, learning skill, Technical skills and Teaching Methods, thereby excluding entrepreneurship skills as shown in Figure 1.3. This represents the model for the implementation of technical and vocational education for this study.

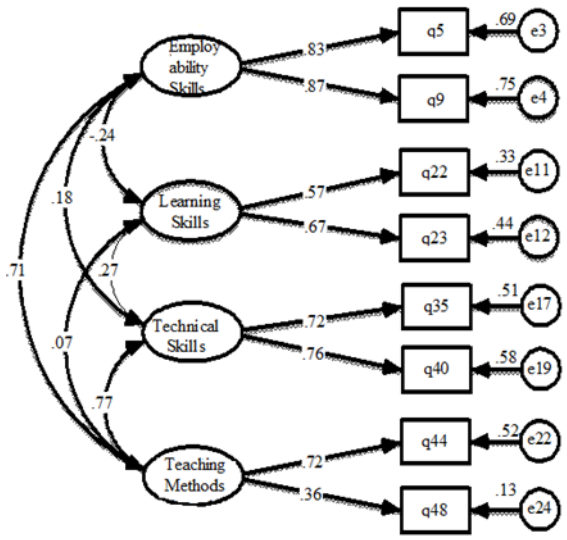


Figure 1.3 Modified model for the implementation of technical and vocational education

AMOS analysis however rejected some of the items that influence the implementation of technical and vocational education. The analysis also contributed in identifying the items, factors and the degree of influence of each skill. The overall AMOS analysis shows that only four (4) skills constructs influence implementation of technical and vocational education. It also shows that eight (8) items from the main constructs contributes towards implementation of TVE. The contributing items were two (2) from employability skills, two (2) from learning skills, two (2) from technical skills and two (2) from teaching methods. Standardized Estimates Chi-square=27.159, df=14, p=.018, Ratio (2 or less)= 1.940, AGFI (more than 0.9)= .923, RMSEA (less than 0.05)= .066, NFI(more than 0.9)= .939, CFI(more than 0.9)= .969, TLI(more than 0.9)= .937 and IFI(more than 0.9)= .970.

Conceptual Model on the Implementation of Technical and Vocational Education in Nigeria

The model in Figure 1.4 is an important guideline for the implementation of technical and vocational education for the training of students that will be equipped with knowledge and skills. The result of the findings of this study and the literature helped in the development of the model through appropriate analysis using Analysis of Moments Structure (AMOS). The influence of the factors towards the implementation of TVE is the contribution for the success of training technical students. Moreover, current teaching and learning of technical subjects needs different approaches due to the demand of variety of skills by the industries all over the world. The industrial sector, society and national development relied on the effective implementation of technical and vocational education program which services the nation's economy. It is also a reciprocal for the industrial system, society and other elements of national development to also justify their needs towards effective technical and vocational education program.

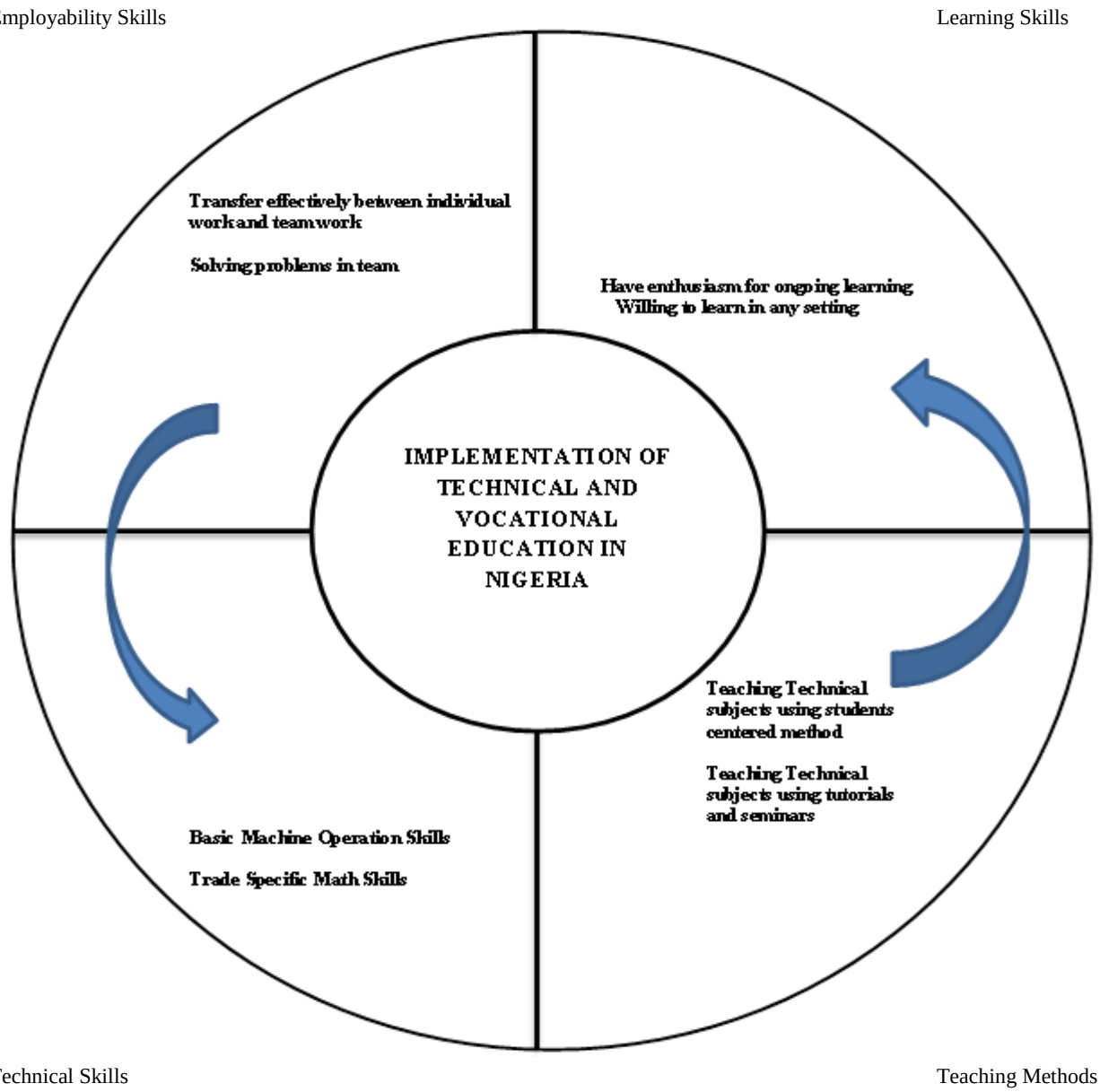


Figure 1.4 Conceptual model on the implementation of technical and vocational education in Nigeria

6.0 CONCLUSION

The model suggests four constructs out of five which have influence towards another. Teaching methods have influence towards learning skills among the students of technical and vocational education; the use of different methods of teaching will assist the learner in acquiring the appropriate knowledge and skills towards the subject matter. It will also provide opportunity for them to broaden their horizon and be more creative under the guidance of the teacher. Learning skills also has influence towards employability skills, the acquisition of employability skills will help the graduates of TVE program to secure and retain job which is a very vital component in terms of employment in the current technological edge. The employability skills as a result of the model have influence towards technical skills in acquiring the rudiments of manipulative skills for a particular skill area, technical skills are said to be more of psychomotor skills which help students in paid jobs or self-employed. From the measurement analysis conducted and construct validity obtained from the items, it shows that the individual constructs are also capable of measuring employability skills, entrepreneurship skill, learning skill, technical skills and teaching methods. The instrument could be used to identify the factors that influence the implementation of TVE which has been validated through a systematic approach using AMOS 16. The result can be used for the purpose of training at various technical and vocational institutions of learning. Moreover, numerous validations were carried out in order to test the instrument for its content validity, construct validity, convergent validity and concurrent validity. Therefore, the researcher believed that the instrument could widely be used to assess the implementation of technical and vocational education program

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