EFFECTS OF THREE CATEGORIES OF MANPOWER ON UNDERGRADUATE STUDENTS' LEARNING OUTCOMES IN TECHNICAL EDUCATION AND THEIR IMPLICATIONS FOR THE CURRICULUM IMPLEMENTATION

Ibiwumi Abiodun Alade
Tai Solarin University of Education, Nigeria

Abstract: *The implementation of technical education curriculum has been besieged with dearth of qualified teaching personnel over the years in Nigeria and some other African countries. Similarly, the available higher institutions where vocational and technical education experts are prepared have not been able to meet this demand of the manpower. This calls for possible intervention strategies which could perhaps address this lingering problem. It is on this observation that this study examines the effects of three categories of manpower on undergraduate students' learning outcomes in technical education and their implications for the curriculum implementation. The pretest, posttest control group, quasi experimental research design with a 4x3x2 factorial matrix was adopted for the study. Sixty technical education undergraduate students from a Nigerian university were purposively sampled for the study. Seven null hypotheses are generated and tested at 0.05 level of significance. Three research instruments were developed, validated, and used for data collection. Data collected were analyzed using Analysis of Covariance (ANCOVA) while Scheffe's post-hoc test was used to explain significant main and interaction effects respectively. Results showed that there is significant main effect of treatment on students' learning outcomes in technical education (F_3, 57 = 132.314; P<0.05). The students taught by vocational educator performed best in basic vocational knowledge acquisition (X=16.38) while those taught by literate artisans had the highest means score on vocational skills acquisition (x = 42.82), then those taught by higher technician group had a mean score of x = 38.27 in vocational skills acquisition, while the control group performed least (x = 31.60). It was concluded that the three categories of manpower are effective at enhancing students' learning outcomes in technical education in various dimensions. To this end, it was recommended that literate artisans should be integrated to the teaching of vocational skills in the tertiary institutions.*

Keywords*:* attitude, higher technician, literate artisan, vocational educator, basic vocational knowledge, vocational skills, vocational education

Background to the Problem

Education for gainful employment has long been considered desirable for every individual to participate as productive members of his/her culture. Education remains the bedrock of growth and development of any nation and a major tool for bringing about desirable changes (Alufohai, 2011). The adoption of this idea can be traced to countries like America, Britain, Japan, and India, among others, which have due consideration for skill-oriented educational programmes. Among such avenues of education which make provision for marketable skills acquisition is technical education. It is often structured in such a way that trainees have the opportunity to acquire manipulative skills and related theory for gainful employment and/or self-employment. This form of education is geared towards production and specific job creation.

Some technical institutions in Nigeria provide technical education with the aim

of turning out many skilled craftsmen, technicians, vocational technical teachers, and other sub-professional personnel to satisfy the manpower needs of Nigeria. This aim makes the role of teaching manpower to put the curriculum content of technical education into practice to be very significant. However, despite of the emphasis placed on vocational and technical education programmes in the *National Policy on Education in Nigeria*, the dearth of qualified teaching personnel over the years has been of much concern. It has been observed that the issue of teacher supply and demand for vocational-technical programmes has been social rather than economic (Alade, 2004). Some schools of thought believe that it is very expensive to establish and maintain technical programmes when infrastructure, equipment, and cost of training teachers are considered. Some other quarters declared that the major issue is that of the attitude of the society towards skilled programmes. Also one problem, which resulted from unfavourable dispositions and inadequate commitment of previous governments in Nigeria, caused a dearth of qualified teachers and researchers in the area of technical education.

As a result, a majority of the unemployed graduates and school leavers have no employable skills because of the nature of the education they received (Abusomwan & Osuyi, 2013). Where there are a dearth of vocational technical education experts, the inadequacies in practical skills acquisition by technical education students in higher institutions becomes worrisome. Alade (2004) observed that as at year 2002, only fifteen universities (ten federal and five states) in Nigeria were offering vocational and technical education courses at the degree level. Even though, as of 2015, the Joint Admission and Matriculation Board records show that there are 147 of federal, state, and private universities in Nigeria, fewer than fifteen of them are still offering technical education as a course of study, thus, creating a shortage of vocational technical graduates expected to teach the senior secondary school vocational subjects.

Lack of enough vocational educators with adequate vocational skills to train Nigerian technical undergraduates is a challenge in Nigeria universities and the other higher institutions where technical education is offered. Consequent upon the rush to produce more vocational technical teachers who will instill manipulative skills in future technical teachers, some modes of training have been suggested over the years. These modes include how people can be attracted and restricted in the teaching of technical subjects; the need to link industrial training with the institutions' means of preparing technical teachers; relationship between technical teacher programmes and curricular innovations of Nigeria educational system, and so on. Similarly, out of the research priorities noteworthy in technical teacher preparation is the involvement of relevant tradesmen in imparting manipulative skills beyond the co-operation received from them during technical teacher trainees' industrial attachment periods.

In Kenya training of technical teachers is targeted at offering the technical institutes a competent workforce that is able to perform the various tasks within their area of specialization (Wafula, Ferej, & Kitainge, 2013). In addition, Kerre (2010) noted that national reviews of education and training reveal that almost 90% of vocational teachers and instructors working in the public vocational training system in Kenya require continuous of upgrading of training skills. Staff members of tertiary technical training institutions feel that a variance exists between the requirements of training institutions and technical teachers trained

in Kenya (Wafula et al., 2013) In the United States of America, manpower production in vocational-technical education gives attention to working practices: the ability to plan one's work, to use materials and time economically, to handle measuring instruments, and to keep the work place tidy. In Great Britain, recruitment of skilled personnel from cooperating developed countries in vocational-technical education such as United States and Japan is paramount, especially in auto mechanic and computers as it geared the national effort towards effective manpower production. Vocational training of students in Germany operates through a dual system: Vocational training is given to students first in the company and later supplemented theoretically in the vocational schools. Germany further set up other supplementary training centres for systematically imparting skills and knowledge through formal training in various courses; all geared to prepare trainees for the world of work.

In Nigeria, other researchers lamented the unsatisfied state of students' vocational and job skills, inconsistent student/vocational teacher ratio, the incompetency of technology teachers, the need to equip young graduates with adequate skills, and the gross deficient of qualified technical teachers in technical education options in Nigerian institutions (Adeyemi, 1997; Apagu, 1997; Okorie, 1993; Olabiyi, 2003). Perhaps due to the very few numbers of universities in Nigeria offering technical education at both undergraduate and postgraduate levels and shortage of manpower in the area, the available research efforts relevant to technical education have been largely unable to solve the critical problem of technical education (Alade, 2006).

Over the years the shortage of vocational manpower in Nigeria secondary schools as a specific case has led to the use of the teaching personnel not specifically in the technical education field handling some vocational subjects like basic technology, basic electronics, and technical drawing. It is not uncommon to see graduates of polytechnics with higher national diploma certificates in engineering/technology/science courses teaching technical education options in secondary institutions. This lack of teaching personnel has led to the invitation of some literate artisans in Nigerian cities to serve as support staff on an informal basis to handle some practical aspects of technical education in some Nigerian higher education institutions.

The artisans, popularly referred to as roadside artisans because they usually operate on roadsides and strategic places in both rural and urban areas in Nigeria environment, are trained under the non-formal apprenticeship schemes, also known as roadside apprenticeship scheme (Olateju, 2001). They work as automotive technicians, metal workers, wood workers and furniture builders, creative artists, electrical/electronic technicians, etc. Roadside artisans have emerged as one of the most dependable group of contributors to national economic development in Nigeria. They are within the reach of the society and are always available to offer prompt and quick service to the public.

The impact of technologists, whose expertise is also in a cluster of high-level technology education added to engineers' function, have often been combined in knowledge, vocational skills acquisition, and activities systematically planned to educate the youth for gainful employment in Nigeria. In any case, there is no clear and laudable evidence to the relative effects of those technologists on technical education trainees at any level in Nigeria.

Uwameiye (1996) recorded a significant difference in students' academic achievement in technical education based on gender and school type. Abayomj (2000) considered gender, educational qualification, age, and salary grade as among the factors that could affect a training objectives. Because these variables are not exclusive categories, and considering the significant place of gender as an issue in technology education worldwide, gender and academic ability are taken as moderating variables in this study.

In spite of the increasing demand for well-equipped technology teachers for vocational and technical institutions in Nigeria, and as laudable as technical education is in Nigeria education policy, the curriculum implementation of technical education programmes in Nigeria is still starved with adequately prepared technical teaching personnel. Also, as with skill development and market productivity, the effect of technical education products from Nigerian higher education institutions has not been felt in the society to an appreciable extent. All these put together informed the need for the study.

Statement of the Problem

The dearth of qualified vocational teaching personnel to implement technical education curriculum in educational institutions in Nigeria has been a lingering problem. Many relevant theoretical and empirical researches available have not been able to conclusively and convincingly solve the critical problem of manpower shortage. It is on this thrust, that this study examined the effects of three categories of manpower on undergraduate students' learning outcomes in technical education and their implications for the curriculum implementation

Research Hypotheses

The following research hypotheses were tested at 0.05 level of significance. Each hypothesis was tested on … students' acquisition of (a) basic vocational knowledge, (b) vocational skills, and (c) attitude to technical education.

H_{01}: There are no significant main effects of treatment (vocational educator, higher technician, and literate artisan) on…

H_{02}: There is no significant main effect of gender on…

H_{03}: There is no significant main effect of academic ability on…

H_{04}: There is no significant interaction effect of treatment and gender on…

H_{05}: There is no significant interaction effect of treatment and academic ability on…

H_{06}: There is no significant interaction effect of gender and academic ability on …

H_{07}: There is no significant interaction effect of treatment, gender and academic ability on ….

Description of Concepts and Variables

- *Basic vocational knowledge:* Rudiments in the concepts and principles of technical education courses often learned before their practical applications in the workshop.
- *Higher technician:* A product of polytechnic with a Higher National Diploma Certificate in technical education related courses and/or a first degree holder in engineering/ technology course(s) related to technical education.
- *Literate Artisan:* A self-employed individual or group of individuals (with the ability to read, write, and communicate to an appreciable extent in any vocational trade similar to university technical education options.
- *Literate:* An individual who can give

vocational information in both theoretical and practical terms to another party in an appreciable understandable English language.

- *Manpower category:* It is teaching personnel with specialization in technical education trade options though with varying professional certificates and / or status.
- *Science-Based Educator:* A science-oriented personnel with vocational ideas sometimes used to teach technical course/trade option(s) in the university system.
- *Vocational educator:* At least a first degree holder in vocational industrial technical education (B.Sc. Ed).

Methodology

The diagram in Figure 1 shows the conceptual framework/model for the study. The framework shows the independent, moderating, and dependent variables. The independent variables are the categories of manpower. The framework equally contains the moderating variables (gender and academic ability of the students) which perhaps are capable of confounding the result of the study. This is followed by the criterion variables, which are the acquisition of basic vocational knowledge, vocation skills, and attitude to technical education, and they are expected to metamorphose into behavioural change (ultimate end) - gainful employment, self-employment or job creation.

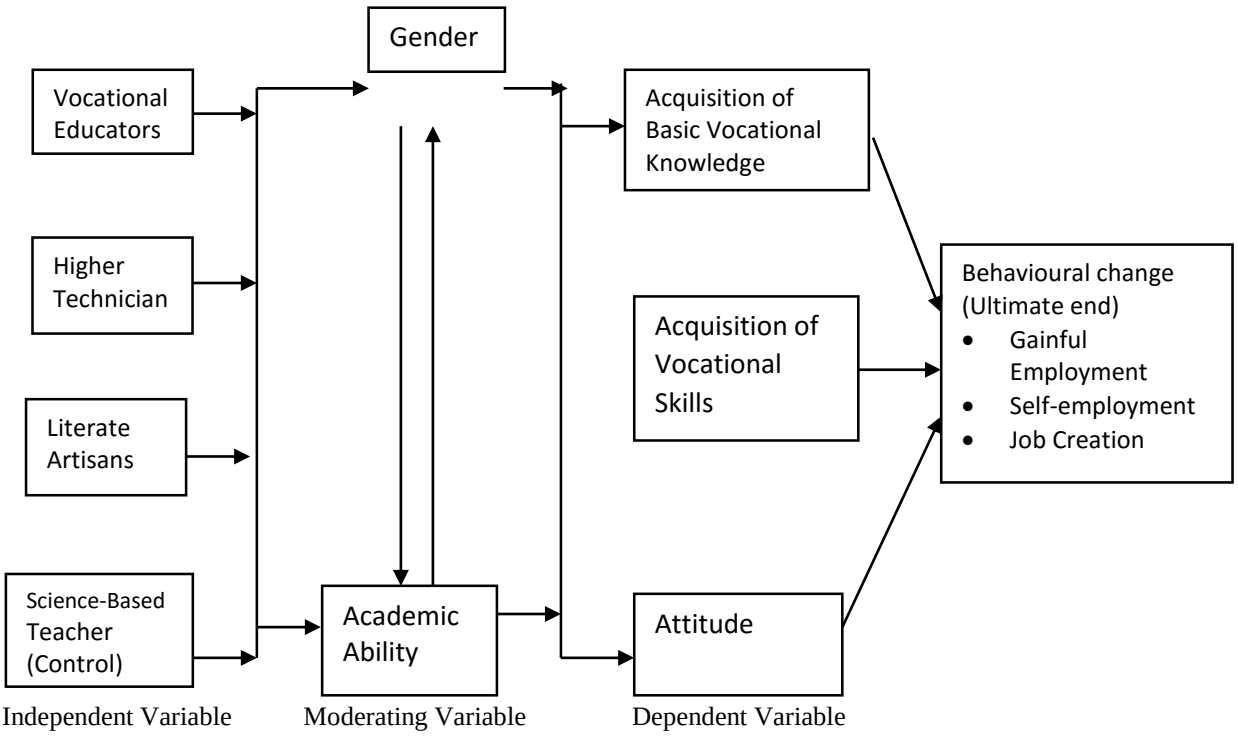

Figure 1. Conceptual framework/model for the study as described in the paragraph above.

Independent Variable

One independent variable (manpower) is manipulated at four category levels: (a) vocational educators, (b) higher technicians, (c) literate artisans, and (d) science-based educator.

Moderator Variables

There are two moderator variables namely (a) gender of participants occurring at two levels: male and female; and (b) academic ability of the participants occurring at three levels: (1) high academic ability (HAA), (2) average academic ability (AAA), and (3) low academic ability (LAA).

Dependent Variables

There are three dependent variables: (a) students' acquisition of basic vocational knowledge, (b) students' acquisition of vocational skills, and (c) students' attitude to technical education.

Research Design

This study adopted a pre-test, posttest control group, quasi-experimental design using a 4x3x2 factorial matrix. These include the manpower categories at four levels (vocational educators, higher technicians, literate artisans, and control group; and academic ability at three levels (high, average and low) (gender at two levels (male and female). The table showing the 4x3x2 factorial matrix of the study is shown in Table 1.

Table 1
The 4x3x2 Factorial Matrix of the Study

Treatment	Gender	Academic ability		
		High	Average	Low
E1	M	Cell 1	Cell 9	Cell 17
	F	Cell 2	Cell 10	Cell 18
E2	M	Cell 3	Cell 11	Cell 19
	F	Cell 4	Cell 12	Cell 20
E3	M	Cell 5	Cell 13	Cell 21
	F	Cell 6	Cell 14	Cell 22
C	M	Cell 7	Cell 15	Cell 23
	F	Cell 8	Cell 16	Cell 24

Note: The 4 x 3 x 2 Factorial Matrix is an indication of how the variables of the study interact together (cells) structurally in practice and not necessarily accommodating any data in the presentation of the research methodology.

Experimental Group 1 (El): $O_1 X_1 O_5$
Experimental Group 2 (E2): $O_2 X_2 O_6$
Experimental Group 3 (E3): $O_3 X_4 O_7$
Control Group 3 (C): $O_4 X_4 O_8$

O_1, O_2, O_3, and O_4 are the pre-test scores of the three treatment groups and control group respectively. O_5, O_6, O_7, and O_8 are the posttest scores of the three treatment and control groups. X_1, X_2, X_3 and X_4, are the vocational educators, higher technicians, and literate artisans (manpower categories) and the control group (any vocational teacher with vocational idea). The quasi-experimental design adopted was to determine the effectiveness of the three categories of manpower, gender, and academic ability as well as their interaction effects on students' acquisition of basic vocational knowledge, vocational skills, and attitude to technical education.

The record of the participants (technical education students) in their academic ability in the institution was used to place them in difficulty ability groups (low, average, high). Also, the scores in the vocational knowledge and vocational skills test and the technical education students' attitude rating scale were obtained before and after the treatment sessions in all the groups.

The Population and Sample/Sampling Techniques

Sixty, 300-level technical education students at Tai Solarin University of Education, Ijebu-Ode, Ogun State, Nigeria, participated in the study: 46 males and 16 females. The low enrollment of females in technical education programmes in Nigeria is probably the result of the belief that technical education is mostly for males. The students were randomly assigned to treatment groups through simple random sampling without replacement for the purpose of analysis and discussions. The choice of 300-level students was because they have been exposed to the rudiments of all the technical education options in their 100- and 200-level courses. The choice of the university was limited to only Tai Solarin University of Education because it is the only one in Ogun State, Nigeria where technical education is offered at the degree level and has been offering it on degree basis before it became a full fledge university. The curriculum content selected for teaching gave due consideration to the acquisition of basic concepts and principles (knowledge) fundamental to the acquisition of vocational skills and attitudes to the technical education options available in the university.

Instrumentation

Three research instruments were used for data collection in this study. They are (a) Undergraduate Students' Acquisition of Vocational Knowledge and Technical Skill Test (USAVKTST); (b) Technical Education Students' Attitude Scale (TESAS); and (c) Teaching Personnel Instructional Guide (TPIG). All three were designed by the researcher.

Description of the Instruments

USAVKTST had three sections. Section A consisted of the demographic data of the students. Section B consisted of 60 multiple test items on the selected concepts, principles, and themes (basic vocational knowledge) in technical education. All questions were objective form with four choices, A-D. Section C consisted of a 4-hour practical in one of the following areas:

- *Setting of piston in the engine block*: In a four stroke-cycle of a four cylinder engine, automobile technology students were asked to set four pistons in a dismantled motor engine, and all the steps involved are assessed accordingly one after the other.
- *Hinges construction*: Given a sizeable sheet of metal, metal work students were asked to pass through the measuring stage, marking-out stage, cutting stage, assembling and final finishing of the hinges construction.
- *Switch controlling a three lamp holder installation*: Following a circuit diagram, the students were to lay out on a sizeable plywood, a switch controlling three lamp holders, and the stages were assessed one after the other.
- *Picture frame construction*: The constructional stages of measuring, marking out cutting into sizeable pieces, preparation of mitre joint, assemblage, and finishing were followed.

The instrument was subjected to face and content validity by experts in technical education and instrument experts (evaluators). The reliability co-efficient of (0.83) was determined using Kuder-Richardson (KR-21) formula.

TESAS consisted of two sections: Section A was the demographic data of the respondents; Section B consisted of 30 items placed on a 4-point Likert type ordinal scale (strongly agree [SA], agree [A], disagree [D], and strongly disagree [SD]). The scoring key ranged from 4 to

1 for positively worded items, while the reverse was used for negatively worded statements.

The face and content validity of TESAS was done by three experts in educational evaluation to determine the suitability of the items in term of language of presentation, clarity of ideas and applicability to the study. The Cronbach Alpha reliability value of 0.87 was obtained for its reliability.

TPIG was prepared by the researcher. It was vetted, and it enabled a vocational teacher in each experimental group and control group to follow the steps below:
Step 1: Administration of pretest;
Step 2: Introduction of the themes/concepts;
Step 3: Theoretical discussion of the selected themes;
Step 4: Questioning and answering;
Step 5: Practical activities;
Step 6: Administration of posttest.

Procedure for Data Collection

The participating categories of manpower were trained by the researchers for one week with emphasis on (a) the rationale and justification for the study, (b) aim and objectives, (c) technical education curriculum content, (d) methodology, instructional procedures and approaches, and (e) the study ethics. The order of presentation (teaching) expected in each of the experimental groups was vividly instructed to the concluding stage.

The field work covered a total of 8 weeks and included the following phases:
Phase 1: Training of the manpower categories – 1 week
Phase 2: Administration of pretest – 1 week
Phase 3: Teaching of technical education students by the manpower categories in their respective experimental and control group – 5 weeks
Phase 4: Administration of posttest and data collection – 1 week.

Method of Data Analysis

Analysis of the data was done using analysis of covariance (ANCOVA) with the pre-test scores as covariates. Multiple classification analysis (MCA) was used to determine the magnitude of the learning outcomes of technical education students in the four groups. Schefee's post hoc analysis was used to determine the sources of significant main and interaction effects obtained. All the hypotheses were tested at $P < 0.05$ level of significance.

Results

Testing the Hypotheses

H_{01} a: There is no significant main effect of treatment on students' acquisition of basic vocational knowledge in technical education.

Table 2 reveals that there is a significant difference in the students' posttest scores in basic vocational knowledge (F_3, 57 = 132.314; $P < .05$). This shows that there is a significant main effect of treatment on post test scores of basic knowledge of students taught by vocational educator, higher technician, literate artisan and those taught by a science teacher with a general knowledge in technical education. Hence, hypothesis 1a is rejected.

Table 2
Summary of ANCOVA of Posttest Scores in Basic Vocational Knowledge by Treatment, Gender, and Academic Ability

Source of variance	Sum of squares	Df	Mean square	F	Sig. (P)	Remark
Main Effect						
Pretest Covariance	294.030	1	294.030	41.054	1.149	Sig
Combined	2030.200	5	620.045	33.0501	.000*	Sig
Treatment	3625.414	3	3508.462	132.314	.000*	Not Sig
Gender	.321	1	.321	.17	.83	Not Sig
Academic ability	9.150	3	9.150	1.170	.231	
2-way interaction						
Combined	100.611	7	20.724	2.017	116	
Treatment + Gender	160.291	3	44.091	6.415	.140	Not Sig
Treatment + Academic ability	3.623	3	0.874	.192	.632	Not Sig
Gender + Academic ability	6.524	1	6.524	1.326	.350	Not Sig
3-way interaction						
Treat. + Gender, Acad. ability	35.116	3	9.431	1.866	.603	Not Sig
Model	4060.211	16	221.794	41.141	.000	
Residual	4853.603	57	4.426			
Total	10114.32	73	12.109			

Significant at P<.05

Table 3 shows that the students in the vocational educators' treatment group had the highest adjusted mean score in basic vocational knowledge acquisition (x = 16.38), followed by those in the higher technician group (x = 16.23) and literate artisan group (x = 15.82), while those in the control group had the least adjusted mean score in basic vocational knowledge (x = 12.18).

Table 3
Multiple Classification Analysis (MCA) of Posttest Scores on Basic Vocational Knowledge by Treatment, Gender and Academic Ability

Treatment + Category	N	Unadjusted Deviation	Eta	Adjusted Deviation	Beta
Vocational Educator	15	1.20		1.34	
Higher technicians	15	1.12	.703	1.19	.594
Literate Artisan	15	.78		.78	
Control Science teacher	15	4.91		-2.86	
Gender					
Male		.40		.02	
Female		-.34	.104	-0.3	0.006
Academic Ability					
High		-.36		.13	
Average		.36	.010	-.42	.048
Low		.28			
R=0.605					
R^2=.366					

Table 4
Schefee Post-hoc Analysis on Students' Basic Vocational Knowledge Acquisition

Treatment	N	Mean score	Vocational Educator	Higher Technician	Literate Artisan	Control
Vocation Educator	15	16.38		*		*
Higher Technician	15	16.23	*			*
Literate Artisan	15	15.82				*
Control	15	12.18	*	*	*	

Grand Mean = 15.04 *Significant difference

Further, the source of the significant effect of treatment obtained in Table 2 was traced using the Schefee post-hoc analysis, and the results are presented in Table 4. Table 4 reveals that the post test score in basic vocational knowledge of the control group (x = 12.18) is significantly different from each of the vocational education (x = 16.38), higher technician (x = 16.23), and literate artisan (x = 15.82) groups. Also, the higher technicians and the vocational educator's groups are significantly different from one another in the posttest score of basic vocational knowledge acquisition.

$H_{01}b$: There is no significant main effect of treatment on students' acquisition of vocational skills in technical education.

Table 5 shows a significant difference in the students' posttest vocational skills scores among the three groups (F_3, 57) = 6.247; P < .05). This implies that there is a significant main effect of treatment on posttest scores in vocational skills of students taught by vocational educator, higher technician, literate artisan, and those taught by a science teacher with general knowledge in technical education. On this basis, hypothesis 1b is rejected.

Table 5
Summary of ANCOVA of Post Test Scores in Vocational Skills by Treatment: Gender and Academic Ability

Source of Variance	Sum of squares	Df	Mean square	F	Sig. (P)	Remark
Main Effect	15	16.38		*		*
Pretest covariance	105.705	1	105.705	1.120	.269	
Combined	2253.071	5	450.578	4.472	.000	Sig
Treatment	2914.12	3	881.151	6.24	.000	Sig
Gender	91.811	1	91.81	.566	.000*	Not Sig
Academic ability	105.196	1	105.196	0.728	.185	Not Sig
Gender + Academic ability	1.41	1	1.273	.012	.814	Not Sig
2-way interaction						
Combined	5618.79	7	641.970	6.728	.185	Not Sig
Treatment + Gender	5104.682	3	1124.794	12.953	.140	Not Sig
Treatment + Academic ability	71.164	3	28.165	.138	.670	Not Sig
Gender + Academic ability	1.41	1	1.273	.012	0.814	Not Sig
3-way interaction						
Treat. + Gender, Academic ability	101.484	3	23.495	.182	.139	Not Sig
Model	1027.11	16	532.892	4.323	.000	
Residual	69180.32	57	108.912			
Total	812.29	73	109.582			

Table 6 presents the multiple classification analysis of the groups showing the magnitude of the groups mean scores in vocational skills. From Table 6, the group taught by literate artisan has the highest posttest mean score in vocational skills (x = 42.82) followed by those taught by vocational educator (x = 41.63), than the higher technician group (x = 38.27), while the control group obtained the lowest mean score (x = 31.60).

Table 6
Multiple Classification Analysis of Posttest Scores on Vocational Skills by Treatment, Gender, and Academic Ability

Treatment + Category	N	Unadjusted Deviation	Eta	Adjusted Deviation	Beta
Treatment Educator					
Vocational	15	1.21		1.38	
Higher technicians	15	1.09	.159	-1.98	
Literate Artisan	15	1.67		2.57	.155
Control Science teacher	15	-3.70		-8.56	
Gender					
Male	46	.62		.39	
Female	14	-.58	0.14		0.021
Academic Ability					
High	37			.39	
Average	17	-65	0.48	.51	.047
Low	06	-67		-.53	
R=.174					
R^2=.30					

Grand Mean = 40.25

Table 7 presents the Schefee post-hoc analysis to find out the source of the significance difference obtained on hypothesis 1b. Table 7 reveals that each of the three treatment groups, vocational educator group (x = 41.63), higher technician group (x = 38.27), and literate artisan group (x = 42.82) is significantly different from the control group, that is, the group taught by a science teacher with a general knowledge in technical education (x = 31.60).

Table 7
Scheffe Post-hoc Analysis on Students' Vocational Skills Acquisition

Treatment	N	Mean score	Vocational Educator	Higher Technician	Literate Artisan	Control
Vocation Educator	15	41.66				*
Higher Technician	15	38.27				*
Literate Artisan	15	42.82				*
Control	15	31.60	*	*	*	

*Significant difference

$H_{01}c$: There is no significant main effect of treatment on students' attitude to technical education.

Table 8 reveals that there is a significant difference in the posttest attitude of the students among the groups (F_3, 57 =18.674; P<05). This implies that there a significant main effect of treatment on the students' posttest attitude to technical education. Hence, hypothesis 1c is rejected.

Table 8
Summary of ANCOVA of Post Test Scores on Attitude by Treatment, Gender, and Academic Ability

Source of variance	Sum of squares	Df	Mean square	F	Sig. (P)	Remark
Main Effect						
Pretest Covariance	140.160	1	140.160	2.201	.126	
Combined	5957.670	5	1292.356	12.214	.000	
Treatment	5837.315	3	1282.372	18.674	.000*	Sig
Gender	99.254	1	99.254	1.024	.000*	Sig
Academic ability	1.016	1	1.016	.101	.793	Not Sig
2-way interaction						
Treatment + Gender	1186.631	3	628.110	5.923	.106	Not Sig
Treatment + Academic ability	30.736	3	12.576	.139	.843	Not Sig
Gender + Academic ability	21.108	1	31.208	.290	.432	Not Sig
3-way interaction						
Treatment + Gender, Academic ability	16.234	3	4.176	.052	.886	Not Sig

To find out the magnitude of the mean scores of each of the groups handled by vocational educator, higher technician, literate artisan, and the control group, the multiple classification analysis is presented in Table 9. Table 9 shows that the vocational educator group obtained the highest attitude mean score (x = 90.40), followed by the literate artisan group (x = 87.44), followed by higher technician group (x = 84.16), while the control group has the least mean score (x = 78.89). Further, the Schefee post-hoc analysis was carried out to trace the source of the significant effect of treatment obtained on students' attitude to technical education.

Table 9
Multiple Classification Analysis of Posttest Scores on Attitude by Treatment, Gender, and Academic Ability

Category	N	Unadjusted Deviation	Eta	Adjusted Deviation	Beta
Vocational educator	15	1.23		1.39	
Higher technicians	15	1.29	.205	-4.85	1.64
Literate artisan	15	1.14		1.57	
Control	15	-3.942		-10.12	
Gender					
Male	46	.42	0.19	0.42	0.5
Female	14	.67			
Academic ability					
High	37	.24		-1.57	
Average	17	.23	0.67	-3.69	0.059
Low	6			-3.72	
R = .294					
R^2 = .66					

Grand Mean = 89.01

From Table 10, it is obtained that the vocational educator group (x = 90.40) is significantly different from each of the other groups. That is literate artisan group (x = 87.44), higher technician group (x = 84.16) and control group (x = 78.89). This implies that the significant effect of treatment on students' attitude to technical education is due to the significant difference between vocational educator group and each of the other three groups.

Table 10
Scheffe Post-hoc Analysis of Students' Vocational Attitude

Treatment	N	Mean Score	Vocational educator	Higher technician	Literate artisan	Control
Vocational educator	15	90.40	*			
Higher technician	15	84.16		*		
Literate artisan	15	87.44			*	
Control	15	78.89	*			

*Significant difference

H_{02}a: There is no significant main effect of gender on students' acquisition of basic vocational knowledge in technical education.

Table 2 reveals that gender has no significant main effect on students acquisition of basic vocational knowledge in technical education (F_1, 57 = 0.83; P >0.05). Hypothesis 2a is therefore not rejected. The Multiple Classification Analysis (MCA) in Table 3, however, shows that male students have a higher mean score in basic vocational knowledge (x = 15.06) than the female students (x = 15.01). The difference of 0.05 has been shown to be insignificant.

H_{02}b: There is no significant main effect of gender on students' acquisition of vocational skills in technician education.

Table 5 reveals that gender has significant effect on students' acquisition of vocational skills in technical education (F_1, 57 = .556; P <.05). Therefore hypothesis 2b is rejected. The MCA in Table 6 also showed that male students obtained a higher vocational skills score (x = 40.64) than the female students (x = 38.24). The difference (2.40) has been shown to be significant.

H_{02}c: There is no significant main effect of gender on students' attitude to technical education.

Table 8 shows a significant effect of gender on students' attitude to technical education (F_1, 57 = 1.024; P < .05); therefore, hypothesis 2c is rejected. As obtained from MCA Table 9, the male students obtained the higher attitude mean score (x = 85.07) than the female students (x = 83.75). The mean difference of 1.22 is significant in this study.

H_{03}a: There is no significant main effect of academic ability on students' acquisition of basic vocational knowledge in technical education.

Table 2 revealed that academic ability has no significant main effect on students' acquisition of basic vocational knowledge in technical education (F_3, 57 = 1.170; P>.05); therefore, hypothesis 3a is not rejected. However, from Table 3, students of average academic level have the highest mean score in basic vocational knowledge (x = 15.18) followed by those of high academic ability (x = 15.17), while the students of low academic level has the least mean score (x = 14.82). The mean difference in each case is insignificant.

H_{03}b: There is no significant main effect of academic ability on students' acquisition of vocational skills in technical education.

Table 5 shows that academic ability has no significant main effect on students acquisition of vocational skills (F_3, 57 = 0.728; P>.05); hence, hypothesis 3b is not rejected. MCA (Table 6) also shows that students of high average academic level have the highest mean score in vocational skills (x = 40.76),

compared with the students of high academic level (x = 40.64) and those in the low academic level (x = 39.72) respectively. However, the differences in each case is insignificant.

H_{03}c: There is no significant main effect of academic ability on students' attitude to technical education.

Table 8 shows that there is no significant main effect of academic ability on posttest attitude of students (F_3, 57 =.101; P>.05) to technical education. Therefore, hypothesis 3c is not rejected. Table 9 shows that students of high academic level have the highest attitude score (x = 87.44), followed by the average academic level (x = 85.32), and the students of low academic level have the least attitude mean score (x= 85.29). However, the mean difference in each case is not significant.

Interaction effects. For all the interaction effects in this study in respect of treatment and gender (H_{04}), treatment and academic ability (H_{05}), gender and academic ability (H_{o6}), and treatment, gender and academic ability (H_{07}) on the dependent measures (basic vocational knowledge, vocational skills, and attitude to technical education, no significant interaction effect was recorded. Hence, hypotheses H_{04}, H_{o5}, H_{o6}, and H_{o7} are not rejected.

Discussion

The findings revealed that there were significant main effects of treatment on students' acquisition of basic vocational knowledge, vocational skills, and attitude to technical education. This finding implies that the three treatment groups are effective compared with the control used. These findings established the fact that literate artisans could also do well in teaching at least the vocational skills under the guidance of vocational educators. The students taught by literate artisan have the highest posttest mean score in vocational skills acquisition (see Table 6). This empirical evidence corroborates Olateju's (2001) study that roadside artisans have emerged as one of the most dependable group of contributors to national economic development in Nigeria. It equally consolidated the report of Alade (2004) that local tradesmen are willing to help the young stars acquire some saleable skill. In fact this would consolidate the efforts of vocational educators through which technical education students acquire more of basic vocational knowledge (table 3) more than those taught by higher technician and literate artisan in this study.

The next findings that gender has no significant main effect on students acquisition of basic vocational knowledge in technical education further reaffirm the research finding of Alade (2006) that female students could equally do well in the technological field especially in the learning of basic concepts and principles in the field. However, disparity occurred significantly in the acquisition of vocational skills where male students performed better (see Table 5). Perhaps this might be as a result of the masculine nature of male students in technical education and a limitation to female students' participation in vocationally-based programmes. Gender has long been found to be a strong factor that could affect a training objectives and cause differences in students' academic achievement in technical education (Abayomi, 2000; Shosanya, 1995; Uwameiye, 1996).

About students' attitude to technical education, the significant difference recorded (see Tables 8 and 9) makes it clear that male students still have more interest in technical education than their female counterparts. On the effect of academic ability on the dependent

measures, the students from average academic level which have the highest mean basic vocational knowledge score (see Table 3) as well as the highest mean vocational skills score (see Table 6) is perhaps a reflection of different categories of manpower used in this study. Thus, the usage of such manpower categories in technical education curriculum implementation would improve the acquisition of basic vocational knowledge, vocational skills, and attitude to technical education, irrespective of gender and academic ability to an appreciable extent.

Implications of the Findings for Technical Education Curriculum Implementation

In the light of the findings presented, this study has implications for the implementation of technical education curriculum vis-à-vis the labour market. Both theoretical and practical aspects of technical education can be better taught using the collective manpower of vocational educators, higher technicians, and literate artisans to further improve the employability capacity of the products in the labour market. When the topic for the day in technical education has to do with acquisition of facts, this study has shown that vocational educators and higher technicians could be more useful, and it also revealed that when the topic is more of psychomotor domain, the expertness of literate artisans should be adopted and integrated into the teaching learning sequence. This change will go a long way to ease the work of vocational educators as well as improving the exposure of technical education students to the marketable skills in their trade option(s). Employing the skills of the manpower categories considered in this study would improve the attitude of technical education students to the course, encourage their confidence to be self-employed, and be job creators in the world of work rather than job seekers at most times.

Interestingly, in Kenya, it is recognized that in today's global market it takes the expertise of talented engineers and technologists together with the skillful hands of craftsmen and technicians to produce high quality goods and services for both local and export markets. This observation in Kenya and the findings of this study call for thorough knowledge of the technical skills that graduates acquired from the institutions offering technical education. The combined efforts of the categories of manpower employed in this study therefore become very significant.

In addition, in some other African countries apart from Nigeria, there is a general feeling among the members of staff of tertiary technical training institutions that a variance exits between the requirements of training institutions and technical teachers trained in the country. The technical teachers appear to lack knowledge and skills to handle their core technical subjects they were trained to teach. Meanwhile, it is not clear whether the trend has anything to do with curricula, training facilities/equipment or training duration offered by the training institutions (Wafulaet al., 2013).

The consistent observation is that the approach to technical education curriculum implementation in the area of personnel in use for the programme needs attention. Kerre's view (2010) is in line with this observation by noting that due to increased technological innovations and the demand for higher education and skills in the modern work place much more is demanded of a trained technical teacher today than ever before. Thus, the three categories of manpower employed in this study could be integrated in technical education curriculum implementation process in Nigeria. All put together would empower the teaching force of technical education as a field of specialization and the

recipients of the subject matter in the area to serve as cornerstone for sustainable development in developing countries of the world, Nigeria inclusive. When this is done, the vision of developing countries in their march towards global competitiveness would not be a mirage. By and large, technical education curriculum in Nigerian higher institutions which is vocationalised in content would indeed be vocational in practice in the implementation approaches using diverse and relevant categories of the manpower identified in this study.

Conclusion

This study stands as part of the efforts to shift from much dependence only on vocational educators as chief implementers of the content of technical education curriculum to a more flexible, relevant, functional, result-oriented, and learner-centred usage of other manpower categories available in the society. This effort is with a view to promoting vocational skills acquisition in technical education and building both the entrepreneurial capacity and market employability of technical education trainees at all levels of education. This study has brought to the fore the importance of three categories of manpower that could work collaboratively to facilitate effective implementation of technical education curriculum in vocational classrooms and industrial laboratories.

The development of quality human resources is thus central to the attainment of vocational goals for industrial and societal development the world over. However, the nature of the vocational-technical training offered in technical training institutions or higher institutions may be partly similar or varies. Likewise, the quality of the vocational skills being acquired through the available curriculum may also be inadequate. These challenges look obvious in Nigeria and some other African countries but could be curtailed. In some, the expertise of talented and expert vocational educators in training institutions, private vocational establishments, engineers and technologists together with skillful hands of craftsmen and technicians are needed in developing countries of the world for adequate curriculum implementation of technical education.

Recommendations

Based on the findings of the study, the following recommendations are made.

- The practical way to achieve technical education objectives is through the adoption of the viable manpower categories employed in this study.
- There should be systematic literacy programmes organized for interested roadside artisans available in our environment. This could be done through organized seminars, workshops, symposia, conferences, public lecturers, short and long term training programmes and other relevant means to improve their educational background.
- A post graduate diploma certificate in education should be a condition before higher technicians could be employed in technical education curriculum delivery.
- The challenge is posed to curriculum developers and policy makers to design a workable curriculum or programme structure showing how best interested literate roadside artisans can be integrated into the programme of activities of educational institutions in order to tap from their vocational skills experience.

References

Abayomi, 0. (2000). *Evaluation of a management training programme in Oyo State* (Unpublished doctoral thesis). University of Ibadan, Nigeria.

Abusomwan, S. B., & Osuyi, S. O. (2013). Technical and vocational education and training (TVET): A tool for national development in Nigeria. *Technical and Vocational Education Journal, 5*(1), 8–32.

Adeyemi, B. A. (1997). *Evaluation of the status of implementation of vocational education programme in the colleges of education in Osun, Ondo and Ekiti States* (Unpublished doctoral thesis). University of Nigeria, Nsukka, Nigeria.

Alade, l.A, (2006). *Evaluation of technical education curriculum in colleges of education in Southwestern Nigeria* Unpublished doctoral thesis). University of Ibadan, Nigeria.

Alade, I. A. (2004). Improving the status of vocational-technical education: A route to national development. In D. F. Elaturoti & K. Babarinde (Eds.). *Teachers' mandate on education and social development in Nigeria* (pp. 95–105). Ibadan, Nigeria: Sterling-Horden Publishers Limited.

Alufohai, E. (2011). *Education as a veritable tool for development in Nigeria.* Ibadan, Nigeria: Triumph-Providential Publishers.

Apagu, V. V. (1997). *Technical in-service competency needs of post primary school building technology teachers in Adamawa State*. (Unpublished doctoral thesis). University of Nigeria, Nsukka, Nigeria.

Kerre, B. W. (2010). *Technical and vocational education and training (TVET): A strategy for national sustainable development*. Eldoret, Kenya: Moi University Press.

Okorie, J. U. (1993). An overview of the development of vocational technical education in Nigeria vocational/technical education and self-reliance. In E. U. Anyakoha & E. G. Osuala (Eds.), *Vocational/Technical Education and Self-Reliance* (pp. 38–49). Nsukka, Nigeria: NVA Publications.

Olabiyi, O. S. (2003). The implementation of technology education curriculum as a mode of sustaining economic growth in democratic setting. In N. E. Neji, M. A. A. Ogunyemi, F. O. N. Oryeukwu, M. Ukponson, & S. O. Agabato (Eds.), *Technology Education in a Democratic Nigeria* (pp. 359–364). Lagos, Nigeria: Rothmed International Limited.

Olateju, A. S. (2001). Revitalizing the apprenticeship system for sustainable poverty alleviation in Nigeria Association of Teachers of Technology (NATT), 14th Annual Conference Proceedings, Lagos, Nigeria.

Shosanya, J. A. (1995). *Village extension agents' perception of the appraisal system in Oyo State agricultural development programme* (Unpublished master's thesis). University of Ibadan, Nigeria.

Uwameiye, R (1996). *Influence of students' background on their academic achievement in*

introductory technology (Unpublished doctoral thesis). University of Nigeria, Nsukka, Nigeria

Wafula, J., Ferej, A. & Kitainge, K. (2013). Towards achieving vision 2030: An evaluation of TVET teacher education system in Kenya. *African Journal of Education, Science and Technology (AJEST), 1*(3), 163–167.

Author

Ibiwumi Abiodun Alade, Ph.D., is a university don who specializes in curriculum and instruction/vocational, industrial, and technical education. He has published articles nationally and internationally. His constant drive for excellence in his academics, research, and working career has earned him distinctions, scholarships, and awards.