

*Full Length Research Paper*

# Effect of meta-learning teaching method on the academic performance of building trades students in technical colleges in South-east Nigeria

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Received 17 August, 2015; Accepted 28 September, 2015

The need to improve academic performance in building trades by students of technical colleges in South-east Nigeria necessitated this study to determine the effect of meta-learning teaching method (MTM) on the students' academic performance. Two research questions guided the study and two hypotheses were tested at 0.05 level of significance. A quasi-experimental design involving experimental and control groups plus pre-test and post-test was adopted. Population of the study was all the 376 National Technical Certificate (NTC) year II building trades students. A sample of 120 was purposively drawn for the study. Instrument for data collection was Building Trades Performance Test (BTPT) validated by experts with a reliability coefficient of 0.60. Data were analyzed with mean, standard deviation and ANCOVA. It was found that MTM improved students' academic performance in building trades. No significant interaction effect was observed between school ownership and the two methods used. Conclusion was drawn and it was recommended that building trades teachers should use MTM while supervisory agencies should assist them through seminars and conferences.

**Key words:** Meta-learning teaching method, academic performance, building trades.

## INTRODUCTION

Formal education is a means of imparting and acquiring knowledge within the four walls of a school. The school system is established to facilitate teaching and learning to empower students with knowledge and skills for positive living in the society. Anyichie and Onyedike (2012) observed that it is expected that classroom learning should be transferred into solving problems in real life. However, according to Duze (2011), the present educational system in Nigeria seems not to be achieving the desired goals and objectives due to noticeable evidence of decline in standard of education and quality

of students especially at the secondary school level. This is clearly shown in the results of both internal and external examinations especially in Mathematics (Anyichie and Onyedike). Some of the factors implicated with the poor academic performance of students include teaching and learning methods, inadequate instructional facilities and students' lack of interest and motivation.

Okpala in Awolabi (2003) observed that the conventional teaching method widely adopted in Nigerian classrooms is more teacher-centred than learner-centred. Bala (2006) noted that the use of lecture method in which

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the teacher is most active often creates frustration and learning difficulties for some students. The conventional teaching method (MTM) emphasizes teaching more than learning and pays little or no attention to the process of learning thereby dwarfing students' creative thinking which is necessary in today's workplace. The educational system is perpetually under pressure to adequately respond to constant changes in the society as a result of technological advancement. Consequently, current developments in research and technology have given rise to the adoption of new methods of teaching which have the potential of efficiently meeting learning needs of today's students (Senchi, 2005 and Uba, 2006). It is important, therefore, to engage students' creative thinking in order to develop their problem solving skills by adopting student-centred methods like meta-learning. In view of the foregoing, this study focused on determining the effect of meta-learning teaching method (MTM) on the academic performance of building trades students in technical colleges in south-east Nigeria by comparing it with the conventional teaching (lecture) method CTM).

Vocational/technical education is a skills training programme recognized all over the world for its potential for equipping youths and unemployed adults for self-employment, employment creation and poverty reduction as well as satisfying the needs of the society (Ezenwafor, 2015). In addition, Ezenwafor et al. (2015) affirmed that vocational technical education contributes enormously to national development hence the Nigerian government acknowledges its relevance and emphasizes the effective implementation of its programmes at all levels in the educational system. There are different trades in vocational technical education in Nigerian technical colleges such as business trades and building trades among others. Building trades are covered in the National Technical Certificate (NTC) and Advanced National Technical Certificate (ANTC) and include brick-laying, concrete mixing, scaffolding among others.

## LITERATURE REVIEW

Literature for this study was reviewed under goals of vocational technical education in Nigeria, teaching methods and students' academic performance, concept of meta-learning and effects of meta-learning on students' academic performance in different areas.

### Goals of vocational technical education in Nigeria

Winner (2000) opined that vocational education is designed to develop skills, abilities, understanding attitudes, work habits and appreciation encompassing knowledge and information needed by workers to enter and make progress in employment on a useful and productive basis. Supporting this view, Odu (2011) and

Ezenwafor (2015) posited that vocational technical education is any kind of education which has the main purpose of preparing individuals for employment in recognized occupation. The Federal Republic of Nigeria (FRN, 2004) stated that the goals of vocational technical education shall be to:

1. Provide trained manpower in the applied sciences, technology and business particularly at craft and advanced craft levels.
2. Provide the technical knowledge and vocational skills necessary for agricultural, commercial and economic development.
3. Give training and impart necessary skills to individuals who shall be self-reliant economically.

In line with the above goals, Ndoni (2005) affirmed that the major goal of vocational institutions is to produce graduates who can perform competently in their chosen vocation without a need for pre-employment training. Consequently, Umar (2010) observed that technical colleges in Nigeria have been training people to become craftsmen and technicians for jobs in both public and private sectors of the economy where competent workers are in high demand to operate and maintain available equipment and machines. However, in view of wide reports of poor academic performance of technical college students in different trades, it appears that technical colleges in Nigeria are not achieving the goals of their creation. This situation is a course of concern to all well meaning Nigerians.

### Teaching methods and students' academic performance

According to Tebabal and Kahssay (2011), the primary purpose of teaching at any level is to bring a fundamental change in students' learning. In the light of this, Ganyaupfu (2013) posited that in order to facilitate the process of knowledge transmission, teachers should apply appropriate teaching methods that best suit specific objectives and level exit outcomes. The author went further to observe that in the traditional epoch, many teachers widely apply teacher-centred methods instead of student-centred methods to impart knowledge to learners. It, therefore, follows that the greatest need of teachers in achieving teaching-learning effectiveness is for them to be conversant with different teaching methods and strategies that recognize the magnitude of complexities of concepts to be covered (Adunola, 2011). Adunola further affirmed that regular poor academic performance by the majority of students is fundamentally linked to application of ineffective (or unsuitable/inappropriate) teaching methods by teachers in the process of imparting knowledge to learners.

Ganyaupfu (2013) grouped teaching methods into

three, namely; teacher-centred methods, student-centred methods and teacher-student interactive methods. The effect of each of these methods on the academic performance of students is briefly highlighted as follows:

**Teacher-centred methods:** Here the teacher controls the transmission and sharing of knowledge and attempts to maximize the delivery of information while minimizing time and efforts. Zakaria et al. (2010) observed that this method does not help student since the teacher merely focuses on dispensing rules, definitions and procedures for students to memorize without actively engaging the students. Consequently, Bala, (2006) asserted that the method often creates frustration and learning difficulties for most students which lead to poor academic performance.

**Student-centred methods:** Greitzer, (2002) remarked that with the advent of the concept of discovery learning, many scholars adopt more supple student-centred methods to enhance active learning. Hesson and Shad (2007) posited that this method promotes interest, analytical research, critical thinking and enjoyment of the teaching-learning process among students. Consequently, the method is considered to be more effective in improving students' academic performance since it does not centralize the flow of knowledge from teacher to students.

**Teacher-student interactive method:** Ganyaupfu, (2013) explained that this method is a combination of the teacher-centred and student-centred methods where the subject information produced by learners is remembered better than the same information presented to them by the teacher. This method encourages learners to search for relevant knowledge rather than the teacher monopolizing the transmission of information to them and has been reported as an effective method of teaching in improving students' academic performance.

### Concept of meta-learning

Meta learning is a student-centred (self-regulated) approach to teaching and learning. It was originally described by Maudsley, (1979) as the process by which learners become aware and increasingly in control of habits of perception, inquiry, learning and growth that they have internalized. Maudsley's conceptual basis of the theory was synthesized under headings and assumptions, structures, change process and facilitation. He enunciated five principles that facilitate meta-learning, namely; students must

1. Have a theory, however primitive.
2. Work in a safe and supportive social and physical environment.
3. Discover their rules and assumptions.

4. Reconnect with reality (information from the environment).
5. Recognize themselves by changing their rules and assumptions.

The idea was later used by Biggs (1985) to describe the state of being aware of and taking control of one's own learning. According to Biggs, the concept is framed around the idea of being aware of and taking control of one's own learning. Implicit in this conception are that (1) people need to have knowledge of how they learn, (2) they have the motivation to be proactive in managing themselves in this way and (3) they have the capacity to regulate their learning. The above definition has similarities with the concept of managing one's own learning or self-regulated learning and implies that meta-learning is a complex mixture of

1. Knowledge products – knowledge of learning/own learning and how self learns.
2. Attitudes – I am going to do it.
3. Capacities and skills – to think and act on thinking in this way.
4. Processes – for doing it.

Therefore, meta-learning is awareness and understanding of the phenomenon of learning itself as opposed to subject knowledge. Important in this definition is the learner's perception of the learning content, which includes knowing what the expectations of the discipline are and more narrowly the demands of a given learning task. Norton and Walters (2005) explained that meta-learning depends on the learner's conceptions of learning, epistemological beliefs, learning processes and academic skills which are summarized as learning approach. A student who has a high level of meta-learning awareness is able to assess the effectiveness of his/her learning approach and regulate it according to the demands of the learning task. Conversely, a student who is low in meta-learning awareness will not be able to reflect on his/her learning approach or the nature of the learning task set. In consequence, he/she will be unable to adapt successfully when studying becomes more difficult and demanding.

Interestingly, meta-learning teaching method could enhance technical college students' academic performance as it assists learners to have a deeper awareness of the context and content of the learning process. It involves the learner who is intentionally aware of the learning processes and sequence which include learner's attention, thinking attitudes, beliefs, expectations, learning strategies, motivations, prior knowledge, memory and understanding (Ogwo and Oranu, 2006). Relevant skills in meta-learning teaching method, according to Ogwo and Oranu, include planning skills, executing skills, monitoring skills and evaluating skills. The authors further suggested some tips by which

teachers can successfully adopt meta-learning technique, which include:

1. Discuss the objectives with the students before starting each lesson.
2. Outline the thinking process skills involved in every aspect of lesson and the best techniques of assisting the students to think through them.
3. Use different attention-sustaining strategies for making students conscious of the tasks at hand.
4. Specify different evaluation tasks and questions for each stage of instruction.

In MTM, the learner can plan, execute, monitor and evaluate the learning activities. Meta-learning entails consciously working on the thought process and enables students to understand their cognitive processes and products through active monitoring together with constant regulation and orchestration of the learning process based on concrete objectives. Some studies have been carried out in Nigeria and other parts of the world which confirm the effectiveness of MTM in improving students' academic performance. For instance, in Nigeria, Anyichie and Onyedike (2012) conducted a study on the effects of self-regulated learning (meta-learning) strategy on secondary schools students' academic performance in Mathematics. The researchers found that the method had significant effect on students' mathematical word problem achievement. On the foreign scene, Dckeyrel et al. (2000) observed that research has indicated that self-regulated learning strategy has positive effect on learners' academic performance. In South Africa, Mothibi (2015) conducted a study on a meta-analysis of the relationship between e-learning (which is related to meta-learning) and students' academic achievement in higher education and reported that significant positive impact was found.

Supporting the foregoing reports, Mahadi and Subramonian (2013) in their study on the role of meta-cognitive self-regulated learning strategies in enhancing language performance in Malaysia reported that the method led to an improvement in students' academic performance. Furthermore, Mahadi and Subramonian cited several researchers in the area with similar results such as Chen (2002), Fuchs et al. (2003), Glaser and Bruostein (2007) and Al-Khatib (2010).

### **Statement of the problem**

The declining academic performance reported by Bala (2006) among others of students in technical subjects in Nigerian technical colleges is a great concern to vocational educators in view of the relevance of technical education to individual self-reliance and the nation's technological and industrial development. Research studies strongly relate academic performance of students to the methods of teaching adopted by the teachers

(Adunola, 2011; Ganyaupfu, 2013). The commonly used teaching method by teachers of technical subjects is the lecture method which is teacher-centred and often creates frustration and learning difficulties for students. The meta-learning teaching method is student-centred and has been found to enhance students' academic performance in different school subjects within and outside Nigeria. Therefore, the problem of this study is that the effect meta-learning teaching method will have in the academic performance of students in technical subjects like building trades is not known. This study, was, therefore considered imperative as it will provide empirical data to guide relevant stakeholders in taking necessary steps for the good of building trades students in technical colleges, their teachers and the Nigerian nation.

### **Purpose of the study**

The main purpose of the study was to determine the effect of MTM on academic performance of building trades students in technical colleges in southeast Nigeria. Specifically the study determined the:

1. Difference in the mean performance scores in Building Trades Performance Test (BTPT) between students taught with meta-learning teaching method (MTM) and those taught with conventional teaching method (CTM).
2. Difference in the mean performance scores in Building Trades Performance Test (BTPT) between students of federal and state technical colleges taught with meta-learning teaching method (MTM) and those taught with conventional teaching method (CTM).

### **Significance of the study**

Findings of this study would be of immense benefits to teachers and students of technical colleges, parents, curriculum planners, Nigerian citizens and the government. The findings will reveal the effects or benefits of MTM in improving the academic performance of building trades students of technical colleges. The improved academic performance and adequate skills acquisition will lead to greater employment opportunities for the students on graduation in both public and private sectors of the economy, help them progress in their career through effective performance, reduce unemployment and poverty as well as their attendant social problems in the country. The outcome will benefit Nigerian citizens and the government.

### **Research questions**

The following research questions guided the study:

**Table 1.** Mean and standard deviation of the experimental and control groups' performance in pre-test and post-test.

Teaching method	Pre-test		Post-test		Mean difference
	Mean	SD	Mean	SD	
Experimental group					
Meta-learning	8.70	1.37	15.03	2.1	6.33
Control group					
Conventional	5.62	1.82	9.68	1.75	4.06

1. What is the difference in the mean performance scores in Building Trades Performance Test (BTPT) of students taught with meta-learning teaching method (MTM) and those taught with conventional teaching method (CTM)?
2. What is the difference in the mean performance scores in Building Trades Performance Test (BTPT) of students of federal and state technical colleges taught with meta-learning teaching method (MTM) and those taught with conventional teaching method (CTM)?

### Hypotheses

The following null hypotheses were tested at 0.05 level of significance.

1. There is no significant difference in the mean performance scores in BTPT between students taught with meta-learning teaching method (MTM) and those taught with conventional teaching method (CTM).
2. There is no significant difference in the mean performance scores in BTPT between students from federal and state technical colleges taught with meta-learning teaching method (MTM) and conventional teaching method (CTM).

### METHOD

The study adopted the quasi-experimental design involving two groups (experimental group and the control group) plus pre-test and post-test. The experimental group (E) was taught with meta-learning teaching method while the control group (C) was taught with conventional teaching method. Pre-test was carried out before the experiment and post-test was administered after the experiment on the two groups. This is in line with the recommendation of Uzoagulu (2011) that when subjects are pre-tested, the design is no longer true experimental but a quasi experimental. The study was carried out in the south-east zone of Nigeria covering Abia, Anambra, Ebonyi, Enugu, and Imo states. The technical colleges in the area offer building trades at the National Business and Technical Board (NABTEB) Examinations with declining performance by the students as reported by Bala (2006) hence the choice of the area for the study.

Population of the study was 376 NTC year II building trades students from all the technical colleges (federal and state) in the area. In Nigeria, federal colleges are colleges that are owned and funded by the federal government while state colleges are those owned and funded by respective states. Purposive sampling

technique was used to select a sample size of 120 students from four schools based on the number of building trades students (males and females), availability of teaching facilities and professionally qualified staff. The sample was grouped into two intact classes of 60 students (45 males and 15 females) each. The two intact classes were randomly assigned to the experimental and control groups. The instrument used for data collection was Building Trades Performance Test (BTPT) containing 20 objective questions based on the curriculum content for National Technical Certificate (NTC) II students. Each item has four options and each correct answer has 1 point while each incorrect answer has 0 point. The test items covered site preparation and scaffolds. The instrument was validated by three experts; two in vocational education and one in educational measurement and evaluation from NnamdiAzikiwe University, Awka. Test-re-test method was used to establish the reliability of the instrument whereby it was administered to an intact class of 26 NTC II building trades students of Government Science and Technical College, Benin City, Edo State twice within an interval of two weeks. The two sets of scores were correlated with the Pearson Product Moment correlation formula and a reliability coefficient of 0.60 was obtained. The pre-test was then administered to the study sample after which the items on the instrument were re-organized before administering the post-test at the end of the experimental period.

The pre-tests and post-tests scores of the groups were collected and used in the analysis. Data were analyzed with the arithmetic mean and standard deviation to answer the research questions while analysis of covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance with the statistical package for social sciences (SPSS). The mean difference between the pre-test and post-test scores of the experimental and control groups was used to answer the research questions. Where the calculated F-value was equal or greater than the F-table value at 0.05 level of significance, the null hypothesis was rejected but where the F-calculated was less than F-table value, the null hypotheses was upheld.

### RESULTS

Table 1 shows that the pre-test and post-test mean scores of the experimental group are 8.70 and 15.03 with a mean difference of 6.33 while the control group's pre-test and post-test mean scores are 5.62 and 9.68 with a mean difference of 4.06. This means that the meta-learning method (MTM) was more effective than the conventional teaching method (CTM) since the mean difference of the group taught with it is greater than that of the group taught with CTM.

Table 2 shows that federal technical college students taught using MTM obtained a mean score of 8.58 in pre-

**Table 2.** Mean and standard deviation of the experimental and control groups' performance in pre-test and post-test based on ownership of institution.

Teaching method	Pre-test			Post-test			Mean difference
	N	Mean	SD	N	Mean	SD	
Experimental group							
Meta-learning	36	8.58	1.44	36	14.78	2.13	6.20
FederalState	24	8.88	1.26	24	15.46	2.22	6.54
Control group							
Conventional	25	6.08	1.93	25	10.00	2.10	3.92
FederalState	35	5.29	1.69	35	9.46	1.44	4.17

**Table 3.** ANCOVA table for students' for post-test mean scores by teaching methods.

Source	D.F	Sum of squares	Means of square	F- cal	F-tab	Sig	Remarks
Teaching	1	1622.4	1622.4	202.20	3.84	0.000	Rejected
Error	239	1909.6	8.023	7			
Total	240	26386					

test and 14.78 in post-test with a mean difference of 6.20 while state technical college students taught in the same way obtained a mean score of 8.88 in pre-test and 15.42 in post-test with a mean difference of 6.54. However, the federal technical college students taught with conventional teaching method obtained a mean score of 6.08 and 10.00 with a mean difference of 3.92 while state college students taught in the same way obtained mean scores of 5.29 pre-test and 9.46 in post-test with a mean difference of 4.17. This shows that the two methods had the same effects on the academic performance of students from both state and federal technical colleges with MTM being higher than CTM.

Table 3 shows that the F-calculated value of 202.207 is greater than F- table value of 3.84 for 1 df numerator and 239 denominator at 0.05 level of significance  $F(1,239) = 3.84$  and  $p < 0.05$ . This shows that there is a significant difference in the mean performance in building trades test between students taught with MTM and those taught with CTM. The null hypothesis of no significant difference between the two groups was therefore, rejected.

In Table 4, the F-calculated is 3.135 and the p-value is  $0.078 > 0.05$ . When compared with F-tabulated with 1 numerator degree of freedom and 239 denominator degree of freedom we have 3.92. This means that there is no significant difference in the mean performance scores between students from federal and state colleges taught with MTM and those taught with CTM. Therefore, the hypothesis was not rejected.

## SUMMARY OF FINDINGS

Findings of the study are summarized as follows:

1. Technical college students taught with MTM achieved higher mean gain than those taught with CTM in the post-test.

2. Teaching method significantly influenced students' academic performance in the BPTP.

3. No significant difference exists in the mean performance between federal college and state college students taught with CTM and MTM.

## DISCUSSION

Findings of the study showed that building trades students taught with MTM achieved a higher mean gain than those taught with CTM. This indicates that MTM is effective in improving students' academic performance in technical subjects like building trades. The study further showed that the outcome is the same in both state and federal colleges. The performance mean gain of the students taught with the CTM and MTM supports the views of Tebabal and Kahssay (2011) that the primary purpose of teaching is to bring about fundamental change in learning. The higher mean gain achieved by students taught with MTM also agrees with the position of Zacharia, Chin and Daud (2010), Adumola (2011) and Ganyaupfu (2013) that teachers need to be conversant with different teaching methods, select and use appropriate ones based on the nature of the subject.

Specifically, the lower achievement by students taught with CTM (which is teacher-centred method) confirms the observation of Bala (2006) and Zacharia, Chin and Daud (2010) that the method often creates frustration and learning difficulties for students leading to low

**Table 4.** ANCOVA table on teaching methods for post-test mean scores by school type.

Source	D.F	Sum of squares	Means of square	F- cal	F-tab	Sig	Remarks
School	1	45.921	45.921	3.135	3.92	0.078	Not rejected
Error	239	3486.06	14.647				
Total	240	26386					

academic achievement. Finally, the higher mean gain achieved by students taught with MTM (which is student-centred method) goes a long way to show its efficacy in improving students' academic performance as posited by Greitzer (2002), Hesson and Shad (2007) and Ganyaupfu (2013) among others. The finding that ownership of institution did not significantly influence academic performance of the technical college students in BTPT in both teaching methods is in line with Ayeduso (2001) who asserted that federal and state technical college students have equal potential and ability if given support and motivation.

## Conclusion

In view of the findings of this study, it was concluded that MTM is an effective method for improving academic performance of technical college students in building trades.

## Implications of the study

Some educational implications are derived from the findings of this study. First, the findings provided empirical evidence on the relative efficacy of meta-learning teaching method for improving technical college students' academic performance. This serves as a basis for teachers of building trades and other trades in technical colleges to adopt the method in order to improve teaching and learning effectiveness as well as students' academic performance. It also provides a rationale for curriculum planners and regulatory bodies to recommend wider application of the method in technical colleges.

## Limitations of the study

The only limitation this study has is the sample size of 120. However, this does not affect the generalizability of the results since quasi-experimental design normally uses fewer sample size.

## RECOMMENDATIONS

Based on the findings of this study, it was recommended that:

1. Teachers of building trades and other technical subjects taught in technical colleges should adopt MTM to improve teaching and learning effectiveness and the academic performance of students.
2. Curriculum planners should recommend a wide use of MTM by teachers of technical subjects at all levels of the education system and ensure its effective application.
3. Supervisory agencies like the National Board for Technical Colleges (NBTC) should organize seminars and conferences on the use of meta-learning for teachers of technical colleges.

## Conflict of Interests

The authors have not declared any conflict of interests.

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