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Effect Of Machining Task Sheets On Academic Achievement And Interest Of Mechanical Craft Students In Technical Colleges In Rivers State, Nigeria

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ABSTRACT
The general purpose of this study was to determine the effect of Machining Task Sheets (MTSs) on academic achievement of mechanical craft students in technical colleges in Rivers State. Specifically, the study sought to: compare the mean achievement of students taught machining operations with MTSs and students taught using conventional method and compare the difference in the mean interest of students taught machining operations with MTSs and students taught using conventional teaching method. The study was guided by two research questions and two null hypotheses tested at 0.05 level of significance. Adopting quasi-experimental approach, the study used entire population of 112 final year mechanical craft students in all the approved technical colleges in the State. Three instruments - Mechanical Craft Achievement Test (MCAT), Mechanical Craft Interest Inventory (MCII), and Retention Mechanical Craft Achievement Test (RMCAT) - were used in the study. Face validation of the instruments was accomplished by five experts. Kuder-Richard 20 (K–20) was used to determine the internal consistency of the instruments. The MCII and MCAT had coefficient of 0.83 and 0.90, respectively. Mean and standard deviation were used to analyze the data collected on the research questions, while Analysis of Covariance (ANCOVA) statistics was used to test the null hypotheses. The findings among others included: Students taught machining operations with MTS had higher mean achievement in the post MECT than those taught using conventional method, and students taught machining operations with MTSs had higher mean interest score than students taught with the conventional method. Based on the findings, it was among others recommend that: MTSs should regularly be used in teaching machining operations in technical colleges generally, and mechanical craft in particular, etc.
Keywords: Machining Task Sheets, mechanical craft, machining operations

INTRODUCTION

Advances in technology have impacted virtually on every facet of human existence. Premised mainly on the application of knowledge, technology appears to have significant influence on all processes of doing things by man. One of these processes, which man also is primarily involved in, is that of transmitting information or knowledge through education. It could thus be perceived that developments in technology are already having their effect on processes of the educational institutions, including technical colleges.

Colleges are usually perceived as synonymous with schools – just as technical colleges are often regarded as technical schools. They (i.e. the technical colleges) are kinds of technical institutions that are concerned mainly with the acquisition of skills and related scientific knowledge. Johnson (2012) defines a

technical college as an educational institution (or school) that prepares students for a career in a specific field. Students at technical colleges are mainly taught skills for their careers which are usually known as trade or occupation (Johnson). The primary objective of technical colleges is the generation of qualified craftsmen toward provision of low level manpower very highly needed for economic/technological development of a nation (Ajokporise, 2010). A nation like Nigeria which is going all out to become a developed economy would largely depend on these colleges in order to realize this dream (of being a developed nation). For adequate provision of the manpower across fields and for even development, there is the need for the technical colleges to run various occupations. One of the major occupations or trades in technical colleges is Mechanical Engineering Craft Practice (MECP).

MECP is one of the principal programmes or trades in Nigerian technical colleges which primary focus is machine tools manipulation. Some of such machine tools on which students in MECP are trained are the lathe, milling machine, drill press. Although other mechanical related trades, such as Fabrication, may reasonably employ machine tools in carrying out their occupational tasks, the primary feature of MECP remains the use of machine tools and equipment, or simply machining (Nungwu, 2009). MECP or simply, mechanical craft as equally used in the present study, prepares students that are expected to on graduation become mechanical craftsmen. Such students are in the course of their studies addressed simply as mechanical craft students.

A student can in basic terms be taken as a person formally engaged in learning, especially on enrollment in a school or college. Mechanical craft students, as used in this study, are those that are mainly learning or being taught machining tasks or operations. Machining could be described as the process of generating products on machine tools, while machining tasks or operations refer to those peculiar performances involved in realizing the end product or accomplishing a particular process. These operational tasks are imparted to the students through the process of instruction.

Instruction relates to the Latin *instruct* which past participle *instruere*, refers to words like, prepare, equip. Instruction concerns the preparing, building or equipping of an individual mainly with knowledge or skills. In education, it involves (the process by which) one with this skills or knowledge directing the other or others for the primary purpose of helping the other(s) to acquire or master the skills or knowledge. It can be said to refer to the ways students are helped to learn what is required in specific levels and specific content areas (Penn-Harris-Madison School Corporation, 2015). Since instruction makes for ways of helping the students to learn, then, to some degree, the much a student benefits from a particular learning situation would depend on the kind of instructional technique or method employed. Instructional method is simply the way knowledge or skill is put forward from or by the source to the receiver as a learner. It refers precisely to the way information is presented to students (O'Bannon, 2012). Instructional methods could be categorized into two broad groups of conventional and non-conventional methods.

Conventional or traditional method of instruction can be described as a teaching technique in which the teacher transmits information verbally to his/her students, sometimes writing on the chalkboard or using instructional materials. The students would in the process listen, take note of points considered important, and sometimes, also ask questions for clarification (Uwameiye & Ojikutu, 2014).Non-conventional teaching methods on the other hand are instructional strategies other than the traditional teaching methods. Opposed to the traditional teacher-centered stereotypical approach, non-conventional methods are generally characterized by active participatory teaching and learning. Non-conventional teaching methods involve innovative techniques which among others tend to offer solution to the issue of students' passiveness and the associated problems in the traditional approach. Through discipline, dedication, preparation, analysis, an instructor can develop non-traditional strategies (Harris, n.d). Examples of such techniques include, concept mapping, problem-based instruction. Since core practical skills such as the machine tool operations are better learned by doing instructional strategy that would aid the students in doing what the students are being taught ought to be adopted. One of the ways of realizing this learning-by-doing during a teaching/learning section is by the use of task instruction sheets.

Task Instruction Sheets (MTSs) are leaves or pages on which broken tasks of step-by-step performances are represented as a guide for accomplishing a particular task. They are sheets of detailed guide for

accomplishing particular task(s)Scanlon & Newcomb (1983) defined MTSs as curriculum materials which advocate the concept of individualized instruction as a technique for managing the laboratory. MTSs appear somewhat like job instruction sheets which list steps of the job, detailing any special knack that may be required to accomplish that job (Lean Enterprise Institute, Inc., 2015). Such instructional sheets are usually used for training on new operations as well as for reinforcing the right operations by experienced instructors. They can thus be used in conjunction with a job sheet to help the student in accomplishing more difficult job. MTSs are usually thought of as a complete guide to the student in doing a specific job selected by the shop instructor for instructional purposes (Eze in Udo-Etuk, 2007). In view of this, MTSs can be seen as a way of instruction whereby a specific skill to be taught is broken into task and represented on a sheet with complete instructions to guide the students in the procedure to follow in accomplishing that task (Udo-Etuk, 2007). There are usually two broad kinds of MTSs - the procedural and hierarchical MTSs.

Hierarchical and procedural MTSs relate to task analysis which outcome forms the crux of MTSs. Task analysis which basically involves the process of braking up the tasks into subtasks, is mainly of these fundamental hierarchical and procedural kinds. Differences in two rest in the intended approach towards the accomplishment of the task. That is, from which to which direction the task is going to be tackled. In view of this, hierarchical task analysis would answer the question, "What must the learner know or be able to do to achieve this task", while procedural analysis will give solution to "What are the mental and or physical steps that the leaner must go through in order to complete this task?" (Instructional Design Knowledge Base, 2014). Thus, while the hierarchical instructional sheet considers or arranges the tasks according to their ranked order of actions, procedural task sheet arranges the performances according to their procedural step-by-step pattern. Machining operations are of machine processes or rather learning or mastering of machining operations. Since machining operations are mainly concerned with step-by-step procedure or process in accomplishing a task, MTSs in the perspective of this study are of procedural kind. Unique feature of MTSs is their task descriptive ability, sometimes with pictorial integration introduced to illustrate each activity statement in a more real situation. Here thus anchors much of the instructional benefits of MTSs. One of the major benefits of MTSs is that, it is used to supplement classroom instruction by providing the learner with an individualized learning experience in the laboratory (Scanlon & Newcomb). Other benefits of MTSs may include: effective delivery of large amount of stuff in a timely manner; adaptability to age and other (individual's) needs of the learner. All this may result in the needed students' achievement.

Achievement in school generally denotes how well a learner does in school. Poor academic performance of individuals in a learning situation refers to one who fails to attain a set standard performance at a given evaluation exercise such as test, examination or assessment (Okoye in Chima, 2014). This means that a candidate or student who scores less or below a given standard is regarded as performing poor academically (Chima, 2014). Yet, students' achievement is usually influenced by other factors such as interest and knowledge retention. A student, for instance, who is more interested in a certain lesson would likely assimilate and retain more than student who is less interested in the lesson. This student's interest may in turn result in the students' good performance in a given test on the lesson. Apart from this influence of interest in retention which may in turn result in improved student's performance, other factors of the learner such as gender, may still affect all three variables. In other words, achievement a student may have in a given course or test, may be influenced by whether the student is male or female. This is usually so especially with practicing or learning of practical skills like the machining operations, which are usually considered more as masculine than feminine in nature.

It is perceivable here that poor performance could in most cases result from poor interest and retention of taught materials. In other words, in a situation or programme where conventional teaching method is dominantly used, student may lose interest, which will in turn lead to low retention, and then, overall poor academic performance. Since conventional method remains the dominant method of teaching the abounding practical skills in technical colleges, it is possible that students of MECP may have reasonably lost learning interest, which has in turn resulted in low knowledge retention as evinced by the students' poor academic performance. Therefore, while there may be no achievement in this case without retention

or recall of what has been acquired, both achievement and retention could be affected by the learner's interest. Retention here can be viewed as how much of the stuff one has acquired stays in one's brain and the person's ability to afterwards recall or recognize the learned, experienced or taught stuff or material. Grades which a learner gets in school show how well the student is retaining what the student is being taught (Yahoo Answers, 2011). Interest, on the other hand, has been defined as a feeling of wanting to learn more (Merriam-Webster, 2014). Of course, one would normally perform or do better in what the person is interested in. All this portends that instructional strategy that improves achievement would have as well increased interest and retention, which in turn could influence the child's overall achievement in the course, such as MECP in the technical colleges in Rivers State.

Rivers State is known to be the industrial hub, and the treasure base, of the country. This crucial position of Rivers State is sequel to the natural oil and gas, and other related industries that abound in the State. These establishments make use of or rather depend greatly on, the products of these technical colleges – the craftsmen. Majority of these craftsmen whom the companies need for their functions, are the mechanical craft graduates (Abdlahi in Atsumbe, 2002). It is thus pertinent that the mechanical craft students at these technical colleges achieve well in order to successfully conclude their programme of study, having the required skills to face the enormous challenges at the field of work.

Conversely however, while the industrial demand of these technical colleges' graduates, especially those of MECP, remains high and obvious, it is found that the students themselves are poorly prepared. This poor preparation makes the students graduate half baked, and so remain unfit for either self or industrial employment demands (John, 2013). The situation in Rivers State is such that, these craftsmen – rather than being employable or self-employed - are simply redundant, unable to demonstrate skills expectedly taught them in the technical colleges. The negative effect of this on economic life of these individuals, the people, and the state at large, is better imagined than expressed. Nevertheless, the graduates' deficiencies have been attributed principally to the dominant use of traditional teaching method, which results primarily in lack of interest and poor performance of the students in the technical colleges (Umunadi, 2009; Daluba, 2013; Tumiba & Andeyarla, 2014).If then the traditional method of teaching, which is mainly available and employed at the technical colleges, is perceived to assume the prime factor for the poor performance of the MECP students, then there is earnest need for non-conventional instructional methods or instruction actively aided by other instructional materials, such as the TTSs. The effectiveness or otherwise of such material has to be ascertained - to check if the use would actually translate into improved achievement of the students. This study was therefore intended to determine the impact of MTSs on academic achievement of mechanical craft students in technical colleges in Rivers State. Improved academic achievement of the students that may result in effectiveness of the MTSs may in turn enable the students graduate with required skills/competence for both self and industrial employment in the society.

Statement of the Problem

The problem of poor performance among Rivers State secondary school students generally, and those of technical colleges in particular, is perceived to have attained an alarming stage. Evidence by results of examination bodies such as the National Business and Technical Examination Board (NABTEB), have always shown that there is high rate of failure in the technical colleges. Technical colleges which ought to have empowered the students with competence to excel, be fit for self and industrial employment, as well as for economic development of the nation have rather created unemployment and poverty (Imandojemu, 2001; Ukut & Udofia in Udofia, Ekpo, Nsa, & Akpan, 2012). Rather than provide students with sound knowledge and vocational skills necessary for economic development, technical colleges in Rivers State have kept churning out half-baked graduates. Most studies (Umunadi, 2009; Daluba, 2013, etc) conducted vis-à-vis the problem attribute the prevailing poor performance mainly to the use of conventional teaching method, especially in teaching the practical-based courses in the technical colleges.

Giving the more practical, sensitive/complex nature of the operational tasks in MECP, it is further perceivable that the use of the conventional methods in teaching the MECP machining operations may have led to the poor performance of the mechanical craft students as also ascertained by the respective MECP heads and other examiners at the technical colleges. This instructional weakness may be as a result

of the teacher-centeredness of the conventional method which results the students' passiveness. One of the ways of making students do what the students are being taught is by teaching the subject matter with instructional guide, such as the MTSs. The question then is, What effect have these MTSs on the students' performance in machining operations?

The Purpose of the Study

The general purpose of the study was to determine the effect of machining task sheets on academic achievement and interest of mechanical craft students in technical colleges in Rivers State. Specifically, the study sought to:

1. Compare the mean achievement of students taught machining operations with MTSs and students taught without the MTSs.
2. Determine the difference in the mean interest of students taught machining operations with MTSs and those taught using the conventional method.

Research Questions

The following research questions were posed to guide the study:

1. What is the difference in the mean achievement scores of students taught machining operations with MTSs and students taught with the conventional method?
2. What is the difference in the mean interest scores of students taught machining operations with MTSs and those taught using the conventional method?

Hypotheses

The following null hypotheses tested at 0.05 level of significance, were formulated to further guide the study:

1. There is no significant difference in mean achievement of students taught machining operations with MTSs and those taught using the conventional method.
2. There is no significant difference in the mean interest of students taught machining operations with MTSs and those taught using the conventional technique.

METHODOLOGY

Quasi-experimental approach was adopted for the study. The study was conducted in Rivers State, which is in South-South Nigeria. The population of the study was 112 final year MECP students in all the approved technical colleges in Rivers State. The target population for this study was all the final year Mechanical Craft students in all the technical colleges in Rivers State. At this level, sampling was done by selecting only NBTE approved technical colleges using purposive sampling technique. The entire population of the final year Mechanical Craft students in these approved colleges was then used for the study, since the number was manageable. Two instruments were used for collection of data for the study. These included, Mechanical Craft Achievement Test (MCAT) and Mechanical Craft Interest Inventory (MCII). The MCAT was used to ascertain the effectiveness of the MTSs with respect to the students' achievement. It consisted of 40 multiple–choice questions which were derived from the four core machining areas in MECP. The questions were taken from their respective areas according to level of relevance. The MCII was used to determine the interest of the students in the course having been taught with the MTSs. The Inventory had 20 items which were modified and adopted from Uchendu (2005). This instrument is simply the reshuffled and delayed MCAT. Content and face validation were used to ascertain the suitability of the items in the instrument. In the present study, content validity was ensured by adhering strictly to a table of specification, while the initial drafts of the MCII and MCAT were subjected to face validation by five experts in the departments of, Technical Education, Ignatius Ajuru University of Education, Port Harcourt, Science and Technical Education, Rivers State University of Science and Technology. Port Harcourt, Curriculum and Educational Technology, University of Port Harcourt, Vocational Teacher Education, and Mechanical Engineering, University of Nigeria, Nsukka. Kuder-Richard 20 (K–20) were used to determine the internal consistency of the instruments. The K–20 estimates coefficient of internal consistency, while Cronbach Alpha is simply a generation and a modified version of the K–20 (Uzoagulu, 2011). To ensure the reliability of the instruments, 20 copies of the MCII, and 20 copies of the MCAT, were respectively administered to 20 final year (part three) mechanical craft

students at Government Craft Development Center (GCDC) Port Harcourt. Applying k-20 formula, $\frac{k}{k-1}$ (1 - $\frac{\varepsilon PQ}{S^2}$) in the analysis of the data collected from the respondents, reliability coefficients of 0.83 and 0.90 were respectively obtained for the MCII and MCAT. Efforts were made to contain certain undesirable variables that could have influenced the validity/outcome of this study. Such variables related to experimental bias, Teacher variables/training of teachers, and inter group contamination. The pre-test instruments (of MCAT and MCII) were first administered to the subjects – final year MECP students - before the commencement of the actual treatment. Core machining processes/operations (areas) in MECP were taught the two experimental and control groups using the MTSs and conventional techniques, respectively. Scores of the pre-test were used mainly as covariates, while items of the instruments were themselves reshuffled and re-administered as post-test to the subjects after the treatment (i.e. teaching the students with the MTSs and using the conventional method). All instruments used in collecting data for this study, in exception of the TISEQ, were administered through the head of each of the MECP departments in all the technical colleges. Data gathered for the study through the use of the instruments were analyzed using mean, standard deviation, and Analysis of Covariance (ANCOVA), using SPSS version 20. The mean and standard deviation were used to analyse the data obtained in respect of the research questions. The standard deviation was utilized to determine the closeness or dispersal of the opinions of the respondents from the mean, while the ANCOVA was used to test null hypotheses at 0.05 degree of significance.

RESULTS

Research Question 1: *What is the difference in the mean achievement scores of students taught with MTSs and students taught with the conventional method?*

Table 1: **Mean and Standard Deviation of the Experimental and Control Groups in the MCAT**

Groups	Pre-test	SD	Post-test	SD	Mean gain
Experimental	25.95	5.49	35.49	2.09	9.54
Control	25.21	4.47	29.74	4.37	4.53

Data presented in Table 1 show that students taught with MTSs (experimental group) had a pretest mean score of 25.95, and post-test mean score of 35.49, while students taught using conventional method (control group) had a pre-test score of 25.21, and post-test score of 29.74. These results clearly indicate a mean deference of 5.01 (i e 9.54 minus 4.53) between the experimental and the control groups in favour of the experimental group. This mean gain is thus attributed to the MTSs.

Research Question 2: *What is the difference in the mean interest scores of students taught machining operations with MTSs and the students taught using the conventional method?*

Table 2: **Mean and Standard Deviation of Pre-test and Post-test Scores of the Experimental and Control Groups in the MCII.**

Groups	Pre-test	SD	Post-test	SD	Mean gain
Experimental	58.67	9.26	73.53	8.81	14.83
Control	57.61	4.92	61.48	3.39	3.87

Data displayed in Table 2 review that students taught with MTSs (experimental group) had a pretest mean score of 58.67, and post-test mean score of 73.50, while students taught using conventional method (control group) had a pre-test score of 57.61, and post-test score of 61.48. These results clearly show a mean deference of 10.96 (i.e 14.83 minus 3.87) between the experimental and the control groups in favour of the experimental group. This mean gain is also attributed to the MTSs.

Hypothesis Testing

Hypothesis 1

There is no significant difference in mean achievement of students taught machining operations with MTSs and those taught using the conventional method.

Table 3: Analysis of Covariance for Achievement Difference between the Experimental and Control Group in the MCAT.

Tests of Between-Subjects Effects

Dependent Variable: VAR00002

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1096.441[a]	2	548.221	61.870	.000	.532
Intercept	2821.478	1	2821.478	318.420	.000	.745
VAR00001	195.347	1	195.347	22.046	.000	.168
VAR00003	836.966	1	836.966	94.456	.000	.464
Error	965.835	109	8.861			
Total	124625.000	112				
Corrected Total	2062.277	111				

a. R Squared = .532 (Adjusted R Squared = .523)

Table 5 shows the computed ANCOVA coefficient (F) to be 94.456 at actual probability (sig) of .000- taken as 0.001. Since the P value is less than the alpha (0.05), the null hypothesis is rejected. That is, with the effect of the pretest covered out, adjusted for, removed or partialled out, the null hypothesis of no significant effect of MTSs on the students achievement is rejected both at 0.05 and 0.01 levels of significance.

Hypothesis 2

There is no significant difference in the mean interest scores of students taught machining operations using MTSs and those taught using the conventional technique.

Table 4: Analysis of Covariance for Interest Difference between the Experimental and Control Groups in the MCII.

Tests of Between-Subjects Effects

Dependent Variable: VAR00002

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	6719.469[a]	2	3359.735	134.223	.000	.711
Intercept	5.593	1	5.593	.223	.637	.002
VAR00001	2779.603	1	2779.603	111.046	.000	.505
VAR00003	2486.881	1	2486.881	99.352	.000	.477
Error	2728.388	109	25.031			
Total	534432.000	112				
Corrected Total	9447.857	111				

a. R Squared = .711 (Adjusted R Squared = .706)

Data presented in Table 6 reveal the F value of 99.352 with significance at .000 (or 0.001). Since the latter is less than the chosen alpha of 0.05, the null hypothesis of non-significant effect of TISs on the students interest is rejected.

Findings of the Study

Based on the data collected and analyzed to answer the research questions and test the hypotheses, major findings of the study are presented under the following sub-headings:

Difference in Mean Achievement and Retention Scores and Interaction Effect

1. Students taught machining operations with MTSs had higher mean achievement in the post MECT than those taught using conventional method
2. Students taught machining operations with MTSs had higher mean interest score than students taught with the conventional method

Hypothesis Testing

H_{o1}: The ANCOVA statistics on hypothesis one showed that the P value of .000 or 0.001 was less than chosen alpha of 0.05. This indicated that there was a significant difference in the mean achievements of students taught machining operations with TISs and those taught using the conventional method, in favour of the former – the teaching with TISs

H_{o2}: Significant difference existed in the mean interest scores of the students taught machining operations with the TISs and those taught using conventional method, in favour of the former.

DISCUSSION OF FINDINGS

Disparity in Mean Achievement and Interest Scores of the Students of different Groups

Findings of this study with regards to research question one to two reveal that students taught machining operations with TISs had higher mean scores in the MCAT and MCII respectively, than those taught using conventional method.

The findings above are in agreement with those of Igbo (1993), Cheta (2000) and Udo-etuk (2007). It has been posited that any suitable instructional method should have the ability to hold the students' interest and attention until the lesson is over (Edu and Ayang, 2012). When interest and attention are drawn and sustained in a teaching/learning situation, the probability of achieving and retaining more could be there. If the use of TISs could ordinarily result in positive difference in learning, then the unique pictorial design in the package used for this study may have specially provoked the students' interest, which in turn, led to increased retention of knowledge gained from the teaching/learning situation.

Hypothesis Testing

H_{o1} and H_{o2}, could as well be considered in tandem. The SPSS ANCOVA statistics as presented in Tables 3 and 4 revealed all two hypotheses testing had their P values greater than the chosen alpha of 0.05. This indicated that the hypotheses were all rejected for the respective "significant effect" alternative hypotheses. The outcomes of these later tests confirm the mean differences earlier recorded in above in post-test on the (two) variables in answering their respective research question. The same findings also seem to support the perceived relationship of the three – achievement and interest - in a teaching/learning situation. If this difference could be attributed to same treatment then the influence brought about on one (achievement), has influenced interest.

The utilization of the ANCOVA statistics in testing these hypotheses was predicted mainly on possible difference among the groups, including difference at the commencement, through and the end of the treatment of experimental period which could affect the validity of the study. In essence, ANCOVA tends to remove differences in initial status of the experimental and control groups (Uzoagulu, 2011) especially when like in the present study, intact classes are involved. To accomplish this, ANCOVA statistics attempts to adjust the post-test scores for pretest variability (Trochim, 2006). Having carried out, adjusted for, and removed or partialled out, the effects of the pretest, three hypotheses of "no significant effect or difference" still stood rejected, not only at 0.05, but 0.01, levels of significance. With these outcomes, one could say that these findings provided the premise to judge as reliable, the inference that teaching with the TISs actually has significant influence in the achievement and interest of the mechanical craft students.

On the significance or otherwise of the interaction effect, it remains very clear from Table 8 that the interaction of treatments and gender has F-cal value of 1.286 with sig value of 0.259. Since 0.259 is higher than 0.05, the null hypothesis for interaction effect of treatment and gender is accepted. Hence,

there is no significant interaction effect of treatments given to students and their gender with respect to their mean achievement scores in machining operations.

This finding corroborates the findings of Mbanefo (2009), Ifeakor (2005), Mebongand Udofia (2008) who noted no significant interaction effect of their investigated instruction methods and gender on the students' achievement.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations were made:

1. Preparation/modification of MTSs should be made regular exercises for technical teachers generally and mechanical craft teachers in particular. This could be achieved through policy making by the college management, NBTE, or ministry of education.
2. Elements of MTSs and usage of the package should be integrated into the mechanical craft curriculum. This could be achieved through the effort of the NBTE, with the State or federal government's assistance.
3. Seminars/workshops and conferences should be organized regularly for serving MECP teachers at the technical colleges to enhance the teachers' knowledge and skills on the preparation and use of MTSs. This would both facilitate the forgoing and increase the awareness of how effective the MTSs are among the college communities and beyond.
4. Based on the unique outcome of this study on effectiveness of MTSs in enhancing the achievement of the mechanical craft students, preparation/modification of MTSs package for acquisition of similar practical operations should be encouraged, especially for a kind similar to the used in the present study. The pairing of every task instruction activity statement with corresponding pictorial illustration may always spur such performance 'miracle'.

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