EFFECT OF TRAINING PROGRAMMES ON THE ACQUISITION OF
ACTIVITY-BASED LESSON PLANNING SKILLS BY NIGERIAN PRESERVICE PRIMARY MATHEMATICS TEACHERS

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Abstract
The present state of Mathematics teaching and learning in the Nigerian school system, especially at the basic education level, has become a source of great concern to Mathematics educators and scholars. The most recent research findings available show that the performance of pupils in primary Mathematics is below average and, also, that the problem solving skills of the pupils is poor. In a report by Nigeria Education Sector Analysis, the national mean percentage scores of primary four and six pupils in numeracy were 33.7 and 35.7 respectively. There are many reasons for this, including but not limited to strategies employed in teaching the subject and attitudes of the pupils towards the subject. To address the problem of the right strategy to use for teaching, the adoption of activity-based strategies has been advocated. Findings have also shown that, primary Mathematics teachers do not possess the necessary skills to plan and use such strategies. The lack of skills to plan an activity-based lesson has been traced to the fact that the teacher were neither trained for this nor taught through activity-based strategies while in colleges. It was against this background that this study sought to determine the effect of two training programmes on pre-service primary mathematics teachers’ acquisition of activity-based lesson planning skills. The two programmes are based on two activity based strategies: student-centred activity strategy and teacher demonstration strategy. Pretest-posttest quasi-experimental research design was used with a total of 337 pre-service teachers in their 100 levels in three colleges of education in southwest Nigeria, 33% of which were males while 67% were females. Pre-service teachers in each of the three colleges were exposed to Student-Centred Activity-Based (SCAB), Teacher Demonstration Strategy (TDS) and conventional teaching method separately. Analysis of Covariance and its post-hoc analysis were used to analyse the data and the result reveals that those exposed to TDS acquired the activity-based lesson planning skills significantly better than those exposed to SCAB. The latter group also performed significantly better than those exposed to conventional teaching strategy. This shows the efficacy of the training programmes in enhancing the acquisition of activity-based lesson planning skills. This paper recommends that these activity based programmes be integrated into teacher training in the country. This will ensure that the skills needed for planning activity-based lessons are acquired by the trainees, especially for teaching such an important and problematic subject as mathematics.

Key words: Lesson planning skills, Activity-based strategies, Pre-service teachers, Mathematics teaching
Introduction

Studies have shown that teacher effectiveness as a variable is a strong determinant of differences in students’ learning. The consequence of teacher effectiveness as a variable is gravely felt, much more than the effect of any other school-related variables, on the students’ learning outcome (Cruickshank, Jenkins and Metcalf 2003, Eggen and Kauchak 2006). Therefore, the training of teachers should be given a paramount place in every society. The Federal Government of Nigeria has made it clear in the National Policy on Education that no educational system can rise above the quality of the teachers (FGN, 2004). This shows the need to train and retrain teachers. This is why teacher education is considered vital in curriculum development and instruction.

Some of the goals of teacher education in Nigeria are to produce highly motivated, conscientious and efficient classroom teachers for all the levels of our educational system; to provide teachers with the intellectual and professional background adequate for the execution of their assignment and make them adaptable to changing situations (FGN 2004). These goals are in line with world declaration on higher education as presented by UNESCO (1998). They are also in line with the provisions of U.S. Department of Education (2003) and the study by Parkay and Stanford (2004). The type of teachers envisaged by these policy makers is what Anderson (2004) termed ‘effective teacher’.

According to Anderson, effective teachers are those who possess the knowledge and the skills needed to attain the educational goals, and are able to use the acquired knowledge and skills appropriately if these educational goals are to be achieved. Medley (1982) called this type of teachers ‘competent teachers’ because effective learning is a product of effective teaching which can only be given by an effective teacher who is considered to have, not only the knowledge of the subject matter, but also possesses the teaching skills (Amobi, 2006).

The present state of Mathematics teaching and learning in the school system, especially at the basic education level, has become a source of great concern to Mathematics educators and scholars. The subject has been identified as the most disliked subject in schools (FGN/UNICEF/UNESCO, 1997; Brown, Brown and Bibby, 2008) with students’ performance worsening every other year at all levels of education (Aremu, 1998). Recent research findings in
Nigeria have shown that the performance of pupils in primary Mathematics is below average and, also, that the problem solving skills of the pupils is poor. According to a report by Nigeria Education Sector Analysis (ESA, 2004), the national mean percent scores of primary four and six pupils in numeracy are 33.7 and 35.7 respectively.

Considering the status and the importance of Mathematics in various spheres of our national life, this poor teaching/learning situation associated with it should not be allowed to continue. Today, technology is the mainstay of any societal development and Mathematics has been recognised as the bedrock of technology and sciences (Ogunsanwo, 2003; Adeyemo and Adetona 2007, Awofala 2008; Rasheed 2008). Indeed, it is not a large claim to make by asserting that we live in an age where no human endeavour can be successful without the application of mathematics and/or technology since almost all kinds of job have been computerized. Apart from this, the subject develops the computational skills of the pupils, skills of solving the day-to-day problems that require mathematical knowledge. It forms the basis for further education in almost all fields of study in all higher institutions (Tella 2009). The economic development also has its root in the mathematical competence of the stakeholders (Ogunsanwo, 2003). Therefore, all hands must be on deck to ensure effective teaching of the subject at the primary school level where solid foundation for further studies in Mathematics, sciences and Technology could be laid.

Two of the cardinal goals of primary education, as stated in the National Policy on Education (FGN, 2004) section 4, number 18a and b are: the inculcation of permanent literacy and numeracy; and the laying of a sound basis for scientific and reflective thinking. These goals cannot be achieved without Mathematics since the subject is the essential nutrient for thought, logic, reasoning and therefore progress. Its abstract nature has, however, been a great challenge for teachers. But with the application of the right strategies, Mathematics could be demystified. Two of such strategies are the Student-Centred Activity-Based (SCAB) and Teacher Demonstration (TDS) forms of activity-based method of teaching (Loeffler, 2010) being proposed here. These two strategies allow pupils to learn Mathematics through adequate use of manipulative materials. The former (SCAB) is more effective when the size of the class is small and there are enough materials to go round the students (Engel, 2002) while the latter (TDS) is more effective when the size of the class is large and there are no enough materials to go round
the learners (Loeffler, 2010). Teachers, especially primary Mathematics teachers, must be able to design and plan lessons based on these strategies in order to impart effective mathematical skills, knowledge and understanding to the pupils at any of these situations. This study intends to achieve this training through the use of SCAB and TDS lesson plan formats.

The problem associated with teaching/learning Mathematics at all levels of education in Nigeria today stems, among other things, from the ineffective teaching of the subject right from the primary school. This ineffectiveness has been due to the non-provision for activity-oriented and pupil-centred lessons which could demystify the teaching and learning of the subject (Amobi 2006 and Adeyemo and Adetona, 2007). It is important to note here that using concrete instructional materials is the major attribute of activity-based instructional strategies. Using such materials in Mathematics lessons is important because of the advantages it could bring into learning the subject such as making concepts more concrete and thereby increasing understanding. This would eventually lead to changing the trend of poor performance and low interest in the subject, a problem which permeates Nigerian primary schools today.

Student-Centred Activity-Based Instructional Strategy (SCAB), a variant of activity-based instructional strategy, helps learners learn new skills, acquire knowledge and gain experience by actively participating in the process of knowledge acquisition (Richardson 1997, The Ontario Curriculum Unit Planner, 2002). Many research findings have shown that SCAB is very effective for teaching abstract subjects especially Mathematics (English and Halford 1995, The Ontario Curriculum Unit Planner 2002, Epstein, 2007). Jensen (2008) confirms that not only do children learn by doing and that movement is the child’s preferred mode of learning but also that physical activity activates the brain much more than doing seatwork. While sitting increases fatigue and reduces concentration, movement feeds oxygen, water, and glucose to the brain, optimizing its performance. Furthermore, learning by doing creates more neural networks in the brain and throughout the body, making the entire body a tool for learning (Hannaford 2005). Active learning is also more fun for young children, which means they would benefit more from it (Pica, 2008).

Teacher Demonstration Strategy (TDS) helps learners view a real or lifelike example of a skill or procedure to be learnt (Loeffler, 2010). It has been described as a method of teaching that relies heavily upon showing the learner a model performance that he should match after he has
seen a presentation that is live, filmed or electronically operated (Rodrigues, 2010). TDS accelerates learning and enhances effectiveness. Students are shown how the work is done by using the actual tools and materials they are expected to work with. Unlike SCAB, it does not require too many materials (Rodrigues, 2010). This is likely to be helpful in the Nigerian situation where there are large classes and materials are not available. Since the learners, in the focus of this study, are the pupils in primary school, this strategy also allows the teacher to control potentially dangerous materials or materials which pupils can turn to dangerous use (Loeffler, 2010).

The way a teacher plans his lesson, in many ways, dictates the mode of presentation the lesson will take (Kellough and Kellough, 2007). Arends (2004) submits that daily plans can take many forms and that the features of a particular lesson often determine the lesson plan format. He explains further that different lesson methods or strategies have their respective different lesson plan formats. A lesson plan can determine whether the learning would be effective or not because it dictates what happens and how it happens during the lesson (Kellough and Kellough 2007; Bahr and Garcia 2010).

Some scholars have observed that pre-service teachers in Nigeria are often taught using lecture method, and the lesson format they are exposed to during the professional practice is teacher-centred (Olosunde 2009; Salami 2009). Since we teach the way we have been taught (Cruickshank, Jenkins and Metcalf 2003; Khazanov 2007), it has, thus, become difficult if not impossible for the product of our teacher education programmes to plan Mathematics lesson in such a way as to promote pupils’ active involvement.

Lesson planning skills, according to Arends (2004), Parkey and Stanford (2004) and Kizlik (2010), are necessary skills all teachers must acquire in order to have a successful and effective teaching. Hence, there is the need to focus on how to develop the lesson planning skills for activity-based instructions in teacher training institutions so as to make the teachers more effective, especially as they teach an abstract subject like mathematics, which students often dread and fail.

The lesson plan currently being used at the University of Ibadan as indicated in the Professional Practice Record Book, has the following features:

a) General information about the class and subject.
b) Expected outcomes in terms of pupils behaviour and needed materials

c) Teacher’s presentation (which is, most of the time, teacher’s activities on ‘how to do it’)

d) Evaluation (class exercises which are always do-it-like-our-teacher-did-it)

Any lesson presented using this format is very likely to be teacher-centred, ‘chalk and talk’ method and pupils would not be actively involved. This type of teaching method has not been found effective in teaching Mathematics (Awofala 2002; Amobi 2003; Olosunde 2009).

In some developed countries where effective teaching is emphasised in the school system, different teaching strategies which have different lesson plan formats that could enhance the implementation of such strategies are developed. That is why there are various lesson plan formats for activity-based instructional strategies. For instance, Engel (2002), while using learner-centred activity-based strategy on statistics students in a college in Germany, used a four part model. The parts are: (1) Introduction of a “real-world” problem involving some aspects of data analysis; (2) performing an activity related to understanding the dynamics of the problem (3) Representing the simulation model with a computer-based random number generator and (4) Mathematical analysis based on probability and mathematical statistics.

In Nipissing University, Ontario Canada, a format was designed for planning activity lesson in which the key stages are: Expectation(s) and learning skills: here the learning outcomes or the objectives of the lesson are clearly stated. Pre-assessment: under pre-assessment stage, the assessment of the learner, learning environment, availability/improvisation of resources are stated. Content: this stage is meant to spell out the “what” of the lesson, that is, what is to be delivered in order to achieve the predetermined expectations. Teaching/learning strategy: here, both the pupils and the teachers activities tailored towards the content as well as the expectations are identified. Assessment: the assessment tools, procedure, collection of data and evaluation are stated and Student/Teacher’s reflections on the lesson: this stage is divided into two parts. Part A deals with evidence of student learning and next steps for student learning while part B deals with evidence of the effectiveness of the teaching and next steps.

It is worth emphasising that in these two lesson plan formats, the pupils’ activities are central to the lesson. There is a distinct difference between these types of lesson plans and the one commonly used in Nigerian Teacher Programmes as discussed earlier. For instance, Activity
Lesson Plan Format developed in Nipissing University, Ontario Canada, has other features, such as: Pre-assessment of classroom environment and available resources and materials; Pupils’ activities as well as expected teachers’ roles and Pupils’ and teacher’s reflections on the lesson. These additional features make the lesson pupils-centred where the teachers act as guides and facilitators of learning. This study adapted the Nipissing University Activity Lesson Format to create a model that could work in this context. This model is preferred because it takes into consideration measurement of the entry behaviour of the pupils and setting the behavioural objectives. It also considers selection and manipulation of materials, understanding the mathematical concepts embedded in the activities; and giving room for scaffolding from a more experienced facilitator (a lecturer or a teacher as the case may be).

Another important factor that could affect Mathematics teaching that was examined in this study is pre-service teachers’ gender. The discussion of and debates about gender and Mathematics and science learning are far from being concluded. Between the period of 1970 and 1990, there were more educational research studies on Mathematics and gender than any other area (Fennema, 2000). Scholars are still working on it in order to have in-depth understanding of the gender factor in Mathematics and science learning. The major concern is whether or not the causal relationship is biologically related or it is socially or environmentally related. If the inability of female to achieve as high as their male counterparts, as revealed by researches (Becker 2003; Gilbert and Gilbert 2003; James 2007) is biologically related, there is little or nothing that can be done to correct it. But on the other hand, if it is socially or environmentally related, then it can be corrected. This is supported by some research findings that show that the gap between male and female students’ performance in Mathematics is disappearing (Austin 2002; Berube and Glanz 2008). The argument here is that, if female students are performing low in Mathematics, there would be less number of female pre-service primary Mathematics teachers and the few that exist would have little knowledge of the subject matter. This eventually would affect their teaching.

However, much effort has been spent on gender and Mathematics learning but little has been done on the influence of teacher’s gender on Mathematics teaching. A few studies have shown that teacher gender significantly influences students’ achievement in Mathematics (Saha, 1983; Mwamwenda & Mwamwenda, 1989). Wong and Lai (2006) found out in a research they
conducted that female student-teachers taught better than male student-teachers. The 2-parts study revealed that female student-teachers’ instructional strategies were more creative and well designed than male student-teachers. It should not be inappropriate, then, to examine the moderating effect of gender on this study that emphasizes the teaching process.

So far, it has been shown that the incessant poor performance of pupils in Primary Mathematics has been attributed to the adoption of teacher-centred method of teaching by the teachers. This method of teaching is characterized by listening, note taking and at times working some mathematical exercises following the teacher’s algorithm. The adoption of activity-based strategies has been advocated as the way out of this problem. The lack of skills by primary Mathematics teachers to plan an activity-based lesson has been traced to the fact that they were not trained for this. Besides this, these trainees were not taught through activity-based strategies while in colleges. Many organizations, individuals and federal government have noticed this shortcoming in the teacher education programmes in Nigeria and have been carrying out various interventions. Various instructional strategies such as cooperative learning, group discussion and activity-based were exposed to primary school teachers either in workshops or in some selected colleges of education. But none of these interventions included the training of these teachers on how to plan the lesson for the new strategy introduced. It is against this background that this study investigated the effects of two activity-based training programmes on pre-service primary mathematics teachers’ acquisition of activity-based lesson planning skills. The effect of pre-service teachers’ gender on the acquisition of activity-based lesson planning skills was also examined.

**Hypotheses**

The following three hypotheses were tested in the study at 0.05 level of significance:

**Ho1:** There is no significant main effect of treatment on pre-service teachers’ lesson planning skills.

**Ho2:** There is no significant main effect of gender on pre-service teachers’ lesson planning skills.

**Ho3:** There is no significant interaction effect of treatment and gender on pre-service teachers’ lesson planning skills.
This study was interested in the acquisition of skills of planning activity-based lessons (that is: selection of behavioural objectives, selection of materials, identifying pupils and teachers’ activities and evaluating the lesson) by pre-service primary school Mathematics teachers in colleges of education in southwest states of Nigeria. Two forms of activity-based instructional strategies (pupil-centred and teacher demonstration) were used to expose the pre-service teachers to the skills of planning and utilization of activity-based lessons: these are the pupils-centred activity-based instructional strategy and teacher-demonstration instructional strategy.

**Methodology**

The study adopted a pretest-posttest, control group quasi-experimental research design for the study. Quasi-experimental research is described as the type of experimental research that is carried out in socio-scientific situation wherein the independent variable(s) cannot be totally controlled (Isangedighi 2004). Three categories of variables are recognised in the study: independent variable, moderator variables and dependent variables.

The Independent Variable comprises the teaching strategies used in the teaching of the pre-service primary school Mathematics teachers. This was manipulated at three levels;

(i) Students-centred Activity-Based Instructional Strategy (SABI)
(ii) Teacher Demonstration Activity-Based Instructional Strategy (TDABI) and
(iii) Conventional Instructional Strategy (CIS)

The Moderator Variable is a trait inherent in the pre-service teachers that could influence their teaching as well as their job performance; in this study, this was gender which is at two levels (male and female) and Dependent Variable was the Activity-Based Lesson Planning Skills.

The target population for this study consists of the students studying Primary Education Studies (PES) in part one of their programme in Colleges of Education in south-western part of Nigeria. This category of students is the potential Mathematics teachers that are to expose the pupils to primary Mathematics and sciences in the nearest future. The one hundred level students, in second semester are purposively selected based on some conditions: (i) These students must have been exposed to various teaching strategies in EDUC 113 (Principles and
Methods of Teaching) and to some primary Mathematics contents in the college in PES 113 (Mathematics in Primary Education Studies 1) (NCCE, 2009). (ii) Because of the Teaching Observation that is involved in this study, the students must have been exposed to treatment before the Micro Teaching Theory (EDUC 213) which comes up in the first semester of second year.

Multi-stage sampling technique was used to select the participants for the study. First, simple random sampling technique was used to select three Colleges of Education in the south-west zone states (Federal and State inclusive). Stratified random sampling was used to ensure that each of the state in the south-west axis of the country is involved and the criterion for their selection is the availability of Primary Education Studies (PES) in the institution. In a situation where there were more than a college that satisfies this condition in a given state, simple random sampling was then used to select one of them. In all, three Colleges of Education that have PES programme were involved in the study and all the Primary Education students in their first year in each of the colleges were involved. Based on this, a total of 337 students in 100 level of NCE programme participated in the research. The three colleges were randomly assigned to treatment groups (one college per a treatment group).

The following research instruments were developed, validated and used for data collection for this study:

1. Activity-Based Lesson Plan Format (ABLPF)
2. Pre-Service Teachers Activity-Based Lesson Plan Scale (PSTABLPS);
3. Students-centred Activity-Based Instructional Package (SABIP)
4. Students-centred Activity-Based Instructional Package Validation Tool (SABIPVT)
5. Teacher Demonstration Instructional Package (TDIP) and

**Activity-Based Lesson Plan Format (ABLPF):** This instrument was adapted from the Activity Planning Format (from Nipissing University). It was used to train the pre-service teachers on how to develop activity-based lesson. It is made up of six parts: (i) general information which includes: subject area, class, topic, sub-topic, time, period and duration. (ii) Pre-assessment stage which includes: entry behaviour, existing learning environment and available resources/materials. (iii) Behavioural objectives which should cover the learning domains (iv)
Classroom activities for both pupils and teachers. (v) Assessment which includes tools for assessment and assessment items and (vi) Teacher’s reflection on the lesson which includes: achievement or otherwise of objectives, effectiveness of teacher’s activities and next step of actions. ABLPF was subjected to criticism from lecturers in the Department of Teacher Education and their comments were used to produce the final version.

**Pre-Service Teachers Activity-Based Lesson Plan Scale (PSTABLPS):** This is a self-designed instrument that measures the pre-service teachers’ skills in (a) stating behavioural objectives for ABL (b) selection/designing of appropriate materials (c) planning pupils/teachers activities and (d) identifying/designing assessment tools. The design of this instrument was tailored towards the adapted pre-service lesson plan format and it was used as a standard to measure the lesson planning skills at the pre-test and post-test levels of the study. The instrument comprised 5 parts. Part 1 deals with demographic data of the students. There is no mark allotted to this part. Part 2 measures the knowledge and skills in stating behavioural objectives for ABL. The items under this part cover (i) learning domains (ii) qualities of good behavioural objective, such as, being stated in measurable terms, condition of demonstration, taking care of average learners in the class and so on and (iii) appropriateness of the objectives to the topic at hand. The total mark allotted to this part was 25 marks. Part 3 deals with skills of identifying/designing/improvising instructional materials that are developmentally appropriate to the pupils as well as the topic at hand. Items here cover (i) appropriateness of the materials to convey mathematical concept to be discussed (ii) age appropriateness and individual appropriateness of the materials (iii) availability/access to the materials by the pupils and the teachers (iv) provision; ready-made or improvised; the cost and number of mathematics ideas it could be used for. 25 marks were allotted to this part too. Part 4 deals with designing both pupils’ and teachers’ activities. Items in this part specify that (i) activity must have mathematical ideas embedded in it, (ii) there should be logical presentation of activities, (iii) there should be time/space consideration, (iv) levels of involvement-individual, group or selected members of the class should be determined. 25 marks were allotted to this part too. Part 5 deals with the skills in identifying/designing of assessment tools for ABL. Items under this cover (i) appropriateness of instrument (ii) validity of instrument (iii) mark allocation (iv) consideration for intellectual, social and physical activities. 25 marks were allotted to this part.
The total score a candidate could obtain in a planned lesson, using this tool to measure it, is 100 marks. The instrument was subjected to constructive criticism in the Department of Teacher Education and Institute of Education at the University of Ibadan. The supervisor of this study was also consulted to this effect. The corrections from the various experts were used to produce the final copy and reliability was determined using inter-rater technique. Correlation coefficient \( r = 0.837 \) was obtained using spearman correlation.

**Students-centred Activity-Based Instructional Package (SABIP):** This stimulus instrument is the most important in this study. It was designed by the researchers and it served as guide on the activity-based instructional strategy as well as the package that was delivered. This was used to prepare the pre-service teachers in the experimental groups. This instrument covers all topics in PES 122 (Mathematics in Primary Education Studies 11). The choice of this course was informed by the following reasons: (i) the course content is basically on primary Mathematics topics and it comes up during the second semester of the 100 level (ii) it is the only primary Mathematics course in the second semester of the 100 level that the pre-service teachers would be prepared with, for the upcoming Micro Teaching Practicum (in EDUC 224). For every topic selected, the instrument covers how to perform the following: (a) state the behavioural objectives (b) selection of instructional and manipulative materials; (c) identify both pupils’ and teacher’s activities; (d) presentation of the planned ABL; (e) evaluation of the whole teaching/learning process. This package also features several worksheets which guided the students on various activities they were expected to carry out. It is worth emphasizing that at every stage of the preparation as identified above, the pre-service teachers were taken through learn-to-do-it-by-doing-it (activity-based) strategy using Activity Planning Format (APF). The validation of this instrument called for another instrument named Activity-Based Instructional Package Validation Tool (ABIPVT). This is a 19-item self-designed instrument. The first two items covered basic information from the assessors; the next 16 items covered all the other aspects of ABIP with responses ranging from adequate or otherwise, appropriate or otherwise and comments about each item; the last item is the general comment on the particular lecture assessed. Ten (10) copies of the instrument were given to each assessor alongside ABIP for the validation process. The responses of the assessors were used to make corrections on ABIP.
There are two important stages in every Mathematics lesson in the primary school; the first stage is when the teacher introduces the new Mathematics skill(s) and the second is when pupils are allowed to practice the newly acquired skill(s). The first stage is, most of the time, teacher-centred, and the pupils are left passive or, at best, left to copy notes. The second stage involves the active participation of the pupils when they are allowed to do some mathematical (paper/pencil) exercises following the steps taught by the teacher. Any Mathematics lesson that engages pupils in only the second stage is not recognised as being activity-based in this study, but a lesson is said to be activity-based if and only if the pupils are actively involved in the first stage.

The type of activity that could take place in the first stage of Mathematics lesson in the primary school is of two forms. The first form is known as manipulative and here the pupils are made to interact with materials or create a real life situation which would expose the first-hand knowledge of the Mathematics skill to be taught. The other form is paper-pencil manipulation of numbers which teacher directed. It exposes the pupils to new mathematical knowledge. The choice of the form of activity to be employed strictly depends on the Mathematics topic. In this study, the first form of activities (manipulation of materials) was the focus.

Teacher Demonstration Instructional Package (TDIP): This instrument, DIP, is almost a replica of ABIP. It contains the course content of PES 122, the activity-based lesson format and the lesson plan for each lecture. The activities are included but this time, they are to be carried out by the lecturer. So, in the lesson plan, the activities are written under the teacher activity. The worksheets are also excluded in this package since the pre-service teachers exposed to this strategy will not be using it. This instrument was also validated by giving it to lecturers in the Department of Teacher Education, Institute of Education and experienced primary Mathematics teachers at the University of Ibadan. These experts examined the instrument for face and the content validity of this stimulus package. Their corrections were effected before the instrument was used to obtain relevant data.

Conventional Strategy Instructional Guide (CSIG): The adoption of this guide was informed by the realization that there are various types of conventional strategies (while some are purely chalk and talk, some are slightly modified). The guide is designed by the researcher to ensure the
consistency of the conventional strategy used in delivering the lesson in the control groups. This guide has a set of steps that were followed:

- Presentation of the course content by the lecturer
- Lectures are held without teaching aids and students are just to take notes and ask questions
- Examples, illustrations and further explanations are done using chalk and talk methods
- At the end, a short test is given (possibly the post-test measure).

All the contents of PES 122 (Mathematics in Primary Education Studies 11) were broken down to the number of weeks for the course. This was validated by experienced lecturers in some Colleges of Education in Nigeria as well as educational research experts in the Faculty of Education, University of Ibadan. Their corrections were effected before the final copy was produced.

**Procedure:** The study was carried out within eleven (11) weeks. The activities were:

1. A training programme for the research assistants that participated in this study was organized and executed. These research assistants were the lecturers teaching PES 122 in the selected colleges, hence they were automatically chosen. The training was to acquaint the lecturers with the respective strategies they were expected to use (either SCAB, TDS or the conventional) and the strategy guides were made available for the research assistants after the training.
2. Pre-test observations.
3. Eight (8) weeks of treatment
4. A week for post-test observation.

Inferential statistics of Analysis of Covariance (ANCOVA) was used to test the null hypotheses; while Estimated Marginal Means was used to evaluate the magnitude of performance in each group. Scheffe’s Post Hoc test (pair-wise comparison) was used to reveal the source(s) of any significant difference among groups that were more than two. The hypotheses were tested at 0.05 level of significance.
Results

Ho1: There is no significant main effect of treatment on pre-service teachers’ lesson planning skills.

Table 1: Summary of Analysis of Covariance (ANCOVA) on Pre-service Teacher Lesson Planning Score

<table>
<thead>
<tr>
<th>source</th>
<th>Type III sum of squares</th>
<th>Df</th>
<th>Mean square</th>
<th>F</th>
<th>Sig.</th>
<th>Partial Eta squared</th>
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<tr>
<td>Corrected model</td>
<td>197123.922</td>
<td>18</td>
<td>10951.329</td>
<td>145.959</td>
<td>.000</td>
<td>.892</td>
</tr>
<tr>
<td>Intercept</td>
<td>153309.767</td>
<td>1</td>
<td>153309.767</td>
<td>2043.307</td>
<td>.000</td>
<td>.865</td>
</tr>
<tr>
<td>Prescore</td>
<td>.053</td>
<td>1</td>
<td>.053</td>
<td>.001</td>
<td>.979</td>
<td>.000</td>
</tr>
<tr>
<td>Treatment</td>
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<td>2</td>
<td>47130.341</td>
<td>628.151</td>
<td>.000</td>
<td>.798</td>
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<tr>
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<td>1</td>
<td>6.667</td>
<td>.089</td>
<td>.766</td>
<td>.000</td>
</tr>
<tr>
<td>Treatmt* gender</td>
<td>329.591</td>
<td>2</td>
<td>164.796</td>
<td>2.196</td>
<td>.113</td>
<td>.014</td>
</tr>
<tr>
<td>Error</td>
<td>23859.609</td>
<td>318</td>
<td>75.030</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>663587.000</td>
<td>337</td>
<td></td>
<td></td>
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<tr>
<td>Corrected total</td>
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</tbody>
</table>

a.  R Squared = .892 (Adjusted R Squared = .886)

Table 1 reveals that there is a significant main effect of treatment on pre-service teachers’ lesson planning skills ($F_{(2,318)} = 628.15; \eta = .80; P<0.05$). Therefore, $H_{01}$ is rejected. Table 2 below reveals the magnitude of performance across the groups.

Table 2: Estimated Marginal Means on the Treatment, Numerical Ability and Gender

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grand mean (Post-score mean)</td>
<td>337</td>
<td>42.81</td>
<td>.76</td>
</tr>
<tr>
<td>Pre-score mean</td>
<td>337</td>
<td>13.93</td>
<td>-</td>
</tr>
<tr>
<td>Treatment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students-centred Activity-based (Exp 1)</td>
<td>73</td>
<td>55.37</td>
<td>1.30</td>
</tr>
<tr>
<td>Teacher Demonstration (Exp 11)</td>
<td>103</td>
<td>61.73</td>
<td>1.70</td>
</tr>
<tr>
<td>Conventional (control)</td>
<td>161</td>
<td>11.32</td>
<td>.81</td>
</tr>
</tbody>
</table>
Table 2 reveals that the pre-service teachers exposed to teacher demonstration have the highest activity-based lesson planning score (61.73); followed by those exposed to students-centred activity-based (55.37) while those exposed to conventional teaching have the least activity-based lesson planning score (11.32). This information is represented in a chart overleaf.

![Bar Chart Showing Levels of Lesson Planning Skills Acquired by the Pre-Service Teachers after Training](chart.png)

**Fig. 3: Bar Chart Showing Levels of Lesson Planning Skills Acquired by the Pre-Service Teachers after Training**

Table 3 shows the source(s) of the significant difference by pairwise comparison.

**Table 3: Summary of Scheffe's Post Hoc Pairwise Comparison of the Scores within the Three Groups**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Mean score</th>
<th>Exp.1</th>
<th>Exp.11</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students-centred Activity-based (Exp. 1)</td>
<td>55.37</td>
<td>*</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Teacher Demonstration (Exp. 11)</td>
<td>61.73</td>
<td>*</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Conventional (Control)</td>
<td>11.32</td>
<td>*</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

Table 3 reveals that the significant main effect exposed by table 1 is as a result of the significant difference between:

i. Activity-based and teacher demonstration strategies

ii. Activity-based and conventional strategies
iii. Teacher demonstration and conventional strategies

This implies that those exposed to teacher demonstration performed significantly better than those exposed to activity-based instructional strategy and that those exposed to activity-based instructional strategy performed significantly better than those exposed to conventional strategy in the acquisition of activity-based lesson planning skills. That pre-service teachers exposed to Students-Centred Activity-Based (SCAB) teaching were able to plan activity-based primary Mathematics lesson better than those exposed to conventional, chalk-and-talk method could be as a result of the fact that those in SCAB learn how to plan lesson in various ways. They learnt how to do this by following the ones planned by their lecturers. They were made to plan several activity-based lessons as student’s exercises and, more importantly, they experienced the lecturer delivering the activity-based lessons he planned. This is unlike what took place in the control group wherein the students were taught the same primary mathematics topics in chalk-and-talk method. The lecturer only wrote on the board and explained and left the students to copy notes. In addition to this, the lecturer only explained to the students always that those topics were better taught using activity-based strategies but he did not show them how to plan and deliver such strategies. This finding corroborates the submission by many scholars that teachers teach the way they were taught (Cruickshank, Jenkins and Metcalf 2003; Khazanov 2007).

Again the finding that those exposed to Teacher Demonstration Strategy (TDS) acquired activity-based lesson planning skills more than those exposed to SCAB is as a result of the fact that the pre-service teachers involved in the study are used to ‘teacher telling’ right from the primary and secondary schools. Therefore, those in TDS find it easier comprehending faster than those in SCAB group. This is in line with the submission of Rodriques (2010) that TDS make learning faster and more effective than some other instructional strategies, especially in a situation where there are large classes (Loeffler, 2010).

**Ho2: There is no significant main effect of gender on pre-service teachers’ lesson planning skills.**

According to the ANCOVA table (Table 1) presented above, there is no significant main effect of gender on pre-service teachers’ lesson planning skills ($F_{(1,318)} = 0.09; \eta = .00; P>0.05$). Therefore, $H_{03}$ is not rejected. Table 2 also revealed the lesson planning mean score of the male pre-service teachers to be 42.58 and that of the female 43.03. The difference between these
values is 0.45, which has been shown not to be significant. This finding, that both male and female pre-service teachers acquired almost the same level of lesson planning skills, could be as a result of the fact that the teaching is more of doing, practical than calculation which required higher level thinking and abstractness. This finding supports the findings that the gap between male and female students’ performance in Mathematics is disappearing (Austin 2002; Berube and Glanz 2008).

**Ho3: There is no significant interaction effect of treatment and gender on pre-service teachers’ lesson planning skills.**

The ANCOVA table revealed that there is no significant interaction effect of treatment and gender on Pre-service teachers’ lesson planning skills \((F_{(2,318)} = 2.20; \eta = .01; P>0.05)\). Therefore, \(H_{05}\) is not rejected. This finding implies that in the three groups, that is, the SCAB, TDS and the control group, there is no significant difference between male and female pre-service teachers’ activity-based lesson planning skills after the treatments. This finding is in line with the second that says the gap between male and female in mathematics performance is almost disappearing. And as discussed earlier, this could be because lesson planning has to do with doings and practical activities than calculations; hence these findings should not be jettisoned.

**Conclusion**

This study investigated the strategies that could be used to train pre-service primary Mathematics teachers such that they will be able to plan activity-based lessons which will aid their ability to deliver activity-based lesson when teaching. The findings have shown that TDS will help these teachers acquire these skills best followed by SCAB strategy and that these two strategies are far better than the common strategy (conventional) used by the lecturers in the colleges of education to train these teachers today in Nigeria.

**Recommendation**

Based on the findings of this study, the following recommendations are proffered:

- Lecturers teaching primary mathematics methodologies in the colleges of education in Nigeria should be re-trained on how to plan lessons based on SCAB and TDS strategies.
It was discovered that majority of these lecturer were not trained on how to do these while in training and it is also difficult for them to train others on how to do it. This could be achieved through organizing workshops.

- Since the students we are to train are used to ‘teacher telling’ TDS is mostly recommended at least for the 100 level students. SCAB could then be used at both 200 and 300 levels so as to equip the teachers with the two strategies.

Lecturers should avoid using the direct instruction or what is commonly called chalk-and-talk to train pre-service primary Mathematics teachers. It has been shown now that this will not allow them to acquire the skills of planning activity-based Mathematics lessons.

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