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# Effectiveness of a Teacher Mentoring Programme in Enhancing Pre-service Chemistry Teachers' Attitude towards the Teaching Profession

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## Authors' contributions

*This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.*

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## ABSTRACT

**Aims:** This study investigated the effectiveness of a teacher mentoring programme in enhancing pre-service teacher's attitude towards the teaching profession.

**Study Design:** The study was a pretest, post test quasi experimental design.

**Place and Duration of Study:** The study took place in Plateau State of Nigeria and lasted for 12 weeks (that is, between April and June 2012).

**Methodology:** The instruments used for the study were Teacher Mentoring Guide (TMG) and Pre-service Chemistry Teachers' Attitude Scale (PCTAS). The reliability for PCTAS was 0.82 using Cronbach's Alpha. A purposive sample of 72 Nigeria Certificate in Education (NCE) final year chemistry teachers was used in Experimental group by serving teachers using a TMG.

**Result:** PCTAS was used to generate data which were analysed using mean, standard deviation and ANCOVA. It was found that there was a significant difference between the mean attitude score of pre-service chemistry teachers exposed to mentoring (experimental) and those that were not ( $F_{1,71} = 17.74, p < 0.05$ ). Conversely, there were no significant differences between the mean attitude score of male and female as well as age category of 18-21 and 22 and above years' pre-service chemistry teachers exposed to mentoring ( $F_{1,35} = 0.11, p > 0.05$  and  $F_{1,35} = 1.29, p > 0.05$  respectively).

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**Conclusion:** Training of pre-service chemistry teachers in teacher training institutions using a structured guide such as TMG facilitated development of positive attitude by pre-service teachers. Gender was not a factor in the extent of positive attitude developed by pre-service teachers mentored using TMG.

*Keywords: Mentoring; mentors; mentees; pre-service teachers; chemistry teachers; attitude to teaching; teaching profession.*

## 1. INTRODUCTION

Chemistry as a subject has remained one of the most relevant science subjects that those in engineering, medicine and pharmacy could not do without. Thus nations struggle to excel in it as they struggle to advance in science and technology. Despite the relevance of the knowledge of chemistry to the society, achievements of students in chemistry in Nigeria as measured by their scores in Senior Secondary School Certificate Examination (SSCE) have been very poor [1,2,3]. Studies by Njoku [4] and Nwagbo [5] show that students perform poorly in the sciences generally and for chemistry the best result between 1984 and 1997 according to Oyedokun [6] was in 1986, when 39.2% of the students passed at credit level. This puzzle has led to a number of unanswered questions including what is happening to teacher education (that is, preparation, instructional strategies, practicum, curriculum, inadequate teachers themselves as well as monitoring and feedback). This was with the assumption that if that aspect is adequately taken care of, there is the likelihood of remarkable improvement in students' performance in chemistry.

The idea of teacher education in Nigeria is as old as the education system itself. Since its inception, a number of categories have been introduced thus: Teacher Grade II certificate, Associateship Certificate in Education and National Certificate in Education at the sub-degree level. Specifically, the Nigeria Certificate in Education (NCE) was introduced to create manpower at the Basic Education level. According to the national policy on education [7], the Nigeria Certificate in Education (NCE) is the minimum basic qualification for entry into the teaching profession in Nigeria. Consequently, it is stressed that the teacher education at the NCE level is to produce highly motivated, conscientious and efficient classroom teachers mainly for primary and junior secondary levels of education system (now regarded as Basic Education, BE for 1<sup>st</sup> to 8<sup>th</sup> grades). It is also to provide teachers with the intellectual and professional background adequate for their assignment and to make them adaptable to any changing situations not only in the life of their country but in the wider world. For the teacher to effectively fit well into these purpose, the attitude of the teacher to teaching as a profession matters.

By implication, therefore, the way the teacher sees and responds to the profession especially in the classroom or his attitude could have great influence on the effectiveness of his teaching. In Nigeria, the general attitude of people towards the teaching profession is negative [8,9]. This attitude has been subtly deposited into the fertile minds of the younger generation especially those in the secondary schools. This is evidenced in the applications made for admission into the Nigerian Universities and Colleges of Education. For instance, it is the rejected candidates from medicine, pharmacy, engineering and so on yearly that come back to read science education eventually and this justifies why they develop negative attitude. Piwuna and Mang [8] reported that in the 2004/2005 applications considered in the courses of study in the University of Jos, of the 6086 candidates that applied to the departments of Medicine, Accounting, Pharmacy, Law and Education; 2992 candidates

applied to read Medicine, Accounting, 1558, Pharmacy 805, Law 592 and Education had only 139 candidates. Unfortunately, of the 139 that applied to the Faculty of education, none applied to the science and technology department (Chemistry Education, Biology Education and Physics Education). In the Colleges of education, this attitude is also portrayed. Records in the admissions office of Federal College of Education (FCE) Pankshin show that from 2002-2007 the number of students that applied to read chemistry and any other science subject through JAMB has never exceeded two. Most of the science education students at the University level are only there as a last resort because their original intention of reading sciences at the secondary school level is to train at the University level to be doctors and pharmacists and not science teachers. This therefore makes them develop negative attitude and hence little or no interest in the profession including while in training or pre-service teaching. Achor and Orji [9] made this observation also. This situation calls for an intervention strategy that could change their attitudinal orientation towards the teaching profession as it could be a first step towards making them become effective teacher that could impact on their students positively.

Despite the importance of the teacher and the negative attitude towards teaching that most pre-service teachers go to teacher training institutions with, it has been observed that the actual training of the pre-service teachers during the teaching practice or practicum leaves much to be desired. Hay-McBer and Ingersoll [10] asserts that a lot of inadequacies exist in teacher training programmes in terms of changing the negative attitudinal dispositions of the pre-service teacher. Buttressing this point, Ingersoll [11], Ingersoll and Smith [12], assert that such inadequacies are due to the way the pre-service teacher is treated during teaching practice. They further add that although teaching at whatever level involves intensive peer interaction with youngsters, it is largely done in isolation of colleagues. This is especially consequential for pre service teachers who upon going for teaching practice are left to their own devices to succeed or fail within the confines of their classrooms. An experience likened by some to being lost at sea [13]. Teaching according to Ingersoll [14] seems to be the only occupation that does not deliberately encourage its young and in which the initiation of new teachers or pre-service teachers on teaching practice is akin to a 'sink' or 'swim' or 'trial by fire' or 'boot camp' experience. Teaching is probably the only profession that expects its beginners to be responsible for the same work expected of experienced teachers. It is certainly difficult to get the best out of such teachers especially in term of performance of their students in public examination.

This trend of being left alone was a source of worry to researchers like Nnadozie [17], Maduabum [15] and Gyuse [16] who assert that in most cases what the supervising lecturer does is to go into the class or stand by the window for about five or ten minutes and give the student teacher a pass or fail grade. To Maduabum [15] nobody between the supervising lecturer and in-service teachers accepts responsibility for helping pre service teachers who require supervisory assistance.

In view of the problem of poor performance of students in chemistry at secondary school level and which is linked to negative attitude of teachers generally and a close study of pre-service teachers' attitude to teaching and poor supervision of pre-service and beginning teachers during teaching practice in Nigerian education system as observed by Maduabum [15] and Gyuse [16], there is the need to deliberately expose pre-service teachers to some forms of apprenticeship. Apprenticeship in education as used in this study is synonymous with mentorship except that mentorship has the coloration of dealing with a young colleague and not a master-servant relationship.

The recent strategy employed by some developed countries where pre-service and new teachers are assisted by colleagues (experienced teachers or mentors), who demonstrate teaching techniques, observe new teacher's classroom teaching, provide feedback and hold support meetings to clarify issues [18,19] is called mentoring. The mentor views the pre service teacher as someone to be helped in translating theories he learnt in the classroom during the pre-service training into practice. The mentor equally serves as a sort of cushion for the reality shock the pre-service teacher is likely to experience on exposure to real classroom situation.

Mentoring has been defined by Haney [20] as a relationship between a less experienced person and a more experienced person in which guidance, advice, support, and feedback are provided. The two key players at the centre of the mentoring process are the mentor and the mentee [21,22]. In this study, the veteran class teacher is the mentor and the pre-service teacher on teaching practice is the mentee. In this way mentoring can be a means of helping a novice to be properly guided on the rudiments of curriculum, teaching, and learning. Despite such promise, the NCE teacher training programme in Nigeria does not seem to involve a deliberate mentoring relationship during teaching practice.

Given the age at which adolescents enter higher institutions, it will be observed that the pre-service teacher is only a few years older than most of the students they are meant to teach. Some are young females sent to all male schools and vice-versa. While this study does not focus on gender crossing (that is sex of mentors and mentees), it may be of interest to find out how male and female pre-service teachers (mentees) exposed to a mentoring programme respond to it in terms of change in their attitude towards their profession. Without proper handling, the pre-service teacher left on his/her own to take decisions may not know what to do and so may become disillusioned. Whether the extent of disillusionment as may be reflected in attitude after a planned mentoring is gender dependent is another source of worry in this study. Therefore the problem of this study is anchored on what the effectiveness of a teacher mentoring programme is in enhancing pre-service chemistry teachers' attitude towards the teaching profession.

## **2. THEORETICAL FOUNDATION FOR THE STUDY**

This study is anchored on Mead's theory of peer interaction [23], Herzberg's theory of motivation [24] and Bandura's social learning theory [25]. Mead [23] stresses the importance of peer interaction in the development of changes in self-system. Mead's theory posits that people who interact mutually influence one another. To Mead, the interaction in the context of cooperation, competition, conflict and friendly discussion can allow individuals to gain understanding about themselves as both subject and object. Mutual interaction could be provided for in the course of a mentoring relationship. Participants in mentoring could develop notions about teaching or themselves through the behaviour directed at them proactively and reactively by either their mentors or mentees. The free environment in the mentoring encourages the mentees to learn voluntarily without any force or coercion, thereby helping in the development of self esteem and positive attitude to teaching.

Herzberg [24] proposed the motivation-Hygiene theory, also known as the two factor theory of job satisfaction. According to this theory, people are influenced by two sets of factors: The motivator factors and Hygiene factors. The motivator factors as identified by Hertzberg are achievement, recognition, work itself, responsibility, promotion and growth. The hygiene factors Hertzberg identified are, pay and benefits, company policy and administration,

relationship with co-workers, supervision, status, job security, working conditions, and personal life

According to Herzberg, "hygienic factors" are things like salary, relationship with supervisors, working conditions and job security. Herzberg's theory of motivation tells us that when factors like these are expected for doing the regular job, but are not present or available, the lack of that thing serves as a 'dissatisfier' and job performance deteriorates. In other words, if hygienic factors are neglected there will be no effectiveness or efficacy in job performance. It is from this background that Sweeny [26] commended that an organization considering mentoring employees who already feel unrecognized for their day-to-day work and who feel they do not receive the support needed to do a good job, will be less likely to seek additional responsibilities such as mentoring, because they are already dissatisfied. Thus if pre-service teachers are mentored, it will lead to good achievement and this achievement will in turn motivate them to be effective in their teaching as they join the teaching profession in future. Also the veteran teachers, who have no reason not to serve as mentors (i.e. no dissatisfiers) will serve as mentors if they perceive they can improve their own success as workers, make a contribution to others' development or address new challenges that will help them grow professionally and personally.

Social learning theory focuses on the learning that occurs within a social context. It considers that people learn from one another; via observation, imitation and modeling. Among others Albert Bandura is considered the leading proponent of this theory. Bandura's social learning theory [25] emphasizes the importance of observing and modeling the behaviours, attitudes, and emotional reactions of others. Bandura [25] states that learning would be exceedingly laborious, not to mention hazardous, if people had to rely solely on the effects of their own actions to inform them on what to do. Most human behaviour is learned observationally through modeling. From observing others one forms an idea of how new behaviours are performed, and on later occasions, this coded information serve as a guide for action (p. 30).

As the pre-service teachers observe the teaching of the serving teachers he/she can model the teaching strategies of the veteran teacher. This relationship can help the pre-service teacher to be effective.

"Strategies consistent with social learning theories include mentoring, apprenticeship, on the job training and internships. Each involves learning in a social situation whereby novice learners model more experienced teachers or co-workers" [27]. As the pre-service teacher observes the teaching of the serving teacher, he/she can model the teaching of the serving teacher. This relationship can lead to good achievement on the side of the pre-service teacher.

An examination of these three theories shows that they are all related in their areas of emphasis. They all have a strong relationship in the area of peer interaction, motivation and modelling and teaching effectiveness. The interplay between these theories provided in a mentoring programme has the great advantage of enhancing the teaching competence of pre-service teachers and re shaping their attitude and behaviours towards the teaching profession.

### 3. RESEARCH QUESTIONS AND HYPOTHESES

The following research questions were answered in this study:

1. What is the effect of Teacher Mentoring Programme (TMP) on (experimental and control groups) pre-service chemistry teachers' mean attitude scores towards the teaching profession?
2. To what extent is there a difference between the mean attitude scores of male and female pre service chemistry teachers exposed to TMP?
3. To what extent is the effect of age on the mean attitude scores of pre-service chemistry teachers exposed to TMP?

The following null hypotheses were tested at 0.05, level of significance:

1. There is no statistically significant difference in the mean attitude scores of pre-service chemistry teachers exposed to TMP and those that were not towards the teaching profession.
2. There is no statistically significant difference in the mean attitude scores of male and female pre-service chemistry teachers exposed to TMP.
3. There is no statistically significant difference in the mean attitude scores of pre-service chemistry teachers that are between the age range of 18-22 years and those that are 22 years and above exposed to TMP.

### 4. RESEARCH METHOD

In this section method adopted are described in three sub units. It consists of the design for the study, instruments and experimental procedure.

#### 4.1 Design

The study was a quasi-experimental study of the pre-test post-test type. Quasi experimental design was used because, the research was conducted in a school setting and as Achor and Ejigbo [28] pointed out; quasi experimental designs are easily conducted in a school setting as certain classroom situations do not lend themselves to some sampling manipulations or control and so intact classes or group are used. The study employed the non randomized pre-test post-test control group design. The research was conducted in Plateau State of Nigeria. The sample was made up of all the 72 NCE III chemistry students of Federal College of Education Pankshin and College of Education Gindiri all from Plateau State that were posted for teaching practice at the end of their NCE III second semester exams. Out of the 72 pre-service chemistry teachers, 33 were females and 39 were males. The experimental and control groups comprised of 36 pre-service chemistry teachers each.

#### 4.2 Instruments

##### 4.2.1 Teacher Mentoring Guide (TMG)

TMG was developed by the researchers based on extensive literature search, reports and from items used in similar studies in and outside Nigeria. The TMG consists of 5 sections: section 1 is concerned with components of a good mentoring relationship, section 2 is the components of a teacher mentoring programme, section 3 is about the structure of the

mentoring session, section 4 is the plan of the mentoring structure and section 5 is a checklist for mentors contact with mentee.

The first section of the TMG adapts the mentoring cycle described by Hay [29]. It involves three stages. The first stage is the critical components of a good mentoring relationship that mentors are expected to take note of. The second stage raises some issues that could be probable problems that mentors may have, and the way forward. The third is about some benefits of the mentoring to the mentors and mentees.

The second section of the TMG is adapted from Hudson and Skamp [30]. Hudson and Skamp identified five factors for mentoring namely, personal attribute, system requirement, pedagogical knowledge, modelling and feedback. Each of the five factors consists of some specific things that are expected of the mentors.

The third section of the TMG is also adapted from Hay [29]. This section is about the structure of the mentoring session. It is structured in four phases. The phases are initiation phase, the target phase, the option phase and the action phase. The last section is the plan of the mentoring structure. The TMG was used to train the mentors. It was also given to the mentors to serve as a guide to them when mentoring the pre-service chemistry teachers on the field.

Though TMG was not used directly to collect data, effectiveness of the mentoring itself was contingent upon it. Thus in a clear three steps its use was explained to the mentors during the training; orderliness, creating time to chart with pre-service teachers, regular visit, system requirements, benefits of mentorship, feedback and exchange of professional ideas. Opportunities were created for the mentors to ask questions and also to do mock use of TMG. This stage provided further clarification and straightened some seemingly ambiguous sections.

TMG was validated by passing it to 2 experienced university chemistry educators and 2 senior chemistry teachers in secondary school. These people examined the contents, the objectives, construction, clarity of sentences and its usability by the mentors. In this process, modifications were suggested especially having to personalize many of the instructions for the mentors and mentees. Since it was not data gathering instrument, it was ensured that mentors were familiar with its contents and use to ensure same condition for all mentees.

#### **4.2.2 Pre-service Chemistry Teachers' Attitude Scale (PCTAS)**

The second instrument, Pre-service Chemistry Teachers Attitude Scale (PCTAS) is a questionnaire developed by the researchers. It consists of two sections. Section I, solicits for demographic information about the respondents relating to sex, age and classes taught during teaching practice (TP). Section II of this instrument is a five point Likert scale questionnaire. The statements in the questionnaire highlight the variables to be studied. This is aimed at providing information on the attitude of the pre-service chemistry teachers towards the teaching profession.

It evolved through a series of preliminary investigations on the general attitude of people to teaching. The survey included 30 items derived from a review of literature. Responses to these items were on a five point Likert scale [ie, Strongly Agree SA=5, Agree A=4, Undecided U=3, Disagree=2, and Strongly Disagree=1] for positive items and the reverse rating of 1, 2, 3, 4 and 5 for negative items.

Initially the instrument consisted of 51 items but was reduced to 30 after validation. PCTAS was validated by two experts in chemistry education, one physics educator and one in measurement and evaluation. They were instructed to inspect appropriateness of the items, construction, double barred items and if they addressed the objectives of the study. Their views were unanimous and emphasized mainly on the need to reduce the number of items. The reduction was based on the fact that many items were too similar and that it becomes boring when the time required for completing the questionnaire is much. Thus many similar items were removed or reduced. PCTAS is used in this study to determine the attitude of pre-service chemistry teachers towards the teaching profession.

Data were collected using TMG and PCTAS developed by the researchers. The TMG was used to train the mentors that mentored the pre-service teachers. The mentors were to meet with the mentees at least once in a week. They were encouraged to allow the mentees watch their teaching and to also observe the mentees teaching. The PCTAS was trial tested on twenty pre-service chemistry teachers. Reliability coefficient was computed using Cronbach alpha which yielded a coefficient of 0.82.

### **4.3 Experimental Procedure**

Twelve mentors were trained by the researcher to assist in mentoring the pre-service Chemistry teachers. The researcher ensured that each of the mentors has a B.Sc.Ed degree in chemistry with at least ten years post qualification experience. This step is necessary to ensure that they have the subject matter experience and the professional qualification required to be able to mentor effectively. It was also to ensure homogeneity in their level of operation.

The mentors were required to have a contact session with the pre-service chemistry teachers at least once a week throughout the teaching practice period. Each mentor is to mentor a maximum of three pre-service chemistry teachers. The researcher gave each of the mentors a copy of the TMG. It is also served as a reference material to them when mentoring the mentees. The control group did their teaching practice in a typical manner; they could ask questions and request assistance from any experienced chemistry teacher, yet nobody was specifically assigned as a mentor. Both groups participated in 12 week experience which is part of the conditions for partial fulfillment of the requirements for the award of Nigeria Certificate in Education (NCE).

## **5. RESULTS**

Results are presented according to research questions and hypotheses.

### **5.1 Research Questions**

#### **5.1.1 Research question 1**

What is the effect of Teacher Mentoring Programme (TMP) on (experimental and control groups) pre-service chemistry teachers' mean attitude scores towards the teaching profession?

In order to ascertain the extent of the effect of Teacher Mentoring Programme on pre-service chemistry teachers' attitude towards the teaching profession, the mean and standard



deviation of both experimental and control groups on the attitude scale (PCTAS) were calculated. The result is as shown on Table 1.

**Table 1. Summary of means standard deviations of experimental and control groups on PCTAS**

Group		Pre-PCTAS	Post PCTAS	Mean diff
Experimental	Mean	2.8898	3.4657	0.5759
	N	36	36	
	S.D	0.3805	0.3613	
Control	Mean	2.9824	3.2657	0.2833
	N	36	36	
	S.D	0.3415	0.1938	

*Key N=Number of respondents, SD=Standard Deviation*

The results on Table 1 show that the experimental group had a post-test mean attitude score of 3.47 and a standard deviation of 0.36. This is higher than that of the control group, with a mean attitude score of 3.27 and standard deviation of 0.34. The pre-test post test gains show that the experimental group had a gain of 0.58 while the control group had a gain of 0.28 on the attitude scale. The difference between the gains of the two groups is 0.29 in favour of experimental group. This difference to some extent seems substantial.

### **5.1.2 Research question 2**

To what extent is there a difference between the mean attitude scores of male and female pre service chemistry teachers exposed to TMP?

To answer this question, the responses of male and female respondents on the attitude scale (PCTAS) were used. The mean and standard deviation of male and female subjects in both the experimental and control groups were calculated. The results are as shown on Table 2.

**Table 2. Mean and standard deviation for pre and post test attitude scores for male and female pre-service teachers in experimental group**

Group		Male	S.D	Mean	N	Female	S.D.	Mean	N
		Mean		diff		Mean		diff	
Experimental	Pre-Test	2.7754	0.4033	0.668	21	2.7344	0.4269	0.6345	15
	Post-Test	3.4439	0.4432		21	3.3689	0.4618		15

Table 2 shows that the male respondents in the experimental group had a post test mean score of 3.44 and a pre-test mean score of 2.78. This shows a mean difference of 0.6685. The female respondents also followed the same trend with a post- test mean score of 3.37 and a pre-test mean score of 2.99. Their mean difference is 0.63. This is almost the same with that of the males as the difference of 0.04 is not substantial.

### **5.1.3 Research question 3**

To what extent is the effect of age on the mean attitude scores of pre-service chemistry teachers exposed to TMP?

To answer this research question the subjects were grouped into two age groups (18-21 years and 22 years and above). The mean and standard deviation of the two age groups in attitude were calculated. The calculation is as shown on Table 3.

**Table 3. Mean and standard deviation for pre test and post test mean attitude scores of teachers of ages 18-21 years and 22 years and above in experimental group**

Group		18-21 yrs mean	S.D	Mean Diff	N	22- above mean	S.D.	Mean Diff.	N
Experimental	Pre-Test	2.8435	0.3858	0.5601	28	3.0521	0.3335	0.6312	8
	Post-Test	3.4036	0.3485		28	3.6833	0.3385		8

Table 3 reveals that the pre-test post-test mean attitude scores of the 18-21 years age group was 2.84 and 3.40 while that of the 22 years and above group was 3.05 and 3.68 respectively. The mean difference of the 18-21 years age group was 0.56 while that of 22-above year's age group was 0.63. The mean difference of the two age groups is almost at par. This implies that TMP had almost the same effect on the attitude of the two age groups.

## 5.2 Hypotheses

### 5.2.1 Hypothesis 1

There is no statistically significant difference in the mean attitude scores of pre-service chemistry teachers exposed to TMP and those that were not towards the teaching profession.

To test this hypothesis the post-test scores of the respondents on pre-service chemistry teachers attitude scale (PCTAS) were subjected to analysis of Covariance (ANCOVA) using pre-test scores as covariates. Table 4 gives the summary of analysis of covariance (ANCOVA) of PCTAS by group (experimental/control).

**Table 4. Analysis of Covariance of pre-Service chemistry teachers' attitude for the experimental and control groups**

Source	Type III sum of squares	Df	Mean square	F	Sig.
Corrected Model	3.7459 <sup>a</sup>	8	0.468	10.325	0.000
Intercept	3.083	1	3.083	67.997	0.000
Pre-PCTAS	2.062	1	2.062	45.481	0.000
Group	0.804	1	0.804	17.739	0.000
Gender	0.104	1	0.104	2.290	0.135
Age	1.816	1	1.816	0.401	0.529
Group*Gender	9.851	1	9.851	0.217	0.643
Group*Age	4.338	1	4.338	0.957	0.332
Gender*Age	5.293	1	5.293	1.167	0.284
Group*Gender Age			6.930	1.528	0.221
Error	2.857	63	4.534		
Total	822.233	72			
Corrected Total	6.602	71			

Key Df = degree of freedom = 71

Table 4 shows that the calculated F value of 17.74 is significant at 0.05 and 1 and 71 degrees of freedom (since  $p = 0.000 < 0.05$ ). The null hypothesis was therefore rejected. This implies that there is a significant difference between the mean attitude of those exposed to TMP and those that were not ( $F_{1, 71} = 17.74, P < 0.05$ ) in favour of the mentored group.

### **5.2.2 Hypothesis 2**

There is no statistically significant difference in the mean attitude scores of male and female pre-service chemistry teachers exposed to TMP.

To test for this hypothesis, the post test scores for the male and female mentored respondents on PCTAS was subjected to analysis of covariance (ANCOVA) using the pre-test scores as covariates. The result is as shown on Table 5. The data on Table 5 was used to test for hypothesis 2 and 3.

**Table 5. Analysis of Covariance of mentored pre-service chemistry teachers on the attitude scale by gender and age**

Source	Type III sum of squares	Df	Mean square	F	Sig.
Corrected Model	3.304	4	0.826	20.256	0.000
Intercept	0.814	1	0.814	19.971	0.000
Pre-PCTAS	2.674	1	2.674	65.581	0.000
Gender	4.435	1	4.435	0.109	0.744
Age	5.267	1	5.267	1.292	0.264
Gender*Age	7.718	1	7.718	0.000	0.989
Error	1.264	31			
Total	4.568	36			
Corrected Total	4.568	35			

Table 5 reveals an F value of 0.11 which is not significant at 0.05. Since the significant level ( $p = 0.74$ ) is higher than the probability level of 0.05, the null hypothesis is, therefore, rejected. This implies that there is no significant difference in the attitude mean score of male and female pre-service chemistry teachers exposed to mentoring ( $F_{1, 35} = 0.11, P > 0.05$ ).

### **5.2.3 Hypothesis 3**

There is no statistically significant difference in the mean attitude scores of pre-service chemistry teachers that are between the age range of 18-22 years and those that are 22 years and above exposed to TMP.

To test this hypothesis, the post-test PCTAS scores of the two age groups were subjected to ANCOVA using pre-tests scores as covariates. Table 5 gives a summary of the analysis of covariance (ANCOVA) of PCTAS of the two age groups. Table 5 shows that calculated F-ratio in respect of the difference between the two age groups (18-21 and 22-above) is 1.29 and not significant at 0.05 since  $p = 0.26 > 0.05$ . This implies that there is no significant difference in the attitude mean score of pre-service chemistry teachers that are between the ages of 18-21 and those that are 22 years and above exposed to TMP ( $F_{1, 35} = 1.29; P > 0.05$ ).

## 6. DISCUSSION OF FINDINGS

This study investigated the effect of teacher mentoring programme on pre-service chemistry teachers' attitude to the teaching profession. The discussion is based on the analyses and findings.

Both research question one and hypothesis one sought to assess the attitude of pre-service chemistry teachers towards the teaching profession and to establish whether or not teacher mentoring programme had a significant effect on their attitude. The finding revealed that the mentored subjects (experimental group) had higher mean post-test score in the PCTAS than the control group. This difference was significant as revealed by the analysis of covariance (ANCOVA),  $F_{1, 71}=17.74$ ,  $P<0.05$ . This implies that mentoring is effective in changing the pre-service chemistry teachers' attitude towards the teaching profession.

This finding is consistent with those of Brown and Wanbach [31], Cheng and Brown [32], Ingersoll [33] and Michael [34], that mentoring has a significant effect on pre-service as well as beginning teachers' attitude. For instance, Micheal [34] found that participation in mentoring and support course experiences can change attitudes and beliefs, develop personal professional skills and cause changes in work relations. The significant difference in this study could be attributed to the opportunity given to the pre service chemistry teachers to interact with experienced chemistry teachers. It does seem that mentoring can be a reliable tool for attitudinal change in teacher education. On the one hand those who are disillusioned could be encouraged from the excitement of the experienced teacher interacting with them. And on the other hand, constant visitation and discussion with the experienced teacher could have given the impression that the profession (of teaching) was such an important one that requires careful handling to pre-service teachers and these are indicators of positive excitement. The control group that did not experience a close attention of the experienced teachers though supervised as at when due for official scoring as an examined course, do not have events to stimulate them towards attitudinal change, hence the difference in attitude identified in this study.

It is revealed in this study that the male students had a higher gain score on the attitude scale (PCTAS) than the females. The difference was however not significant;  $F_{1, 35}= 0.11$ ,  $P>0, 05$ . This implies that TMP is similarly favourable to both sexes. This finding support earlier report in literature about the contribution of mentoring to mentees' attitude and dispositions [35,36,22,37,34]. Although most of the literature did not consider gender difference in attitudinal change upon exposure to mentoring, the result shows that mentoring has equal effects on both groups (male-female).

The reasons for the no significant difference in the attitude mean score of both male and female pre-service chemistry teachers exposed to mentoring could be discerned from the fact that mentoring as a treatment was well structured. It was done using a structured Teacher Mentoring Guide (TMG) and that the mentoring process was neither discriminating nor constituting a distinctive gender trait in the manner of implementing the treatment. By implication, if a method is stimulating and exciting without some forms of stereotyping, the likelihood of male and female respondents having same view, attitude, and disposition could be high. Irrespective of the sex of who mentors who, there is a strong indication that a well structured mentoring programme is not gender discriminative.

It was equally found that the post-test mean attitude scores of pre-service teachers of 22 years and above age group is a bit higher than that of the 18-21 years and it was further

found that the difference is not statistically significant:  $F_{1, 35}=1.29$ ,  $p>0.05$ . Since mentoring has been found to be effective in bringing about attitudinal change in beginning and pre-service teachers [36,19,34], the finding that there is no significant difference in the attitude mean score of pre service chemistry teachers due to age was not surprising. This finding however, disagrees with that of White beck [38]. White beck found that age may affect pre-service teachers teaching processes as well as their levels of more positively directed attitude towards the teaching profession. The reason for the difference between the present study and that of White beck may be because the present study employed a structured mentoring guide that was used to mentor the pre-service chemistry teachers. The result obtained in this study was expected because the TMG used has a clear and consistent focus on mentoring, particularly, in the area of establishing good attitudinal change. The mentors were trained and motivated enough to help the mentees to appreciate the teaching profession. One of the focus of the mentoring provided was on fostering in the pre-service teachers the disposition and abilities necessary to teach chemistry effectively and to appreciate the teaching profession. Another reason why the result obtained in this study was quite expected is because there was regular formal and informal meeting between the mentor and mentees. Since the two age groups in the study were all at the formal level of operation or reasoning, and the mentoring provided did not discriminate against any age group, the parity in the result was not surprising.

Globally the findings in this study align with the earlier findings of Gold [39] in New York City, Cheng and Brown [32] in Toronto as well as Leon-Carrillo [40] in Philippines. Aside the fact that a trend seems to emerge; studies on mentoring is gradually shifting from general to subject specifics and currently beyond integrated science to subjects like chemistry. The dimension of using mentoring as an intervention strategy to develop positive attitude in pre-service teachers especially in chemistry towards teaching is relatively new and attention seeking. Though focus in this study is Nigeria Certificate in Education (NCE), a qualification that is equivalent of A level knowledge with techniques of teaching integrated, teaching science/chemistry effectively to further improve on students' performance could be a possibility subsequently via organized mentoring to bring about attitudinal change.

## **7. CONCLUSION AND IMPLICATIONS OF THE FINDINGS**

The findings from this study have shown that mentoring has a positive effect on pre-service chemistry teachers' attitude to the teaching profession irrespective of age and gender. It is also found in this study that pre-service teachers that were not mentored by serving teachers were not positively disposed to teaching profession. These findings of the study seem to have some teaching and curricular implications.

The implication of these findings on the production of professional chemistry teachers is that all professional steps required in the making of the teacher, including having an experienced chemistry teacher on ground to oversee their activities and on one-to-one basis where possible while on teaching practice are needed to enhance acquisition of positive attitude to teaching. This was expressed by Cutler [41] and Lepi [42] that new teachers need someone they can confide in and run to when in confusion. The purpose of teaching practice in the teacher education curriculum is to mould the pre-service teacher to be the type of teacher that the nation desires him/her to be. Where such exercise is not able to effectively mould the pre-service teacher in terms of his/her attitudinal disposition to teaching as a profession, then the essence of the teaching practice exercise may appear defeated. This situation is regrettable. As was the case in this study, most of the schools have no serving teachers. The pre-service teachers were therefore used as a replacement for experienced teachers or

mentors in such classes and could therefore not give the desired professional expertise that is clamored for.

## **8. RECOMMENDATION**

Based on the findings of the study the following recommendations were advanced:

1. There should be an increased effort geared towards improving the attitude of pre-service chemistry teachers. This can be done by deliberately mentoring the teachers while in the teacher training institution or during teaching practice as the case may be. This will help them to appreciate the teaching profession.
2. Since the mentored pre-service chemistry teachers were found to have experienced an attitudinal change, such changes could be because of the nature of TMG used in the study. There is therefore a need for teacher training institutions to develop a standard mentoring guide for serving chemistry teachers that could be used to mentor the teachers that are sent to their schools on teaching practice. This is because without such a guide the serving teachers may not know where and how to look for help.
3. There is need for an orientation to be given to serving chemistry teachers by teacher training institutions using a structured guide such as the TMG used in the present study on the roles they are expected to play when student teachers are sent to them on teaching practice. This will help the serving teachers to appreciate their chosen career.
4. Pre-service chemistry teachers should not be sent for teaching practice to schools where there are no serving teachers in their subject area. This is because the pre-service teacher definitely needs someone to put him/her through if she/he must develop the correct attitude to teaching and do the teaching effectively also. The presence of an experienced teacher could be used to advantage in this regard.
5. Teacher education curriculum planners could also bring in mentoring as a major component of the curriculum as is obtained in other fields such as medicine, pharmacy and law. This will not only give it recognition but becoming mandatory for teacher training institutions.

## **COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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