Indonesian Journal of Teaching in Science

IJOTIS

Journal homepage: http://ejournal.upi.edu/index.php/ IJOTIS/

Cultivating the Pedagogical Competence of Pre-Service Science Teachers through Microteaching

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ABSTRACT

The article investigated microteaching's effects on pre-service chemistry teachers' preparation for teaching practice at the Federal College of Education, Zaria. A sample of 80 pre-service teachers was selected randomly using the balloting method into the experimental and control groups from a population of 400 students. The experimental group was trained for six weeks using the microteaching modules for the teacher training program, while the control group did not undergo the training. The Microteaching Evaluation Template (MET) with a reliability coefficient of 0.65 was employed as the instrument for data collection. Data was analyzed using mean, standard deviation, and t-test at p≤ 0.05. The finding from the study revealed that pre-service teachers exposed to microteaching modules performed better in teaching practice than the control group. Furthermore, the study discovered that microteaching benefited both male and female pre-service teachers. The study recommends that microteaching be adopted as a vital instructional tool to enhance the delivery of pre-service teachers.

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ARTICLE INFO

Article History:
Submitted/Received 15 Sep 2024
First Revised 19 Oct 2024
Accepted 28 Dec 2024
First Available online 29 Dec 2024
Publication Date 01 Mar 2025

Keyword:
Microteaching,
Microteaching,
Pre-service teachers.

1. INTRODUCTION

Education plays a negligible role in the advancement of any society, with educators occupying a minor position within this framework. The National Guideline on Education in 2013 of the Federal Republic of Nigeria declares that education will remain a top priority in national planning and development, as the quality of a country's education system depends on its teachers. Teaching highlights the importance of the teacher training program within the broader teacher education program. One of the objectives of training pre-service teachers is to cultivate experienced educators who can effectively deliver classroom instructions (Kalande, 2006). Over the years, educators and scholars (Ralph, 2014), have diligently searched for best practices that adequately prepare trainees to become competent classroom practitioners. However, there is presently a shortage of literature on how teacher education impacts classroom practices (Alhassan, 2012). Microteaching, as an individualized and effective method, can be employed to train teachers under supervision (Benton-Kupper, 2001). Microteaching holds potential for both pre-service and in-service teacher training, enabling teachers to enhance their skills (Igwe, 2013). Similarly, microteaching is a deliberately organized simulated social skill development stage that offers valuable feedback to teachers regarding their behaviors (Syed and Zaid, 2005). Perceive microteaching as a clinical teaching program that allows teachers to gain real-life classroom experience in a monitored environment (Utami & Nafi'ah, 2016).

As a crucial area of formal teacher training programs for pre-service and in-service teachers, microteaching has specific objectives. The primary aim is to develop confidence and promote the logical presentation of lesson delivery during teaching by practicing and mastering various teaching skills within smaller groups of students (Roush, 2008). Furthermore, microteaching provides an ideal environment for practice-based teaching, which instills self-evaluative skills in teacher-trainees (Arsal, 2015). This aspect of teacher education is vital because it allows trainees to acquire the qualities of effective teaching and avoid common mistakes. It also equips the teacher trainee with adequate mastery skills and techniques of good teaching. During microteaching (Roush, 2008), pre-service teachers get ample opportunities to create skills in drawing learners' attention, asking questions, using and managing time efficiently, and bringing the lesson to a conclusion. Moreover, some researchers (Sen, 2010) perceived microteaching to improve class management skills, provide abilities to select appropriate learner activities, use teaching goals, and overcome any difficulties encountered during the process. While learners are learning, teacher candidates individuals can enhance their abilities in the provision of feedback measurement and assessment (Allen, 1967). In addition, through the observation of their colleagues' presentations, they are allowed to assess various instructional approaches (Abdurrahman, 2010).

Teacher trainees can adequately benefit from microteaching in developing essential skills such as writing lesson plans, identifying teaching goals, stage presentations, applying evaluation techniques, and asking questions (Wang & Wang, 2023). Through this process, teacher trainees gain self-confidence in a supportive environment and are provided with ample opportunities to learn multiple skills in a short amount of time. Microteaching experience is beneficial in achieving teaching goals by planning model lessons and learning the importance of preparation, organization, and presentation in promoting students' learning (Asregid *et al*., 2023). It is crucial to select activities that are logical and in the right step to improve content delivery and immediate feedback helps to determine productivity and teaching strategies. Some researchers Lee *et al*. (2023) adequate questioning skills

DOI: http://dx.doi.org/10. 17509/xxxx.xxxx
p- ISSN 2776-6101 e- ISSN 2776-6152

promote a strong learning environment which is one of the beneficial features of microteaching. It creates an atmosphere that encourages different thinking and interaction, making it possible for learners to ask questions at different difficulty levels.

Some researchers (Sagdic & Sahin, 2023) highlighted the stages of microteaching, including pre-observation, note-taking during observation, analysis of strategies, reviewing the tape, and self-evaluation by the teacher candidate.

As a highly individualized type of teacher training technique, microteaching has been shown to effectively modify the behaviors of teachers under training (see **Figure 1**). The steps in microteaching involve a cycle of teaching, criticizing, re-planning, re-teaching, and re-criticizing.

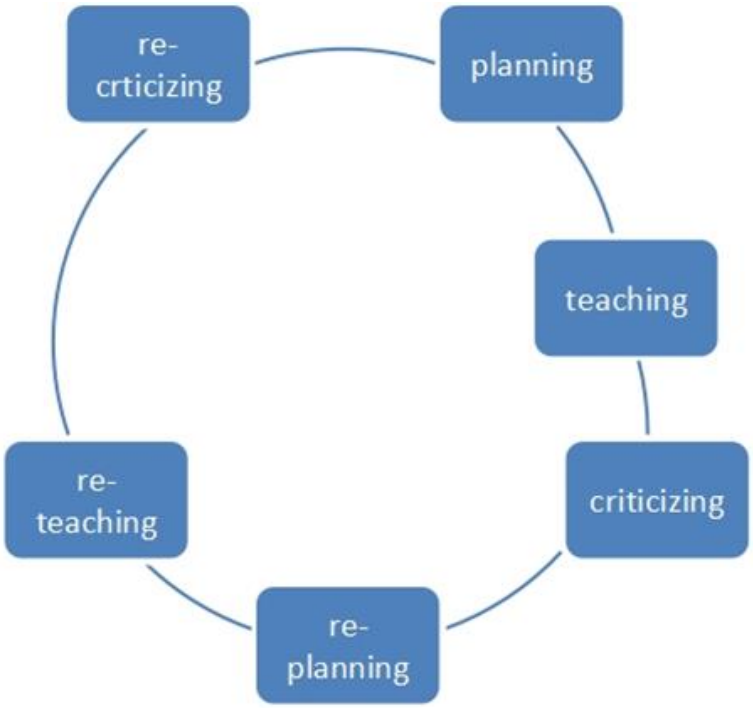

Figure 1. Structure.

During the instructional period, candidates engage in the development of lesson plans featuring predetermined content, as well as the delivery of micro-lessons to actual students (Utami & Nafi'ah, 2016). These micro-lessons are carefully planned and prepared in advance. The proceedings are documented through the use of videotapes or portable receivers, which are subsequently viewed by pre-service teachers after the lecture. Critical evaluation of the micro-lessons takes place during the assessment phase (Sagdic & Sahin, 2023). This stage involves the review, discussion, analysis, and assessment of the micro-lessons by both the guide teacher and peers. Pre-service teachers receive destructive praise and recommendations, which they subsequently fail to utilize to revise their lesson plans. Following this revision, they re-teach the micro-lessons to the same group of students, while utilizing the identical procedure for documenting the second set of micro-lessons. Alongside the guide teacher and peers, present their critiques, drawing comparisons between the strengths and weaknesses exhibited in the first and second micro-lessons. This iterative process enables pre-service teachers to evaluate their areas of strength and weakness and make improvements accordingly.

Teacher training programs in universities have been known to fall short in explicitly connecting theory and practice, which often results in pre-service teachers feeling ill-

DOI: http://dx.doi.org/10.17509/xxxx.xxxx
p- ISSN 2776-6101 e- ISSN 2776-6152

prepared for field experience. This lack of preparation can cause them to feel less confident in their teaching abilities. To tackle this concern, the present investigation examines the effective practices executed by student teachers during their teaching practice and assesses their pedagogical skills and knowledge through microteaching sessions. Teacher efficacy pertains to an individual's capacity to achieve desired outcomes in teaching. Teachers with a high sense of efficacy were unlikely to persist in their teaching profession due to their belief that the success of their students was a direct outcome of their personal efforts and teaching ability (Ghaith & Shaaban, 1999). Teachers possessing a strong sense of efficacy (Tschannen-Moran & Woolfolk, 2001) devote more energy to meeting the learning needs of their students, demonstrate greater enthusiasm for teaching, and set higher benchmarks for both them and their students.

The objectives of the study were to:

(i) Examine the extent to which microteaching has influenced lesson presentation.
(ii) Examine the extent to which microteaching has influenced lesson evaluation.
(iii) Determine the effect of microteaching on gender performance during instructional delivery.
(iv) Determine the extent to which microteaching has influenced teaching techniques.

To provide a proper guide to the research work, the following research questions were answered:

(i) What is the difference in the mean performance of pre-service teachers exposed to microteaching and those that were not during lesson presentation?
(ii) What is the difference in the mean performance of pre-service teachers exposed to microteaching and those who were not during lesson evaluation?
(iii) What is the difference in the mean performance between male and female pre-service teachers exposed to microteaching during instructional delivery?

The following hypotheses were formulated for the study:

(i) H01: There is no significant difference in the mean performance of pre-service teachers exposed to microteaching and those not during lesson presentations.
(ii) H02: There is no significant difference in the mean performance of pre-service teachers exposed to microteaching and those not during lesson evaluation.
(iii) H03: A significant difference does not exist in the mean performance of male and female pre-service teachers exposed to microteaching during instructional delivery.

Education is vital for the development of society, and teachers play a crucial role in the educational system. This research is an essential resource for both teacher trainees and educators' education fields. More so, it will allow them to evaluate how adequate the teacher education curriculum is in shaping the knowledge base, instructional strategies, and overall competencies of pre-service teachers for delivering classroom instruction. Moreover, the research findings will be a valuable tool for professional organizations, such as the Science Teachers Association (NUT), regulatory bodies like the Teachers Registration Council of Nigeria (TRCN), and government entities, including the Ministry of Education. They can use this research to assess and maintain the standards of teacher qualifications in the field.

2. METHODS

This article investigated the effects of microteaching on pre-service chemistry teachers at the Federal College of Education in Zaria, Kaduna State. The sample was made up of 400 pre-service teachers enrolled in their first and second years of the teacher training program. The researcher selected first and second-year students because microteaching is only introduced

DOI: http://dx.doi.org/10. 17509/xxxx.xxxx
p- ISSN 2776-6101 e- ISSN 2776-6152

in the second year of the program and first-year students have not yet been exposed to microteaching practice.

The study employed a quasi-experimental research design of experimental and control groups. The two groups were pretested to ensure that their performance in microteaching was similar. The experimental group was exposed to microteaching for six weeks, whereas the control group did not participate. The research design is presented in the following.

(i) EG -> O_1 -> X_1 -> O_2

(ii) CG -> O_1 -> X_0 -> O_2

where EG is the Experimental group; CG is the Control group; X_1 is the Treatment using Microteaching; X_0 is the No treatment; O_1 is the Pre-test; and O_2 is the Post-test

This study consisted of 400 pre-service teachers who were training to become chemistry teachers (see **Table 1**). They were in their first and second year of a teacher training program and were enrolled in the Federal College of Education Zaria, Kaduna State. The participants were studying chemistry biology, chemistry physics, and chemistry integrated service.

Table 1. Population of Pre-service Teachers.

S/N	Course Combination	Level	Male	Female	Total
1.	Chemistry/Physics	1	30	20	50
2.	Chemistry/Biology	1	15	35	50
3.	Chemistry/Inte.Sci.	1	20	5	25
4.	Chemistry/Physics	2	50	30	80
5.	Chemistry/Biology	2	100	60	160
6.	Chemistry/Inte.Sci.	2	15	20	35

This study involved a group of 80 pre-service chemistry teachers from the Federal College of Education Zaria. The sample size was chosen by the central limit theory, which recommends a minimum of 30 samples. The participants were randomly chosen from various chemistry combinations by the balloting method.

The instrument research used in this study was the Microteaching Evaluation Test (MET), which consisted of four sections: A, B, C, and D. Section A focused on lesson introduction, while Section B dealt with lesson presentation. Section C focused on lesson evaluation, and Section D concerned the summary of the lesson presentation.

The assessment tool used was the Microteaching Evaluation Test (MET). To validate the instrument, three experts with qualification of a PhD, and are senior lecturers in the science education department at Federal College of Education Zaria were provided with copies of the instrument to review. This was carried out to ensure the instrument's validity.

To determine the reliability of the instrument (MET), test-retest reliability was employed, and field tests were conducted with 30 pre-service teachers from the Federal College of Education who did not participate in the study. The Pearson product-moment correlation was used to establish the reliability and a reliability coefficient of r = 0.65 was obtained.

To address the research inquiries, the investigation analyzed and evaluated three null suppositions. An adjusted significance level of 0.05 was utilized to ascertain whether to concede or dismiss the null supposition. Preceding the intervention, an initial appraisal was executed to measure the competence levels of the two cohorts. The computed t-test revealed that the students in both cohorts possessed comparable abilities before undergoing the intervention.

DOI: http://dx.doi.org/10.17509/xxxx.xxxx
p- ISSN 2776-6101 e- ISSN 2776-6152

3. RESULTS AND DISCUSSION

3.1. Research Question 1: What is the difference in the average performance of pre-service teachers exposed to microteaching and those who were not during lesson presentations?

In **Table 2**, pre-service teachers who were exposed to microteaching during lesson presentation (Experimental group) had an average score of 58.0, with a standard deviation of 3.80. On the other hand, those who did not undergo microteaching training scored an average of 32.00, with a standard deviation of 4.6. The outcome of the study indicated that pre-service teachers who were engaged in microteaching training performed better during lesson presentations than those who did not.

Table 2. Descriptive Statistics for Lesson Presentation.

S	N	X	SD	Mean Diff
Experimental group	41	58.00	3.80	
Control group	39	32.00	4.60	26.00

3.2. Research Question 2: What is the difference in the average performance of pre-service teachers exposed to microteaching and those who were not during lesson evaluation?

From the information presented in **Table 3**, the average score for the participants in the experiment group was 54.70, while the control group had an average score of 22.90 on the lesson evaluation test. Based on these results, it was concluded that the experimental group showed better performance in evaluating their lessons during microteaching. This indicated that there was a significant difference in the overall performance of pre-service teachers exposed to microteaching and those who were not during lesson evaluation.

Table 3. Descriptive statistics for Lesson Evaluation.

S	N	X	SD	Mean Diff
Experimental group	41	54.70	5.90	
Control group	39	22.90	6.30	31.80

3.3. Research Question 3: What is the difference in the average performance between male and female pre-service teachers exposed to microteaching during instructional delivery?

During the presentation of microteaching lessons, male and female pre-service teachers engaged in microteaching, had a mean score of 50.90 and 49.00 respectively with a mean difference of difference of 1.40. in favor of male pre-service teachers. However, this difference was subjected to a test of hypothesis to see if it was significant.

Table 4. Descriptive Statistics for Male and Female Pre-service Teachers Exposed to Microteaching.

Group	N	X	SD	Mean Diff
Male	25	50.90	5.160	
Female	15	49.50	7.450	1.40

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3.4. Research Hypothesis 1: H01: There is no significant difference in the mean performance of pre-service teachers exposed to microteaching and those not during lesson presentations.

From **Table 5**, the calculated P value is less than P = 0.05, the level of significance, at df 78. The calculated mean performance in microteaching lesson presentation was 58.0 and 32.0 for experimental and control groups respectively. Therefore, there is a significant difference. The null hypothesis of no significant difference is rejected.

Table 5. t-test Analysis for lesson Presentation.

Group	N	X	SD	Df	Tcal	tri	P	Remark
EG	41	58.00	3.80	78	3.5	1.67	0.001	Significant
CG	39	32.00	4.60					

Note: Significant at P ≤0.05

3.5. Research Hypothesis 2: $H_{02:}$ There is no significant difference in the mean performance of pre-service teachers exposed to microteaching and those not during lesson evaluation.

Based on the data in **Table 6**, the P value calculated is below the significance level of p≤ 0.05 at df 78. The mean averages for the experimental and control groups were 54.7 and 22.9, respectively, indicating a significant difference. This suggests that pre-service teachers who were exposed to microteaching performed better in lesson evaluation compared to those who were not. As a result, we reject the null hypothesis of no significant difference.

Table 6. t-test Analysis for Lesson Evaluation

Group	N	X	SD	Df	Tcal	tri	P	Remark
EG	41	54.70	5.90	78	4.00	1.67	0.001	**Significant**
CG	39	22.90	6.30					

Note: Significant at P ≤0.05

3.6. Research Hypothesis 3: H03: There is no significant difference in the mean performance of male and female pre-service teachers exposed to microteaching during instructional delivery.

From **Table 7**, the calculated P value of 0.122 is higher than the level of significance of P = 0.05, with a degree of freedom of 38. The mean score for instructional delivery was 50.9 for males and 49.5 for females in the experimental group. This indicates that there is no significant variance in the average performance of male and female pre-service teachers who underwent microteaching.

Table 7. t-test Analysis for Male and Female Pre-service Teachers.

Group	N	X	SD	Df	Tcal	tri	P	Remark
EG	25	50.90	5.16	38	1.26	1.73	0.122	**Not significant**
CG	15	49.50	7.45					

3.7. Discussion

The article aimed to investigate the impact of microteaching on pre-service chemistry teachers' performance in lesson presentation and evaluation. The results showed that pre-

DOI: http://dx.doi.org/10.17509/xxxx.xxxx
p- ISSN 2776-6101 e- ISSN 2776-6152

service teachers exposed to microteaching demonstrated better performance in lesson presentation and evaluation than those who did not undergo the training. The result of this finding was in line with the earlier results of some researchers (Adeleke, 2011; Kalande, 2006), who highlighted the importance of teacher education programs in producing competent teachers. The study also found that there was no significant difference in the average performance of male and female pre-service teachers exposed to microteaching during instructional delivery, which indicated that microteaching is equally effective for both genders.

The outcome of this research supports the national policy on education of the Federal Republic of Nigeria, which prioritizes the quality of the country's education system, as it is dependent on its teachers. Microteaching has been identified as an effective technique for teacher training, allowing teachers to improve their skills and develop competencies necessary for effective teaching. This finding is consistent with the earlier work (Gorge, 2000; Ralph, 2014), which emphasized the need for teacher education programs to prepare trainees to become competent classroom practitioners.

The results of the investigation carry significant ramifications for the professional growth of pre-service educators and the standard of education in Nigeria. The outcomes of the investigation suggest that microteaching is an important tool for improving the instructional abilities of pre-service teachers, which may lead to better results for students. The conclusions of the investigation are in line with the previous research (Tschannen-Moran & Woolfolk, 2001) on teacher effectiveness, suggesting that prospective teachers who participate in microteaching are unlikely to demonstrate increased enthusiasm for teaching and establish higher goals for themselves and their students. Consequently, it is recommended that microteaching be integrated into the curriculum for teacher education to adequately prepare pre-service teachers.

4. CONCLUSION

Microteaching is an effective technique for teacher training, improving pre-service teachers' instructional skills and competencies. The study's results align with earlier research on teacher education, emphasizing the importance of preparing trainees to become competent classroom practitioners. Therefore, microteaching should be incorporated into the teacher education curriculum to improve the quality of education in Nigeria and produce effective teachers who can excel in the classroom. Based on the findings, the following recommendations were made:

(i) Pre-service teachers' instructional delivery can be enhanced by emphasizing lesson presentation steps.

(ii) The College of Education administrators should take steps to ensure the provision of instructional materials and create a conducive environment for the effective implementation of microteaching courses.

5. ACKNOWLEDGMENT

We would like to express our sincere gratitude to the management of the Federal College of Education Zaria for their support and assistance in making sure that the data collection became a success. The data supporting this study's findings are available at the request of the corresponding author. The authors have no form of conflict of interest.

6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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DOI: http://dx.doi.org/10.17509/xxxx.xxxx
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DOI: http://dx.doi.org/10. 17509/xxxx.xxxx
p- ISSN 2776-6101 e- ISSN 2776-6152