Review of: "Effects of Teachers' Professional Development on Students' Academic Achievement"

Yüksel Savucu[1]

1 Firat (Euphrates) University

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Effects of Teachers' Professional Development on Students' Academic Achievement

Olubunmi Kayode Ayanwoye[1]

Author(s) details

Declarations

Abstract

Learning outcomes in African and Caribbean countries do not seem to be improving in recent years, and stakeholders in the educational sectors have adopted a number of policies yet without significant impact. Teacher professional development programmes were recommended but without any kind of serious evaluation. This study, therefore, evaluated the effects of teacher cluster meeting workshops organised by the Nigerian government on students' achievement.

The theory of continuous improvement guided the study, and an ex-post facto type of pretest-posttest, control group, and quasi-experimental design was employed to test the hypotheses generated using schools that participated in the workshop and agreed to participate in the study. Students' achievement scores before and after the workshop attendance were used as instruments. Data were analysed using descriptive and inferential statistics to test the hypotheses at a 0.05 level of significance.

The study revealed significant differences in the experimental students' pretest and posttest ($t_{(1,1476)=}$-161.79); control students' pretest and posttest ($t_{(1,1417)=}$-12.79); treatment and control groups posttests ($t_{(1,2884)=}$156.62); experimental group pretest and control group posttest ($t_{(1,2884)=}$-12.79) and control group pretest and experimental group posttest ($t_{(1,2884)=}$-158.96).

Implications to teaching and learning to improve Students' achievement were discussed, and the provision of periodic teacher professional development programmes was recommended.

Olubunmi Kayode, AYANWOYE (Ph. D.)
Department of Science Education,
Faculty of Education,
Federal University Oye-Ekiti, Oye-Ekiti, Nigeria.
olubunmi.ayanwoye@fuoye.edu.ng; ayanwoyekayode@yahoo.com
08067126715

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Teaching and learning in Africa and the Caribbean have improved drastically in recent years as the percentage of pupils completing elementary schools across countries has risen (World Bank, 2020). At the same time, studies (Bold et al., 2017; Patrinos and Angrist, 2018) have revealed that the quality of education in Africa and the Caribbean is also suffering because less than half of primary school students in Sub-Saharan Africa are proficient in performing accurate mathematical computations and this is placing these nations in the lower half of the learning spectrum. Additionally, Angrist et al. (2019), Filmer et al. (2020) and Le Nestour and Sandefur (2020) reported that a combined measure of schooling quantity and quality in terms of mathematical manipulations indicate that learning outcomes in more African countries do not seem to be improving in recent years.

According to Malik and Salman (2018), despite the high value placed on learning in Nigeria and the government's efforts, students' achievements in both external and internal examinations have consistently remained low. This is peculiar to other schools in Africa and the Caribbean, and the international community has referred to this situation as a learning crisis (World Bank, 2018).

Prior attempts to address this led stakeholders in the African and Caribbean educational sectors to adopt a number of policies, such as the use of the mother tongue in the classroom (Evans & Acosta, 2020), as seen in Nigeria (Federal Republic of Nigeria, 2013), Cameroon (Laitin et al., 2019), Kenya (Piper et al., 2018), and Uganda (Brunette et al., 2019; Kerwin and Thornton, 2020). School feeding programmes in Ghana (Aurino et al., 2019); Senegal (Azomahou et al., 2019); Rwanda (Mensah and Nsabimana, 2020); Burkina Faso (Nikiema, 2019); Burundi (Parker et al., 2015) and Kenya (Hulett et al., 2014). Buildings of more schools in Burkina Faso (Ingwersen et al., 2019; Kazianga et al., 2019); Niger (Bagby et al., 2016); Benin (Deschênes and Hotte, 2019) and Zambia (Ashraf et al., 2020). Students' academic performance remains a cause for concern despite these policies.

Recent evidence on high absenteeism rates and inadequate levels of pedagogical and subject knowledge suggests that better teacher policies may be helpful to improve educational outcomes because teachers play such a crucial role in students' education (Bold et al., 2017; Chelwa et al., 2019; Mbiti et al., 2019; Mbiti & Schipper, 2020; Zeitlin, 2020). This led Karamanos (2020) to emphasise that while there may be a number of different ways to improve the quality of teaching for improved mathematical achievement in developing countries, policymakers in developing countries must place great stock in teacher professional development programs as these seek to improve learning.

Though earlier reviews of pedagogical interventions showed encouraging evidence (Conn, 2017), the vast majority of teacher professional development programmes in Africa and the Caribbean, according to Evans and Acosta (2020), go without any kind of serious evaluation (Duflo et al., 2020; Popova et al., 2018).

The importance of maintaining teachers' pedagogical and subject-matter knowledge, however, cannot be overstated. Chuku (2018) suggested that teachers be given opportunities to come together, participate in professional development, collaborate, analyse the common core standards, break them down, and discuss across grade levels—elementary, middle, and high school—how their common core works and how it breaks down to deeper learning as knowledge is not static and does not solely rest on an individual. While supporting this, Ladele (2018) argued that teachers should pursue ongoing professional development to become aware of best practices that could improve students' performance.

The study was based on the theory of continuous improvement of Masaaki Imai (Imai, 1989).

The theory's foundation is a four-step model:

- Plan: Recognise an opportunity and make a change plan.
- Do: Put the change into practice on a small scale.
- Check: Evaluate the impact of the change by using data to analyse the outcomes of the change.
- Take action: If the change was successful, put it into practice on a larger scale while continuing to monitor your outcomes. Restart the cycle if the change did not work.

It is crucial to realise that trained teachers have received training in pedagogy, classroom management, and teaching techniques. However, outside of longer-term professional development, updating teachers' content and pedagogical knowledge is inevitable. One of the most common excuses teachers give for performing below expectations is a lack of on-the-job training and retraining.

It follows that raising the standard of the teaching workforce is equivalent to raising students' outcomes since researchers have identified improving teacher quality as a successful strategy for raising student achievement (Darling-Hammond, 2002; Greenberg, Rhodes, Ye, & Stancavage, 2004). Donkoh (2017) asserts that even after teacher candidates graduate, their education is still ongoing. They should go to seminars, workshops, and conferences after graduation to stay up to date on the latest information. For this reason, governments in Africa and the Caribbean collaborate with local, national, and international non-governmental organisations to provide basic school teachers with in-service training. These give them the chance and exposure to brush up on the material they learned during their initial teacher training as well as discover cutting-edge teaching techniques.

Professional development programmes, according to Mahmoudi and Yonca Özkan (2015), appear to be one of the ways to preserve a high standard of teaching and retain high-quality teaching staff, as the teacher is the centre of classroom instruction.

Teachers should constantly learn new things, improve their professionalism, and use more effective teaching methods, according to Huang and Shih (2017). The study by Yoon, Duncan, Lee, Scar loss and Shapley (2007), which found that students' academic achievement increased by 0.54 standard deviations when their teachers participated in professional development programmes compared to students whose teachers did not participate in such programmes, is evidence of this. Additionally, there are not many opportunities for teachers in African and Caribbean primary schools, particularly those in remote areas, to take part in in-service education.

The Nigerian government has recently made significant investments in teacher professional development programmes by organising teacher cluster meetings and workshops through the Universal Basic Education Commission (UBEC) and State Universal Basic Education Board (SUBEB) for science-based teachers in primary schools, especially Mathematics and English teachers. The Ministry of Education mandated that the training material should put an emphasis on teaching ethics, subject-specific knowledge, and pedagogical practices in order to enhance teachers' professional development, with the ultimate goal of improving the professional efficacy of teachers in both rural and urban areas throughout all of Nigeria's states.

Although there is a strong correlation between teachers' professional development and students' academic achievement, as was discussed above, Jacob and Lefgren (2004) found no statistically or academically significant effect on either reading or mathematics achievement when in-service professional development had been increased. These findings remained the same when they took student ability, gender, and racial subgroups into account. Similar findings were made by Harris and Sass (2011) when they discovered that primary teachers' productivity was unaffected by past professional development, whereas middle and high school mathematics teachers' productivity was positively impacted. Furthermore, Adeniran, Ishaku and Akanni (2020) noted that neither of the three studies conducted showed a positive effect on student achievement at the end of the year that the professional development was implemented, as measured by accountability tests or tests created specifically for the studies, indicating that improving teachers' knowledge or practice did not translate into improvements in student achievement. The majority of the measured components of instructors' knowledge and practice, according to the studies, were not linked to student progress.

In a different Ghanaian study, teaching teachers how to deliver targeted instruction raised students' results on a test that integrated Mathematics and English (Beg et al., 2020). Additional instruction for school administrators and inspectors had no further effect. The government of South Africa compared in-class coaching to traditional, centralised teacher training, finding that coaching had an impact that was more than twice as great (Cilliers et al., 2019). Only pupils with teachers who benefited from coaching in the following batch of students exhibit learning benefits, and even those are only half as significant as the effects in the first cohort (Cilliers et al., 2020). Improved teacher performance and child literacy were the results of a teacher training programme that included partially scripted lesson plans and weekly text message support for teachers (Jukes et al., 2017). Children's preparation for school in Ghana increased marginally as a result of teacher training for preschool instructors (Wolf et al., 2019). Early childhood education centres in Kenya saw improved learning because of a comprehensive programme that included teacher mentoring, training, and instructional materials (Donfouet et al., 2018). While a teacher training program in Rwanda (Blimpo & Pugatch, 2020) created to support a new entrepreneurship curriculum in secondary schools did not raise student test scores, teacher training in Malawi only improved outcomes in informal preschools when accompanied by parent training (Özler et al., 2018).

Due to these conflicting emotions, it is necessary to clarify the situation in order to equip basic education with the skills and knowledge necessary to comprehend and participate in modern society and promote overall national development.

Statement of the Problem

The Nigerian government and other developing nations recently heavily invested in teacher professional development programmes as measures to improve students' achievement, but there is only limited evidence of whether these programmes are effective or not. Recognising the role that mathematics plays in a nation's scientific and technological advancement, as well as students' persistent failure in the subject at both the basic and secondary educational levels, the Nigerian government and other developing countries invested in these programs. The Nigerian government has, at best, only gotten subjective feedback from the program trainers and teachers who have received training.

Few studies have shown a causal connection between the evaluated programmes and student outcomes, despite the fact that researchers have compared various professional development programmes, investigated the potential of new teaching technologies, and assessed teacher learning and other outcomes within these programmes using more quantitative approaches. Particularly, there have not been many thorough, extensive analyses of the effects of teacher professional development initiatives on pupil achievement in developing nations. Therefore, the purpose of this study was to

evaluate the effects of teacher cluster meeting workshops that the Nigerian government had organised through UBEC and SUBEB in recent years on students' mathematical achievement.

Hypotheses

- **$H_0$1:** There is no significant difference in the pretest scores of the treatment and control groups.
- **$H_0$2:** There is no significant difference in the pretest and posttest scores of the experimental group.
- **$H_0$3:** There is no significant difference in the pretest and posttest scores of the control group.
- **$H_0$4:** There is no significant difference in the posttest scores of the treatment and control groups.
- **$H_0$5:** There is no significant difference in the pretest scores of the experimental group and the posttest scores of the control group.
- **$H_0$6:** There is no significant difference in the pretest scores of the control group and the posttest scores of the experimental group.

Research Design

This study adopted a pretest-posttest, control group, quasi-experimental design of ex-post facto type. The schematic diagram for the design is presented below:

O1O3X1X2O2O4…… Experimental group Control O1X1O2…… Experimental group O3X2O4…… Control

Where;

- O_1 and O_3 are the pre-mathematical achievement scores for the Experimental and control groups, respectively.
- O_2 and O_4 are the post-mathematical achievement scores for the Experimental and control groups, respectively.
- X_1 is for the Experimental Treatment;
- X_2 is for the Control Treatment.

Sample and Sampling Technique

The sample consisted of students of the teachers who participated in the series of teacher cluster meeting workshops organised by the Nigerian government in recent years through UBEC and SUBEB and who agreed to participate in the study as the Experimental group and the students of the teachers who did not participate in the workshop as the Control group, the two groups must be from the same school. To select the experimental sample for the evaluation, the researcher first secured access to the list of all teachers who participated in the workshop in Oyo State. It should be noted that the researcher was not involved in choosing the teachers who participated in the workshop. The next step of the sampling process was to choose the actual experimental students from the overall list of trainees. In order to select a sample representative of the majority of schools in Oyo state, a purposive sampling technique was used to select students of the teachers who have been teaching Mathematics in the same class before and after the workshop. If a teacher in the sample taught Mathematics in more than one class, random selection was used to select one class for inclusion in the study. If a teacher taught more than one Mathematics class in the same level, all classes in that level were included in the sample.

The next step of the sampling procedure was to select teachers who did not participate in the workshop to serve as the control group. The researcher called each treatment school to ask whether there were other Mathematics teachers teaching the same class as the treatment teacher. If there was more than one other teacher, one was randomly selected as the control teacher. (If there was only one, that teacher was the control). If there was not another Mathematics teacher in that class, then the researcher did not select that school for the study. In total, there were 38 pairs of treatment and control groups with a total of 2886 students (1468 and 1418 students in the experimental and control groups, respectively).

Instrumentation and Method of Data Collection

The first set of instruments as pretest scores was the achievement scores of students before the workshop attendance, while students' achievement scores after the workshop attendance served as the posttest scores. The researcher collected the students' achievement scores at the end of the session that proceeded the term of the workshop attendance (pretest scores) and that of the immediate session after the workshop attendance (posttest). It is believed that whatever findings that come out of this study can be generalised as implying a reflection of the role of teacher professional development programmes as measures to improve students' achievement.

Data Analysis

To be able to make meaningful deductions, the data obtained were statistically analysed using descriptive statistics of mean and standard deviation and inferential statistics of t-test to test the hypotheses at 0.05 level of significance.

Testing the Null Hypotheses

- **$H_0$1:** There is no significant difference in the pretest scores of the treatment and control groups.

	N	Mean	Std. Dev.	t	df	Sig.	Decision
Experimental Group	1468	24.74	0.97				
Control Group	1418	24.74	0.97	0.00	2884	0.98	Accept

Table 1. Descriptive and Inferential Statistics of Students' Pre-Achievement Scores

p > 0.05 (not significant)

The results in Table 1 show that there was no significant difference between the pretest scores of the treatment and control groups ($t_{(1,284)} = 0.00$; p = 0.98 > 0.05). The pretest scores of the treatment and control groups do not differ in terms of mean (24.74) or standard deviation (0.97), either. Since there is no discernible difference in the pretest scores of the treatment and control groups, we accept the null hypothesis.

- **$H_0$2:** There is no significant difference in the pretest and posttest scores of the experimental group.

N	Mean	Std. Dev.	t	df	Sig.	Decision	
Experimental Students' Pre-Achievement Scores	1468	24.74	0.97				Do not
Experimental Students' Post-Achievement Scores	1468	80.86	13.07	-161.79	1467	0.00	Accept

Table 2. Descriptive and Inferential Statistics of Experimental Students' Pre- and Post-Achievement Scores

p < 0.05 (Significant)

The results in Table 2 show there was a significant difference between the experimental students' pre- and post-achievement scores ($t_{(1,1476)} = -161.79$; p = 0.00 < 0.05). The Experimental Students' Pre- and Post-Achievement Scores demonstrate a substantial difference according to the mean (24.74 and 80.86) and standard deviation (0.97 and 13.07) values. As a result, we reject the null hypothesis, which states that there is no discernible difference between the experimental group's pretest and posttest scores.

- **$H_0$3:** There is no significant difference in the pretest and posttest scores of the control group.

	N	Mean	Std. Dev.	t	df	Sig.	Decision
Control Students' Pre-Achievement Scores	1418	24.74	0.97				Do not
Control Students' Post-Achievement Scores	1418	25.59	2.43	-12.79	1417	0.00	Accept

Table 3. Descriptive and Inferential Statistics of Control Students' Pre- and Post-Achievement Scores

p < 0.05 (Significant)

The results in Table 3 show there was a significant difference between the Control Students' Pre- and Post-Achievement Scores ($t_{(1,1417)} = -12.79$; p = 0.00 < 0.05). The Control Students' Pre- and Post-Achievement Scores demonstrate a substantial difference according to the mean (24.74 and 25.59) and standard deviation (0.97 and 2.43) values. As a result, we reject the null hypothesis, which states that there is no discernible difference between the control group's pretest and posttest scores.

- **H_04:** There is no significant difference in the posttest scores of the treatment and control groups.

	N	Mean	Std. Dev.	t	df	Sig.	Decision
Experimental Group	1468	80.86	13.07				Do not
Control Group	1418	25.59	2.43	156.62	2884	0.00	Accept

Table 4. Descriptive and Inferential Statistics of posttest scores of the treatment and control groups

p < 0.05 (Significant)

The results in Table 4 demonstrate a significant difference between the posttest scores of the treatment and control groups ($t_{(1,2884)} = 156.62$; p = 0.00 < 0.05). The posttest results of the treatment and control groups reveal substantial differences in the means (80.86 and 25.59) and standard deviations (13.07 and 2.43), respectively. Since there was a discernible difference between the treatment and control groups' posttest scores, we reject the null hypothesis.

- **H_{05}:** There is no significant difference in the pretest scores of the experimental group and the posttest scores of the control group.

	N	Mean	Std. Dev.	t	df	Sig.	Decision
Experimental Students' Pre-Achievement Scores	1468	24.74	0.97				Do not
Control Students' Post-Achievement Scores	1418	25.59	2.43	-12.79	2884	0.00	Accept

Table 5. Descriptive and Inferential Statistics of pretest scores of the experimental group and posttest scores of the control group

p < 0.05 (Significant)

The results in Table 5 show that there was a significant difference ($t_{(1,2884)} = -12.79$) in the pretest scores of the experimental group and posttest scores of the control group (p = 0.00 < 0.05). However, the mean (24.74 and 25.59) and standard deviation (0.97 and 2.43) values show insignificant differences in the pretest scores of the experimental group and the posttest scores of the control group. Therefore, we do not accept the null hypothesis, which says that there is no significant difference in the pretest scores of the experimental group and the posttest scores of the control group.

- **H_{06}:** There is no significant difference in the pretest scores of the control group and the posttest scores of the experimental group.

	N	Mean	Std. Dev.	t	df	Sig.	Decision
Control Students' Pre-Achievement Scores	1418	24.74	0.97	-158.96	2884	0.00	Do not Accept
Experimental Students' Post-Achievement Scores	1468	80.85	13.08				

Table 6. Descriptive and Inferential Statistics of pretest scores of the control group and posttest scores of the experimental group

p < 0.05 (Significant)

The results in Table 6 show that there was a significant difference ($t_{(1,2884)} =$ -158.96) in the pretest scores of the control group and posttest scores of the experimental group (p = 0.00 < 0.05). The mean (24.74 and 80.85) and standard deviation (0.97 and 13.08) values also show significant differences in the pretest scores of the control group and posttest scores of the experimental group. Therefore, we do not accept the null hypothesis, which says that there is no significant difference in the pretest scores of the control group and the posttest scores of the experimental group.

Discussion of Findings

This study has demonstrated that there was no variation in the students' entry level. This can be a result of the kids receiving early treatment on an equal footing. The outcomes also demonstrated a notable improvement in the pupils taught subsequently by the instructors who took part in the teacher cluster meeting workshop. Additionally, students who were taught by instructors who did not attend the teacher cluster-meeting workshop exhibited somewhat better performance than their counterparts; this may be due to interference and interaction between the two groups. Additionally, the study revealed a significant difference between the post-achievements of the students of the teachers who participated in the teacher cluster-meeting workshop and those of their counterparts who did not participate in the workshop, despite an insignificant difference in the initial performance of the students before a teacher participated in the workshop. The findings also revealed a significant difference between the pretest and posttest scores of the kids whose teachers attended the teacher cluster meeting workshop and those of their peers whose instructors did not attend the workshop. Additionally, this was true for both the posttest results for students whose instructors had attended the workshop as well as the pretest results for students whose teachers had not.

As improving teacher quality has been found to be a successful way to improve student achievement, the results of this study showed that updating teachers' knowledge of pedagogy and subject matter is equivalent to improving students' achievement. This implies that improving the quality of the teaching workforce is equivalent to improving student outcomes.

This revelation corroborates those of Donkoh (2017), Chuku (2018) and Ladele (2018), who asserted that even after teacher candidates graduate, their education is still ongoing, and they should go to seminars, workshops, and conferences to stay up to date on the latest information. This indicates that the training of teachers does not end after teacher trainees have graduated. Likewise, these findings validated that of Yoon, Duncan, Lee, Scar loss and Shapley (2007), whichwho found that students' academic achievement increased when their teachers participated in professional development programmes compared to students whose teachers did not participate in such programmes; Beg et al., (2020) who discovered that teaching teachers how to deliver targeted instruction raised students' results; Cilliers et al., (2019) who revealed that in-class coaching had an impact that was more than twice as great than traditional, centralised teacher training; Cilliers et al., (2020) where it was revealed that only pupils with teachers who benefited from coaching exhibit learning benefits; Jukes et al., (2017) who established the fact that improved teacher performance and child literacy were the results of a teacher periodic professional development trainings and Donfouet et al., (2018) who revealed that early childhood education centers in Kenya saw improved learning because of a comprehensive programme that included teacher mentoring, training, and instructional materials.

The finding of this study is, however, contrary to those of Jacob and Lefgren (2004) and Harris and Sass (2011) who reported no statistically or academically significant effect on either reading or Mathematics achievement when in-service professional development had been increased and Adeniran, Ishaku and Akanni (2020) that noted no positive effect on student achievement at the end of the year that the professional development was

implemented, as improving teachers' knowledge or practice did not translate into improvements in student achievement.

Conclusion

Given that mathematics is a subject that all people must master in order to succeed in school and to survive in daily life, good mathematics teaching and learning in the educational system is essential for any country to experience meaningful development on all fronts. As mathematics is not a static body of knowledge to be learned, effective teaching and learning of mathematics in the school system demands the application of updated knowledge that will bring about active learning.

Recommendation

Among other recommendations, the following ones were made in light of the study's findings:

- In order to raise the academic achievement of every student, teachers should work to comply with state and federal accountability requirements by updating their pedagogical and subject-matter knowledge practices.
- Educators should be given regular opportunities to meet together in the form of workshops, seminars, and conferences, participate in professional development activities, work together, and debate the shared core standards across grade levels.
- The government and other stakeholders in the education sector should spend more money on the professional development of instructors.
- Teachers who have not yet benefited from the programme should attend the subsequent sessions of the workshop.

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