

The Effect of Primary Science Teacher Professional Development on Pupils' Academic Performance

Jamil Mikhail Yahaya¹, Abubakar Ibrahim¹, Nuhu Sani Abdullahi², Shu'aibu Adamu¹, & Salisu Bashir Gwangwazo³

¹ Primary Education Department, School of Early Childhood Care and Primary Education, Federal College of Education (Technical) PMB 060 Gombe, Gombe State Nigeria

² Science Education Department, School of General Studies Education, Federal College of Education (Technical) PMB 060 Gombe, Gombe State Nigeria

³ Vocational and Technical Education Unit, National Commission for Colleges of Education – NCCE – Abuja, Nigeria

DOI: 10.29322/IJSRP.13.04.2023.p13612
<http://dx.doi.org/10.29322/IJSRP.13.04.2023.p13612>

Paper Received Date: 15th February 2023

Paper Acceptance Date: 27th March 2023

Paper Publication Date: 6th April 2023

Abstract- The study investigated the effect of Millennium Development Goals teacher professional development workshop on pupils' academic achievement in primary science in Nigeria. A sample of 3008 pupils' scores drawn from rural, urban and semi urban schools were used and analysed using ANCOVA. Pupils taught by teachers who have attended the series of workshops were considered as experimental group (1504 pupils) otherwise control group (1504 pupils). Three hypotheses were tested and the overall results of the experimental group indicated that there was no significant mean difference between the groups on the post-workshop scores of the pupils' science achievement, $F(2, 1500) = 18.16$, $p = .063$, eta squared = .56, and so the null hypothesis stands upheld. Similarly, for the control group, there was no significant difference on the post workshop scores of the pupils' science achievement, $F(3, 1496) = 29.94$, $p = .259$, eta squared .38. The same results were obtained for the specific groups of the pupils in rural, urban and semi urban areas giving sufficient statistical justification to uphold all the 3 null hypotheses, disfavoured the alternative. The magnitude of the difference in means of the two groups on the overall (Experimental Group $M = 68.18$, $SD 16.85$ and Control Group 68.22 , $SD 16.985$) is very weak, indicating that the workshop attendance of the primary science teachers has no any significance effect on the achievement of the pupils in their science subject irrespective of their background. Some of the limitations of the study among others are that attention was not paid to gender and teacher qualifications despite their significant roles in pupils' achievement. Hence it is recommended among others, too, that interested researchers can explore from that area.

Index Terms- Academic Achievement, Primary Science, MDGs Workshop, Teacher Professional Development

I. INTRODUCTION

Teacher Professional Development (TPD) refers to advanced training that addresses the need for professional knowledge, skill, attitude and experience in the classroom, (Prodigygame.com, 2017, Fullan, 2016). When used in an educational context, the term *professional development* refers to any form of specialised training that helps school teachers, administrators, and other stakeholders enhance and strengthen their professional knowledge. In other words, it denotes any kind of formal or informal continuing education programme for educators Fullan, 2016, Guskey, 2000). For instance, Formal Continuing Education might include but not limited to conferences, full time or part-time courses, seminars, retreats, teacher training sessions, and workshops. While the Informal Education includes conducting independent or collaborative research or investigation, participating in peer learning activities, or simply conversing with a colleague in the teachers' lounge.

Cox, (2019) contended that when institutions are recruiting teachers, there are a number of basic requirements that need to be satisfied namely: a college degree, working experience with children, and, of course, patience. However, the needs for a variety of professional development, skills, attitudes and content knowledge of the subject matter were also considered for one to be an effective teacher. She also observed that as rapid developments in technology integrates into

our daily lives, they surely affect the way children learn and teachers teach. Therefore, contemporary teachers need to be competent in not only basic skills but new skill sets which can only be achieved through effective professional development.

Moreover, a 2023 Queens University of Charlotte's Report narrated that education is a never-ending process. That is, it does not stop after earning a degree and starting a career, but continues with professional development of career-minded individuals who constantly improve their skills and become more proficient at their jobs. The report also urges education administrators to encourage teachers to pursue their professional development for not only to ensure the best learning outcomes for their learners, but also to be more effective and satisfied in various other aspects of their work.

With the current changing times in the world and the beginning of new century, education systems around the world in almost every society are not left behind. This makes almost every nation become engaged in serious and promising educational reforms chief among which is the professional development of teachers. Communities are aptly acknowledging the fact that teachers are not only one of the factors that need to be changed in order to improve the education systems, but they are the most significant change agents in these reforms (Yagambi, 2021; International Institute for Educational Planning – IIEP -, 2003). This significantly indicates the role of teachers in educational reforms in two folds. First, indicating them as both subjects and objects of reform that makes the field of TPD a growing and challenging one, and secondly the one that has received major attention during the past few years.

Literature has indicated the significance of TPD in bringing the desired changes in learners' academic performance and societal development. For instance, Education Brief, (2023); Awodjii, Omotayo, Ogbudinkpa, & Agharanya, (2020); Bell and Gilbert (1996) independently attest to the fact that teacher professional development is a form of human development. It involves a continuous process of reflection, learning and action to further teachers' knowledge, experience, attitudes and skills, leading to enhanced teaching and learning practices that impact on students' learning positively.

Moreover, it is believed to bring personal change in the teacher which is mediated in a social context and gives the ability of applying it in practice as indicated in Mizell (2010); Alexandrou, & Swaffield (2014); Washington, (2019) and Mader (2015). They added that effective teacher development shall be composed of these components: social, professional, and personal developments. Washington also specifically contended that the outcome of professional learning benefits the teacher and the learners in multiple areas including curriculum and instruction, differentiation, and self-reflection. He also noted that effective TPD enhances skills, attitudes, knowledge and experience and adds value to the school as a whole. When it comes to personal growth and development of teachers, Washington again observed that there need to be a system of feedback, team collaboration, and personal and professional growth goals. TPD supports active learning, collaboration with peers, and models best practices in the field. He concluded that knowing this not only highlights the significance of professional development, but also the keys to improving TPD.

Professionally qualified teachers are famous in discharging their duty diligently and so positively affect learners' achievement. It is noteworthy at this juncture that to be a teacher is one thing while it is another to be professionally qualified. In clarifying who a professionally qualified teacher is, Yagambi, (2021), Cox, (2019) and Mader, (2015) articulated that a professionally qualified teacher is the one who holds the content knowledge required to teach core academic subjects and has a state teaching license. This is exactly what is currently going on in Nigeria about the certification of teachers by the Teachers' Registration Council of Nigeria (TRCN). Hence, only professionally qualified teachers receive teaching license that qualifies them to teach.

This new emphasis was welcomed by both teachers and stakeholders in education as it represents the much needed appreciation of the work of teachers and, at the same time, promotes the concept of teaching as a profession. That might be the contributing reason in Nigeria within the last decades, where the office of the Senior Special Assistant to the President (SSAP) on Millennium Development Goals (MDGs) embarked on a nationwide professional development of primary school teachers. In the exercise, hundreds of thousands of teachers received retraining. Four core primary school subjects were given priority in the exercise namely: Mathematics, English Language, Primary Science and Social Studies. It was meant to reform the professional capacity of primary school teachers. This is because the Nigerian federal government is not oblivious of the fact that more could not be done than developing the professional capacity of teachers in bringing a significant improvement to learners' achievement.

In MGDs workshop, teachers from different schools, local education authorities (LEAs) and varied local governments converge for a common purpose: their professional development. They share ideas, experiences, knowledge and skills under the facilitation of a professional teacher trainer. The workshop has been carried out in series for many years. But since the beginning of the first workshop to the last, there were minimal follow up studies to investigate how well the retrained teachers changed. In other words, the application of the taught ideas, skills, experience and knowledge gained in the professional development workshops remained unknown at the moment. Therefore a study of this type has been long overdue. There is the need to know whether the teachers have improved professionally or otherwise putting into consideration the amount of money involved in the exercise. It is against this background that the study sought to find out the effect of primary science teacher professional development on pupils' academic

performance. The choice of primary science as the subject of investigation was informed by the amount of work involved in the study because it might be nearly impossible to study all the four core subjects mentioned above. Moreover, primary science is within the specialisation and research interest of the investigators.

II. STATEMENT OF THE PROBLEM

Large sum of money that runs into millions of US dollar was used in the MDGs workshop for retraining of primary school teachers for many years. The money was sourced from international donor individuals, agencies and or governments of developed nations. The gesture was solely carried out to improve the professional competence of primary school teachers so that citizens' foundation to personal, societal and national development is laid solidly. However, since the beginning of the workshops to date, very little or nothing is known about the actual application of the acquired ideas, skills, experience and knowledge on the part of the primary school teachers. Practically, there was no „feedback' in any form that may indicate the next line of action to be taken. The international donors must be informed of the impact of the workshops they financed so that more donations in other sectors could be attracted. Also, the nation's authorities must have a picture of what is going on with respect to the practical application of the learned content by the primary school teachers. This will help in understanding the strengths and weaknesses of the workshop which is currently unknown. There is need also to understand what need to be corrected and when to correct it and so on. But the current situation of not minding what is happening at the primary schools after such huge interventions would not help matters and poses a great threat that may severe international relations. It might also questions the competencies of all relevant agencies involved in the retraining exercise. A study of this kind is paramount at this moment.

III. OBJECTIVES OF THE STUDY

To guide the conduct of the study, the following research objectives have been formulated:

- i. To find out the significant mean difference in the achievement of pupils in primary science before and after MDGs TPD workshops in urban primary schools after controlling for their pre-workshop scores.
- ii. To find out the significant mean difference in the achievement of pupils in primary science before and after MDGs TPD workshops in semi-urban primary schools after controlling for their pre-workshop scores.
- iii. To find out the significant mean difference in the achievement of pupils in primary science before and after MDGs TPD workshops in rural primary schools after controlling for their pre-workshop scores.

IV. RESEARCH QUESTIONS

- i. What is the significant mean difference in the achievement of pupils in primary science before and after MDGs TPD workshops in urban primary schools after controlling for their pre-workshop scores?
- ii. What is the significant mean difference in the achievement of pupils in primary science before and after MDGs TPD workshops in semi-urban primary schools after controlling for their pre-workshop scores?
- iii. What is the significant mean difference in the achievement of pupils in primary science before and after MDGs TPD workshops in rural primary schools after controlling for their pre-workshop scores?

V. RESEARCH HYPOTHESES

- i. There is no significant mean difference in the achievement of pupils in primary science before and after MDGs TPD workshops in urban primary schools after controlling for their pre-workshop scores. (H01: $\mu_1 = \mu_2$)
- ii. There is no significant mean difference in the achievement of pupils in primary science before and after MDGs TPD workshops in semi-urban primary schools after controlling for their pre-workshop scores. (H02: $\mu_3 = \mu_4$)

- iii. There is no significant mean difference in the achievement of pupils in primary science before and after MDGs TPD workshops in rural primary schools after controlling for their pre-workshop scores. ($H_0: \mu_5 = \mu_6$)

VI. METHODOLOGY

Population and Sample

The population of the study comprises of all primary school teachers and their pupils in Gombe State Local Government Education Authorities (LGEAs). However, sampling was limited only to primary science teachers whether they participated in MDGs teacher professional development workshops or not irrespective of their highest qualifications. All the eleven local government areas (LGAs) of Gombe state were involved in the study and two schools were randomly selected and used as sample for the study. Final sampling was based on the schools that responded positively to the request of their end of term results. All pupils' scores of classes 4, 5 and 6 in the primary schools that responded formed the sample of the study. Examination scores obtained and used for the study are those administered by the primary science teachers before and after attending the MDGs teacher professional development workshops. Results obtained were of one thousand, five hundred and four (1504) pupils each for the two groups.

VII. INSTRUMENTS

The instrument for data collection was primary science teacher-made test (PSTMT) obtained from the terminal examination administered to the pupils. The use of PSTMT is as a result of non-existence of a standardised test in primary schools, unlike before where a common entrance standardised test is conducted annually and used for placement of graduating pupils into junior secondary schools. The examination scores of science teachers before and after the beginning of the nationwide TPD workshop formed the data for the study. Data collected and used also covered examination scores of teachers who do not have the opportunity to participate in the MDGs TPD workshops with the assistance of research assistants. Scores of pupils taught by teachers that do not attend the professional development workshop was used as a control group. Scores of pupils while scores of pupils taught by the teachers that attended the workshops were used as experimental group's scores.

VIII. DATA ANALYSES AND RESULTS PRESENTATION

Quantitative data collected were the terminal examination scores of primary 4, 5 and 6 pupils. The examination questions usually were scrutinised in the school by a more experienced teacher, usually a Sessional Head or Assistant Head Teacher. About three thousand seven hundred scores were collected and screened. A total of 3008 pupils' score were finally used that comprises of scores before and after participation of the teachers in the MDGs workshop. The scores before the workshop were treated as pre-test scores and those after the workshop as post-test scores. Hence, data were analysed using analysis of covariance (ANCOVA) to test the 3 hypotheses to find out if there is any significant difference in the primary science achievement of the pupils from urban, rural and semi-urban areas. Furthermore, pupils numbering 1504 taught by teachers who participated in the MDGs TPD workshop are considered as the experimental group of the study and equally those taught by the teachers who did not participate in the MDGs TPD workshop as control group numbering also 1504.

Like any other statistical tool having certain assumptions to be met, there are specific statistical assumptions that need to be met when using ANCOVA. These assumptions are normality of the distribution of scores, measurement of the covariates, correlation among the covariates, linearity of the dependent variable and the covariates, homogeneity of regression slopes and the Levene's Test of Equality of Error Variance. The need for data to meet these assumptions is important for results' accuracy and minimised errors. However, violations of one or more of these assumptions does not always affects results especially where there is a very large sample size - 30+ - (Yahaya, Zain and Karpudewan, 2016, 2014; Pallant, 2007; Stevens, 1996; Tabachnick and Fidell, 1996). In this study, an extremely large sample is involved (more than one thousand five hundred pupils' scores) which makes testing the assumption unnecessary. Yet, the researchers decided to check for one or more of the assumptions despite the fact that even if they are violated, there is no problem.

IX. DESCRIPTIVE STATISTICS

The descriptive statistics provides the mean values and standard deviations calculated while giving the number of participants in each of the groups. That is out of the 1504 pupils' examination scores, 484 are of pupils from urban

primary schools, 486 from rural primary school and 551 from semi urban primary school. All this information and that of the control group are shown on tables 1 and 2 below:

Table 1: Descriptive Statistics for Experimental Group Scores

Background of the Pupils	Mean	Standard Deviation	<i>n</i>
Urban School Pupils	67.97	16.270	484
Rural School Pupils	68.33	16.098	469
Semi Urban Pupils	68.35	15.935	551
Total	68.18	16.085	1504

Table 2: Descriptive Statistics for Control Group Scores

Background of the Pupils	Means	Standard Deviation	<i>n</i>
Urban School Pupils	70.47	16.953	509
Rural School Pupils	69.99	16.936	488
Semi Urban Pupils	71.18	17.077	507
Total	68.22	16.985	1504

X. NORMAL DISTRIBUTION OF SCORES

The scores obtained were checked for outliers using the SPSS statistical software. Normality test was conducted to ensure that there is normal distribution of scores from the output of the SPSS.

Normal curves are seen which indicated that the scores obtained and used for the analyses are normally distributed.

XI. LEVENE’S TEST OF EQUALITY OF ERROR VARIANCES

The details on table 3 below indicated that there was no violation of the assumption of equality of error variances for both experimental and control groups’ examination score because the statistical values obtained are greater than .05, except for control group’s general scores.

Table 3: Levene's Test of Equality of Error Variances

Groups	Specification	<i>F</i>	<i>df1</i>	<i>df2</i>	<i>Sig.</i>
Exp Grp	Overall	.360	2	1501	.697
Ctrl Grp	Overall	2.015	624	879	.000
Exp Grp	Urban	1.080	1	491	.299
	Rural	.023	1	479	.880
	Semi-Urban	2.029	1	528	.155
Ctrl Grp	Urban	.001	1	491	.981
	Rural	1.559	1	479	.212
	Semi-Urban	.372	1	528	.542

If the value is smaller than .05 (and therefore significant), it means that the variances are not equal, and that there is violation of the assumption. In this case, the values for all specific groups and experimental group’s overall are much larger than our cut-off of .05, statistically showing non-violation of the assumption and that the variances are equal. The control group’s value that is statistically significant, .000, showing the assumption’s violation was already observed that violation of one or more of the assumption with a large sample size of 30+ would not cause any problem (Yahaya, Zain

and Karpudewan, 2016, 2014; Pallant, 2007; Stevens, 1996; Tabachnick and Fidell, 1996). Since the study’s sample is extremely large – 1504 –, the study is on the safe line.

XII. HOMOGENEITY OF REGRESSION SLOPES

Table 4 below is an output table of SPSS software that depicted the significant value that was statistically obtained from the test of the homogeneity of regression slopes. All that is required on the table is the significant value across “Background*EGScores” which is .693. If the Significant Level for the interaction is less than .05, then the interaction is statistically significant, indicating the violation of the assumption. In this study the significant value is .693, comfortably above the cut-off. Therefore, the assumption of homogeneity of regression slopes was not violated.

Table 4: Homogeneity of Regression Slopes Tests of Between-Subjects Effects

Dependent Variable: Pre/Post Workshop Experimental Examination Scores					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	216817.331 ^a	5	43363.466	377.607	.000
Intercept	39936.498	1	39936.498	347.765	.000
Background	215.962	2	107.981	.940	.391
EScores	215971.534	1	215971.534	1.881E3	.000
Background *EGScores	84.360	2	42.180	.367	.693
Error	172026.700	1498	114.838		
Corrected Total	388844.031	1503			

a. R Squared = .558 (Adjusted R Squared = .556)

The overall results of the study were shown on table 5 below, where a one-way between-groups analysis of covariance was conducted to compare the effectiveness of MDGs teacher professional development workshop on primary science pupils’ achievement. The independent variable was the background of pupils taught by these teachers and the dependent variable consisted of scores of the pupils taught by the science teachers after having fully participated or not in the MDGs TPD workshops. The pupils’ examination scores before their teachers participated in the workshop were used as the covariates in this analysis. After conducting the preliminary checks on the data, it was ensured that there was no violation of the assumptions of normality, linearity, homogeneity of variances, homogeneity of regression slopes, and reliable measurement of the covariates. After adjusting for pre-test scores of the experimental group, there was no significant mean difference between the two groups on the post-test scores of pupils’ science achievement, $F(2, 1500) = 18.16, p = .063, \eta^2 = .56$, (see table 5). Therefore, the null hypothesis stands upheld. There was a strong relationship between the pre- workshop and post-workshop scores of the pupils taught primary science before and after their teachers attended MDGs TPD workshop as indicated by an eta squared value of .56. Similarly, after adjusting for the control group pre-test scores, there was no significant different between the two groups on the post-test scores of the pupils’ science achievement, $F(3, 1496) = 29.94, p = .259, \eta^2 = .38$ (see table 5). There was a relationship between the pre-workshop and post-workshop scores of the pupils taught primary science by their teachers without attending the MDGs TPD workshop as indicated by an eta squared value of .38.

The table also shows specific groups’ statistical justification of upholding the null hypotheses for all the groups of the pupils according to their background. This means there was no significant difference in the achievement of rural, urban and semi urban pupils in primary science irrespective of their teachers having attended the MDGs TPD workshop or not. The magnitude of the difference in means of the two groups (Experimental Group $M = 68.18, SD 16.85$ and Control Group $68.22, SD 16.985$. See tables 1, 2 & 5) is very weak, indicating that the workshop attendance has no any significance effect on the achievement of the pupils in their science subject. This means the achievement of the pupils remained statistically the same irrespective of either their background or their teachers having attended the MDGs TPD workshop or not.

Table 5: Results Summary for All Groups

Groups	Specification	Means	F	t	p < .05	Eta*	Decision
Exp Grp	Overall	68.18	(2, 1500)	18.159	.063	.56	Uphold H ₀
Ctrl Grp	Overall	68.22	(3, 1496)	29.941	.259	.38	Uphold H ₀
	Urban	50.91	(2, 3.373)	52.281	.636	.58	Uphold H ₀
Exp Grp	Rural	48.93	(2, 12.889)	23.894	.769	.56	Uphold H ₀
	Semi-Urban	48.83	(2, 22.756)	24.430	.751	.548	Uphold H ₀
	Urban	49.53	(2, 28.556)	12.518	.775	.249	Uphold H ₀
Ctrl Grp	Rural	51.05	(2, 24.368)	11.447	.607	.224	Uphold H ₀
	Semi-Urban	51.11	(2, 32.400)	13.099	.494	.262	Uphold H ₀

*Partial Eta Squared

XIII. DISCUSSIONS

Where strong significant difference occurred between groups, usually a Bonferroni adjustment is conducted to keep the alpha level stronger - $\alpha_{adj} = \alpha/n$, where n is the total number of tests scores obtained in the study to keep the alpha level for the total experiment at $\alpha_{exp} = .05$ (Yahaya, Zain and Karpudewan, 2016, 2014; Napierala, 2012; Pallant, 2007, Price, 2000, Karpudewan, Ismail and Roth, 2012; Karpudewan, 2009). But in this study, this adjustment is unnecessary since the results indicated no significant difference, giving sufficient reason to uphold all the 3 null hypotheses, in disfavour of the alternative.

The results obtained have indicated that something went wrong with the whole exercise of the MDGs TPD workshops conducted in series by the Nigerian government. This is because researches such as Washington, (2019); Alexandrou, & Swaffield (2014); Mader (2015) and Mizell (2010) have shown the significance of teacher professional development in bringing personal change in the teacher. This include among others mediating in a social context and giving the ability of applying the acquired knowledge, experiences, skills and necessary attitudes in to practice. But this is contrary to what was obtained here according to the results of this study.

Nevertheless, Mader, (2015) distinctly reported a survey involving more than 10,500 teachers in 3 large public school districts. The survey shows how TPD to help teachers improve discovered the contrary. They found out that only 30% of teachers improved their performance as indicated by several factors including evaluation ratings and classroom observations. The study also found that no specific type or amount of professional development helped teachers improve. In a related development, Staff, (2014) articulated that too often, a TPD is simply a waste of time. He cited a report by National School Boards Association’s Centre for Public Education titled

Teaching the Teacher’ which narrated that most TPD programmes neither changes the teachers’ teaching practices nor improves students’ learning. This substantiate what was obtained in this study as the results informed no significant improvement in the performance of the teachers before and after attending a TPD exercise. It also informed a corresponding indifference in the improvement of those teachers that have not attended the TPD programme.

To justify the ineffectiveness of TPD, Staff, (2014) observed that the programme might be typically because it:

- Focuses on too many goals, which are sometimes conflicting
- Is irrelevant or non-meaningful to teachers
- Is delivered in an ineffective lecture style
- Does not involve on-going support or feedback for teachers

- Is often associated with unrealistic expectations for implementation time, outcomes, etc.

These justifications may characterise the MDGs TPD workshops that were conducted in series in Nigeria. Similarly, Tóth and Szivák (2022) reported a significant contradiction between the central expectations towards teachers in Hungary and their belief in their professional development. This justifies the contrary expectations shown by the primary science teachers after attending the professional development workshop conducted in series in Nigeria since no statistically significant difference was discovered in the achievement of the pupils before and after attending the workshop.

However, Kiru and Maftai (2022), Maier (2020) argued that TPD programmes are influenced by age and the quality of the professional training provider, timing of the courses and the fund invested. Kiru and Maftai specifically added that age has a significant influence on teachers' choice of professional development programmes while teachers with average experience exhibits more sense of interest. This is in contrast to the MDGs TPD workshops because the local education authorities only received circulars notifying them of the date, time and venues of the workshops without their input into the timing and the choice of whom to attend. Sometimes, wrong people are chosen for the attendance where some teachers receive professional training in areas contrary to their specialisation. Hence, it is not surprising if significant indifference is discovered in the achievement of pupils taught by the teachers that have participated in the MDGs TPD workshops and those that have not.

Although, Kiru and Maftai (2022) concluded that unlike tertiary school lecturers, teachers in pre- primary, primary and secondary schools are more willing to improve themselves, based on an intrinsic motivation. But in the Nigerian situation, the choice for participating in professional development programmes is highly influenced by some factors. These factors may include among others: political influence, nepotism, loyalty syndrome, God fatherism, proximity, etc. This suggests that all genuine learning activity inclusive of professional development supposed to start from the individuals' choice not nomination from authorities above. And also the content that formed the materials of the workshop needs to pay more attention to the affective and motivational conditions that determine teacher development, because they are the actual engines of learning as justified by Darling-Hammond, Hyler and Gardner (2017), Yaakob, Sufi, & Yusof, (2020) and Korthagen, (2017).

Sims, *et al*, (2022) also observed small positive effects of TPD on pupils' test scores. They have not relented on their efforts and therefore took it a challenge to explore more and make it a piece of advice for those tasked with designing or commissioning a better Professional Development Programme. To achieve this, they develop a new theory of effective Professional Development Programme based on some combinations of causally active components. These components are targeted at developing teachers' insights, goals, techniques, and practice. The Nigerian situation is also in need of similar effort since the current phenomenon indicated that there was very little or no positive effect of the Professional Development Programme so far conducted through the MDGs.

Consequently, there are several factors that might have contributed to the ineffectiveness of the TPD workshops such as wrong choice of participants, timing and specialisation of the teachers. Other factors might be the participants' paying more attention on the monetary benefits of attending the professional development exercise than attention on the actual content of the programme. Also, prolong stagnation at a level for more than a decade or so might be a contributing factor because of its tendency to increase and sustain frustration.

XIV. CONCLUSION

This study involves finding out the effectiveness of TPD workshops on pupils' academic achievement in primary science in Nigeria. A sample of 3008 pupils' and their termly examination scores were used. The scores are of those pupils whose teachers participated in the professional development programme and those that have not before and after the programme. Analysis of covariance was used in the data analyses and results indicated no significant difference in the achievement of the pupils that were taught primary science by teachers who participated in the TPD programme and those that have not. Also the pupils' background: urban, rural and semi urban was discovered to have no any significant effect on their achievement. This means that professional development programmes was seriously affected by some factors that have contributed to its ineffectiveness. The factors might strictly be Nigerian such as timing, choice of participants, monetary benefits, loyalty syndrome, teacher qualifications and nepotism among others.

XV. LIMITATIONS OF THE STUDY AND SUGGESTIONS FOR FURTHER RESEARCH

The study was limited to finding out the effectiveness of TPD workshop on rural, urban and semi urban pupils' achievement in primary science despite the fact that there are other strong factors that can be explored such as gender and qualification of the teachers. Also the study focuses on primary science though the MDGs TPD programme was

conducted on 4 core primary subjects in Nigeria namely: Mathematics, English Language, Science and Social Studies.

Therefore interested researchers are urged to explore the other 3 subject areas not covered in the study. It is also recommended for further research other effective contributing factors such as prolonged stagnation at a level for a decade or so and it may affect pupils' achievement.

XVI. ACKNOWLEDGEMENT OF SPONSORSHIP

This study was fully funded by the Nigerian **Tertiary Education Trust Fund (TETFund)** under the Institutional Based Research (IBR) fund allocated to Federal College of Education (Technical) Gombe, Gombe State Nigeria

REFERENCES

- [1] Awodjii, O. A., Ogbudinkpa, I. C. & Agharanya, M. C. (2020). Teachers' Professional Development: A Panacea to Quality Education in Nigeria. *International Journal of Educational Management*, pp 11 - 23.
- [2] Alexandrou, A., & Swaffield, S. (2014). *Teacher leadership and professional development*. Abingdon: Routledge. *Educational Researcher*, 33(8), 3–15. doi:10.3102/0013189X033008
- [3] Bell, B., & Gilbert, J. (2005). *Teacher Development: A Model from Science Education*. Taylor & Francis e-Library: <https://doi.org/10.4324/9780203975145>
- [4] Cox, J. (2019). 15 Professional Development Skills for Modern Teachers. Accessed on 27th, February 2023 from: <https://www.teachhub.com/>
- [5] Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). *Effective Teacher Professional Development*, from: <https://learningpolicyinstitute.org/product/effective-teacher-professional-development>
- [6] Fullan, M. (2016). *The New Meaning of Educational Change* (5th Ed.). Teachers College Press.
- [7] Guskey, T. (2000). *Evaluating Professional Development*. Corwin Press, Inc.
- [8] Karpudewan, M., Ismail, Z. & Roth, W-M. (2012). Efficacy of Green Chemistry Laboratory Based Pedagogy: changes in environmental values of Malaysia pre-service teachers. *International Journal of Science and Mathematics Education*. (2012) 10, pp 497-529.
- [9] Karpudewan, M. (2009). *The effects of Green Chemistry Experiment on Environmental Value and Knowledge and Chemistry Concepts among Pre-service Teachers*. An Unpublished Thesis in fulfilment of the Requirement for the award of PhD, School of Educational Studies, Universiti Sains Malaysia.
- [10] Kiru, R. S. & Maftai, L. (2022). Study on the professional development of primary school teachers. Proceedings of the EDULEARN 22 Conference held on 4th – 6th July 2022 at Palma, Mallorca, Spain. DOI: 1021125/edulearn.2022.1205. Accessed on 16th March, 2023 from: <https://www.researchgate.net/publication/362125032>
- [11] Korthagen, F. (2017). Inconvenient truths about teacher learning: towards professional development 3.0. *Teachers and Teaching*, 23(4), 387-405. Retrieved on 23-October- 2019 from: <https://doi.org/10.1080/13540602.2016.1211523>
- [12] Mader, J. (2015). New report reveals that teacher professional development is costly and ineffective. Accessed on February 27th, 2023 from: <https://hechingerreport.org/>
- [13] Maier, M. (2020). Repere in formarea continuă a cadrelor didactice din învățământul preuniversitar, *Buletin Stiintific, seria A, Fascicula Filologie*, (29) 1, pp. 351-357.
- [14] Mizell, H. (2010). Why professional development matters? USA, www.learningforward.org
- [15] Napierala, M. A. (2012). What is Bonferoni Corrections? *American Academy of Orthopaedic Surgeons*. Accessed from: www.aaos.org
- [16] Pallant, J. (2007). *SPSS survival manual: a step by step guide to data analysis using SPSS for Windows*, 3rd Edition.
- [17] Price, I. (2000). One-Way ANOVA. Bonferroni Adjustment. University of New England, Amidala NSW. Accessed from: www.une.edu.au
- [18] Prodigygame.com (2017). What is Professional Development for Teachers? Accessed on 27th February, 2023 from: <https://www.prodigygame.com/main-en/blog/teacher-professional-development/>
- [19] Queens University of Charlotte (2023). The Importance of Professional Development for Educators. Accessed on 27th, February 2023 from: <https://online.queens.edu/resources/article/professional-development-for-educators/>
- [20] Staff, T. (2022). 8 Tips for Effective Teacher Professional Development. Accessed on February 20th, 2023, from: <https://tuiopay.com/blog/>
- [21] Sims, S., et al, (2022). Effective teacher professional development: new theory and a meta- analytic test. (EdWorkingPaper: 22-507). Retrieved from Annenberg Institute at Brown University, from: <https://doi.org/10.26300/rzet-bf74>
- [22] Stevens, J. (1996). *Applied Multivariate Statistics for the Social Sciences*. 3rd Edition, Mahwa, NJ: Lawrence Erlbaum. Chapter 6.
- [23] Tabachnick, B. G. & Fidell, L. S. (2007). *Using multivariate statistics* (5th edition). Boston: Pearson Education, p 54.
- [24] Tóth, A. N. & Szivák, J. (2022). Theoretical framework model (TFM) for examining the professional development of teachers. *International Journal of Instruction*, 15, (3): 733- 750. <https://doi.org/10.29333/iji.2022.15340a>
- [25] Washington, B. (2019). Keys to Improving Teacher Professional Development. Accessed On February 19th, 2023, from: <https://www.graduateprogram.org/2019/09/>
- [26] Yaakob, M. F. M., Don, Y., Sufi, I., & Yusof, M. R. (2020). Teachers' Professional Development, Level across Cohort of Generations in Malaysia. *International Journal of Instruction*, 13(4), 443-456. Retrieved on 14-October-2021, from: <https://doi.org/10.29333/iji.2020.13428a>
- [27] Yahaya, J. M., Zain, A. N. & Karpudewan, M. (2016). College students' attitudes towards sexually themed science content: a socioscientific issues approach to resolution, *International Journal of Science Education*, 38: (7), 1174-1196, DOI: 10.1080/09500693.2016.1174349
- [28] Yahaya, J. M. Zain, A. N. & Karpudewan, M. (2014). The Effects of Socio-Scientific Instruction on Pre-service Teachers' Sense of Efficacy for Learning and Teaching Controversial Family Health Issues, *International Journal of Science and Mathematics Education*, Ministry of Science and Technology, Taiwan 2014
- [29] Yangambi, M. (2021) Teacher Professional Development and Student Achievement in a Developing Country. *Creative Education*, 12, 2283-2300. doi: 10.4236/ce.2021.1210173.

This publication is licensed under Creative Commons Attribution CC BY.

<http://dx.doi.org/10.29322/IJSRP.13.04.2023.p13612>

www.ijsrp.org

AUTHORS

First Author – Jamil Mikhail Yahaya, Primary Education Department, School of Early Childhood Care and Primary Education, Federal College of Education (Technical) PMB 060 Gombe, Gombe State Nigeria, jamilgombe@yahoo.com
jamil2000.jmy@gmail.com

Second Author – Abubakar Ibrahim, Primary Education Department, School of Early Childhood Care and Primary Education, Federal College of Education (Technical) PMB 060 Gombe, Gombe State Nigeria

Third Author – Nuhu Sani Abdullahi, Science Education Department, School of General Studies Education, Federal College of Education (Technical) PMB 060 Gombe, Gombe State Nigeria

Fourth Author – Shu'aibu Adamu, Primary Education Department, School of Early Childhood Care and Primary Education, Federal College of Education (Technical) PMB 060 Gombe, Gombe State Nigeria

Fifth Author – Salisu Bashir Gwangwazo, Vocational and Technical Education Unit, National Commission for Colleges of Education – NCCE – Abuja, Nigeria