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RELATIONSHIP BETWEEN PROFESSIONAL DEVELOPMENT PROGRAMS AND SECONDARY SCHOOL MATHEMATICS TEACHERS' TEACHING-EFFICACY IN MINNA METROPOLIS, NIGER STATE

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ABSTRACT :

Teacher teaching efficacy remains a critical determinant of instructional effectiveness and students' academic achievement in mathematics. However, persistent poor performance in mathematics among secondary school students in Niger State has continued to raise concerns about the effectiveness of teachers' professional development programmes in strengthening classroom practice. This study investigated the relationship between professional development programmes and secondary school mathematics teachers' teaching efficacy in Minna Metropolis, Niger State, Nigeria. The study adopted a descriptive correlational survey design. The population comprised all secondary school mathematics teachers in public and private secondary schools in Minna Metropolis, from which a sample of 269 teachers was selected using multi-stage sampling procedures involving stratified and proportionate random sampling techniques. Data were collected using a researcher-developed instrument titled Mathematics Teachers' Professional Development Programmes and Self-Efficacy Questionnaire (MTPDPSEQ), which was validated by experts and yielded a reliability coefficient of 0.80 using Cronbach's alpha. Data were analysed using simple linear regression at 0.05 level of significance. The findings revealed that participation in online professional development programmes showed a weak positive but statistically insignificant relationship with mathematics teachers' teaching efficacy ($\beta = .060$, $p > .05$). Similarly, seminar-based professional development programmes demonstrated a weak and non-significant relationship with teaching efficacy ($\beta = .040$, $p > .05$), while workshop-based professional development also showed no statistically significant relationship with teaching efficacy ($\beta = .020$, $p > .05$). The study concludes that although professional development remains essential for teacher growth, participation in isolated and conventional professional development formats may not be sufficient to strengthen teachers' efficacy beliefs. The study recommends that professional development for mathematics teachers should be redesigned to include sustained, practice-based, collaborative, and classroom-embedded experiences capable of building mastery and strengthening teachers' confidence for effective mathematics instruction.

Keywords: Professional development, teaching efficacy, mathematics teachers, secondary education, Minna Metropolis

Introduction

The pursuit of effective teacher professional development (PD) has long been a central concern in mathematics education, given its potential to enhance instructional quality and student outcomes (Otun & Olaoye, 2019). Mathematics education is indispensable, as it develops the critical and creative thinking skills necessary for informed citizenship and provides the mathematical literacy essential for sound decision-making (Otun, 2022). Despite this significance, mathematics is frequently perceived as a difficult subject, resulting in widespread student disaffection (Gonzalez & Maxwell, 2020). This challenge persists even though mathematics underpins the natural and social sciences, and proficiency in it strengthens reasoning abilities. Evidence suggests that students' difficulties in grasping mathematical concepts cannot be attributed solely to their own limitations; rather, the quality of mathematics instruction emerges as a primary determinant of student achievement (Otun & Olaoye, 2019).

Extending this argument, a teacher's mathematical knowledge substantially influences student learning outcomes (Otun, 2022). Research indicates that many teachers remain unaware of how students overgeneralise mathematical concepts, leading to foundational errors that impede future learning (Gonzalez & Maxwell, 2020). Within the classroom, teachers cultivate students' analytical abilities, enabling them to appreciate, identify, and solve complex problems. Effective teachers accomplish this by employing diverse pedagogical strategies to foster meaningful understanding (Awodiji et al., 2020). Consequently, the nature and depth of teachers' mathematical knowledge warrant careful investigation. This line of inquiry has focused on what constitutes sufficient Mathematics Subject Matter Knowledge (MSMK) for effective teaching. Historically, a minimalist view prevailed, wherein teachers were considered knowledgeable if they could merely perform the mathematics prescribed in the curriculum (Gonzalez & Maxwell, 2020). Today, this perspective is widely rejected, reflecting the increased rigour of modern mathematics curricula. However, a growing consensus holds that subject matter knowledge alone is insufficient for effective instruction; the ability to translate such knowledge into learner-accessible forms demands a distinct and more complex professional expertise (Sodangi et al., 2022).

Professional Development is the primary mechanism for cultivating this specialised knowledge (Awodiji et al., 2020). Encompassing a range of activities from workshops and peer mentoring to degree programmes and collaborative research PD is defined as systematic, lifelong learning aimed at enhancing teachers' competencies, motivation, and overall effectiveness (Nwarie & Nwakudu, 2019; Sodangi et al., 2022). The overarching goal of PD is to positively influence teachers' knowledge, skills, and beliefs, thereby rendering their classroom practice more beneficial to students. As contemporary educational reforms emphasise, PD is paramount for meeting rigorous standards and enabling teachers to acquire new, effective content delivery strategies (Nwarie & Nwakudu, 2019). Importantly, well-designed PD programmes have been shown to significantly affect not only teachers' pedagogical knowledge but also their teaching efficacy the belief in one's capability to promote student learning, even under challenging conditions (Woodcock et al., 2022; Jacob et al., 2017). Research consistently demonstrates that teachers who engage in high-quality PD exhibit deeper mathematical knowledge for teaching, which in turn strengthens their classroom confidence and effectiveness (Lee & Vongkulluksn, 2023). For example, recent studies have found that PD leads to significant gains in teachers' use of standards-based pedagogies and their efficacy in teaching mathematics (StudyCorgi, 2020). Given that high teacher efficacy correlates robustly with greater student achievement, it is recognised as a vital predictor of performance in mathematics education (Jacob et al., 2017).

Although PD enhances knowledge and efficacy, these factors are also mediated by teaching experience (Bamidele & Adekola, 2017). Experience enriches teachers' practice, refining their pedagogical techniques and classroom management skills through sustained professional exposure (Fatoba et al., 2020). Experienced teachers often draw on a richer background to manage problems effectively and foster student autonomy (Bamidele & Adekola, 2017). Nevertheless, research has yielded inconsistent conclusions regarding the direct effect of teaching experience on student performance, suggesting that its role may be more complex, potentially moderating the relationship between professional learning and classroom practice (Fatoba et al., 2020).

These three pillars professional development, pedagogical content knowledge, and teaching efficacy form a critical nexus for improving mathematics instruction (Sodangi et al., 2022; Woodcock et al., 2022). While international literature affirms their importance, there is a pressing need to understand how these variables interact within specific local contexts. In Minna, Niger State, despite various educational initiatives, challenges in mathematics achievement persist (Niger State Secondary Education Assessment Committee, 2024). It remains unclear how available PD opportunities for secondary school mathematics teachers are specifically influencing their pedagogical content knowledge and sense of teaching efficacy (Ministry of Education, 2020). Furthermore, the role of teaching experience in moderating these relationships in this particular setting has not been empirically examined (Federal Republic of Nigeria [FRN], 2013). This gap in contextual understanding necessitates an investigation focused on the unique circumstances and challenges faced by teachers in this region. Therefore, this study investigated the relationship between professional development mediums, pedagogical content knowledge, and teaching efficacy among secondary school mathematics teachers in Minna Metropolis.

Persistent deficiencies in secondary school mathematics teachers' ability to foster deep conceptual understanding often stem from inadequate integration of pedagogical knowledge with subject-specific content during teacher preparation (Niger State Secondary Education Assessment Committee, 2024). Although general teaching skills receive emphasis, insufficient attention to mathematics-specific pedagogy leaves many teachers ill-equipped to teach complex concepts effectively (Ministry of Education, 2020). This challenge is particularly acute in Niger State, where student performance in mathematics remains poor (FRN, 2013). Key contributing factors include a severe shortage of qualified mathematics teachers, the deployment of non-specialist teachers (including unqualified personnel such as serving NYSC members), and the prevalence of teachers holding only an NCE qualification which contravenes national policy requiring higher qualifications for senior secondary level (Niger State Secondary Education Assessment Committee, 2024; Ministry of Education, 2020). These systemic issues create an urgent need for effective PD programmes to enhance teachers' pedagogical content knowledge and teaching efficacy core elements for improving instructional quality and student achievement (FRN, 2013). Accordingly, this study investigates the relationship between professional development programmes, pedagogical content knowledge, and teaching efficacy among secondary school mathematics teachers in Minna, Niger State.

Literature Review

The relationship between professional development (PD) and mathematics teachers' pedagogical content knowledge (PCK) and teaching efficacy has attracted considerable research attention. This review synthesises recent empirical studies across three thematic areas: (1) the effectiveness of online PD, (2) the impact of seminar and workshop-based PD, and (3) the mediating role of teacher characteristics such as experience and self-efficacy. The goal is to identify consistencies, contradictions, and gaps that justify the present investigation. Online professional development (OPD) has gained prominence, particularly following the digital transformation of education. A meta-analysis by Morina et al. (2025), synthesising 102 quantitative studies, found that OPD had medium effects on teacher-level outcomes (Hedges' $g = 0.71$) and classroom-level outcomes ($g = 0.55$), but only a small effect on student-level outcomes ($g = 0.19$). Notably, collective participation and synchronous formats yielded larger effect sizes than asynchronous designs, suggesting that interaction and real-time collaboration are critical OPD features.

Similarly, Meyer et al. (2023) surveyed 387 teachers participating in formal OPD and reported high levels of cognitive activation and structural clarity, but only moderate collaboration. While all quality characteristics predicted teacher satisfaction, only cognitive activation and collaboration predicted changes in professional practices. This underscores a recurring theme: engagement and interactivity matter more than content delivery alone. However, OPD is not without challenges. Cowart and Jin (2024) examined an OPD series for instructional technology coaches and found that while all ten design elements (e.g., active learning, modelling, feedback) were perceived as beneficial, hindrances such as ineffective modelling, collaboration difficulties, technical issues, and home distractions limited learning. These findings highlight that OPD's effectiveness depends heavily on implementation quality.

Other studies have shown positive outcomes under specific conditions. Linde et al. (2023) reported that an online course significantly improved teachers' theoretical understanding and self-efficacy in developing students' self-regulated learning skills. Wang and Zhang (2023), using the Community of Inquiry framework with 456 Chinese middle school teachers, found that online learning quality significantly predicted self-efficacy and perceived achievement, with self-efficacy playing a mediating role. Together, these studies suggest that when OPD is interactive, cognitively activating, and well-structured, it can enhance teacher efficacy and knowledge but the effect is variable and context-dependent.

Traditional face-to-face PD formats, particularly seminars and workshops, have also been extensively studied. Perez and Cruz (2024) investigated a seminar on teaching in a Philippine higher education institution and found significant improvements in teaching performance (average rating rising from 80.67 to 83.33), especially among newly hired or inexperienced faculty. This suggests that seminars may be most beneficial for early-career teachers. Salami and Spangenberg (2024) conducted a quasi-experimental study with 70 mathematics teachers holding NCE qualifications. Teachers with high subject knowledge performed significantly differently from those with high pedagogical knowledge, and students of teachers with low pedagogical knowledge actually outperformed students of teachers with low subject knowledge. This surprising result challenges the assumption that subject knowledge alone drives student outcomes, instead emphasising the unique contribution of PCK.

Adams et al. (2023) explored PD's impact on mathematics teachers' PCK in Ghanaian senior high schools using a case study design. Their findings confirmed that PD positively influenced PCK, though the study did not quantify magnitude. Osei-Owusu (2022), in a large-scale survey of 4,102 Ghanaian teachers, found a significant positive relationship between PD and professional knowledge ($\gamma = 0.26$, $p < 0.001$), with professional knowledge partially mediating the relationship between PD and student academic performance. This is a critical insight: PD improves student outcomes primarily by enhancing teachers' professional competencies, not directly. Nkundabakura et al. (2023) evaluated a continuous professional development (CPD) programme in Rwanda and found statistically significant improvements in mathematics teachers' PCK (effect size 0.450, $p < 0.001$), alongside medium learning gains (0.37). Qualitative data revealed enhanced engagement, confidence, and self-efficacy. Importantly, no gender differences emerged, suggesting the programme was equitable. Goes and Fernandez (2023) similarly found that a CPD programme on redox reactions improved chemistry teachers' PCK components, particularly knowledge of instructional strategies. Yet, a consistent limitation across many workshop and seminar studies is their short-term, event-based nature. As Sims and Fletcher-Wood (2021) argue, sustainable PD requires ongoing, practice-based support rather than isolated events. This may explain why some studies find weak or null relationships between one-off PD and deep teacher beliefs like efficacy.

Several studies have examined how teacher characteristics moderate PD effects. Lee et al. (2022) evaluated a year-long PD programme for mathematics teachers and found significant changes in self-efficacy, epistemological beliefs, and pedagogical knowledge, though content knowledge decreased in the first-year cohort before increasing in subsequent years. Teaching practice improved by approximately one standard deviation, and multiple regression showed that self-efficacy and epistemological beliefs influenced practice. This suggests that sustained PD can shift both knowledge and beliefs, but the trajectory may be non-linear. Al-Barakat et al. (2023) investigated student teachers' motivation toward PD participation and found very high levels of awareness that PD develops ambition, perseverance, and active engagement. This highlights that motivation is a precondition for PD effectiveness. Sodangi et al. (2022) surveyed secondary school science and mathematics teachers in Zamfara State, Nigeria, and found low awareness and participation in PD due to lack of incentives, employer support, affordability, and poor publicity. Teachers identified content knowledge and pedagogy as their most needed areas.

However, several gaps remain in the literature, most studies examine PD formats in isolation, yet teachers experience multiple PD mediums (online, seminars, workshops) simultaneously. Also, while international meta-analyses report medium-to-small effects, empirical evidence from Niger State is scarce. The present study addresses these gaps by investigating the relationship between three PD mediums (online, seminars, workshops) and teaching efficacy among secondary school mathematics teachers in Minna.

3.0 Methodology

This study utilised a descriptive correlational survey research design to investigate the relationships between professional development and teaching efficacy. This methodology is chosen for its capacity to systematically collect data from a sample to describe the characteristics of a larger population and to explore the correlational patterns among variables in their natural setting (Berends et al., 2019). The population for this study consisted of all secondary school teachers in Minna metropolis, Niger State. The sample size for this study was 269 teachers were selected for the study. A multi-stage sampling procedure was employed. First, stratified sampling technique was used to group the schools into strata; public and private secondary schools. Next, a proportionate stratified random sampling technique was used to select the sample mathematics teachers across the school type. A researcher-developed instrument titled the "Mathematics Teachers' Professional Development Programs and Self-Efficacy Questionnaire" (MTPDPSEQ) was used to collect data for this study. The questionnaire was divided into six (6) sections. Section A collected the bio-data of the respondents, including school type. Sections B through F all utilised a five-point Likert scale for responses: Strongly Agree (SA) = 5, Agree (A) = 4, Undecided (U) = 3, Disagree (D) = 2, and Strongly Disagree (SD) = 1. Section B focused on the online medium of professional development, Section C on the seminar medium, and Section D on the workshop medium, while Section E assessed their teaching efficacy. The content and face validity of the research instrument were established through an expert review process. The questionnaire was submitted to three experts to evaluate the instrument based on the clarity of the items, the appropriateness of the content, and its overall suitability for achieving the research objectives. The instrument was revised and finalised based on their feedback and recommendations, ensuring it was appropriate for the target population. The overall reliability coefficient for the instrument was 0.80, indicating a high degree of internal consistency. The data collected were analysed using a linear regression to test the null hypotheses at 0.05 level of significance. The null hypotheses include:

- H01: There is no significant relationship between participation in online professional development programmes and mathematics teachers' teaching efficacy.
- H02: There is no significant relationship between participation in seminar-based professional development programmes and mathematics teachers' teaching efficacy.
- H03: There is no significant relationship between participation in workshop-based professional development programmes and mathematics teachers' teaching efficacy.

Results

H_{01}: There is no significant relationship between the participation in online professional development programs and Mathematics teachers' teaching efficacy. To test this second null hypothesis, a simple linear regression was conducted and presented in Table 1a-c.

Table 1a: Linear Regression Model Summary on the Relationship between professional development program attended Online and Mathematics Teachers' Pedagogical Teaching Efficacy

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.060[a]	.004	.000	7.92364	.004	.979	1	317	.323

Table 1a presents the results of a simple linear regression analysis conducted to examine the relationship between participation in online learning professional development and mathematics teachers' teaching efficacy. The regression model was statistically significant, r (1, 315) = 0.060, r^2 = 0.004, p = .323. This indicates that workshop participation is a significant predictor of variance in teachers' PCK.

Table 1b: Linear Regression ANOVA Summary on the Relationship between professional development program attended Online and Mathematics Teachers' Pedagogical Teaching Efficacy

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	61.473	1	61.473	.979	.323[b]
	Residual	17014.468	316	62.784		
	Total	17075.941	317			

Table 4.*4*b presents the regression model was not statistically significant, F (1,317) = 0.979, p = .323. This indicates that the online learning score is not a significant predictor of teachers' teaching efficacy.

Table 1c: Linear Regression Coefficients Summary on the Relationship between professional development program attended Online and Mathematics Teachers' Pedagogical Teaching Efficacy

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	T	Sig.
1	(Constant)	41.944	2.194		19.121	.000
	Online Learning Score	.054	.055	.060	.990	.323

Table 1c: Examining the regression coefficients, the standardized coefficient (β) for the online learning score was .054. This represents a very weak positive relationship, was not statistically significant (t = 0.990, p = .323). Thus, we fail to reject the null hypothesis (H_{02}). Hence, there is no statistically significant relationship between participation in the online learning professional development program and the mathematics teachers' teaching efficacy in this sample. Similarly, the analysis of the second research hypothesis showed no significant relationship between online learning and Mathematics teachers' teaching efficacy. This outcome is best explained through Bandura's (1986) Social Cognitive Theory, which identifies mastery experiences and vicarious learning as primary sources of efficacy. The online programmes investigated in this study likely failed to provide these crucial inputs. As noted in the literature, a lack of physical proximity in online settings makes it more difficult to foster the deep interaction and peer collaboration that facilitate vicarious learning (Powell and Bodur, 2019). Furthermore, a typical online course does not offer the hands-on, real-classroom application necessary to build a sense of mastery. Without these powerful, experience-based sources, the online format would logically have a negligible impact on a teacher's core belief in their professional capabilities.

H_{02}: There is no significant relationship between the participation in Seminars and Mathematics teachers' teaching efficacy. To test this third null hypothesis, a simple linear regression was conducted as presented in Table 4.5a-c.

Table 2*a*: Linear Regression Model Summary on the Relationship between professional development program attended Seminars and Mathematics Teachers' Pedagogical Teaching Efficacy

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.040[a]	.002	-.002	7.93162	.002	.432	1	317	.512

Table 2 presents the results of a simple linear regression analysis conducted to test the relationship between participation in seminar-based professional development and mathematics teachers' teaching efficacy. The regression model was not statistically significant, r (1,317) = 0.040, r^2 = 0.002, p = .512.

Table 2b: Linear Regression Model ANOVA Summary on the Relationship between professional development program attended Seminars and Mathematics Teachers' Pedagogical Teaching Efficacy

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	27.149	1	27.149	.432	.512[b]
	Residual	17048.793	271	62.911		
	Total	17075.941	272			

From Table 2b, F (1,317) = 0.43, p = .512. This indicates that seminar participation does not serve as a significant predictor of variance in teachers' reported teaching efficacy.

Table 2c: Linear Regression Model Coefficient Summary on the Relationship between professional development program attended Seminars and Mathematics Teachers' Pedagogical Teaching Efficacy

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	42.571	2.321		18.345	.000
	Seminar Participation Score	.036	.055	.040	.657	.512

From Table 2c, The model accounts for a negligible proportion of the variance in efficacy (R^2 = .002). The standardised regression coefficient (β) for seminar participation is .040, indicating an extremely weak positive relationship. This relationship is not statistically significant (t = 0.657, p = .512). Based on this analysis, we fail to reject the null hypothesis (H_{04}). There is no statistically significant relationship between participation in the seminar-based professional development program and mathematics teachers' teaching efficacy in this sample. In line with the preceding findings, the test of the secod hypothesis demonstrated no significant relationship between seminar attendance and Mathematics teachers' teaching efficacy. This result reinforces the idea that simply receiving information is insufficient to alter a teacher's robust belief system. According to Bandura's (1986) framework, seminar participation offers only weak sources of efficacy; it may provide some verbal persuasion from a presenter but offers little opportunity for the much more powerful influences of mastery or vicarious experiences. This finding aligns perfectly with the principle that effective professional development must be sustainable and ongoing rather than a 'one-time event' (Sims and Fletcher-Wood, 2021), as building resilient efficacy requires a more sustained, supportive, and practice-based process than a single seminar can provide

H_{03}: There is no significant relationship between participation in workshops and Mathematics teachers' teaching efficacy. To test this sixth and final null hypothesis, a simple linear regression was conducted as presented in Table 3a-c.

Table 3a: Linear Regression Model Summary on the Relationship between professional development program attended Online and Mathematics Teachers' Pedagogical Teaching Efficacy

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.020[a]	.000	-.003	7.93634	.000	.109	1	317	.741

Table 3a presents the results of a simple linear regression analysis conducted to test the relationship between participation in workshop-based professional development and mathematics teachers' teaching efficacy. The regression model was not statistically significant, r (1, 317) = 0.020, r^2 = 0.000, p = .741.

Table 3*b*: Linear Regression Model ANOVA Summary on the Relationship between professional development program attended Online and Mathematics Teachers' Pedagogical Teaching Efficacy

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	6.879	1	6.879	.109	.741[b]
	Residual	17069.063	271	62.985		
	Total	17075.941	272			

Table 3b presents the results of a simple linear regression analysis conducted to test the relationship between participation in workshop-based professional development and mathematics teachers' teaching efficacy. The regression model was not statistically significant, F (1, 317) = 0.11, p = .741. This indicates that workshop participation does not reliably predict variance in teachers' reported teaching efficacy.

Table 3*c*: Linear Regression Model Coefficients Summary on the Relationship between professional development program attended Online and Mathematics Teachers' Pedagogical Teaching Efficacy

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	42.343	5.224		8.106	.000
	Workshop Participation Score	.039	.119	.020	.330	.741

From Table 3*c*, the model's explanatory power is effectively zero, accounting for approximately 0% of the variance in efficacy (R^2 = .000). The standardised regression coefficient (β) for seminar participation is .039, indicating an extremely weak positive relationship. This relationship is not statistically significant (t = 0.330, p = .741). Based on this result, we fail to reject the null hypothesis (H_{06}). There is no statistically significant relationship between participation in the workshop-based professional development program and mathematics teachers' teaching efficacy in this sample. This showed that despite the positive impact on knowledge, there was no significant relationship between workshop-based professional development participation and teaching efficacy. This is a nuanced but critical finding that highlights the distinction between knowledge and belief. While a workshop can successfully impart knowledge (PCK), it appears insufficient on its own to alter deeply held efficacy beliefs. This can again be explained through Social Cognitive Theory (Bandura, 1986). A single workshop, while providing the *tools* for a mastery experience, is not the mastery experience itself; that can only occur when a teacher successfully implements and refines new strategies in their own classroom over time. This result shows the literature's emphasis on the need for sustainable, cyclical, and supportive professional development (Sims and Fletcher-Wood, 2021). To build efficacy, a one-off workshop must be followed by opportunities for classroom practice, reflection, and feedback, which were likely beyond the scope of the workshops measured in this study.

Conclusion

The study established that although professional development remains an important component of teacher growth, participation in online, seminar-based, and workshop-based professional development programmes alone does not significantly predict mathematics teachers' teaching efficacy in Minna

Metropolis. Strengthening teaching efficacy requires sustained, practice-oriented, and context-based professional support systems. Based on this, the following recommendations were made:

i. Professional development programmes should include practical classroom implementation sessions.
ii. Mentoring and peer coaching should accompany professional development activities.
iii. Schools should institutionalise continuous reflective practice among mathematics teachers.
iv. Government should improve funding and access to quality mathematics teacher development programmes.
v. Teacher development should focus on building mastery experiences to strengthen efficacy beliefs.

REFERENCES

- Adams, A. K.; Asemnor, F.; Nkansah, V. & Adonu, H. (2023). The Impact of Professional Development on the Pedagogical Content Knowledge of the Mathematics Teacher . *Asian Journal of Advanced Research and Reports* 17(3),19-28
- Al-Barakat, A. A1*, Alakashee, B. A., Al Karasneh, S. M, El-Mneizel, E. F, Ahmad, J. F, Al-Qatawneh, S. S. (2023). Student teachers' motivation toward participation in the professional development programs. *Emerging Science Journal, 7 (2), 64-78*
- 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.* 11-23. Retrieved from https://www.researchgate.net/publication/344380042
- Bamidele, A. D. & Adekola, F. F. (2017). Effects of teacher's qualifications and teaching experience on students' academic achievement in Basic Science in junior secondary school. *International Journal of Education and Evaluation*, 3(2), 1 – 9.
- Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Prentice-Hall.
- Cowart, J.; Jin, Y. (2024). Leading Online Professional Development for Instructional Technology Coaches with Effective Design Elements. *Educ. Sci.* 14, 697, 1-30
- Fatoba, J. O; Akinnodi, O. D, Adeleye, A. M, Olofin, S. O. (2020). "Teachers' Teaching Experience and Secondary School Students' Performance in Science Subjects in Ondo State, Nigeria". *International Journal of Academic Research in Business, Arts and Science,* 2(6),35-43
- Fatoba, J. O; Akinnodi, O. D, Adeleye, A. M, Olofin, S. O. (2020). "Teachers' Teaching Experience and Secondary School Students' Performance in Science Subjects in Ondo State, Nigeria". *International Journal of Academic Research in Business, Arts and Science,* 2(6),35-43
- Federal Republic of Nigeria (2013). *National policy on education*. Abuja: NERDC Press.
- Goes, L.F.; Fernandez, C. (2023). Evidence of the Development of Pedagogical Content Knowledge of Chemistry Teachers about Redox Reactions in the Context of a Professional Development Program. Educ. Sci. 13, 1159
- Gonzalez, K. & Maxwell, G. M. (2020). Mathematics teachers' efficacy, experience, certification and their impact on student achievement. *Journal of Instructional Pedagogies* , 21(1), 1-11
- Jacob, R.; Hill, H. & Corey, D. (2017) The Impact of a Professional Development Program on Teachers' Mathematical Knowledge for Teaching, Instruction, and Student Achievement, *Journal of Research on Educational Effectiveness*, 10:2, 379-407
- Lee, H. & Vongkulluksn, V. W. (2023). Enhancing Mathematics teacher professional learning through a contextualized professional development program, Teacher Development, 27(1), 92-115
- Linde, I.; Sarva, E.; Daniela, L. (2023) he Impact of an Online Professional Development Course on Teachers' Comprehension and Self-Efficacy in Developing Students' Self-Regulated Learning Skills. *Sustainability,* 15, 1-14.
- Morina, F.; Fütterer, T.; Hübner, N.; Zitzmann, S.; & Fischer, C. (2024). Effects of online each professional development on teacher-, classroom-, and student-level outcomes: A meta-analysis. Computers & Education 228(1), 1-23
- Niger State Secondary Education Assessment Committee (2024). Main Report, Volume I
- Nkundabakura, P.; Nsengimana, T. Nyirahabimana, P.; Nkurunziz, J. B; Mukamwambali, C; Dushimimana, J.C.; Batamuliza, J., Byukuseng, C. & Iyamuremye, A. (2024). Effectiveness of the continuous professional development training on upper primary mathematics and science and elementary technology teachers' Pedagogical Content Knowledge in Rwanda. Discover Education, 3(12), 1-17
- Nwarie, U. N., & Nwakudu, G. N. (2019). Availability and constraints of capacity building programmes for teachers' productivity in secondary schools in Abia State, Nigeria. *Journal of Education in Developing Areas,* 27(2), 296-306.
- Osei-Owusu, B. (2021). Retrospective Assessment of The Successes and Challenges of Double Track System in Senior High Schools in Sekyere Central District of Ghana. *British Journal of Education*, *9*(9), 18–30.
- Osei-Owusu, B. (2021). Retrospective Assessment of The Successes and Challenges of Double Track System in Senior High Schools in Sekyere Central District of Ghana. *British Journal of Education*, *9*(9), 18–30.
- Otun, I. W. & Olaoye A. A. (2019). Repositioning pre-service Mathematics teacher preparation and professional development in Nigeria: an analysis of the curriculum of Mathematics teacher education in the learning and teaching of JSS Mathematics method courses. *Abacus (Mathematics Education Series*), 44(1), 284-297
- Otun, W. I. (2022). Strengthening pre-service Mathematics teachers' knowledge of students' thought processes, students' misconceptions and text analysis skill. *Journal of Mathematics and Science Teacher,* 2(2), 1-14
- Perez, C. & Cruz, R. A. O. (2024). Effect of Seminar on Teaching on the Performance of Teachers in Higher Education Rowena. *Pan-African Journal of Education and Social Sciences (PAJES),* 5(1), 112-119
- Powell, C. G., & Bodur, Y. (2019). Teachers' perceptions of an online professional development experience: Implications for a design and implementation framework. Teaching and Teacher Education, 77, 19–30.
- Sims, S., & Fletcher-Wood, H. (2021). Identifying the characteristics of effective teacher professional development: a critical review. *School Effectiveness and School Improvement*, 32(1), 47–63.

- Sodangi, U.; Isma'il, A. & Abdulrahaman, A. (2022). Perception of secondary school science and Mathematics teachers on Professional development participation in Zamfara State, Nigeria. *Integrity Journal of Education and Training***,** 6(2), 37-45
- StudyCorgi, E. (2020). *Mathematics Teachers' self-efficacy, its importance, and effects.* https://studycorgi.com/Mathematics-teachers-self-efficacy/
- Wang, M. & Zhang, L. J. (2023). Understanding teachers' online professional learning: A "community of inquiry" perspective on the role of Chinese middle school teachers' sense of self-efficacy, and online learning achievement, 9(1), 1-14
- Wood-cock, S., Sharma, U., Subban, P., & Hitches, E. (2022). Teacher self-efficacy and inclusive education practices: Rethinking teachers' engagement with inclusive practices. Teaching and Teacher Education 117(1), 1-12