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Continuous Professional Development and Teacher Effectiveness: A Structural Equation Modeling Study in the Somali State of Ethiopia

Abdiaziz Sheik Mohamed[1*] **and Manoj Govindaraj**[1]

[1]*Department of Management Studies, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu 600062, India.*

[*]zayidabdiaziz@gmail.com (Corresponding Author)

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ABSTRACT

Background: Teacher professional development is a significant factor in the quality of the education system. Ethiopia continues to improve its educational institutions and develop teachers; however, the Somali Regional State faces several challenges, including inadequate institutional support, delayed and low salaries, inconsistent training programs, insufficient student motivation strategies, and inadequate learning environments.

Purpose: This study examines the significance of teacher professional development in sustaining an efficient educational system in the Somali Regional State of Ethiopia, with a specific focus on the influence of institutional support, motivating promotion, and recognition of teacher professional development.

Methods: A quantitative cross-sectional design was used to gather information from 265 teachers in the Somali Regional State of Ethiopia using a structured questionnaire instrument, which was analyzed in SPSS and PLS to investigate the relationships among factors of challenges in teacher professional development.

Results: The result highlights effective teacher professional development, which requires the successful integration of institutional support and specific conditions. The findings demonstrate that the latent constructs explain more than 50% of the variance in the observed indicators. Examination of the measurement model suggests that the constructs also demonstrate adequate indicator reliability, internal consistency, and convergent validity. The strong outer loadings, high CR and rho-A values, and adequate AVE scores all together suggest that the measurement instruments have psychometric validity appropriate for examining structural models.

Conclusion: The study concluded that, for the classroom process to become even more efficient, it should focus on professional development using technology and on increasing teachers' abilities. This is a big deal for policymakers, school leaders, and sector professionals in their efforts to ensure the efficiency of teaching within educational institutions..

1. Introduction

Teacher Professional Development (TPD) has been identified as a significant factor for enhancing the quality of education and learning results at the global level (Shi & Chen, 2026). Teacher professional progress is a traditional concept that is viewed as an episodic activity for developing teacher knowledge in a specific subject area (Yoon & Goddard, 2023). Contemporary perspectives on teacher professional development have conceived of it as a continuous, systematic, and contextualised approach to developing teachers' knowledge, practices, and professionalism (Bellibaş *et al.*, 2025; Jerrim *et al.*, 2025). This modification is due to the recognition of the evolving nature of the teaching profession, which requires teachers to adopt a lifelong learning approach for meeting the developing curriculum needs and diversity of learners (Kisi, 2023; Lipka *et al.*, 2025; Zeng, 2023).

Numerous studies demonstrate that there is a strong positive correlation between effective professional development and enhanced students' academic performance. For instance, recent study

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findings indicate that effective teacher professional development, characterized by active learning approaches, collaboration, alignment with the curriculum's objectives, and sustained duration, is connected with enhanced teaching quality and students' learning outcomes (Uzorka *et al.*, 2024; Ventista & Brown, 2023). In this regard, the significance of investing in teachers' professional development as a way of strengthening education systems has been highlighted by other empirical studies (Ajani, 2023; Amemasor *et al.*, 2025).

Across African countries, the implementation and success of teacher professional development have been a subject of concern due to various challenges that affect education systems in this region. In most cases, education systems in Sub-Saharan Africa have been characterised by challenges such as a lack of institutional support and overcrowded classrooms (Nakidien *et al.*, 2021). In this regard, various professional development programmes have been implemented to counteract these challenges. However, it has been noted that such programs have a limited effect in changing teaching practices in classrooms without proper mentoring and follow-up mechanisms in place (Wambugu *et al.*, 2019). Recent studies have noted that teacher professional development models that are context-specific, school-based, and collaborative have a more significant impact in changing teaching practices and student academic performance (Mitchell *et al.*, 2024).

In the case of Ethiopia, the improvement of the quality of teachers has been a significant objective of the education system as a whole. The Ministry of Education has institutionalized the CPD system as a framework for developing the pedagogical competence of teachers (Melesse & Gulie, 2019). Nevertheless, the findings of studies examining the effectiveness of CPD for teachers have been inconsistent. Some studies have shown a positive impact of CPD for teachers; however, other studies have shown the absence of such an impact. It is suggested that more research is required to find out the factors that lead to such differences (Faro *et al.*, 2025; Shin *et al.*, 2025).

The Somali Regional State in Ethiopia is an extremely challenging context for education, characterised by geographical remoteness, a lack of qualified teachers, and poor institutional infrastructure (Garay Abad & Hattie, 2025; Somali Teacher Development Association, 2024; Worku, 2025). In such contexts, the interplay between institutional support, teachers' competence and motivation, and engagement in CPD programs is considered instrumental for the success of continuous professional development (Tadesse *et al.*, 2020). Nevertheless, there is an apparent scarcity of research exploring the structural relationships among the abovementioned factors and their combined impact on teachers' effectiveness in this context. Therefore, this study aims to address the research gap by examining the structural relationships among the key factors of continuous professional development and their impact on teachers' effectiveness using structural equation modelling (SEM).

1.1. Literature Review

The global discourse on teacher professional development (TPD) has undergone considerable change over the last three decades. Initial foundational studies focused on the significance of moving beyond fragmented workshops toward sustained and practice-oriented learning opportunities for teachers (Nīmante *et al.*, 2025; Rachmadtullah *et al.*, 2025). Recent studies have also conceptualized effective professional development for teachers in terms of structured, coherent, and content-based professional development that links teachers' learning to instructional improvement (Bufasi *et al.*, 2025).

At the same time, the global literature has also highlighted challenges. Professional development programs have been found to be unsuccessful when they are not relevant to the context, lack institutional support, and lack mentoring (Lindvall *et al.*, 2019). Hence, today's literature has focused on the systemic alignment of TPD and has highlighted the importance of aligning professional development with curriculum reforms. This change in perspective from training to professional learning can provide a lens to analyze the effectiveness of CPD in developing countries (Dinh & Nguyen, 2023; Merino *et al.*, 2025).

During the 2000s and 2010s, Africa placed greater emphasis on teacher professional development (TPD) and educational excellence. Asmare (2025) indicated that Teacher Professional Development (TPD) is underperforming due to systemic issues such as insufficient resources, inadequate policy implementation, and a lack of subsequent support. Research in Ghana and South Africa indicated that

teacher training workshops, without accompanying in-class support, had a negligible impact on instructional quality and student performance (Kimondolo *et al.*, 2025). A recent study from Africa suggests that Teacher Professional Development (TPD) models that take into account local constraints, provide ongoing mentorship, and encourage collaborative learning communities can help enhance the quality of education (Mitchell *et al.*, 2024; Nakidien *et al.*, 2021).

Moreover, research has increasingly utilized empirical and meta-analytic methodologies to assess the impact of TPD. For example, on a large scale, it was found that professional development is most effective when it involves elements of active learning, collaboration, modeling of strategies, and duration (Kraft *et al.*, 2018). Likewise, a number of systematic reviews have confirmed that high-quality TPD has a significant impact on teacher effectiveness and student achievement, especially when implemented in the classroom (Ventista *et al.*, 2023). This evidence on a global scale indicates that TPD is not just a professional duty but a key enabler of quality in education.

1.1.1. Teacher Professional Development in Africa

In Sub-Saharan Africa, teacher professional development has been framed as a key intervention aimed at addressing the challenges facing the quality of education. In most cases, the educational system in the region has faced challenges such as overcrowding, a lack of qualified teachers, inadequate infrastructure, and insufficient instructional materials (Sims *et al.*, 2025). In such a case, TPD has been recognized as a cost-effective way of improving teacher capacity.

Implementation issues limit a number of African TPD initiatives, according to empirical evidence. For example, short-term workshops without mentoring have been shown to have limited effectiveness in terms of instructional transformation (Murphy-Graham *et al.*, 2026). Recent studies conducted across the continent have highlighted that professional development models that are context-specific, such as school-based and collaborative models, are more effective in terms of instructional transformation (Tambak *et al.*, 2025). The research carried out in Africa demonstrates that institutional support and teachers' motivation make significant contributions to student academic performance as mediating factors. This suggests that professional development programs may fail to influence the classroom in the absence of administrative support and incentives (Mitchell *et al.*, 2024). This study demonstrates that the effectiveness of teacher professional development in Africa is dependent not only on the program but also on the quality of the educational system.

1.1.2. Teacher Professional Development in East Africa

Studies conducted in East Africa have consistently identified a strong link between teacher professional development and students' academic performance. Research conducted in Kenya showed that teacher coaching and peer collaboration significantly enhanced literacy and numeracy learning outcomes in primary schools (Dyosini, 2024). This shows that mentoring and feedback mechanisms have a greater impact on teachers' effectiveness than professional development alone.

The literature from East Africa highlights challenges such as insufficient funding, logistics, and monitoring, which affect the sustainability of continuous professional development initiatives. Therefore, although the literature demonstrates that the development of teachers can enhance learning outcomes, the success of the process still depends on the context and institutional support (Nelson *et al.*, 2026; Sifuna, 2007).

In Ethiopia, education reform policies have consistently emphasized teacher quality as the fundamental pillar for national development. Successive Education Sector Development Programs (ESDP) and the recently launched Education Development Roadmap have prioritized the institutionalization of Continuous Professional Development (CPD) as a strategy for enhancing pedagogical competence and institutional effectiveness (Barnes *et al.*, 2018). The continuous professional development policy framework was formulated with the objective of promoting structured CPD, reflective practice, and collaboration at primary and secondary education levels in Ethiopia (Desimone & Pak, 2017; Oliso, 2021).

Studies conducted in different contexts in Ethiopia have shown that while continuous professional development policies have had a positive impact on collegial working, professional dialogue, and teacher engagement, their impact on instructional

transformation and academic outcomes is inconsistent (Melesse & Belay, 2022). Similarly, Mohammed and Gutema (2021) have shown that while teachers recognize the importance of continuous professional development policies, their implementation is often hindered by insufficient follow-up supervision, mentoring support, and contextualization to local school realities, suggesting that CPD policies are implemented more as a compliance-driven administrative exercise rather than a transformative process.

However, more recent assessments of school-based professional development programs in Ethiopia have shown that contextual adaptations and commitment from school leadership are also important factors in determining program effectiveness (Tiruneh *et al.*, 2025). The effectiveness of CPD is also dependent on the integration of motivation, support, and competence development factors. Thus, it is important to understand structural relationships between these factors to improve educational quality (Faro *et al.*, 2025).

Previous studies from Ethiopia have mainly concentrated on descriptive analyses of the implementation of CPD instead of exploring the predictive and mediating relationships among the determinants of teacher effectiveness. Therefore, the structural basis for the relationship between continuous professional development and institutional and motivational factors is not sufficiently clear. This study seeks to bridge this knowledge gap by utilizing a structural equation modeling method to explore the relationships between professional development participation, teaching competence, motivation and support, continuous professional development, and teaching effectiveness within the Somali Regional State. This study thus contributes to the broader discussion about the significance of professional development and the quality of education in developing educational systems.

1.1.3. Theoretical Framework

Gary Becker (1993) conceptualized the Human Capital Theory, which informs this study. This theory asserts that investing in education and training activities improves the knowledge, skills, and productivity of individuals, thus improving their performance outcomes. In the context of the education sector, CPD is an investment in the professional capital of the teaching staff. Teachers' engagement in professional development, motivation and support, and their professional competence are all factors that facilitate the development and utilization of their professional skills. This means that improvement in professional capital will lead to enhanced effectiveness in teaching and the ability to handle contextual challenges. The Human Capital Theory, therefore, provides a conceptual framework to explore the relationships between the CPD determinants and the perceived barriers in the Somali Regional State in Ethiopia.

2. Methodology

The study employed a quantitative cross-sectional correlational research design to examine the structural relationship between Continuous Professional Development (CPD) and factors associated with it in public schools in the Somali Regional State of Ethiopia (Hunziker *et al.*, 2024). The quantitative approach is appropriate for the study since it aims to analyze and measure the relationships between specified constructs through the use of statistical tools. The study uses a correlational design, which allows for the exploration of variable associations without disrupting the setting.

The conceptual framework of the study aims to investigate the influence of institutional support, teaching competence skills, motivation, and participation in professional development on CPD and, finally, the influence of continuous professional development on teachers' effectiveness. Due to the contribution of several latent constructs and indirect relationships in this study, a major analytical tool that has been used is partial least squares structural equation modeling (PLS-SEM). This tool is more appropriate for complex models that involve several constructs and is commonly used in social sciences for both predictive and exploratory purposes.

The target population consisted of all permanent public-school teachers in the Somali Regional State of Ethiopia. According to the Education Bureau of the Somali Regional State, there are 12,470 instructors in several administrative zones. For this study, a proportional stratified sampling method was used for its representativeness. Here, each stratum is defined by each of the organizational zones. The sample size was determined using the Yamane formula (1969) for finite population estimation.

Where n is the sample size, N is the population size (12,470), and e is the accuracy level (0.06). Using this formula, the minimum sample size was determined as 277 respondents.

A structured questionnaire was designed to gather data based on existing literature on teacher professional development and educational effectiveness. The structured questionnaire had six constructs: Continuous Professional Development (CPD), Teaching Effectiveness (TE), Teaching Competence Skills (TCS), Motivation and Institutional Support (MIS), Participation in Professional Development (PRD), and Challenges and Barriers (CB). The structured questionnaire used a five-point Likert scale to measure all constructs, ranging from strongly disagree (1) to strongly agree (5). To confirm content validity, the structured questionnaire was reviewed by experts in educational research.

2.1. Data Collection and Analysis

The study collected data through an online questionnaire in the 2025 academic year from public school teachers in the Somali Regional State of Ethiopia. The questionnaire was distributed through school administration and professional networks to secure representation of all the selected strata. The duration of data collection was eight weeks, and all respondents were voluntary participants. The study adhered to ethical guidelines, particularly emphasizing anonymity and confidentiality. The calculated sample size was 277, of which 265 completed questionnaires were used in the final analysis, resulting in a response rate of 95.7%. Proportional stratified sampling was employed to ensure representation of administrative regions, followed by simple random sampling.

A structured questionnaire was developed that measured multiple constructs: Continuous Professional Development (CPD), Teaching Effectiveness (TE), Motivation and Institutional Support (MIS), Teaching Competence Skills (TCS), Participation in Professional Development (PPD), and Challenges and Barriers (CB). The items were modified from scales used in the literature and tailored to the current context. Expert review in the fields of educational research and measurement was used to ensure content validity. A pilot study was undertaken to ensure clarity, reliability, and contextual fit. A five-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree), was used to rate all items.

The data were analysed in two phases using the Statistical Package for the Social Sciences (SPSS) and SmartPLS. Initially, descriptive statistics were calculated to describe the respondents' demographics. In the second stage, Partial Least Squares Structural Equation Modelling (PLS-SEM) was used to test relationships between latent variables.

SmartPLS-SEM was selected due to its appropriateness for complex models with multiple constructs, its predictive nature, and its ability to handle non-normal data distributions and smaller sample sizes (Hair *et al.*, 2021). The study adopted the two-step method. In the initial step, the measurement model was assessed. Reliability of the indicators was measured by the outer loadings (≥ 0.70) and Composite Reliability (CR) (cut-off value of 0.70 or more), and internal consistency reliability by Cronbach's alpha (CA). Average Variance Extracted (AVE; ≥ 0.50) was used to assess convergent validity.

In the second stage, the structural model was evaluated to investigate the hypotheses. The path coefficients, t-values, and p-values were examined to determine the strength and significance of the paths. The bootstrapping method (5,000 resamples) was used to measure the stability of the estimates. The coefficient of determination (R^2) was used to evaluate the predictive power of endogenous constructs, while the effect size (f^2) was used to assess the influence of predictor variables on endogenous constructs.

2.2. Ethical Approval

The study was conducted in an ethical manner according to established research ethics and principles. Participation in the study was entirely voluntary, and informed consent was obtained from all research participants before data collection commenced. The study strictly maintained the confidentiality and anonymity of the research participants.

The conceptual framework illustrates the relationships among teacher professional development, motivation and institutional support, teaching competence, continuous professional development, and challenge barriers of teacher development.

2.3. Theoretical Alignment of Hypotheses under Human Capital Theory

The study was based on the Human Capital Theory as proposed by Gary Becker (1993). This theory

argues that investments in education, training, and skill development increase the productivity and performance outcomes of individuals. In the context of education systems, Continuous Professional Development (CPD) represents an investment in teachers' professional capital, with the expectation that increased knowledge and professional competencies will increase their performance outcomes.

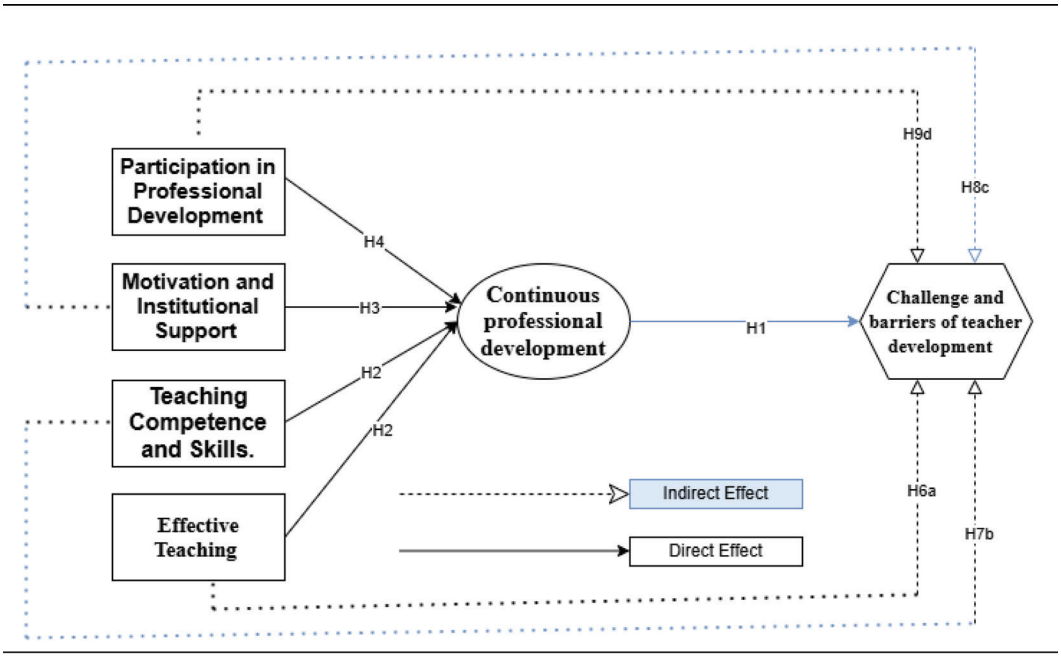


Figure 1: Conceptual Framework and Hypothesis Model

- **H1: Participation in professional development to continuous professional development** The Human Capital Theory views training participation as the primary means of developing human capital. The greater the participation of individuals in structured learning activities, the greater their capacity for knowledge and skill acquisition and professional competencies. In this study, participation of teachers in professional development activities is considered a direct investment in professional capital; hence, it is expected that higher participation will improve the effectiveness of professional development activities.
- **H2: Motivation and institutional support to continuous professional development** Human Capital Theory also acknowledges that the rate of return on investment in training depends on the presence of certain enabling conditions. Organizational support, motivation structures, and access to resources all contribute to the productivity of the investment made in human capital. The more the teacher internalizes the support and motivation structures within the institution, the more he/she will be able to utilize the competencies learned. Therefore, motivation and support act as a catalyst for CPD.
- **H3: Teacher competence and skill to continuous professional development** According to Human Capital Theory, prior knowledge facilitates the absorption and utilization of new knowledge. Teachers who have basic knowledge in pedagogy are in a better position to utilize advanced professional learning. Therefore, competence in teaching can be both the stock of human capital and the reinforcing factor that enhances the effectiveness of additional training investments.
- **H4: Effective teaching practice to continuous professional development** Human Capital Theory establishes a relationship between skill accumulation and observable productivity outcomes. Effective teaching practices embody the application component of professional capital in learning environments. As teachers reflect and implement evidence-based instructional strategies, CPD programs are more likely to result in observable outcomes. Thus, effective teaching practices reinforce and build upon continuous professional development programs.
- **H5: Continuous professional development to challenge and barrier for teaching development**

Based on Human Capital Theory, investing in professionals' skills helps individuals overcome structural constraints more effectively. As teachers gain more knowledge and expertise in teaching through Continuous Professional Development (CPD), they can better handle contextual challenges. Hence, CPD can help teachers overcome the challenges they perceive more effectively.

These hypotheses collectively suggest a conceptualization of Continuous Professional Development (CPD) as a strategic process for investing in human capital, wherein participation, institutional support, and competence development yield improved professional outcomes and diminished structural barriers within the education system.

3. Results and Discussion

The study targeted 277 respondents for data collection. Of these, 265 questionnaires were correctly completed and returned, while 12 were incomplete and not included in the final analysis. In general, most researchers consider a response rate of 70% to be acceptable (A. Beehr *et al*., 2024).

Table 2. Demographic Characteristic of Respondents (n = 265)

Variable	Category	n	%
Gender	Male	203	76.6
	Female	62	23.4
Age	20-29	111	41.9
	30-39	88	33.2
	40-49	56	21.1
	50+	10	3.8
Educational level	Diploma	150	56.6
	Bachelor's degree	98	37.0
	Master's degree	17	6.4
Teaching experience	1-5 years	29	10.9
	6-10 years	104	37.4
	11-15 years	70	26.4
	16-20 years	46	17.4
	20+ years	16	6.0

The table above indicates that 203 (76.6%) of the sample consisted of male instructors, while 62 (23.4%) were female teachers. The gap is ascribed to the respondents' male majority, as most parents in the Somali Regional State prioritize male education while assigning domestic tasks to females. The data show that 111 participants (41.9%) were between the ages of 20 and 29, 88 people (32.2%) were between the ages of 30 and 39, 56 respondents (21.1%) were between the ages of 40 and 49, and 10 participants (3.8%) were 50 or older. The findings indicate that the majority of teachers in the Somali Regional State are youthful and within the productive age demographic.

Of the teaching qualifications, 150 (56.6%) had diplomas, while 98 (37.0%) had first degrees. Additionally, 17 (6.4%) respondents managed to obtain master's degrees. It is evident that fifty percent of the respondents had diplomas, which may influence the issues revolving around professional growth; however, academic qualifications are insufficient for professionals to achieve the goals of the institution.

In conclusion, 29 individuals (10.9%) had teaching experience of 1–5 years, 104 individuals (37.4%) had 6–10 years, 70 individuals (26.4%) had 11–15 years, and 46 individuals (17.4%) had 16–20 years, and 16 individuals (6%) had over 20 years of experience. The experience reveals that most teachers are highly skilled and enthusiastic.

Table 3 shows how well the outer measurement model works, including how reliable the indicators are, how consistent the internal consistency reliability is, and how valid the construct convergence is for all the constructs in the study. The evaluation conforms to recognized standards for Partial Least Squares Structural Equation Modeling (PLS-SEM) to ensure the measurement model's adequacy and reliability.

All of the measuring items' outer loadings are higher than the minimum allowed level of 0.70, except for two indicators (CB3 = 0.710 and TCS3 = 0.698), which are still within the acceptable range for exploratory social science research (Hair *et al.*, 2019). Hair *et al*. (2019) assert that loadings ranging from 0.60 to 0.70 are deemed acceptable, provided that supplementary reliability and validity standards are met. Thus, all indicators were maintained as they substantially augment their respective frameworks.

We used Cronbach's Alpha (CA), rho-A, and Composite Reliability (CR) to assess internal consistency reliability. Cronbach's Alpha coefficients for all constructs fall between 0.773 and 0.882, which is higher than the acceptable level of 0.70. This indicates that all of the constructs are highly reliable. The rho-A values range from 0.830 to 0.887, which also indicates that the

constructs are reliable. The Composite Reliability values for all constructs are higher than 0.70, ranging from 0.864 to 0.927. This indicates that the measurement items are highly consistent with one another.

Table 3: Measurement Model Assessment Results

Construct	Code	Outer Loading	CA	rho-A	CR	AVE
Challenge and barriers of teacher development	CBTD1	0.870	0.773	0.832	0.864	0.682
	CBTD2	0.887				
	CBTD3	0.710				
Continuous professional development	CPD1	0.871	0.857	0.859	0.913	0.777
	CPD2	0.884				
	CPD3	0.890				
Effective teaching	ET1	0.861	0.841	0.846	0.904	0.758
	ET2	0.886				
	ET3	0.866				
Teaching competence and skill	TCS1	0.896	0.783	0.830	0.873	0.699
	TCS2	0.898				
	TCS3	0.698				
Motivation and institutional support	MIS1	0.744	0.780	0.837	0.868	0.689
	MIS2	0.861				
	MIS3	0.878				
Participation in professional development	PPD1	0.936	0.882	0.887	0.927	0.810
	PPD2	0.911				
	PPD3	0.851				

Average Variance Extracted (AVE) is employed in determining the convergent validity of the study. The values of AVE for all the constructs were above the required minimum of 0.50, with values varying from 0.682 to 0.810. The constructs of Classroom Behavior (AVE = 0.682), Continuous Professional Development (AVE = 0.777), teacher effectiveness (AVE = 0.758), TC Skills for Learning (AVE = 0.699), Motivation and Institutional Support (AVE = 0.689), and Professional Participation Development (AVE = 0.810) have high convergent validity.

The results show that the latent constructs are able to explain more than 50% of the variance in the observed indicators. Examination of the measurement model suggests that the constructs also demonstrated adequate indicator reliability, internal consistency reliability, and convergent validity. The strong outer loadings, high CR and rho-A values, and adequate AVE scores all together suggest that the measurement instruments have psychometric validity and, therefore, are appropriate for examining structural models. The quality criteria are met with respect to moving on to assess the relationships among constructs.

Table 4: Reliability and Convergent Validity Results

Construct	Cronbach's Alpha	rho_A	Composite Reliability	AVE
CB	0.773	0.832	0.864	0.682
CPD	0.857	0.859	0.913	0.777
ET	0.841	0.846	0.904	0.758
TCS	0.783	0.830	0.873	0.699
MIS	0.780	0.837	0.868	0.689
PPD	0.882	0.887	0.927	0.810

Source: PLS (2025)

Table 4 illustrates the outcomes of the reliability and convergent validity assessments for the structural equation model. The results indicate that all constructs exhibit robust internal consistency and are suitable for measurement purposes. Cronbach's Alpha scores range from 0.773 to 0.882, above the minimum threshold of 0.70, hence indicating the reliability of the results.

Rho-A values range between 0.830 and 0.887, which shows stability and consistency within the constructs. The values for Composite Reliability range between 0.864 and 0.927, which is well beyond the acceptable limit of 0.70. This result shows that there is consistency among the properties being measured.

Average Variance Extracted (AVE) was used to determine convergent validity. All constructs had values ranging from 0.682 to 0.810, exceeding the minimum threshold of 0.50. These findings indicate that each construct significantly contributes to the variation in its indicators. The results show that the measurement model is psychometrically robust and suitable for further structural model and hypothesis testing.

Table 5 and 6 illustrate the direct and indirect effects of constructs on each other, along with path coefficients and significance levels (t-values). The results indicate that Continuous Professional Development (CPD) has a strong and statistically significant effect on challenge and barrier teaching development (CB) ($\beta = 0.860$, $p < 0.001$). Changes to Continuous Professional Development have a big effect on how teachers act in the classroom. ET has a big effect on CPD ($\beta = 0.948$, $p < 0.001$), which shows how important it is to improve CPD.

Table 5. Path Analysis Direct Effect

Hypothesis	Path	β	Mean	S D	T-value	P-value	Decision
H1	CPD -> CB	0.860	0.863	0.014	59.930	0.000	Supported
H2	ET -> CPD	0.948	0.947	0.044	21.586	0.000	Supported
H3	TCS -> CPD	0.089	0.088	0.042	2.139	0.033	Supported
H4	MIS -> CPD	0.238	0.240	0.034	7.011	0.000	Supported
H5	PPD -> CPD	-0.301	-0.300	0.034	8.760	0.000	Supported

Note: β= path coefficient; SD= standard deviation
Source: SmartPLS 3

Table 6: Indirect Effect Mediation Analysis

Hypothesis	Path	β	Mean	S D	T-value	P-values	Decision
H6a	ET -> CPD -> CB	0.815	0.817	0.041	19.988	0.000	Supported
H7b	TCS -> CPD -> CB	0.076	0.076	0.036	2.134	0.033	Supported
H8c	MIS -> CPD -> CB	0.204	0.207	0.029	7.070	0.000	Supported
H9d	PPD -> CPD -> CB	-0.258	-0.259	0.029	8.889	0.000	Supported

Note: β= path coefficient; SD= standard deviation
Source: SmartPLS 3

The teaching competence skill for learning (TCS) ($\beta = 0.089$, $p = 0.033$) and Motivation and Institutional Support (MIS) ($\beta = 0.238$, $p < 0.001$) factors have a positive impact on CPD. PRD has a big negative consequence on CPD ($\beta = –0.301$, $p < 0.001$).

The effects of mediation examined through the indirect effects show that CPD does a strong job of mediating the indirect pathways from ET, TCS, MIS, PRD, and CB. This suggests that the Theory of Planned Behavior (TPB) functions as a primary mechanism affecting teaching effectiveness (Ajzen, 2020). The findings indicate that CPD is the principal determinant influencing ET, and MIS substantially enhances CPD. There is, however, an ironic negative effect of pedagogic progress that is explained.

Figure 2 illustrates the outcomes of the structural equation modeling, showcasing the relationships among teaching effectiveness (TE), teaching competence skill (TCS), Motivation and Institutional Support (MIS), participation in Professional Development (PRD), Continuous Professional Development (CPD), and challenge and barrier (CB). The model indicates that CPD serves as the primary connection among institutional, technical, and professional elements and classroom behavior. There exist robust positive correlations from ET to CPD and from CPD to CB. The integration of technology in the classroom significantly enhances professional development, hence improving instructional practices among teachers. Motivation, institutional support,

and teaching competence and skill make a significant improvement to continuous professional development, stressing the importance of institutional support and technology skills. In the study, the relationship between PRD and CPD is inversely proportional, indicating that some variations might exist in the planning process concerning the educational process. The SEM analysis indicates that CPD plays a significant role in enhancing teacher effectiveness as a result of the organizational and technical roles. From the structural model analysis, continuous professional development plays a central role in specifying the behavior exhibited in the classroom. Educational Technology exerts a strong positive influence, while Pedagogical Development exerts a negative influence (Hair *et al.*, 2019).

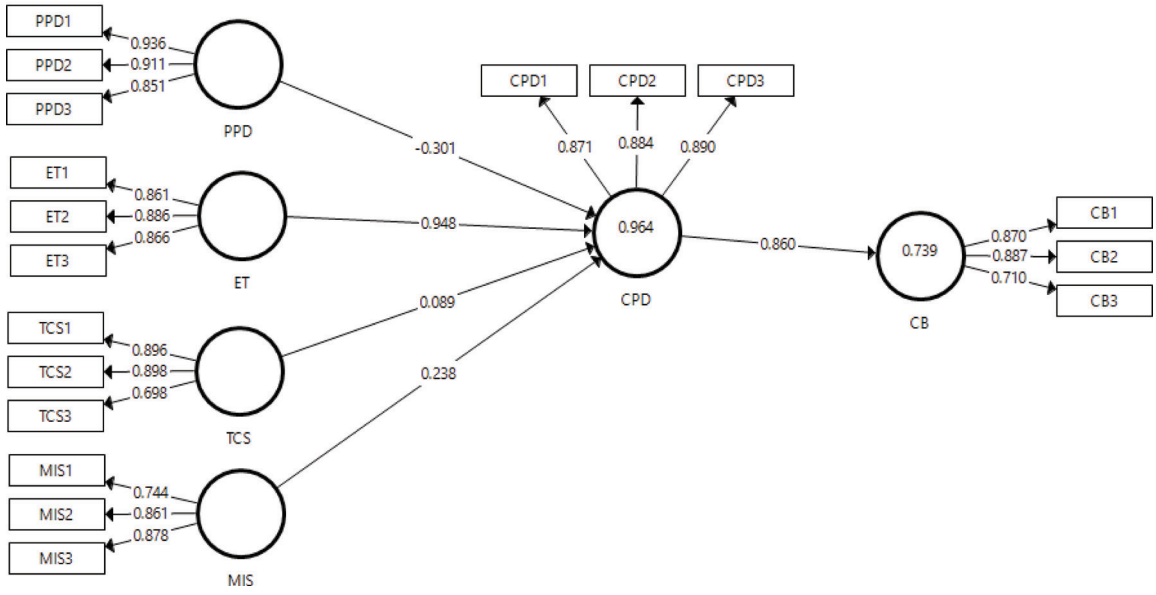


Figure 2: Structural Equation Model Results

4. Discussion

The research has provided valuable empirical information on the issues affecting competence in classroom activities in relation to Continuous Professional Development (CPD). It is clear that all the educators surveyed are young and have at least a diploma. More than 75% of the educators surveyed were men, and more than 40% were under 30. This means that most of them represent the younger generation and do not necessarily have extensive experience. This situation can also be seen in young educational systems, where a lack of sufficient ability for advanced levels and deep-seated gender imbalances create a challenging environment. Moreover, this indicates that most of these educators have limited access to higher education, as 56.6% hold a diploma degree, which can make it difficult for them to be creative in their teaching (Hanushek *et al.*, 2020).

The measurement model results indicated that all the constructs were reliable and valid. The Cronbach's Alpha, rho-A, and Composite Reliability values of all the latent constructs were higher than the thresholds that have been proposed, and the AVE values were more than 0.50. This suggests that the data is consistent and convergent at a high level. The results show that TE, TCS, MIS, PPD, CPD, and CB instruments, which measure teaching effectiveness, competence skills, motivation and institutional support, professional development participation, continuous professional development, and challenges and barriers to teaching development, have proven to be both reliable and valid (Liu *et al.*, 2025; Zhang *et al.*, 2025). This strong measurement base increases confidence in the outcome of the structural framework.

The findings indicate a crossover among these concepts, especially in the overlap among ET, CPD, and TCS. Such crossovers are common in educational

research, which generally view technology, competence, and development as interconnected concepts. The concepts demonstrate strong theoretical foundation and statistical suitability for structural analysis. The major finding of the study is both structural and significant in the results of the structural model. Continuous professional development was the strongest predictor of student behavior in class ($\beta = 0.860$, $p < 0.001$), demonstrating that teachers who engage in extensive CPD display superior classroom techniques that reflect excellence in teaching methodology. Enhanced continuous professional development contributes to enhanced teaching practice. Educational technology has significantly impacted Continuous Professional Development ($\beta = 0.948$), reflecting the transformative nature of technology and its ongoing impact on education and the development of educational skills (Kim & Seo, 2018).

Teacher professional development has been significantly associated with teaching competence, motivation, and support; therefore, teachers require adequate institutional support and must possess technological competence to improve their professional growth. A negative effect of teacher participation development on continuous professional development was observed in the case studies. This unexpected result may indicate ineffective program administration, unmet teacher requirements, or ineffective training, resulting from insufficient planning and unclear professional development plans within specific programs. Several observations from case studies indicate that Continuous Professional Development (CPD) remains the primary approach through which technology, skills, and institutions altogether shape students' behavior in the classroom (Mohammed & Gutema, 2021). This will help sustain schools and teacher-supported professional development initiatives. To improve the educational process, there is a requirement for stronger support infrastructure for schools and teacher-supported continuous professional development.

4.1. Recommendation

The study proposed different strategies to facilitate effective teacher learning, enabling instructors to be more effective within their respective teacher professional development capacities and ensuring positive students' academic performance. It is recommended that educational policymakers prioritize investment in professional development programs that strengthen curriculum implementation, as it is an immense component of efficient learning dynamics within classrooms, capacity building, workshops, and ensuring adequate financial assistance. Teachers ought to be offered need-based professional development sessions, which will contribute to their objective of enhancing the teaching and learning process.

To effectively integrate technology in teaching and learning, educators themselves need to develop their skills in both technology and pedagogical skills. To promote positive work environments, organizations should establish a framework for a better support system, professional development, motivation, and effective teaching resources. Teachers should also make continuous efforts to improve their roles in teaching competence skills to ensure the proper use of modern resources available in the professional environment, which includes actively engaging in training programs and collaborating with peers to exchange best practices. Finally, regarding teachers' professional progress, greater attention should be focused on reforming the current framework for professional development, learning, and teaching programming.

4.2. Implications

These results have important practical meaning for the educational environment. Continuous professional development is significant in improving students' academic performance within teaching and learning contexts. Plans for teacher development should prioritize the implementation of educational reform. Due to the significant influence of technology in education, institutions should strengthen technology infrastructure to develop teachers' skills in this field.

These factors include institutional support and teaching competence skills as essential elements for managerial consideration. Strong institutional support for the impact of teaching is significant for educational management, and enhancing teacher work performance is critical in this regard, considering the inverse relationship between professional development and continuous professional development.

5. Research Contribution and Future Direction

This study contributes to the current literature by providing empirical evidence on the significant role of

continuous professional development in influencing the effectiveness of teaching practices. This study contributes to teacher professional development by incorporating elements that do not involve continuous professional development, such as teacher competency skill, professional development, and institutional support, as well as improvements in teaching practices through the use of teaching competence, all of which are important within the changing landscape of education.

The empirical evidence presented in this study provides new insights into the interdependencies among several influences and teacher effectiveness, particularly in resource-constrained settings. Continuous professional development for teaching and academic performance is not considered within this study. Future research could use mixed methods to acquire comprehensive qualitative data from teachers regarding professional development programs. It is also fundamental to promote comparative analysis in alternative regions or the evaluation of several schools to corroborate and generalize the findings.

There should also be efforts to identify the source of the unexpected negative correlation between teacher professional development, motivation, and institutional support. Future research on the relationship between student academic performance and teacher motivation will be interesting. These findings will help to understand how they could change the way schools are managed. These aspects will make it more challenging to improve educational quality and to implement teachers' professional development in a more complex and nuanced approach.

6. Conclusion

This study examines the structural relationship between participation in professional development, teaching competence, motivation, institutional support, and continuous professional development in the Somali Regional State of Ethiopia using SmartPLS-SEM. Consistent with prior research, these findings validate continuous professional development as a key mediating role in the relationship between institutional, motivational, and teacher competence factors and teaching effectiveness, as well as perceived challenge barriers of teacher development.

Strong effects were observed for teaching effectiveness, motivation, and competence on continuous professional development, and these factors also had a significant effect on perceived barriers. These findings emphasize continuous professional development as a key human capital investment for enhancing teaching quality, especially in low-resource environments. Policy and management recommendations are offered for improving the quality of education, teacher professional development, and teaching quality through teacher effectiveness and continuous professional development.

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Authorship Contribution

Abdiaziz Sheik Mohamed: Conceptualization, data collection, data analysis, visualization, organization, writing original draft, and preparation of final draft.
Manoj Govindaraj: Supervision, conceptualization, review and editing, and final proofreading of the manuscript.

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Ethical Approval

The study was conducted in an ethical manner according to established research ethics and principles. Participation in the study was entirely voluntary, and informed consent was obtained from all research participants before data collection commenced. The study strictly maintained the confidentiality and anonymity of the research participants.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial

relationships that could be construed as a potential conflict of interest.

Declarations

The authors declare that this work is original. The study was conducted among teachers in the Somali regional state using a questionnaire administered by the author. All sources and references have been properly acknowledged, and work has not been submitted to or published in any other journal, conference, or academic outlet.

Data Availability Statement

Authors declare that the data supporting the conclusions of this study can be obtained upon request from the corresponding author, ASM. The data is not publicly accessible as it contains information that may compromise the privacy of research participants.

AI Disclosure Statement

Artificial intelligence (AI) tool was used to enhanced language clarity, fluent and Grammarly; however, interpretation, analysis, discussion and conclusion was conducted by authors own.

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