Investigating the Determinants Affecting the Efficacy of Professional Development for Teachers: An Exploratory Inquiry in the Context of Vietnam

Vu Cam-Tu[1], Hoang Thi-Nga[2], Vu Thi-Binh[3], Le Thi Hong-Chi[4*], Tran Thi Ha Giang[5], Pham Thi Hong Hanh[6]

[1] *VNU University of Education, Vietnam National University, Hanoi, Vietnam*
E-mail: vucamtu@vnu.edu.vn
ORCID: https://orcid.org/0000-0003-3534-8691

[2] *Hai Phong University, Hai Phong, Vietnam*
E-mail: ngaht85@dhhp.edu.vn
ORCID: https://orcid.org/0009-0009-4664-6054

[3] *Thai Nguyen University, Lao Cai, Vietnam*
E-mail: vuthibinh@tnu.edu.vn
ORCID: https://orcid.org/0009-0001-0949-2107

[4] *Hung Vuong University, Phu Tho, Vietnam*
E-mail: lethihongchi@hvu.edu.vn
ORCID: https://orcid.org/0000-0003-4565-6495
* Corresponding author

[5] *Hanoi Metropolitan University, Hanoi, Vietnam*
E-mail: tthgiang@daihocthudo.edu.vn
ORCID: https://orcid.org/0000-0002-6061-5424

[6] *Hanoi Pedagogical University 2, Hanoi, Vietnam*
E-mail: phamthihonghanh@hpu2.edu.vn
ORCID: https://orcid.org/0000-0002-1520-0676

DOI: 10.26907/esd.20.2.05
EDN: LPRQUM
Submitted: 17 February 2024; Accepted: 27 May 2025

Abstract
Professional development (PD) is important in promoting educational reform achievements at many levels in all countries. In the last ten years, teacher professional development activities have received more attention and investment from the Vietnam Ministry of Education and Training, especially in the context of fundamental and comprehensive education reform. This study was conducted to identify the factors affecting the effectiveness of professional development for teachers, as manifested by the effectiveness of developing knowledge and skills or changes in teachers' attitudes and beliefs in Vietnam. The study used a quantitative method. By stratified random sampling, 1,459 survey samples were collected from teachers working at the three levels of primary school, secondary school, and high school in Vietnam. The study's findings indicate a substantial influence of all variables within the model on the enhancement of teachers' knowledge and skills and alterations in attitudes and beliefs within the educational context of Vietnam. Notably, active learning and duration emerge as the two factors exerting the most pronounced impact on the efficacy of professional development for teachers in Vietnam. Based on these outcomes, the study provides insights and recommends policy adjustments tailored to the professional development needs of teachers in Vietnam.
Keywords: Effective Professional Development, factors influence, professional development, teacher, Vietnam.

Исследование факторов, влияющих на эффективность профессионального развития учителей: поисковое исследование на примере Вьетнама

Ву Кам-Ту[1], Хоанг Тхи-Нга[2], Ву Тхи-Бинь[3], Ле Тхи Хонг-Чи[4*], Чан Тхи Ха Зянг[5], Фам Тхи Хонг Хань[6]

[1] *Институт образования, Вьетнамский национальный университет, Ханой, Вьетнам*
E-mail: vucamtu@vnu.edu.vn
ORCID: https://orcid.org/0000-0003-3534-8691

[2] *Университет Хайфона, Хайфон, Вьетнам*
E-mail: ngaht85@dhhp.edu.vn
ORCID: https://orcid.org/0009-0009-4664-6054

[3] *Университет Тай Нгуен, Лаокай, Вьетнам*
E-mail: vuthibinh@tnu.edu.vn
ORCID: https://orcid.org/0009-0001-0949-2107

[4] *Университет Хун Вуонг, Футхо, Вьетнам*
E-mail: lethihongchi@hvu.edu.vn
ORCID: https://orcid.org/0000-0003-4565-6495
* Автор, ответственный за переписку

[5] *Ханойский столичный университет, Ханой, Вьетнам*
E-mail: tthgiang@daihocthudo.edu.vn
ORCID: https://orcid.org/0000-0002-6061-5424

[6] *Ханойский педагогический университет № 2, Ханой, Вьетнам*
E-mail: phamthihonghanh@hpu2.edu.vn
ORCID: https://orcid.org/0000-0002-1520-0676

DOI: 10.26907/esd.20.2.05
EDN: LPRQUM
Дата поступления: 17 февраля 2024; Дата принятия в печать: 27 мая 2025

Аннотация
Профессиональное развитие (ПР) играет значительную роль в продвижении образовательных реформ на различных уровнях во всех странах. За последние десять лет со стороны Министерства образования и подготовки кадров Вьетнама мероприятиям по профессиональному развитию учителей уделено большое внимание, оказана особая финансовая поддержка, что связано с фундаментальной и комплексной реформой образования в стране. Данное исследование направлено на выявление факторов, влияющих на эффективность профессионального развития учителей Вьетнама, что проявляется в качестве их знаний и навыков, в изменениях их установок и убеждений. Исследование проводилось с использованием количественного метода: с помощью стратифицированной случайной выборки было собрано 1 459 анкетных опросов от учителей, работающих в начальных, средних и старших классах Вьетнама. Результаты исследования свидетельствуют о существенном влиянии всех переменных модели на уровень знаний и навыков учителей, на изменение их установок и убеждений. Особо выделяются такие факторы профессионального развития, как активность обучения и его продолжительность: они оказывают наиболее выраженное воздействие на эффективность ПР учителей. Полученные результаты позволяют рекомендовать корректировку обра-

зовательной политики Вьетнама с целью удовлетворения потребности учителей в их профессиональном развитии.
Ключевые слова: эффективность профессионального развития, влияющие факторы, профессиональное развитие, учитель, Вьетнам.

Introduction

Professional development (PD) plays a crucial role in driving educational reform. Research shows a positive link between teacher professional development (TPD) and student academic achievement (Fischer et al., 2018). As a result, studies on PD and its effective characteristics have grown. A widely accepted conceptual framework for evaluating PD's impact on teachers and students was introduced by Desimone (2009), and supported by various scholars. Consensus points to 5 main groups of factors: Focusing on specific content, Engaging teachers in active learning, Coherence, Sufficient duration, Enabling the collective participation of teachers (Desimone, 2009; Garet et al., 2001; Hunzicker, 2010). Some other characteristics have also been added by authors: Activities close to practice (Penuel et al., 2007), physical and psychological comfort of participants (Freeman et al., 2004). However, more research is needed to understand how PD operates across diverse educational and cultural contexts.

In Vietnam, TPD has received increased attention from the Ministry of Education and Training (MoET) and researchers (Do et al., 2021; Tinh et al., 2021). Changes in curriculum, textbooks, and social context require teachers to constantly strive to improve their professional level and design effective and appropriate lessons for students (Phan & Nguyen, 2021). According to MoET, TPD is considered a key factor in successfully implementing fundamental and comprehensive educational reform (Hoang et al., 2020).

In that context, professional learning activities for teachers in Vietnam are determined to include External professional learning activities (Degree upgrading courses, Short courses, and workshops, 'Good teacher' title competitions) and School-based professional learning activities (Hosting 'Good Teacher' title competitions, Classroom observations of other teachers, Weekly professional meetings, Mentoring, Seminars and speeches from famous people, Experience initiatives and self-study) (Hallinger et al., 2021). Teachers perceive PD as essential and participate in programs organized by schools and education departments, as well as in online professional communities.

Some individual factors affecting the effectiveness of teachers' PD have also been discussed by research, such as principal's instructional leadership (Nguyen et al., 2023), self-awareness of teachers and managers impacts the PD of high school teachers in Vietnam (Dung et al., 2020). However, the factors affecting the effectiveness of PD for teachers in Vietnam still need to be comprehensively researched to provide a perspective on this issue in the education system in a developing country.

This study aims to identify factors that affect the effectiveness of teachers' PD, expressed through changes in knowledge, skills, attitudes, and teachers' beliefs in the context of educational innovation in Vietnam. These factors will be discussed to propose appropriate teacher development policies for implementing the educational system in a diverse cultural environment in Vietnam.

Literature review

Characteristics that influence the effectiveness of TPD

PD activities are defined as the professional growth of a teacher through the accumulation of experience and knowledge, and the systematic review of their teaching process (Ninlawan, 2015). Darling-Hammond & McLaughlin (2011) define TPD as a process that promotes teachers' understanding of teaching and learning and provides

opportunities for teachers to understand their students better. McLaughlin & Zarrow (2001) argue that developing teacher development programs is an important strategy to improve student learning outcomes. The definition of PD of teachers is defined from different perspectives, but still sets the same mission: to constantly update, modify, and progress in parallel with the rapid pace of change of the times (Cordingley et al., 2005).

PD activities are defined as the professional growth of a teacher through the accumulation of experience and knowledge, and the systematic review of their teaching process (Ninlawan, 2015). Darling-Hammond & McLaughlin (2011) define TPD as a process that promotes teachers' understanding of teaching and learning and provides opportunities for teachers to understand their students better. McLaughlin & Zarrow (2001) view TPD as key to improving student outcomes. Despite varied perspectives, the core goal remains: to constantly update, modify, and progress in parallel with the rapid pace of change of the times (Cordingley et al., 2005).

Based on the findings of previous studies, the factors that influence the effectiveness of TPD include five main factors based on the five characteristics of effective PD: Content focus, Active learning, Coherence, Duration, and Collective participation (Desimone, 2009; Garet et al., 2001; Kowalski et al., 2020). In addition, some other influencing factors have also been identified in previous studies (Freeman et al., 2004; Schneider & Krajcik, 2002; Supovitz & Turner, 2000).

The *Content focus* factor is the relationship between activities that focus on the subject's content and how students learn that content through improved teacher knowledge and skills, improved practice, and, to a lesser extent, improved student performance. This factor is reflected in the following manifestations: Activities that differ from the subject taught and the methods of teaching taught; activities that differ in terms of the specificity of the changes in teaching practice encouraged; activities that differ in terms of the learning objectives of students (Desimone, 2009; Garet et al., 2001; Kowalski et al., 2020).

Active Learning allows teachers to actively participate in meaningful discussions, planning, and practice through PD activities. It is often characterized by some forms used in PD activities, including observation or observation by experts, interactive feedback and discussion, review of student work in the topic area in discussion, and direction of discussion (Darling-Hammond & McLaughlin, 2011; Desimone, 2009; Garet et al., 2001). This factor manifests itself through the following manifestations: the opportunity to observe professional teachers and be observed teaching (Capps et al., 2012); the opportunity to actively strengthen teachers' understanding (Putnam & Borko, 2000); the modeling of preferred teaching strategies (Garet et al., 2001); the opportunity to analyze classroom videos or student work; planning how to use new curriculum materials and new teaching methods in classrooms; reviewing student work in subjects.

Coherence is the degree to which a teacher's learning is consistent with the teacher's knowledge and beliefs. Manifestations include: Levels of TDP are based on the teachings learned by teachers, focusing on content and teaching by national and local standards, frameworks, and assessments, supporting teachers in the development of continuous, sustained professional communication with other teachers who try to change their teachings in similar ways (Garet et al., 2001; Penuel et al., 2007).

Duration: This factor is demonstrated through: Having enough time can allow teachers to create new knowledge and understanding consistently; teachers have sufficient time to apply new knowledge to classroom teaching and to gather practical feedback; too much training time does not have a practical effect (Cohen & Hill, 2000; Garet et al., 2001).

Collective participation: This factor includes: Teachers working together are more likely to have the opportunity to discuss concepts, skills, and problems arising from their PD; teachers from the same school, department, or class can share common curriculum

materials, courses, and assessment requirements. Through shared PD, they can integrate what they learn with other aspects of their teaching environment; teachers of the same students can discuss the needs of students between classes and grade levels; PD can help maintain changes in practice over time, as some teachers leave school teaching and other new teachers join the department (Garet et al., 2001).

Effective professional development of teachers

Desimone (2009) proposed a basic model, shown in Figure 1, and recommended that it be used in all empirical causal studies of PD. This model represents an interactive, non-recursive relationship between important features of PD, teachers' knowledge and beliefs, classroom practice, and students' results. As shown in the figure, the core theory of action for the PPD would probably follow the following steps: (1) teachers have effective PD experience; (2) teachers increase their knowledge and skills and/or change their attitudes and beliefs; (3) teachers use their new knowledge and skills, attitudes and beliefs to improve the content of their teaching or teaching, or both; (4) changes in teaching promote more excellent student learning (Desimone, 2009).

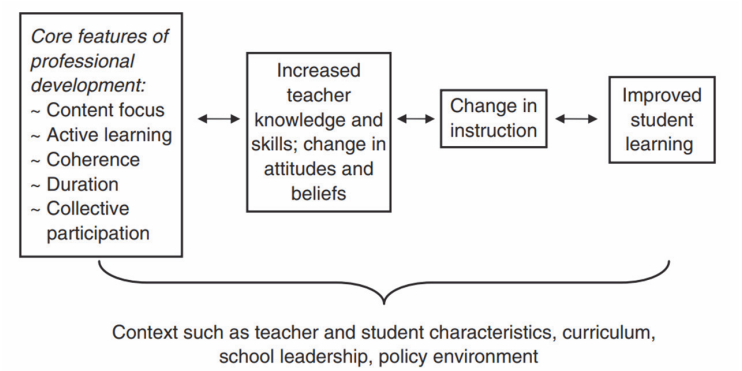


Figure 1. *Core conceptual framework for studying the effects of PD on teachers and students (Desimone, 2009)*

Some researchers have proposed additional factors that could influence the implementation of PD and make some well-designed literature-based PD models unable to achieve the desired learning and teaching gains (Li et al., 2021). McChesney & Aldridge (2019) proposed a new conceptual model consisting of five stages: intended PD, received PD, accepted PD, applied PD, the impact on students, and several obstacles that affect the possibility of teachers participating in the PPD entering each successive phase.

Building on the conceptual framework of effective teacher PD by Desimone (2009), Li et al. (2021) designed the WSD-PD (Workshop-Seminar-Demonstration Class PD) model (see Figure 2). The PD program in this study consisted of five parts: (1) training focused on conceptual change teaching (Content focus), (2) testing new teaching strategies in authentic classroom designs new practices and observed classrooms (Active learning), (3) meeting the needs of teachers, schools, and districts (Coherence), (4) a year as a period (duration), and (5) professional learning communities in the form of more comprehensive and strategic integration activities (Collective participation). Based on the above, the conceptual framework of Li et al. (2021) referred to the conceptual model of McChesney & Aldridge (2019).

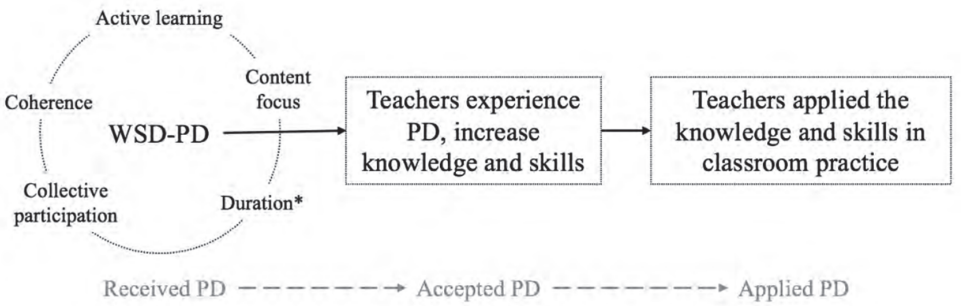


Figure 2. *The Workshop-Seminar-Demonstration Class PD (WSDPD) model (Li et al., 2021)*

Research model and hypothesis building

The research goal is to understand the factors that affect the effectiveness of PD for teachers. This article built a research model based on Desimone (2009) and Li et al. (2021) research models. In this model, five factors of effective PD characteristics (acting as independent variables) will impact the Teacher (EPD variable - acting as the dependent variable) by increasing teachers' knowledge and skills and changing their attitudes and beliefs about teaching. The independent variables were adapted from Hunzicker's (2010) research.

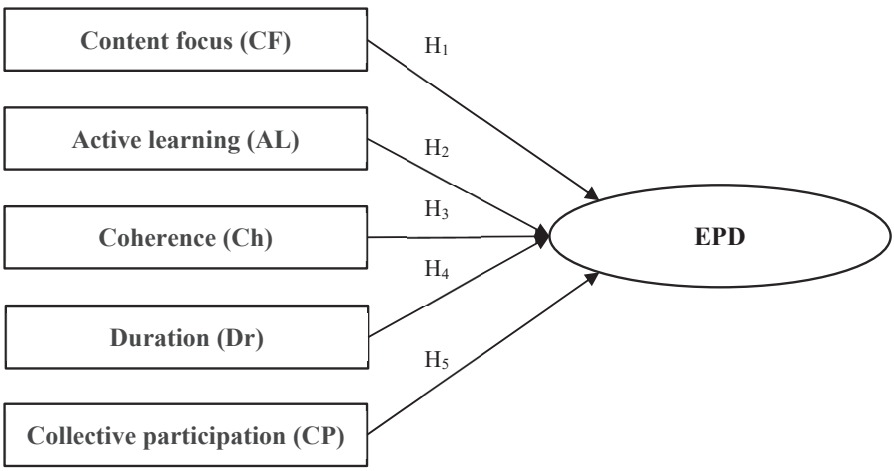


Figure 3. *Research model of how effective PD characteristics impact teachers*

With the research model above, an exploratory study was conducted to test the hypotheses:

H1: Content focus positively impacts teachers' knowledge and skills while also changing their attitudes and beliefs about teaching.

H2: Active learning positively impacts teachers' knowledge and skills while also changing their attitudes and beliefs about teaching.

H3: Coherence positively impacts teachers' knowledge and skills while also changing their attitudes and beliefs about teaching.

H4: Duration positively impacts teachers' knowledge and skills while also changing their attitudes and beliefs about teaching.

H5: Collective participation positively impacts teachers' knowledge and skills while also changing their attitudes and beliefs about teaching.

The results of the test of the hypothesis will help answer the two questions raised by the study:

RQ1: Do the characteristics of effective PD significantly influence the development of knowledge and skills or change the attitudes and beliefs of teachers in Vietnam?

RQ2: What are the recommendations and suggestions for the PD of teachers in high schools in Vietnam?

Method

Participants

This cross-sectional quantitative study surveyed teachers at elementary, middle, and high schools across Vietnam. Due to time and resource constraints, stratified sampling was used to ensure representation by school type (public/private), working area (mountains, rural, urban), and region (North, Central, South). The questionnaire was distributed online via Google Forms and data was collected over three weeks (August 9 – September 1, 2023). Collaborators supported participants through email and messaging apps (Facebook, Zalo) to ensure objective and complete responses.

Research tool

Based on the research model and Hunzicker's checklist (2010), this study employed a quantitative survey using a structured questionnaire with two parts: (1) eight items gathering participants' background information, and (2) 23 items assessing teacher agreement with statements on five characteristics of effective PD. The instrument was adapted from Hunzicker's (2010) checklist to align with the research context in Vietnam. Specifically, Content Focus (CF), adapted from "Instructional-focus," examines how PD enhances content delivery and teaching methods.

Active Learning (AL), derived from "Job-embedded," emphasizes teachers' active participation, the application of new knowledge, and reflective practice. Coherence (Ch), modified from "Supportive," evaluates the alignment of PD activities with teachers' needs and the broader educational context, reflects the continuity and sufficiency of PD time for knowledge application. Collective Participation (CP), derived from "Collaborative," gauges the extent of group interactions, peer collaboration, and engagement in professional learning communities. An additional construct, Effectiveness of PD Activities (EPD), was added to evaluate overall PD impact on teachers' knowledge, skills, attitudes, and beliefs. The adaptation maintained theoretical consistency with Hunzicker's framework.

All items were translated into Vietnamese and back-translated to ensure semantic equivalence. A pilot with 30 teachers (10 each from primary, middle, and high schools) tested item clarity and comprehension. After receiving feedback from the pilot, the questionnaire was adjusted before being used in the official survey. The questionnaire was a 5-point Likert scale, ranging from strongly disagree to strongly agree.

Data analyses

The multivariate regression analysis in SPSS 26 software was used to analyze and test the proposed hypotheses. The collected data is cleaned, and the reliability of each factor is evaluated through Cronbach's Alpha coefficient according to the instructions of Hair et al. (2014) and the Corrected Item - Total Correlation values of the observed variables according to the instructions of Cristobal et al. (2007). EFA factor analysis is used to evaluate the convergence and validity of each factor in the research model, with the following conditions: (1) Factor loading of observed variables is greater than

0.5; (2) The KMO coefficient satisfies 0.5 ≤ KMO ≤ 1 (Hair et al., 2014); (3) Sig value of the Bartlett test is less than 0.05; (4) Extracted variance value or cumulative variance Eigenvalue > 50% (Gerbing & Anderson, 1988), used to determine the number of extracted factors considering a value greater than 1. The 95% confidence interval of the correlation coefficient was used to check the value to distinguish between factors in the model (Gerbing & Anderson, 1988). Finally, the multivariate regression equation model is used to test the proposed hypotheses with the criterion of statistical significance at the 5% level.

Results

Information about the study sample

A total of 1,466 teacher responses were received. After removing incomplete or invalid entries, 1,459 valid responses were retained for analysis. Sample characteristics are summarized in Table 1.

According to the results in Table 1, the gender distribution was uneven, with 68.9% female and 31.1% male respondents – reflecting the general gender trend in Vietnam's teaching profession (Vietnam Ministry of Education and Training, 2019, 2020). While responses were relatively balanced across the three education levels (primary, lower secondary, upper secondary), a significant majority (91.7%) worked in public schools, with only 8.3% from private institutions. Nevertheless, the sample met the study's representativeness criteria.

To get more information about participation in PD training activities, the questionnaire was investigated and showed that the number of teachers responding to annual training is quite high, This suggests sustained attention and investment in teachers' professional growth in Vietnam.

Table 1. *Information about the study sample*

General information		*Number*	*%*
Gender	Male	454	31.1
	Female	1005	68.9
Working seniority	Under 5 years	188	12.9
	5-10 years	188	12.9
	10-15 years	270	18.5
	15-20 years	301	20.6
	Above 20 years	512	35.1
Academic degree	Bachelor of College	132	9
	Bachelor of University	1033	70.8
	Master	282	19.3
	PhD	12	0.8
The subject in charge of teaching	Math	782	53.6
	Literature	164	11.2
	English	99	6.8
	Natural Sciences subjects (other than Math)	286	19.6
	Social Sciences subjects (other than literature)	117	8
	Foreign language subjects (other than English)	11	0.8
Working school level	Primary school	410	28.1
	Junior high school	563	38.6
	High school	486	33.3

General information		*Number*	*%*
Working school type	Public school	1271	87.1
	Gifted/specialized public school	18	1.2
	Public school for ethnic minority students	49	3.4
	Domestic private/people-founded school	109	7.5
	Private/people-founded schools with foreign elements	12	0.8
Working region	Urban area	618	42.4
	Rural area	504	34.5
	Mountain area	337	23.1
Level of participation in PD activities	Never before	38	2.6
	Join annually	990	67.9
	Participate only when assigned by management levels	431	29.5

Testing the scale and analyzing factors in the research model

Using the Cronbach's Alpha coefficient test for each scale, the Cronbach's alpha coefficient of the factors ranging from 0.88 to 0.96, satisfying the required level of reliability (≥ 0.6) and the total variable correlation coefficient are all greater than 0.3. This proves that the observed variables in the factors are highly consistent, the scales of the factors are sufficiently reliable, and no observed variables are removed from the scale (Table 2).

Use the EFA factor analysis method to test the convergence of factors in the research model. The analysis results in Table 2 show that the 23 observed variables converge on six factors (loading factors are all greater than 0.5) and satisfy the following conditions:

– The KMO coefficient is used to consider the appropriateness of EFA factor analysis, reaching a value of 0.92, satisfying the condition of $0.5 \leq KMO \leq 1$, showing that factor analysis is acceptable for the research data set (Table 3).

– Sig Barlett's Test is used to see if the observed variables in the factor are correlated and whether the factor analysis is meaningful or not. According to Table 3, sig = 0.000 < 0.05 shows that factor analysis is appropriate for the variables under consideration.

Table 2. *Results of testing the scale and analyzing EFA factors*

Factor/Item	*Factor loading*	*Cronbach's Alpha*
Activities related to curriculum contents and teaching methods (CF)		
CF2	0.89	0.94
CF3	0.88	
CF4	0.88	
CF1	0.87	
Cohesion, cooperation, and relevance in the learning community (Ch)		
Ch4	0.75	0.88
Ch3	0.74	
Ch2	0.73	
Ch5	0.72	
Ch6	0.68	
Ch1	0.67	
Active learning activities (AL)		
AL1	0.84	0.90
AL2	0.80	
AL3	0.79	

Collectivity, professional learning community participation (CP)		
CP2	0.82	0.88
CP1	0.82	
CP3	0.75	
Duration for PD activities (Dr)		
Dr1	0.87	0.91
Dr3	0.87	
Dr2	0.87	
Effectiveness of PD activities (EPD)		
EPD2	0.96	0.96
EPD3	0.95	
EPD1	0.94	
EPD4	0.94	

Table 3. *KMO Coefficient and Sig Barlett's Test*

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.92
Bartlett's Test of Sphericity	Approx. Chi-Square	20835.05
	df	171
	Sig.	0.000

Before conducting multivariate regression analysis, Pearson correlation analysis was performed to test the factors' significance coefficients and linear relationships. The significance coefficient sig between the dependent variable EPD and the independent variables CF, AL, Ch, Dr, and CP all have a value of 0.000, less than 0.05, showing a linear relationship between the factors. The correlation coefficient between the independent and dependent variables ranges from 0.40 to 0.74, showing a moderate to strong correlation (Table 4).

The analysis results in Table 4 also show that the estimate of the 95% confidence interval of the correlation coefficients shows that the confidence interval of the most significant correlation is the pair EPD - AL (0.71-0.78), which does not contain the value 1, thus, all factors in the model reach discriminant value.

Table 4. *Results of the discriminant validity test*

	EPD	*CF*	*AL*	*Ch*	*Dr*	*CP*
EPD	1					
CF	0.40 (0.35-0.45)	1				
AL	0.74 (0.71-0.78)	0.39 (0.33-0.44)	1			
Ch	0.55 (0.51-0.60)	0.51 (0.45-0.56)	0.56 (0.51-0.60)	1		
Dr	0.52 (0.47-0.57)	0.24 (0.18-0.30)	0.49 (0.44-0.54)	0.42 (0.36-0.47)	1	
CP	0.54 (0.50-0.58)	0.38 (0.32-0.44)	0.57 (0.53-0.62)	0.61 (0.57-0.65)	0.40 (0.35-0.46)	1

Note: Values in brackets are confidence intervals of 95%.

Evaluate the suitability of the research model

The commonly used measure to evaluate the appropriateness of a linear model is the adjusted R^2 coefficient (Adjusted R Square), which reflects the level of explanation of the dependent variable of the independent variables in the regression model. Table 5 shows that $R^2 = 0.61$ shows that the independent variables CF, AL, Ch, Dr, and CP explain 60.9% of the change in the dependent variable EPD; the remaining 39.1% of the change in EPD will be due to other variables in addition to model and research errors.

Table 6 shows the sig value of the F test used to test the goodness of fit of the regression model. The F statistic with a probability of rejection with a sig = 0.000 is enough to conclude that the adjusted R^2 value is accepted. The Durbin-Watson value of 1.68 satisfies the condition in the range of 1.50-2.50, indicating that the model does not have first-order serial autocorrelation. Therefore, the multivariable regression model is appropriate for the collected data set.

Table 5. *Regression model summary*

Model	*R*	*R Square*	*Adjusted R Square*	*Std. Error of the Estimate*	*Durbin-Watson*
1	0.78	0.61	0.61	0.62	1.68

Table 6. *ANOVA regression table*

Model		*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
1	Regression	860.47	5	172.09	455.20	0.000
	Residual	549.32	1453	0.38		
	Total	1.409.79	1458			
a. Dependent Variable: EPD						
b. Predictors: (Constant), CF, Dr, CP, AL, Ch						

The results of testing the model and research hypotheses in Table 7 show that the variance inflation factor VIF has a value less than 10 (less than and equal to 2), so multicollinearity does not occur, the independent variables in the model are independent of each other. Besides, the sig value of the t-test (testing the significance of the Beta regression coefficient) of the variables CF, AL, Ch, Dr, and CP are all less than 0.05, thus concluding that these independent variables have statistically significant, all have an impact on the dependent variable EPD. The regression coefficients all have positive signs, so the effects are positive, and the impact level of the variables depends on the beta regression coefficient. Thus, hypotheses H1, H2, H3, H4, and H5 are accepted.

Table 7. *Model testing results and research hypotheses*

Hypothesis	*Relationship*			*Standardized Beta Coefficient*	*Sig*	*VIF*	*Accept/not accept*
H1	CF	→	EPD	0.07	0.000	1.38	Accept
H2	AL	→	EPD	0.53	0.000	1.85	Accept
H3	Ch	→	EPD	0.10	0.000	2.02	Accept
H4	Dr	→	EPD	0.17	0.000	1.39	Accept
H5	CP	→	EPD	0.08	0.000	1.84	Accept

Normalized regression equation:

$$EPD = 0.53*AL + 0.17*Dr + 0.10*Ch + 0.08*CP + 0.07*CF + \varepsilon$$

According to the regression analysis results, five hypotheses are accepted corresponding to 5 factors (characteristics of PD effectiveness) that positively impact the PD (including knowledge, skills, attitudes, and beliefs) of school teachers. The results show that the impact of factor AL is the strongest (regression coefficient is 0.53), followed by factor Dr (regression coefficient 0.17), followed by factor Ch (regression coefficient 0.10), the two factors that have the least impact are CP (regression coefficient 0.08) and CF factor (regression coefficient 0.07).

To have more comments on whether the effectiveness of teachers' PD differs between genders, ages, or regions in Vietnam, the authors performed tests on the differences between T-Test and ANOVA. The T-Test results for the EPD variable by gender in Table 8 show that sig = 0.77>0.05, so there will be no difference between men and women in effective PD.

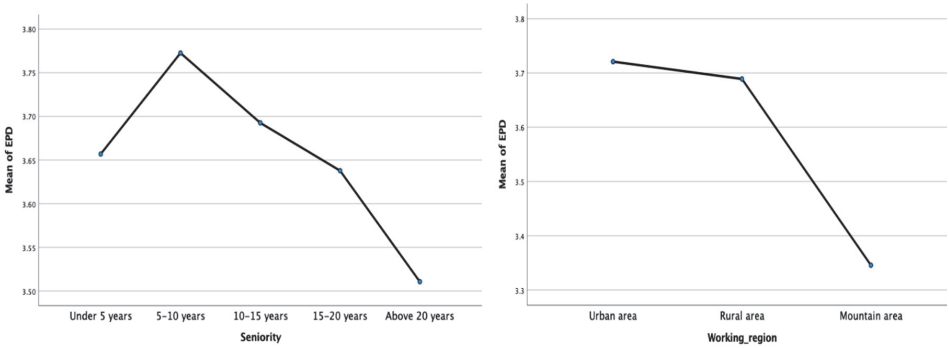
Table 8. *T-test results of EPD variable by gender*

Gender	*Levene's Test for Equality of Variances*		*t-test for Equality of Means*
	F	*Sig*	*Sig.*
Male	8.79	0.003	0.77
Female			

The ANOVA test results for the EPD variable by seniority and work location in Table 9 show that the sig is less than 0.05, so there will be differences between age groups and work areas in effective self-improvement. That means teachers in different age groups or with different working areas will have different PD effectiveness. Furthermore, the graph results in Figure 4 show that the most obvious difference in seniority is between teachers with 5 to less than ten years of experience and teachers with 20 years or more. The effectiveness of teachers' PD also clearly differs between cities and mountainous areas.

Table 9. *EPD's One way ANOVA test results according to teacher's seniority and place of work*

		Levene's Test of Homogeneity of Variances	*Welch*
		Sig	*Sig*
Seniority	Under 5 years	0.01	0.015
	5-10 years		
	10-15 years		
	15-20 years		
	Above 20 years		
Working region	Urban area	0.03	0.000
	Rural area		
	Mountain area		



(a) *(b)*

Figure 4. *The mean of EPD*
(a) according to the teacher's seniority; (b) according to the teacher's place of work

Discussion

The initial research results indicate that the factors in the model significantly influence the effectiveness of PD for teachers, as manifested through impacting the development of knowledge and skills or altering the attitudes and beliefs of teachers in Vietnam. The factor with the strongest impact (AL) on teachers' PD (most evident in improving teachers' knowledge and skills while changing their attitudes and beliefs about teaching) is consistent with the results in previous studies (Capps et al., 2012; Garet et al., 2001; Kowalski et al., 2020; Putnam & Borko, 2000).

According to the research results, the Dr factor is the second most influential factor in the effectiveness of teachers' PD (H4). However, in previous research, this factor only ranked third after comfort factors (physical and mental) and technology factors (Freeman et al., 2004) or after the formal element of activities and collective participation of teachers in the same school, class, or subject (Garet et al., 2001).

Some other factors are believed to impact the effectiveness of teachers' PD, as identified by some scholars: Activities close to practice (Penuel et al., 2007), physical and psychological comfort of participants (Freeman et al., 2004), teachers immersing themselves in learning experiences and witnessing innovative teaching models (Supovitz & Turner, 2000), curriculum materials with educational value for teachers and students (Schneider & Krajcik, 2002), teachers receiving direct guidance during teaching as stipulated in innovation documents (Penuel et al., 2011), the importance of strong principal support is emphasized (Banilower et al., 2007). However, these factors have not yet been widely recognized.

Furthermore, the analysis indicates differences in perceived PD effectiveness (EPD) by teachers' experience and work location. One possible explanation is that older, more experienced teachers may become set in their instructional practices and less receptive to new approaches, reducing the perceived effectiveness of PD initiatives (Rinaldi, 2007). In contrast, teachers with moderate experience (around 5–15 years) still have a strong need and motivation for professional growth, so they tend to engage more actively in PD and find it more beneficial (Saade et al., 2018). Therefore, educational managers and training providers should consider teacher seniority when designing PD programs. More support should be directed toward encouraging veteran teachers to continue learning and applying new methods while sustaining the high engagement of mid-career teachers. Additionally, the regional disparity implies that teachers in remote or mountainous regions should be given greater attention and resources.

Conclusion

The research results indicate that the characteristics of effective PD significantly impact the development of knowledge and skills or the alteration of attitudes and beliefs of teachers in Vietnam and the five hypotheses have been confirmed. Active Learning and Duration are the two most influential characteristics in the effective PD of teachers in Vietnam.

Starting from the results of the initial research, it can be seen that managers and training institutions in Vietnam should pay attention to several issues in the design of training and training programs for effective implementation of PD activities of teachers: Firstly, limit short-term theoretical training activities while enhancing training activities that provide teachers with more opportunities for practice or increase the duration by combining various forms of training (such as combining online and in-person training). Secondly, focus on selecting and recommending teachers to participate in training courses based on their years of experience to ensure the most effective outcomes. Thirdly, more attention should be given to teachers in mountainous areas, as there is currently a disparity in the effectiveness of PD among teachers in different regions.

To further affirm the factors influencing the effectiveness of PD for teachers in Vietnam, future experimental studies should be conducted to assess the impact of TPD on changing students' learning outcomes.

Funding

This research is funded by the Vietnam National Foundation for Science and Technology Development (NAFOSTED) under grant number 503.01-2021.19.

Conflict of Interest

The authors declare that they have no conflict of interest in this research.

Compliance with Ethical Standards

The authors ensure that this research paper was done in compliance with Ethical Standards.

Acknowledgements

This research is funded by the Vietnam National Foundation for Science and Technology Development (NAFOSTED) under grant number 503.01-2021.19.

References

Banilower, E. R., Heck, D. J., & Weiss, I. R. (2007). Can professional development make the vision of the standards a reality? The impact of the national science foundation's local systemic change through teacher enhancement initiative. *Journal of Research in Science Teaching*, *44*(3), 375–395. https://doi.org/10.1002/tea.20145

Capps, D. K., Crawford, B. A., & Constas, M. A. (2012). A Review of Empirical Literature on Inquiry Professional Development: Alignment with Best Practices and a Critique of the Findings. *Journal of Science Teacher Education*, *23*(3), 291–318. https://doi.org/10.1007/s10972-012-9275-2

Cohen, D. K., & Hill, H. C. (2000). Instructional Policy and Classroom Performance: The Mathematics Reform in California. *Teachers College Record: The Voice of Scholarship in Education*, *102*(2), 294–343. https://doi.org/10.1111/0161-4681.00057

Cordingley, P., Bell, M., Thomason, S., & Firth, A. (2005). The impact of collaborative continuing professional development (CPD) on classroom teaching and learning. *Review: How Do Collaborative and Sustained CPD and Sustained but Not Collaborative CPD Affect Teaching and Learning.*

Cristobal, E., Flavián, C., & Guinalíu, M. (2007). Perceived e-service quality (PeSQ): Measurement validation and effects on consumer satisfaction and web site loyalty. *Managing Service Quality: An International Journal*, *17*(3), 317–340. https://doi.org/10.1108/09604520710744326

Darling-Hammond, L., & McLaughlin, M. W. (2011). Policies That Support Professional Development in an Era of Reform. *Phi Delta Kappan*, *92*(6), 81–92. https://doi.org/10.1177/003172171109200622

Desimone, L. M. (2009). Improving impact studies of teachers' professional development: Toward better conceptualizations and measures. *Educational Researcher*, *38*(3), 181–199. https://doi.org/10.3102/0013189X08331140

Do, T-T., Hoang, K. C., Do, T., Trinh, T. P. T., Nguyen, D. N., Tran, T., Le, T. T. B. T., Nguyen, T. C., & Nguyen, T-T. (2021). Factors Influencing Teachers' Intentions to Use Realistic Mathematics Education in Vietnam: An Extension of the Theory of Planned Behavior. *Journal on Mathematics Education*, *12*(2), 331–348. https://doi.org/10.22342/JME.12.2.14094.331-348

Dung, N. T. K., Huy, N. H. D., Hang, N. T., & Ha, D. T. T. (2020). Self-perception of teachers and managers of the impact of teachers' professional development in Vietnam. *Education and Self Development*, *15*(2), 21–30. https://doi.org/10.26907/esd15.2.03

Fischer, C., Fishman, B., Dede, C., Eisenkraft, A., Frumin, K., Foster, B., Lawrenz, F., Levy, A. J., & McCoy, A. (2018). Investigating relationships between school context, teacher professional development, teaching practices, and student achievement in response to a nationwide science reform. *Teaching and Teacher Education*, *72*, 107–121. https://doi.org/10.1016/j.tate.2018.02.011

Freeman, J. G., Marx, R. W., & Cimellaro, L. (2004). Emerging Considerations for Professional Development Institutes for Science Teachers. *Journal of Science Teacher Education*, *15*(2), 111–131. https://doi.org/10.1023/B:JSTE.0000044866.11608.ae

Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What Makes Professional Development Effective? Results From a National Sample of Teachers. *American Educational Research Journal*, *38*(4), 915–945. https://doi.org/10.3102/00028312038004915

Gerbing, D. W., & Anderson, J. C. (1988). An updated paradigm for scale development incorporating unidimensionality and its assessment. *Journal of Marketing Research*, *25*(2), 186–192. https://doi.org/10.1177/002224378802500207

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). *Multivariate data analysis: Pearson new international edition.* Essex: Pearson Education Limited, *1*(2).

Hallinger, P., Tran, N. H., & Truong, T. D. (2021). Mapping the professional learning of primary teachers in Vietnam: a multi-method case study. *Professional Development in Education*, *49*(5), 856–870. https://doi.org/10.1080/19415257.2021.1879218

Hoang, A., Ta, H. T., & Thuy, T. N. (2020). *Thói quen phát triển chuyên môn của giáo viên ở các trường phổ thông Việt Nam [Professional development habits of teachers in Vietnamese high schools]*. https://doi.org/10.35542/osf.io/94hbg

Hunzicker, J. (2010). Effective professional development for teachers: a checklist. *Professional Development in Education*, *37*(2), 177–179. https://doi.org/10.1080/19415257.2010.523955

Kowalski, S. M., Taylor, J. A., Askinas, K. M., Wang, Q., Zhang, Q., Maddix, W. P., & Tipton, E. (2020). Examining Factors Contributing to Variation in Effect Size Estimates of Teacher Outcomes from Studies of Science Teacher Professional Development. *Journal of Research on Educational Effectiveness*, *13*(3), 430–458. https://doi.org/10.1080/19345747.2020.1726538

Li, N., Liu, E., Liu, C., & Guo, S. (2021). Rethinking the Factor of Duration for Professional Development: A Workshop-Seminar-Demonstration Class Model for Science Teachers. *Eurasia Journal of Mathematics, Science and Technology Education*, *17*(12). https://doi.org/10.29333/ejmste/11351

McChesney, K., & Aldridge, J. M. (2019). What gets in the way? A new conceptual model for the trajectory from teacher professional development to impact. *Professional Development in Education*, *47*(5), 834–852. https://doi.org/10.1080/19415257.2019.1667412

McLaughlin, M. W., & Zarrow, J. (2001). Teachers engaged in evidence-based reform: Trajectories of teachers' inquiry, analysis, and action. *Teachers Caught in the Action: Professional Development That Matters*, 79–101.

Nguyen, H. T., Vu, N. T. T., Ha, X. V., Dinh, H. V. T., Truong, T. D., & Reynolds, B. L. (2023). Principal instructional leadership and its influence on teachers' professional development at

Vietnamese primary schools. *Education 3-13*, *53*(3), 408–416. https://doi.org/10.1080/03004279.2023.2195409

Ninlawan, G. (2015). Factors Which Affect Teachers' Professional Development in Teaching Innovation and Educational Technology in the 21st Century under the Bureau of Special Education, Office of the Basic Education Commission. *Procedia - Social and Behavioral Sciences*, *197*, 1732–1735. https://doi.org/10.1016/j.sbspro.2015.07.228

Penuel, W. R., Fishman, B. J., Yamaguchi, R., & Gallagher, L. P. (2007). What makes professional development effective? Strategies that foster curriculum implementation. *American Educational Research Journal*, *44*(4), 921–958. https://doi.org/10.3102/0002831207308221

Penuel, W. R., Gallagher, L. P., & Moorthy, S. (2011). Preparing Teachers to Design Sequences of Instruction in Earth Systems Science: A Comparison of Three Professional Development Programs. *American Educational Research Journal*, *48*(4), 996–1025. https://doi.org/10.3102/0002831211410864

Phan, T. T. T., & Nguyen, T. V. A. (2021). Tìm hiểu thực trạng về động lực phát triển chuyên môn giáo viên tại Việt Nam [Understanding the current situation of motivation for teacher professional development in Vietnam]. *Vietnam Journal of Education*, *512*(2-10/2021), 59–64.

Putnam, R. T., & Borko, H. (2000). What Do New Views of Knowledge and Thinking Have to Say About Research on Teacher Learning? *Educational Researcher*, *29*(1), 4–15. https://doi.org/10.3102/0013189X029001004

Rinaldi, A. G. P. (2007). *Teachers' perspectives of the career-stage appropriateness of professional learning programs*. University of Georgia.

Saade, S., Ghazala, F., Farhat, A., & Hallit, S. (2018). Attitudes towards continuous professional development: a study of pharmacists in Lebanon. *Pharmacy Practice*, *16*(1), 1103. https://doi.org/10.18549/PharmPract.2018.01.1103

Schneider, R. M., & Krajcik, J. (2002). Supporting Science Teacher Learning: The Role of Educative Curriculum Materials. *Journal of Science Teacher Education*, *13*(3), 221–245. https://doi.org/10.1023/A:1016569117024

Supovitz, J. A., & Turner, H. M. (2000). The effects of professional development on science teaching practices and classroom culture. *Journal of Research in Science Teaching*, *37*(9), 963–980. https://doi.org/10.1002/1098-2736(200011)37:9<963::AID-TEA6>3.0.CO;2-0

Tinh, P. T., Le, T. T. T., Nguyen, P.-T., Le, C. D., Nguyen, M.-T., & Nguyen, T.-T. (2021). Preparing Pre-Service Teachers for Mathematics Teaching at Primary Schools in Vietnam. *Eurasia Journal of Mathematics, Science and Technology Education*, *17*(5). https://doi.org/10.29333/ejmste/10863

Vietnam Ministry of Education and Training. (2019). *Estimated number of students for the 2019-2020 school year*. https://moet.gov.vn/thong-ke/Pages/Thong-ke-giao-duc-trung-hoc.aspx

Vietnam Ministry of Education and Training. (2020). *General data on college-level teacher training for the 2018-2019 school year*. https://moet.gov.vn/thong-ke/Pages/dao-tao-giao-vien-cao-dang.aspx?ItemID=6637

