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Analyzing the Relative Effectiveness of Professional Development Activities and Dimensions for Elementary School Teachers of English as a Foreign Language

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ABSTRACT: *This study employs correspondence analysis to examine how elementary school EFL teachers perceive the effectiveness of various professional development activities (PDA) in relation to key dimensions of teacher professional development (TPD). Data were collected from 139 in-service English teachers in Taiwanese elementary schools through a structured questionnaire. The analysis revealed that EFL teachers' perceptions varied notably based on their years of teaching experience and academic qualifications. While professional growth, subject-specific development, and curriculum and teaching consistently emerged as core PD dimensions across groups, novice teachers and those with bachelor's degrees tended to favor a wider array of collaborative and reflective activities, such as teaching journals, teacher communities, and portfolios. In contrast, more experienced and master's-level teachers demonstrated a preference for integrated, content-focused approaches, particularly workshops and observation linked to classroom management. Across all subgroups, seminars and collaborative teaching showed weaker associations with perceived effectiveness, particularly when linked to abstract or less actionable PD dimensions. These findings highlight the importance of tailoring TPD programs to align with EFL teachers' developmental stages and academic backgrounds. Differentiated, targeted TPD design may enhance both relevance and impact in supporting EFL teacher growth and instructional quality.*

Key words*: English as a foreign language, professional development activities, professional development dimensions.*

1. Introduction

In the context of English as a Foreign Language (EFL) education, teacher professional development (TPD) is increasingly recognized as a pivotal factor in improving instructional quality and student learning outcomes (Richards, 2005; Avalos, 2011). Over the past two decades, numerous studies have investigated various aspects of teacher professional development, including teacher learning (Borg, 2011), teacher identity (Beauchamp & Thomas, 2009), reflective practice (Farrell, 2012), communities of practice (Wenger, 1998; Li et al., 2017), and teaching practice and beliefs (Guskey, 2002; Opfer & Pedder, 2011). These studies have collectively contributed to a deeper understanding of how teachers grow professionally within both individual and institutional contexts.

While the existing literature offers a rich account of the nature, processes, and outcomes of TPD in EFL settings, most of this research focuses either on evaluating the impact of specific TPD programs or on understanding teachers' professional learning experiences. Fewer studies, however, have examined how the effectiveness of TPD activities, such as workshops, peer coaching, or action research, relates to the underlying dimensions of teacher professional development, such as cognitive, experiential, attitudinal, and contextual aspects (Evans, 2014).

Richards (2005) identifies several key dimensions of teacher professional development, which interact to influence the extent to which teachers engage in and benefit from TPD activities. In spite of widespread

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implementation of these activities, there remains a pressing question regarding the underlying factors that determine their effectiveness. Recent theoretical frameworks suggest that the impact of TPD initiatives may not solely depend on their format or content, but also on how they align with various dimensions of teacher professional development (Desimone, 2009). However, few studies have systematically examined the relationships between these dimensions and the perceived effectiveness of specific TPD activies in EFL contexts. Without such understanding, TPD programs risk being designed in ways that are misaligned with teachers' developmental needs, leading to limited or short-lived impacts (Evans, 2014).

Moreover, individual teacher characteristics, such as years of teaching experience and educational qualifications, have been shown to influence how teachers engage with and benefit from professional development (Day & Gu, 2007; King, 2016; Wyatt & Ager, 2021). Novice teachers may prioritize strategies that enhance their instructional skills or classroom management (i.e., cognitive and experiential dimensions), while more experienced teachers might seek opportunities for reflection, innovation, or contextual negotiation (attitudinal and contextual dimensions). Similarly, teachers with advanced academic degrees may evaluate TPD activities through different lenses, potentially engaging more critically with theoretical content or research-based practices.

Despite the relevance of these factors, few research has examined how teaching experience and academic qualifications might shape teachers' perceptions of the effectiveness of various TPD activities across the dimensions of professional development. Understanding how these personal variables interact with TPD perceptions can offer valuable implications for differentiated TPD design, ensuring that teacher learning is not only effective but also meaningful and sustainable across diverse career stages.

In response to this gap, the current study adopts correspondence analysis (CA), a multivariate statistical technique particularly suited for exploring relationships among categorical data, to investigate what perceived effectiveness of commonly used TPD activities are associated with the different dimensions of professional development. CA has been widely applied in educational research to uncover patterns that are not immediately observable through traditional frequency-based approaches (Greenacre, 2017). By visually mapping the associations between activities and developmental dimensions, this method allows for a deeper interpretation of how different forms of TPD are experienced and valued by teachers. This understanding is crucial for developing more dimension-responsive TPD that are tailored to the diverse and situated needs of EFL teachers, particularly in non-English-dominant educational systems where top-down, one-size-fits-all TPD often dominate (Nguyen, 2017).

2. Teacher Professional Development

Teacher Professional Development (TPD) refers to the continuous, deliberate, and systematic efforts undertaken to improve teachers' professional knowledge, instructional skills, classroom practices, and overall effectiveness across the span of their teaching careers (Shulman, 1987). TPD is grounded in the recognition that teaching is a complex, evolving profession that requires sustained intellectual and practical engagement. It includes a broad range of learning activities—both formal (e.g., workshops, seminars, degree programs, certification courses) and informal (e.g., peer collaboration, reflective journaling, online communities of practice)—that aim to enhance teachers' pedagogical content knowledge, instructional strategies, and adaptive expertise (Darling-Hammond et al., 2017; Borko, 2004). This process is shaped not only by institutional initiatives but also by teachers' own agency, professional identity formation, and reflective practice (Day, 1999; Villegas-Reimers, 2003). It recognizes that teachers must continually adapt to evolving curriculum standards, emerging technologies, diverse student populations, and shifting sociopolitical contexts in education (OECD, 2019). Thus, professional development contributes to teacher motivation, self-efficacy, and job satisfaction, which in turn influence classroom effectiveness (Day & Sachs, 2004).

Moreover, TPD is increasingly viewed as a socially situated activity embedded within the school culture and wider educational system, and constitutes a multifaceted, dynamic, and recursive process. The ultimate aim of TPD is not only to improve individual teacher dimensions but also to enhance collective instructional capacity at the school and system levels, thereby contributing to improved student learning outcomes and equity in education.

TPD reflects the professional journey of teachers as they strive for excellence in teaching and adapt to the complex realities of educational practice. The core components of teacher professional dimension are as follows (Richards, 2005):

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1. Generic dimension refers to a set of essential abilities that are applicable across different educational contexts and are not limited to specific subject matter. These competences include knowledge, skills, and attitudes that support effective communication, collaboration, leadership, and problem-solving in diverse school environments. Its key dimensions include interpersonal communication, teaching behaviors and personal growth (Lin & Wu, 2016).

2. Subject matter dimension refers to a teacher's deep understanding of the content within a specific discipline, as well as the pedagogical strategies required to teach that content effectively. It is often conceptualized as encompassing both content knowledge (CK) and pedagogical content knowledge (PCK) (Shulman, 1986).

3. Educational professional dimension encompasses teachers' understanding of educational theories, ethics, student development, and classroom practices. It is the ability to design assessments, manage classrooms, engage in reflective practice, and participate in professional communities, including general curriculum, counseling, classroom management and educational settings (Richards, 2005).

A substantial body of empirical research underscores the importance of TPD in improving teacher effectiveness and student outcomes. For example, Desimone (2009) identified core features of effective PD programs, including content focus, active learning, coherence, duration, and collective participation, which have been consistently associated with positive instructional change. Darling-Hammond et al. (2017) conducted a meta-analysis of TPD programs and found that sustained, collaborative, and content-rich professional development positively influenced both teaching practices and student achievement. Opfer and Pedder (2011) proposed an ecological model of teacher learning that recognizes the complex interplay of individual, school, and system-level factors, suggesting that successful TPD requires alignment across multiple layers of the educational system.

3. Professional Development Activities for Language Teachers

In the evolving landscape of language education, TPD has become increasingly recognized as a cornerstone for improving instructional quality and student learning outcomes. Effective PD activities empower language teachers to refine their pedagogical practices, stay current with linguistic research, and adapt to diverse classroom contexts. Contemporary approaches to PD often stress collaborative learning, reflective practice, and the integration of technology, moving away from one-time workshops toward more dynamic, practice-oriented models (Borg, 2015). Given the complex demands of language teaching in multilingual and multicultural settings, strategically designed PD initiatives are vital for equipping educators with the knowledge and skills necessary to foster meaningful language acquisition among learners.

Richards (2005) identified eleven key activities that educators can engage in to foster their own professional development as follows:

1. Workshops are structured, short-term educational programs that focus on specific aspects of teaching or language pedagogy. Typically led by experts or experienced practitioners, workshops provide teachers with opportunities to engage in demonstrations, discussions, and collaborative problem-solving. They promote the acquisition of practical techniques and awareness of recent trends in language teaching (Farrell, 2007). For instance, a workshop on task-based learning may lead teachers to revise their classroom activities to better align with communicative objectives.

2. Self-monitoring involves teachers systematically observing and analyzing their own teaching practices. This can include recording lessons, maintaining reflective journals, or using checklists to assess instructional behavior. It fosters reflective practice and self-regulation, helping teachers identify areas for improvement (Bailey, 2006). For example, a teacher might notice through video observation that their wait time for student responses is insufficient, prompting changes in questioning strategies.

3. Teacher community are small, voluntary collectives where educators share experiences, resources, and solutions to teaching challenges. These groups may meet regularly, either in person or online, and often follow a peer-led, egalitarian structure. Support groups enhance collegiality, reduce professional isolation, and promote emotional resilience (Hobbs, 2012). A group focused on ESL teaching, for example, may co-develop culturally responsive lesson plans.

4. Teaching portfolios is a curated collection of artifacts that document a teacher's instructional practices, development, and philosophy. Portfolios may include lesson plans, student feedback, reflective essays, and

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evidence of student learning. They support introspection and professional accountability (Tillema & Smith, 2007). Portfolios are especially effective in performance evaluations and teacher certification processes.

5. Analysis of critical incidents involves examining unexpected or problematic classroom events to understand their causes and implications. Teachers write narratives of the incidents and reflect on the pedagogical decisions made and their outcomes. This strategy cultivates critical thinking and adaptive expertise (Tripp, 1993). For example, an incident involving student resistance to group work may highlight cultural differences in learning expectations.

6. Observation is a reciprocal process wherein teachers observe each other's classes to provide constructive feedback. Observers follow agreed-upon guidelines and conduct pre- and post-observation discussions to ensure mutual benefit. It encourages collaborative reflection and disseminates effective teaching practices (Carroll & O'Loughlin, 2014). A teacher adopting peer-recommended questioning techniques may notice increased student participation.

7. Teaching journals are reflective writings where teachers record and analyze their daily teaching experiences. They may be kept individually or shared with mentors and peers for discussion. Journaling supports long-term reflection and personal growth (Richards & Farrell, 2005). For instance, a teacher tracking classroom management efforts may discern patterns linked to student engagement.

8. Case analysis involves examining detailed narratives of teaching scenarios to explore pedagogical issues and decision-making. Teachers discuss cases in groups or study them independently, often guided by analytical frameworks. This practice enhances problem-solving skills and pedagogical reasoning (Richards & Lockhart, 1996). A case involving conflict during pair work may prompt a reevaluation of classroom interaction norms.

9. Action research is a systematic, practitioner-led inquiry aimed at improving teaching practices through a cyclical process of planning, acting, observing, and reflecting. Teachers identify a classroom issue, implement a strategy, collect data, and refine their approach based on findings. It generates teachers to become context-specific knowledge producers and empowers teachers as researchers (Burns, 2010). For example, a teacher might use action research to test the effectiveness of visual aids in vocabulary instruction.

10. Collaborative teaching involves two or more instructors collaboratively planning, delivering, and evaluating a course. Teachers co-develop lessons and alternate or co-deliver instruction, with shared responsibility for student outcomes. It facilitates collaborative planning and shared responsibility, and fosters professional dialogue and innovation (Villa et al., 2013). A novice teacher paired with a mentor in team teaching may accelerate their development of classroom management skills through modeling and feedback, thereby contributing to situated learning and mentorship (Villa et al., 2013).

11. Mentoring pairs an experienced teacher with a novice to provide guidance, support, and feedback. It can be formal (as part of induction programs), informal or part of a structured induction program, involving regular feedback and collaborative goal-setting. Effective mentoring accelerates the professional development of novice teachers and contributes to knowledge transmission across generations. It reinforces professional identity, confidence and effectiveness and fosters reflective practice (Wang & Odell, 2002).

While varying in structure and scope, not all of these are equally implemented in actual teaching environments, especially in Taiwan. activities such as self-monitoring, analysis of critical incidents, case analysis, and mentoring are often underutilized in practice, despite their theoretical value. These approaches require a high level of individual initiative, structured reflection, and institutional support—resources that are frequently lacking in many educational settings. Teachers may find it difficult to engage in these strategies due to time constraints, lack of training, or limited collaboration among colleagues, and therefore, are excluded in this study. In contrast, seminars and conferences have become more prevalent forms of professional development, largely because institutional policies often mandate encourage teacher participation. Attendance at these events is typically documented and recognized as formal professional development, making them more accessible and feasible for educators under administrative expectations. As such, while certain strategies proposed by Richards hold pedagogical merit, their practical uptake remains limited compared to more formally structured activities like seminars and conferences, which are widely recognized as formal and structured modes of professional development for language teachers.

A seminar typically involves a focused, small-group academic session that allows for in-depth discussion on specific teaching methodologies, language theories, or pedagogical innovations. Conferences, by contrast, are usually larger-scale events that bring together educators, researchers, and practitioners to share research

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findings, instructional practices, and emerging trends in the field of language education (Richards & Farrell, 2005).

These forms of professional engagement have shown significant value in enhancing teacher knowledge and fostering reflective practice. As Avalos (2011) notes, participation in conferences can lead to increased awareness of contemporary educational issues and promote a sense of professional identity. Similarly, seminars provide opportunities for active engagement, critical dialogue, and feedback, which are essential for developing informed teaching practices (Borg, 2015). Furthermore, both seminars and conferences facilitate networking and collaboration across institutional and national boundaries, thereby broadening teachers' professional communities and exposing them to diverse perspectives (Opfer & Pedder, 2011).

Although they may lack the ongoing support found in long-term professional learning communities, the structured content and institutional recognition of seminars and conferences make them accessible. Particularly in systems where attendance is institutionally mandated, these strategies contribute meaningfully to teachers' continuous learning and pedagogical renewal, and thus, are included in this study.

4. Research Purpose and Questions

This study aimed to explore whether the perceived effectiveness of various professional development strategies correlates with the different dimensions of teacher professional development, as reported by practicing teachers. Understanding these relationships can provide actionable insights for policymakers, school leaders, and teacher educators in designing and prioritizing PD programs that are both effective and relevant to teachers' professional needs. The research questions are as follows:

(1) To what extent are the perceived effectiveness of professional development strategies associated with the dimensions of teacher professional development?

(2) To what extent do teachers' years of teaching experience influence their perceptions of the effectiveness of professional development strategies across different professional development dimensions??

(3) To what extent do educational qualifications influence their perceptions of the effectiveness of professional development strategies across different professional development dimensions?

5. Method and Materials

A sample of 139 elementary school English teachers in Taiwan participated in this study. The demographic characteristics of the participants are summarized as follows: 94 participants were female, and 45 were male. All participants majored in English language teaching or English-related disciplines (e.g., English, foreign languages, and literature) during their academic training. Regarding educational qualifications, 55 held a bachelor's degree, while 84 had obtained a master's degree. Participants had between 3 and 19 years of teaching experience in English language instruction at the elementary school level, and among them, 32 had less than 5 years, 49 had 6 to 10 years, and 58 had more than 10 years of experiences. The study excluded substitute teachers due to the variability in their teaching hours and contractual assignments, which could introduce inconsistencies in data related to long-term teaching practices.

Data were collected using a structured questionnaire consisting of 9 items, and The questionnaire was distributed and returned via Google Forms to 139 English teachers through email, yielding a response rate of 100%. Participants were asked to responded to each question requiring the selection of a single response from a list of 9 categories. The categorical data from all participants will be aggregated into a two-way contingency table, where rows and columns represent two categories (i.e. professional development activities and teacher professional development) as shown in Table 1. The resulting matrix will be analyzed using correspondence analysis to explore the underlying associations and visual structures between row and column variables.

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Table 1. Categorical Data.

Professional development activity (○)		**Teacher professional development (TPD)**	
○1	Seminars	✶1	Interpersonal communication

○2	Workshops	✶2	Teaching behaviors
○3	Observations	✶3	Personal growth
○4	Conferences	✶4	Content knowledge
○5	Action research	✶5	Pedagogical knowledge
○6	Teacher communities	✶6	Curriculum & teaching
○7	Teaching journals	✶7	Counseling
○8	Teaching portfolios	✶8	Classroom management
○9	Collaborative teaching	✶9	Educational settings

Data were analyzed using correspondence analysis (CA), which is an exploratory multivariate statistical technique designed to analyze the relationships between categorical variables presented in a contingency table. The method transforms the data into a low-dimensional graphical display that facilitates the interpretation of associations among rows and columns (Greenacre, 2017). The resulting low-dimensional representation allows for the simultaneous visualization of both rows and columns of the contingency table in a common geometric space, facilitating interpretation of the relationships between categories (Beh, 2004).

The central focus of CA is on visualizing the data structure through biplots, where both row and column categories are represented in the same coordinate space. The proximity between points in the map reflects the strength of association; categories located near each other tend to co-occur more frequently than expected under independence. Contributions to inertia and the quality of representation (measured by squared cosine values) are key metrics for evaluating the relevance of dimensions and the adequacy of the graphical representation (Greenacre & Hastie, 1987). Moreover, supplementary points (either rows or columns not used in the construction of the dimensions) can be projected onto the solution space to further enrich the interpretation without influencing the core analysis (Le Roux & Rouanet, 2010).

6. Results

6.1. Results of All Teachers

Conferences (○4) and content knowledge (✶4) were very close together, suggesting a strong association. Workshops (○2) and curriculum & teaching (✶6), and action research (○5) and teaching behaviors (✶2) were also relatively close, implying moderate associations.

Seminars (○1) and interpersonal communication (✶1) were located at opposite ends of the plot, indicating minimal association between these categories. Similar, teaching journals (○9) and educational settings (✶9) were farther apart as well, implying a weaker relationship.

There was a visible cluster of professional growth (✶3), content knowledge (✶4), pedagogical knowledge (✶5), and curriculum & teaching (✶6) in the central-right area of the plot, suggesting these categories might share similar profiles. Another smaller group consisting of seminars (○1) and conferences (○4), and teacher communities (○6) and collaborative teaching (○9) appeared in the lower-right area, possibly indicating another pattern of association.

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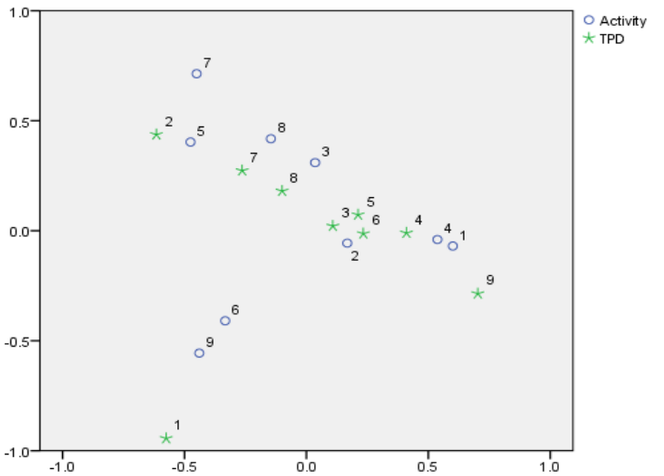


Figure 1. Correspondence Map of all teachers

6.2. Results of Teachers with Under 5-Year Experiences

Conferences (○4) and content knowledge (✶4) and Educational settings (✶9) were very close together, suggesting a strong association. In addition, Workshops (○2) and professional growth (✶3), pedagogical knowledge (✶5) and curriculum & teaching (✶6), and action research (○5) and counseling (✶7), and teacher communities (○6) and interpersonal communication (✶1) were also relatively close, implying moderate associations.

Seminars (○1) and counseling (TPD 7) were located at opposite ends of the plot, indicating minimal association between these categories. Moreover, action research (○5) and content knowledge (✶4) were farther apart as well, implying a weaker relationship.

There was a visible cluster of professional growth (✶3), pedagogical knowledge (✶5) and curriculum & teaching (✶6) in the central-right area of the plot, suggesting these categories might share similar profiles. Another smaller group consisting of teaching journals (○7) and teaching portfolios (○8) appeared in the lower-left area, possibly indicating another pattern of association.

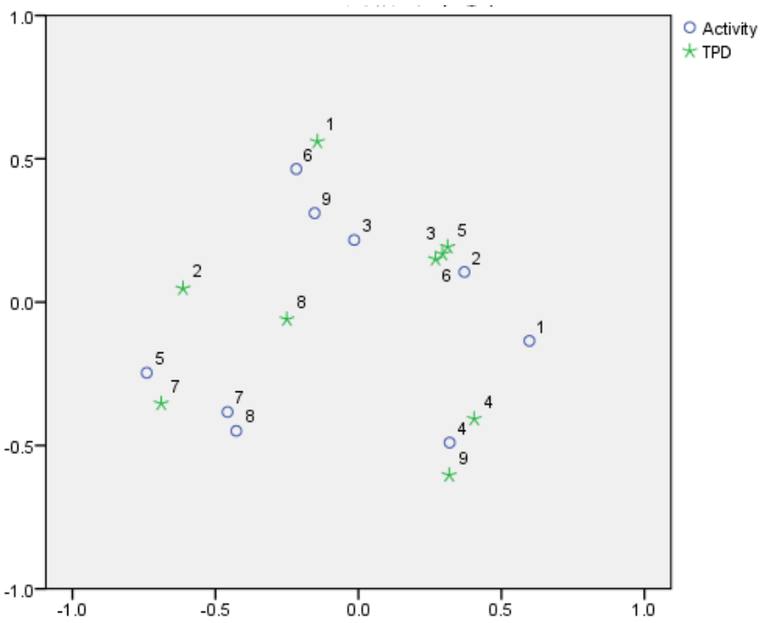


Figure 2. Correspondence Map of Teachers with Under 5-Year Experiences.

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6.3. Results of Teachers with 5-10-Year Experiences

Seminars (○1), workshops (○2) and conferences (○4) was located close to content knowledge (✶4), pedagogical knowledge (✶5) and curriculum & teaching (✶6), and observations (○3) to professional growth (✶3), suggesting notable correspondences between these pairs. This indicated that these TPD items were particularly representative or associated with the respective activities.

Seminars (○7) was located at near the central left, while educational settings (✶9) was near the bottom-right of the plot, suggesting that they do not co-occur frequently. These distances implied that the expected joint occurrence of these categories under independence was not substantially different from their observed relationship.

A notable cluster can be observed in the central region of the plot, where seminars (○1), workshops (○2), observations (○3), conferences (○4) and professional growth (✶3), content knowledge (✶4), pedagogical knowledge (✶5), curriculum & teaching (✶6), Classroom management (✶8) were relatively close to one another. This clustering suggested a shared profile or similar pattern of co-occurrence among these mid-index categories, potentially indicating a common underlying dimension or factor that influences both sets. Seminars (○1) and collaborative teaching (✶9) were more isolated, which indicated unique patterns that diverge from the central or dominant associations captured by the first two dimensions.

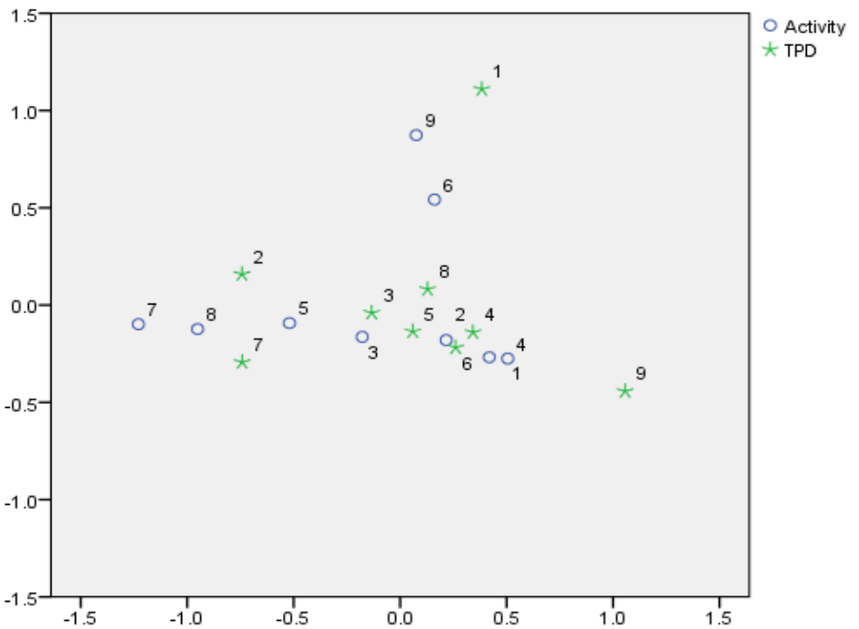


Figure 3. Correspondence Map of Teachers with 5-10-Year Experiences.

6.4. Results of Teachers with above 10-Year Experiences

The closeness of action research (○5) and teaching behaviors (✶2) suggested a relatively strong association between these pairs, implying a pattern of co-occurrence. Another close pairs included workshops (○2) and professional growth (✶3) and curriculum & teaching (✶6), as well as observations (○3) and pedagogical knowledge (✶5) and classroom management (✶8) which shared similar distributional profiles. These spatial proximities suggested that these TPD items were particularly relevant to their corresponding activities in terms of categorical patterns.

Seminars (○1) and interpersonal communication (✶1) were quite distant, indicating minimal statistical association. Similarly, collaborative teaching (○9) and educational settings (✶9) were far apart. This distance implied that any relationship between them was weaker than what would be expected under association assumptions.

A moderate clustering was visible in the central region of the plot, where observations (○3) and teaching portfolios (○8), and professional growth (✶3), content knowledge (✶4) and curriculum & teaching (✶6) were

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fairly concentrated respectively. This suggested that these mid-range categories exhibited similar association patterns and share an underlying dimension.

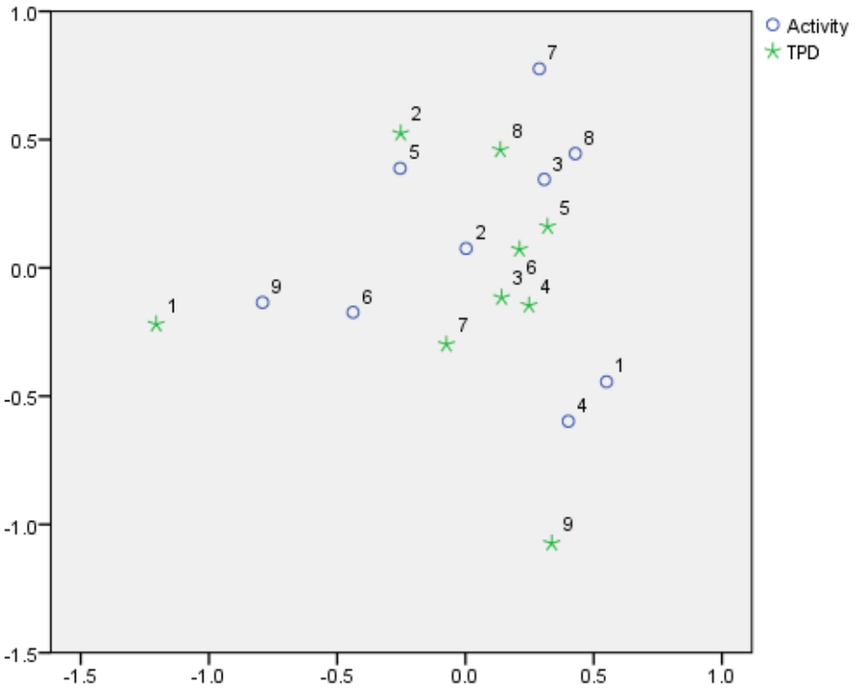


Figure 4. Correspondence Map of Teachers with above 10-Year Experiences.

6.5. Results of Teachers with a Bachelor Degree

Several category pairs exhibit strong proximity, suggesting meaningful associations. For example, seminars (○1) and educational settings (✶9), as well as teaching journals (○7) and classroom management (✶8), were positioned very close to each other, indicating a relatively strong correspondence between these pairs. Similarly, teaching portfolios (○8) and counseling (✶7), and workshops (○2) and professional growth (✶3), pedagogical knowledge (✶5) and curriculum & teaching (✶6) were closely aligned in the upper-left quadrant, implying a higher-than-expected frequency of co-occurrence. These near-aligned pairs reflected a consistent structure of correspondence.

Certain category pairs, despite sharing the same numerical index, were located at considerable distances from one another. For instance, seminars (○1) and interpersonal communication (✶1) were separated along the horizontal axis, suggesting a weak or negligible relationship. Likewise, collaborative teaching (○9) was located more toward the bottom-left, while educational settings (✶9) was situated closer to the center-right, again implying low association strength.

The plot revealed one main cluster, comprising teacher communities (○6) and collaborative teaching (○9) along with content knowledge (✶4), pedagogical knowledge (✶5) and curriculum & teaching (TPD 6), indicating a potential shared dimension, such as a common response style or behavioral theme.

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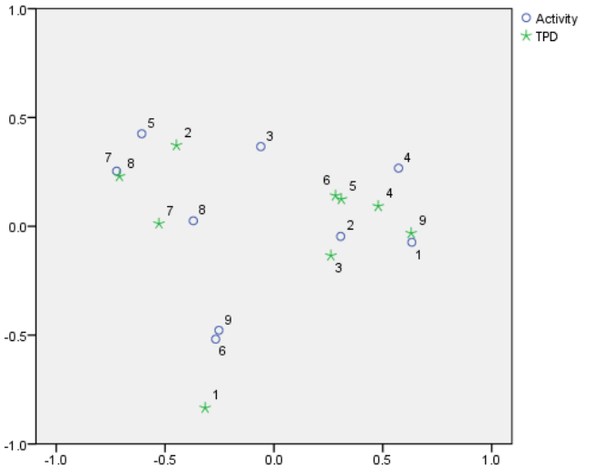


Figure 5. Correspondence Map of Teachers with a Bachelor degree.

6.6. Results of Teachers with a Master's Degree

Workshops (○2) was located close to professional growth (✶3), pedagogical knowledge (✶5), curriculum & teaching (✶6), and classroom management (✶8), suggesting notable correspondences between these pairs, that is, these TPD items were particularly representative or associated with the respective activities.

Seminars (○1) and educational context (✶9) were located at opposite ends of the plot, indicating minimal association between these categories. Moreover, collaborative teaching (○9) and interpersonal communication (✶1) were farther apart as well, implying a weaker relationship.

There was a visible cluster of professional growth (✶3), pedagogical knowledge (✶5), curriculum & teaching (✶6) and classroom management (TPD 8) in the central-right area of the plot, suggesting these categories might share similar profiles. Another smaller group consisting of seminars (○1) and conferences (○4) appeared in the lower-right area, possibly indicating another pattern of association.

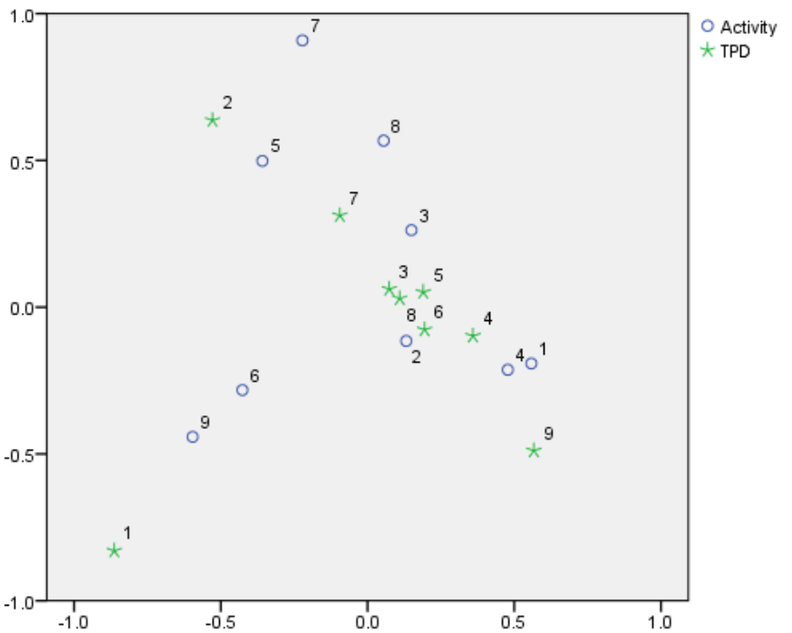


Figure 6. Correspondence Map of Teachers with a Master's Degree.

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7. Discussion

The results of the present study reveal patterns of association between professional development activities (PDA) and the dimensions of teacher professional development (TPD). In terms of a strong perceived effectiveness of these combinations. Notably, workshops are closely associated with the curriculum and teaching dimension, indicating that teachers perceive hands-on, structured learning experiences as highly effective for enhancing instructional practices. Similarly, action research is linked with teaching development, underscoring its relevance in fostering reflective practice and pedagogical innovation. In contrast, some PD strategies are perceived as less strongly associated with certain dimensions. For instance, seminars are weakly connected to Interpersonal communication, and teaching journals to collaborative teaching, possibly due to the less interactive or practical nature of these activities compared to workshops or action research. The clustering patterns highlight the grouping of professional growth, content knowledge, and curriculum & teaching suggests a multidimensional perception, where PD initiatives that support subject-specific expertise are simultaneously seen as enhancing curricular and pedagogical knowledge. Additionally, the co-occurrence of seminars-conferences and teacher communities-collaborative teaching emphasizes the social and collegial dimensions of professional growth. These clusters reflect a more holistic understanding of PD, where effectiveness is perceived in terms of interconnected developmental outcomes.

As to across all experience levels, there is a consistent emphasis on professional growth and content/pedagogical knowledge as key dimensions of effective PD. For example, workshops and conferences are repeatedly linked with professional development in all three groups, highlighting the shared belief that structured, content-rich formats are instrumental in supporting teacher growth. All three experience groups exhibit clustering patterns that demonstrate the interrelatedness of TPD dimensions, such as pedagogical knowledge–curriculum & teaching–personal growth appeared across the groups. This suggests a common perception that effective TPD must simultaneously address content knowledge, pedagogy, and professional identity.

In each group, seminars appeared nuanced perceptions. When combined with other activities (e.g., seminars-workshops), seminars alone were often seen as less impactful, especially when tied to abstract themes such as the educational settings or counsel. However, early-career teachers display the broadest range of PD associations. Their responses showed high perceived effectiveness for diverse activities, including action research, teacher communities and conferences, and dimensions such as counseling and interpersonal communication. This suggests that novice teachers are exploring various sources of support and knowledge as they establish their teaching identity.

Mid-career Teachers exhibited a more refined focus on strategy integration. For example, seminars-workshops-conferences combinations were frequently associated with content knowledge and curriculum & teaching, indicating a desire for practical and subject-specific development. Their perceptions reflected a transition from foundational learning to targeted pedagogical improvement. The most experienced group demonstrates selective, practice-oriented PD preferences. Activities like action research, observations, and teaching portfolios were closely tied to teaching behaviors and classroom management. This suggested a shift toward reflective practice and individualized professional learning, as experienced teachers sought deeper instructional refinement and autonomy.

While teacher communities and teaching journals were strongly associated with effectiveness among novice teachers, these activities appeared less central for experienced teachers. Conversely, teaching portfolios and observations gained significance for the most experienced group, reflecting a greater reliance on self-directed, evaluative forms of TPD.

Last but not least, regarding the results based on their educational qualifications, both groups viewed personal growth and curriculum & teaching as central PD dimensions, consistently linked with activities such as workshops and pedagogical knowledge. These shared patterns suggest that regardless of academic qualification, teachers prioritized PD that enhanced instructional content and practical application. Nevertheless, both groups ranked seminars and collaborative teaching low in terms of perceived effectiveness, especially when associated with abstract dimensions like educational settings or interpersonal communication. This indicated a broader skepticism towards strategies that may lack direct, actionable classroom application. In addition, both qualification levels demonstrated clustering patterns that combined content knowledge, curriculum & teaching, and classroom management. This convergence reinforced the idea that effective PD was multidimensional and must integrate subject mastery with instructional execution.

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Bachelor's degree holders showed a broader and more varied association with PD activities. In addition to workshops, they perceived seminars, teaching journals, and teaching portfolios as effective when linked to dimensions such as educational settings, classroom management, and counseling. This may reflect a more exploratory approach to PD, possibly due to more limited prior academic exposure to pedagogical theory. In contrast, Master's degree holders demonstrated a more focused pattern of integrated, content-rich strategies such as workshops that addressed multiple dimensions simultaneously. This indicated a deeper, more selective engagement with PD, likely informed by their advanced academic training. Bachelor-level teachers showed stronger proximity associations with teaching journals, portfolios, and teacher communities, suggesting a higher perceived value in peer-supported and reflective practices. These activities were not as prominently valued among Master's degree holders, who might already engage in such practices at a more autonomous level or prefer formal, content-based PD.

With regard to clustering differences, bachelor's degree holders displayed clusters such as teacher communities–collaborative teaching and content knowledge–curriculum & teaching, reflecting an emphasis on foundational teaching identity and social-professional support. Conversely, Master's holders formed clusters around seminars–conferences and personal growth–classroom management, indicating a more individualized, expertise-driven PD orientation focused on higher-level teaching competencies.

8. Conclusion

These findings suggest that teachers perceive the effectiveness of PD strategies not in isolation but through their alignment with specific developmental needs. Strategies that offer direct, experiential learning (e.g., workshops, action research) are viewed as more impactful for core teaching competencies, whereas those focused on communication or reflection (e.g., journals, seminars) are seen as complementary rather than central. The clustering further indicates that teachers value integrated approaches that simultaneously address content knowledge, pedagogy, and professional identity.

It is obvious that educational qualifications significantly influence teachers' perceptions of the effectiveness of professional development strategies. While both Bachelor's and Master's degree holders recognize the importance of professional growth and curriculum-related development, their preferences diverge in complexity, focus, and preferred methods. Bachelor-level teachers tend to value a broader range of collaborative and reflective learning and diverse activities, whereas Master-level teachers prioritize more professional learning experiences, favoring more targeted, integrated, integrated, content-focused and advanced approaches. These distinctions highlight the need for differentiated professional development designs that align with teachers' academic backgrounds and evolving professional needs.

All teachers value PD that enhances subject knowledge and instructional competence, whereas their perceptions of effective activities evolved with their teaching experiences. Novice teachers seek breadth and support; mid-career teachers emphasize relevance and integration; and experienced teachers prioritize depth, reflection, and practice-based inquiry. These findings reinforce the need for differentiated PD pathways that are responsive to the evolving needs and professional maturity of teachers throughout their careers.

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