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ALIGNING TEACHERS' PROFESSIONAL DEVELOPMENT NEEDS AND LEARNING PREFERENCES FOR MICROLEARNING DESIGN

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Abstract

Designing accessible and relevant continuous professional development (CPD) requires an understanding of both teachers' learning needs and their preferences for engaging with professional learning materials. This study examined these two dimensions to inform the design of microlearning-based CPD. A quantitative descriptive needs analysis was conducted with 57 teachers who voluntarily participated through non-probability recruitment via institutional channels, representing elementary, junior secondary, senior secondary, and vocational schools in the Special Region of Yogyakarta, Indonesia. Data were collected through an online questionnaire and analyzed using frequencies, percentages, and mean scores. The findings identified data-based learning evaluation (M = 4.00), formative assessment (M = 3.95), and artificial intelligence in learning (M = 3.95) as leading perceived professional learning needs. Most respondents preferred microlearning units lasting three to seven minutes (73.7%), sequential learning pathways (70.2%), and video-based content (80.7%). Time constraints were the most frequently reported barrier (45.6%). The survey findings were subsequently used to inform a preliminary seven-stage CPD content mapping comprising 143 proposed microlearning units, which have not yet undergone expert or user validation. The study provides an initial empirical basis for microlearning design decisions rather than evidence of intervention effectiveness.

Keywords: Continuous Professional Development; Instructional Design; Microlearning; Needs Analysis; Teacher Education.
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INTRODUCTION

Continuous professional development (CPD) plays a critical role in enabling teachers to respond to changing educational demands, particularly in instructional practices, assessment, and educational technology. Effective professional development requires more than participation in occasional training activities; it should facilitate sustained changes in teachers' knowledge, instructional practices, and professional competencies. Sancar et al.(2021) conceptualized teacher professional development as a comprehensive process shaped by individual and contextual factors. Furthermore, Sims et al. (2025) demonstrated the importance of professional development mechanisms that promote teachers' understanding, motivation, instructional techniques, and application of learning in classroom practice. Research synthesizing teacher professional learning has highlighted the importance of sustained professional development, coaching, and collaboration, although the evidence for direct improvements in student outcomes varies across intervention types (Ventista & Brown, 2023).

Despite its importance, teachers frequently encounter challenges in accessing professional learning opportunities. Instructional responsibilities, administrative workloads, scheduling constraints, and differences in institutional support can limit participation in conventional professional development activities. Reports on teachers' professional development in England have examined the practical and organizational conditions affecting participation (Ofsted, 2024a, 2024b). In low and middle income countries, technology-mediated teacher professional development offers promising opportunities, but its sustainability and effectiveness depend substantially on local conditions and human support (Hennessy et al., 2022). These challenges highlight the need for professional learning approaches that accommodate teachers' working conditions while maintaining instructional relevance and continuity.

Digital learning environments offer opportunities to make professional development more flexible and accessible. Online platforms and social media enable teachers to access learning resources, exchange instructional experiences, and participate in professional communities beyond formal training settings. Lantz-Andersson et al. (2018) identified formally organized and informally developed online teacher communities as important environments for professional learning. However, digital accessibility does not automatically guarantee meaningful learning. Professional development activities still require appropriate content selection, instructional organization, interaction, and opportunities to apply new knowledge. Digital professional development also requires more than access to online materials; appropriate instructional design, facilitation, and institutional support remain important considerations (Philipsen et al., 2019) .

Microlearning has emerged as a potential approach to organizing professional learning into concise, focused, and accessible instructional units. Rather than being defined solely by

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short duration or video-based delivery, microlearning can be understood as an instructional approach that organizes learning experiences around specific objectives, manageable content, and meaningful learning activities. Alias and Razak (2025) identified various microlearning strategies, including bite-sized content delivery, mobile learning, and video-based learning. Monib et al. (2025) further emphasized that effective microlearning requires appropriate pedagogical organization and targeted learning objectives. In teacher education, Kohnke et al. (Kohnke et al., 2024) discussed microlearning as an approach to flexible professional development in online and blended learning environments. Research involving early childhood educators has also examined the potential of small learning steps within online professional development, highlighting the relevance of microlearning to educators' professional learning contexts (Pölzl-Stefanec & Geißler, 2022).

The design of microlearning-based CPD must therefore consider several interconnected instructional characteristics. Learning duration should be manageable without compromising the complexity of the intended competency. Content formats should correspond to specific learning objectives, while sequencing, interaction, feedback, and reflection should support understanding and practical application. Research on asynchronous professional development also highlights the potential importance of structured feedback and facilitation in supporting teachers' learning (Marei et al., 2021) . Moreover, evidence from microlearning research suggests that short learning activities can support knowledge development in particular educational contexts, although findings from other disciplines should not automatically be generalized to teacher professional development (Frosch & Lindauer, 2025) .

These considerations are particularly relevant to elementary education, where teachers are expected to integrate pedagogical knowledge, assessment practices, and digital resources into diverse classroom situations. Differences in digital readiness and technological access may further influence teachers' opportunities to engage in online professional learning. Research on teachers' digital literacy in rural settings highlights the importance of considering contextual readiness when introducing technology-supported learning activities (Rofiah et al., 2024) . Consequently, microlearning-based CPD should be designed not only for brevity and convenience but also for accessibility, practical relevance, and instructional coherence.

A central challenge is determining both the professional learning content and the characteristics of the learning experience. These dimensions can be represented through two complementary questions: what do teachers need to learn, and how do they prefer to learn it? The first dimension concerns professional learning priorities, including pedagogy, assessment, and educational technology. The second concerns learning duration, content formats, sequencing, interaction, feedback, and digital accessibility. Research examining teachers' professional development preferences reinforces the importance of considering the relationship between teachers' expectations and research-informed recommendations (Ehlert & Souvignier,

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2024) . However, teachers' preferences should inform instructional design decisions rather than serve as the sole determinant of pedagogical effectiveness.

Although previous studies have examined teacher professional development, online professional learning, and microlearning strategies, these strands of research often emphasize different aspects of professional learning. Studies of teacher professional development have investigated the conditions and mechanisms associated with effective learning opportunities (Sims et al., 2025; Ventista & Brown, 2023), while microlearning research has examined instructional characteristics and delivery strategies (Kohnke et al., 2024; Monib et al., 2025). A design-oriented issue that warrants further investigation is how teachers' perceived professional learning priorities and their learning preferences can be considered together when developing preliminary microlearning-based CPD resources. This issue is particularly important because identifying relevant CPD topics does not automatically determine how those topics should be organized into accessible and pedagogically coherent learning experiences.

The present study addresses this issue by integrating the what to learn and how to learn dimensions within a quantitative needs analysis. The term aligning in this study refers to connecting teachers' reported professional development needs with their learning preferences to inform preliminary instructional design decisions. It does not imply that the resulting microlearning design has been implemented, validated, or demonstrated to improve learning outcomes. This approach is intended to provide an empirical basis for organizing CPD content and identifying suitable characteristics of potential microlearning units.

Accordingly, this study aims to identify teachers' CPD content priorities, examine their preferences for microlearning-based professional learning, and translate the findings into preliminary instructional design implications. The study addresses three research questions: (1) What professional learning topics do teachers perceive as most needed? (2) What microlearning characteristics do teachers prefer regarding duration, formats, sequencing, interaction, and digital delivery? and (3) How can these needs and preferences inform the design of microlearning-based CPD? The findings are expected to provide an empirical foundation for developing focused, structured, and accessible professional learning resources, including potential applications in elementary education.

METHODS

Research Design

This study employed a quantitative descriptive needs-analysis design to identify teachers' professional learning needs and preferences for microlearning-based continuing professional development (CPD). The research was situated within the Analysis phase of the ADDIE instructional design model (Branch, 2009), which emphasizes the identification of learning needs, learner characteristics, and contextual conditions as a foundation for

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instructional design. Accordingly, the study focused on collecting and analyzing empirical data to inform preliminary CPD design decisions rather than developing, implementing, or evaluating the effectiveness of a microlearning intervention.

The needs analysis was structured around two complementary dimensions: what to learn and how to learn. The former examined teachers' perceived professional development priorities, particularly in assessment, instructional practices, and educational technology. The latter investigated their preferences regarding learning duration, content formats, instructional sequencing, interaction, feedback, digital learning environments, and participation barriers. These dimensions provided an analytical framework for translating teachers' reported needs and preferences into preliminary design implications for microlearning-based CPD.

Participants and Sampling

The study involved 57 teachers from public and private schools in the Special Region of Yogyakarta, Indonesia. Participants represented four educational levels: elementary schools (n = 23; 40.4%), junior secondary schools (n = 12; 21.1%), senior secondary schools (n = 14; 24.6%), and vocational schools (n = 8; 14.0%). The sample comprised 36 female teachers (63.2%) and 21 male teachers (36.8%). Regarding educational qualifications, 38 participants (66.7%) held a diploma or bachelor's degree (D4/S1), while 19 (33.3%) held a master's degree (S2).

Participants were recruited using non-probability voluntary-response sampling through institutional communication and questionnaire distribution. Coordination with the Yogyakarta City Education Office facilitated access to public elementary and junior secondary schools, while the Special Region of Yogyakarta Education, Youth, and Sports Office supported questionnaire distribution to public senior secondary and vocational schools. Private schools were contacted directly.

Participation was voluntary, and all 57 completed questionnaires were included in the analysis. Given the non-probability sampling approach and institutional distribution procedures, the sample may have been subject to self-selection bias, particularly among teachers interested in digital professional learning. Therefore, the findings were interpreted as descriptive evidence of the participating teachers' reported needs and preferences rather than as statistically representative estimates of the wider teacher population.

Research Instrument

Data were collected using a researcher-developed online needs-analysis questionnaire informed by literature on teacher professional development, microlearning, digital learning, and professional learning preferences. The instrument was designed to capture teachers' professional development priorities and their preferred characteristics of microlearning-based CPD.

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The questionnaire comprised four main sections. The first collected respondents' demographic and professional characteristics, including educational level, gender, educational qualifications, and employment status. The second assessed perceived professional learning needs across ten CPD topics: diagnostic assessment, differentiated instruction, Problem-Based Learning, Project-Based Learning, instructional module and learning-device development, digital learning media development, artificial intelligence in learning, Learning Management System utilization, formative assessment, and data-based learning evaluation.

The third section examined teachers' learning preferences and digital learning practices, including preferred learning duration, content formats, instructional sequencing, social media use, interaction, feedback, and supporting learning features. The fourth section addressed barriers to CPD participation and teachers' expectations regarding an ideal microlearning experience.

The instrument incorporated five-point Likert-scale items, single-choice questions, multiple-response questions, and an open-ended question. Likert-scale items were used to assess perceived professional learning needs and agreement with statements concerning learning preferences, whereas categorical and multiple-response items captured specific preferences, practices, and participation barriers. The open-ended item provided an opportunity for respondents to express additional expectations concerning microlearning-based professional development.

Before data collection, the questionnaire underwent a review by one academic evaluator who was also a member of the research team. The evaluator assessed the instrument's suitability for the study and concluded that it could be used without revision. Although this procedure provided preliminary feedback on instrument suitability, it did not constitute independent expert-panel validation. No formal content validity index or reliability coefficient was established. Consequently, the instrument was treated as a descriptive needs-assessment tool rather than a fully psychometrically validated measurement scale.

Data Collection Procedures

Data were collected through an online questionnaire distributed to teachers through the participating institutions and schools. The questionnaire provided information about the study's purpose and the confidentiality of respondents' information. Participation was voluntary, and respondents completed the questionnaire based on their professional experiences, perceived learning needs, and preferences for CPD activities.

Following data collection, responses were screened for completeness and consistency. All 57 completed questionnaires were retained for descriptive analysis. The resulting dataset was organized according to the two analytical dimensions, what to learn and how to learn, to facilitate the identification of professional learning priorities, preferred learning characteristics, and perceived barriers to participation.

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Data Analysis

Data were analyzed using descriptive statistics, including frequencies, percentages, mean scores, and standard deviations (SD). Frequencies and percentages were calculated to summarize participants' characteristics, preferred microlearning duration, content formats, learning sequences, desired instructional features, and barriers to CPD participation. For multiple-response items, percentages were calculated using the total number of respondents (N = 57) as the denominator; therefore, the percentages across response categories were not expected to sum to 100%.

Mean scores and standard deviations were used to summarize responses to five-point Likert-scale items concerning professional development needs and learning preferences. Higher mean scores indicated stronger reported needs or agreement with the measured statements. Scores above the scale midpoint (3.00) were interpreted as reflecting generally positive perceived needs or preferences. However, mean scores were used primarily for descriptive comparison, and small differences between items were not assumed to indicate statistically or substantively meaningful differences.

No inferential statistical tests were conducted because the study aimed to describe participants' reported needs and preferences rather than test hypotheses or estimate population-level relationships.

Translation of Needs-Analysis Findings into Preliminary CPD Design

Following the descriptive analysis, findings from the what to learn and how to learn dimensions were integrated through a needs-to-design translation process. This process connected teachers' reported professional development needs with their preferred learning characteristics to generate preliminary instructional design recommendations.

Professional learning priorities informed the identification and organization of CPD content areas, while learning preferences informed initial decisions regarding content chunking, unit duration, instructional sequencing, media formats, interaction, feedback, and digital accessibility. For example, preferences for concise learning activities and video-based content were considered in developing potential short, focused learning units, whereas preferences for sequential learning and practical application informed the organization of structured learning pathways and classroom-relevant activities.

This integration provided the basis for organizing a preliminary seven-stage CPD content architecture comprising 143 proposed microlearning units. The architecture was developed as an initial instructional planning output derived from the needs-analysis findings, rather than as a completed or validated learning intervention. Accordingly, the proposed structure and instructional implications require subsequent expert validation, teacher feedback, and implementation-based evaluation before conclusions can be drawn regarding their feasibility, usability, or effectiveness.

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RESULTS AND DISCUSSION

The needs analysis identified a range of professional competencies considered important by the participating teachers. As shown in Table 1, all ten CPD topics received mean scores ranging from 3.65 to 4.00 on a five-point scale, suggesting generally positive perceived needs across assessment, pedagogy, and educational technology. Given the relatively narrow range of mean scores, differences between topics should be interpreted cautiously. The rankings indicate relative differences in perceived needs rather than substantially distinct professional development priorities.

Table 1. Teachers' Perceived Needs for CPD Content

Rank	CPD content	Mean
1	Data-based learning evaluation	4.00
2	Formative assessment	3.95
2	Artificial intelligence in learning	3.95
4	Digital learning media development	3.91
5	Instructional module and learning-device development	3.89
6	Diagnostic assessment	3.88
7	Differentiated instruction	3.86
8	Problem-Based Learning	3.84
9	Project-Based Learning	3.81
10	Learning Management System utilization	3.65

As presented in Table 1, the mean scores for the ten CPD topics ranged from 3.65 to 4.00 on a five-point scale, indicating generally positive perceived professional learning needs among the participating teachers. Data-based learning evaluation obtained the highest descriptive mean (M = 4.00), followed closely by formative assessment and artificial intelligence in learning (both M = 3.95). However, the small differences between these mean scores should not be interpreted as evidence of meaningful differences in priority. Rather, the findings suggest that assessment-related competencies and educational technology were among several areas of professional learning interest reported by the participants. The interpretation of these patterns should also consider the variability of responses, as reflected in the standard deviations reported in Table 1.

The prominence of assessment-related competencies is particularly noteworthy. Data-based evaluation and formative assessment are closely connected to teachers' ability to identify learning difficulties, monitor progress, and adjust instruction. The high priority assigned to data-based learning evaluation is consistent with research conceptualizing teachers' data literacy as a multidimensional competency involving knowledge, skills, dispositions, and data-informed professional practices (Lee et al., 2024). Furthermore, Schildkamp et al. (2020) identified assessment literacy, pedagogical knowledge, and collaboration as important prerequisites for implementing formative assessment. These findings suggest that CPD on assessment should

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integrate conceptual understanding with practical opportunities to interpret learning evidence and plan instructional responses. These competencies are relevant to continuous instructional improvement rather than isolated technical skills. Sancar et al. (2021) emphasized that teacher professional development involves interconnected processes influenced by teachers' professional contexts. Similarly, Sims et al. (2025) highlighted the importance of professional development mechanisms that support the acquisition and application of instructional knowledge and techniques. The proposed ANALYZE and IMPROVE stages can be understood as opportunities to connect professional learning with the interpretation and application of educational evidence. Teaching analytics has been discussed as an approach to supporting teachers' diagnostic and data-informed pedagogical decisions (Ndukwe & Daniel, 2020). The present findings suggest that CPD content should connect assessment knowledge with practical opportunities to analyze learning evidence and make instructional decisions.

The relatively high ratings for artificial intelligence and digital learning media also indicate teachers' interest in technology-related professional competencies. However, these findings should not be interpreted as evidence that participants already possess the skills required to use these technologies effectively. Rather, the ratings represent perceived learning needs. Similarly, digital competence involves more than operating technological tools; it includes understanding and using digital resources appropriately for instructional purposes (Fernández-Batanero et al., 2022; Heine et al., 2023). The high rating for artificial intelligence in learning indicates an important area for subsequent professional development. Research reviewing teacher training for AI has identified implementation challenges and the need for appropriate training strategies (Aljemely, 2024). Accordingly, AI-related microlearning should address pedagogical applications and critical decision-making rather than focusing exclusively on tool operation. Research examining teachers' digital readiness, including Rofiah et al. (2024) , provides a relevant perspective on why technology-related CPD should consider teachers' existing competencies and educational contexts.

Another important finding concerns practical applicability. Participants reported a strong preference for learning materials that could be directly applied in classroom practice ($M = 4.21$). This preference suggests that professional development should prioritize authentic instructional problems and actionable learning outcomes. Ehlert and Souvignier (2024) , in examining the relationship between teachers' professional development preferences and research-informed recommendations, provide a useful perspective for interpreting the importance of aligning program design with teachers' expectations without assuming that preference alone determines instructional effectiveness.

For elementary education, the findings suggest potentially relevant CPD topics, particularly formative assessment, differentiated instruction, and digital learning resources. However, the study involved teachers from elementary, junior secondary, senior secondary, and

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vocational schools, whose professional learning needs may differ across educational contexts. Therefore, the identified priorities and the resulting preliminary microlearning design should be interpreted as cross-level findings rather than as representative estimates of the needs of elementary or madrasah teachers specifically. Further research involving a larger and more focused sample of elementary and madrasah teachers is needed to establish the relevance of these priorities and design recommendations to these educational settings.

The perceived need for differentiated instruction is relevant to evidence that professional development can improve teachers' knowledge, attitudes, and differentiation practices, particularly when training is connected to specific subject contexts (Kahmann et al., 2022).

Table 2. Teachers' preferences for CPD delivery and perceived participation barriers (N = 57)

Response category	n	%
(a) Preferred CPD duration		
< 3 minutes	4	7.0
3–5 minutes	19	33.3
5–7 minutes	23	40.4
7–10 minutes	9	15.8
> 10 minutes	2	3.5
Total	**57**	**100.0**
(b) Preferred CPD content format		
Video	46	80.7
Carousel	32	56.1
Infographic	31	54.4
Short article	27	47.4
Animation	18	31.6
Live session	9	15.8
Podcast	8	14.0
(c) Main barrier to CPD participation		
Time constraints	26	45.6
Internet access	11	19.3
Motivation	8	14.0
Cost	6	10.5
Other	4	7.0
Distance	2	3.5
Total	**57**	**100.0**

Teachers' learning preferences revealed an interest in concise professional learning activities combined with clear instructional organization. As presented in Table 2 ((a).Preferred CPD duration), 42 respondents (73.7%) preferred microlearning units lasting between three and seven minutes, with the largest group selecting five to seven minutes (40.4%).

These findings provide an empirical basis for considering short learning units in the preliminary CPD design. They are consistent with literature describing microlearning as an approach that organizes learning around concise and focused content (Alias & Abdul Razak,

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2025; Monib et al., 2025). Monib et al. (2025) further emphasized the importance of instructional objectives, pedagogical organization, and delivery characteristics in microlearning design. The preference for short learning units should be interpreted alongside pedagogical considerations. Alias and Abdul Razak (2023) examined the pedagogical aspects of microlearning across educational settings, providing support for designing concise learning experiences around clear objectives and meaningful instructional activities.

However, the preferred duration identified in this study should not be interpreted as an experimentally established optimal duration. The questionnaire measured teachers' preferences rather than learning achievement, retention, or performance across different video lengths. Studies examining short learning activities in other educational contexts, including Ho et al. (2025) and Frosch and Lindauer (2025) , may provide comparative perspectives, but their findings cannot be directly generalized to teacher CPD. Therefore, the three-to-seven-minute range should serve as a preliminary design guideline that remains adjustable according to learning objectives and content complexity.

Beyond duration, participants expressed positive perceptions of smaller learning units as supporting understanding (M = 4.28) and gradual learning as supporting remembering (M = 4.12). Furthermore, 40 respondents (70.2%) preferred sequential learning, while 17 (29.8%) preferred freely selecting topics. This pattern indicates that flexibility should not be equated with the absence of instructional structure.

Microlearning can accommodate both preferences through a modular learning pathway. Individual units may remain accessible independently, while their organization follows a coherent progression from foundational concepts to practical application. Research on microlearning design for adult learners, such as So et al. (2020) , offers a relevant perspective for considering the relationship between focused content, instructional organization, and learner characteristics. In the present study, the preference for sequential learning provides a direct empirical justification for organizing CPD topics into interconnected modules rather than distributing unrelated learning materials.

Content format preferences further inform the proposed design. As shown in Table 2 ((b). Preferred CPD content format), video was selected by 46 respondents (80.7%), followed by carousel (56.1%) and infographic (54.4%). Although video was the most frequently selected format, the substantial preferences for carousels, infographics, and short articles indicate that a video-only approach may not accommodate the full range of teachers' learning preferences. This finding supports a multimodal content strategy in which different formats serve different instructional functions.

Video may be appropriate for demonstrating teaching procedures, illustrating classroom scenarios, or modeling the use of digital tools. Infographics and carousels may be useful for summarizing assessment procedures, presenting decision-making steps, or providing

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concise references. Short articles can support explanations requiring more detailed reading. These possibilities are consistent with the broader range of microlearning strategies discussed by Alias and Razak (2025) and Monib et al. (2025) .

Research by Astiwardhani and Sobandi (2024) also provides a relevant educational context for considering microlearning in relation to understanding, retention, and motivation. Nevertheless, the present findings establish format preferences rather than comparative evidence of format effectiveness. Accordingly, format selection should be based on the learning objective, content characteristics, and accessibility requirements rather than popularity alone.

Taken together, the findings indicate that teachers preferred professional learning experiences that were short but organized, flexible but coherent, and predominantly visual without being restricted to a single format. These characteristics provide a foundation for designing microlearning-based CPD that responds to teachers' reported preferences while preserving instructional continuity.

The findings indicate that teachers valued learning-oriented interaction and support features in microlearning-based CPD. Feedback after quizzes or exercises received a mean score of 3.89, while the perceived usefulness of quizzes for checking understanding obtained a mean of 3.79. Among the desired features, quizzes were selected most frequently (n = 31), followed by progress tracking (n = 25) and an AI assistant (n = 24). These preferences suggest that teachers expected digital professional learning environments to provide opportunities for checking understanding, monitoring progress, and obtaining additional learning assistance.

These findings highlight the importance of moving beyond passive consumption of short digital content. Interactive learning activities can provide opportunities for teachers to reflect on instructional concepts and connect them with classroom situations. Marei et al. (2021) examined feedback-oriented facilitation in asynchronous teacher professional development, providing a relevant perspective on the role of feedback in supporting online learning. Similarly, Monib et al. (2025) identified interaction and appropriate instructional support as important considerations in microlearning design. The preference for quizzes, feedback, and progress monitoring suggests that participants valued learning support beyond content delivery. Research on interactive virtual professional development has explored the potential of immediate feedback for supporting teachers' professional learning (Copur-Gencturk & Orrill, 2025).

However, the findings also suggest that different forms of interaction may have different perceived value. Interest in badges or certificates obtained a mean score of 3.35, while the perceived motivational value of points or rewards was relatively lower (M = 3.18). Although these results do not establish the effectiveness of particular motivational features, they indicate that the participating teachers placed greater emphasis on learning support than on extrinsic rewards. Consequently, quizzes, meaningful feedback, and progress monitoring may deserve higher design priority than reward-oriented gamification mechanisms.

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The potential inclusion of an AI assistant should also be interpreted cautiously. Its selection by 24 respondents indicates interest in AI-supported learning assistance, but it does not demonstrate that an AI assistant would improve learning outcomes. Its instructional role would therefore need to be specified and evaluated during subsequent development. Possible functions include clarifying concepts, providing additional examples, and supporting reflection on instructional tasks.

The analysis further revealed a distinction between familiarity with social media and its perceived educational suitability. Participants reported frequent daily social media use (M = 4.35), whereas their perceptions of social media effectiveness for learning (M = 3.21) and comfort with learning through social media (M = 3.37) were more moderate. This suggests that frequent platform use should not automatically be interpreted as readiness to engage in structured professional learning through the same platforms.

Lantz-Andersson et al. (2018) emphasized the role of formally and informally organized online teacher communities in professional learning. Professional learning networks may also provide opportunities for collaboration and knowledge exchange that complement individually accessed digital materials (Prenger et al., 2021) . In the present context, their findings provide a basis for considering social media as a potential access and communication environment. Nevertheless, the organization of learning activities, interaction, and instructional support remains essential.

The analysis also identified barriers that may influence participation in CPD. As shown in Table 2 ((c). Main barrier to CPD participation), time constraints were the most frequently reported barrier, selected by 26 of the 57 participants (45.6%). The prominence of time constraints is consistent with the broader challenge of accommodating professional learning within teachers' instructional and administrative responsibilities. Reports examining teachers' professional development have similarly highlighted the influence of organizational and practical conditions on participation (Ofsted, 2024a, 2024b) . The findings therefore support the consideration of flexible, self-paced learning activities that can be completed without requiring prolonged participation in scheduled training sessions.

Internet access, identified by 19.3% of respondents, also indicates the importance of digital accessibility. Research on teachers' digital readiness in rural contexts (Rofiah et al., 2024) offers a relevant perspective on why technology-supported professional development should account for differences in access and competence. Accordingly, microlearning materials may benefit from mobile-friendly formats, manageable file sizes, and alternative downloadable resources.

Taken together, the findings suggest that microlearning-based CPD should combine flexible access with meaningful learning support. Short duration alone is insufficient; learning

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units should also provide focused objectives, opportunities for interaction, and practical activities that support application in teaching contexts.

The integration of the what to learn and how to learn dimensions provided a basis for translating the needs-analysis findings into preliminary instructional design decisions. The first dimension identified professional learning priorities, while the second provided information about teachers' preferred learning duration, content formats, sequencing, interaction, and accessibility. Together, these dimensions informed both the organization of CPD content and the characteristics of potential microlearning units.

This approach reflects the importance of aligning professional learning content with teachers' needs and the conditions under which learning takes place. Ehlert and Souvignier (2024) examined the relationship between teachers' professional development preferences and research-informed recommendations, highlighting the relevance of considering teacher perspectives in professional learning design. Similarly, Kohnke et al. (2024) discussed the potential of microlearning to support flexible teacher professional development. The present study extends these considerations by explicitly connecting reported content needs and learning preferences to preliminary design decisions.

The translation of professional learning needs into structured instructional activities is consistent with research emphasizing the importance of deliberate learning design in professional development for digital education (Olney et al., 2024) . However, the seven-stage architecture and its 143 potential microlearning units remain preliminary design outputs requiring further review and validation.

The needs-to-design translation process involved identifying teachers' reported professional learning priorities, interpreting their learning preferences, and connecting these findings to preliminary instructional design decisions. Rather than treating content needs and learning preferences as separate findings, the analysis considered how both dimensions could jointly inform the organization and delivery of microlearning-based CPD. Table 5 presents this analytical connection by linking empirical findings with their interpretation, corresponding design implications, and examples of proposed microlearning units or features. These recommendations represent preliminary design propositions informed by the needs analysis rather than validated instructional solutions.

Table 5. Translation of Needs-Analysis Findings into Microlearning Design Implications

Empirical Finding	Preliminary Design Implication
1. Broad professional learning needs across assessment, pedagogy, and technology	1. Organize CPD content into an integrated competency-oriented content map
2. 73.7% preferred learning units lasting 3–7 minutes	2. Use concise, focused units as an initial duration guideline

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Empirical Finding	Preliminary Design Implication
3. 70.2% preferred sequential learning	3. Provide a structured pathway while allowing flexible access to individual units
4. 80.7% selected video as a preferred format	4. Prioritize video where appropriate and complement it with other instructional formats
5. Preferences for quizzes, feedback, and progress tracking	5. Incorporate formative learning checks and meaningful learning support
6. Time constraints were the main barrier (45.6%)	6. Support flexible, self-paced participation
7. Practical applicability received M = 4.21	7. Connect content with authentic classroom tasks and instructional problems

Based on the needs-to-design synthesis, the preliminary CPD content architecture was organized into seven interconnected stages: DIAGNOSE, DESIGN, DEVELOP, IMPLEMENT, ASSESS, ANALYZE, and IMPROVE. These stages represent a proposed sequence of professional learning activities, beginning with identifying instructional needs and progressing toward instructional planning, implementation, assessment, analysis, and improvement.

Based on the needs-to-design synthesis, a preliminary CPD content architecture was proposed to organize professional learning topics into seven interconnected stages: DIAGNOSE, DESIGN, DEVELOP, IMPLEMENT, ASSESS, ANALYZE, and IMPROVE. These stages serve as an organizational structure for potential learning content, progressing from identifying instructional needs to planning, developing, implementing, assessing, analyzing, and improving teaching practices. The preliminary content map identified 143 potential microlearning units distributed across the seven stages: DIAGNOSE (12 units), DESIGN (36 units), DEVELOP (14 units), IMPLEMENT (37 units), ASSESS (14 units), ANALYZE (15 units), and IMPROVE (15 units). These units represent proposed instructional components rather than completed or validated learning materials. The seven-stage structure is presented as a preliminary content organization informed by the needs analysis, not as an established instructional design model.

Importantly, these 143 units represent potential instructional components rather than completed videos or validated learning modules. Depending on their objectives and complexity, individual units may be developed as short instructional videos, tutorials, infographics, carousels, interactive activities, or other suitable formats.

The proposed architecture also illustrates the importance of balancing flexibility and instructional coherence. Although teachers preferred relatively short learning units, most

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respondents also favored sequential learning. Therefore, individual microlearning units should be sufficiently focused to support flexible participation while remaining connected to broader professional learning objectives. This interpretation is consistent with Alias and Razak (2025) and Monib et al. (2025) , who emphasized the importance of instructional organization and pedagogical considerations in microlearning design.

For elementary education, the architecture offers a potential framework for organizing professional learning around practical instructional activities, such as diagnosing learning needs, designing differentiated instruction, developing digital resources, and conducting formative assessment. However, its applicability to elementary and madrasah teachers requires further investigation because the present sample included teachers from multiple educational levels.

The contribution of this study therefore lies not in demonstrating the effectiveness of a completed microlearning intervention but in establishing a needs-informed approach to preliminary instructional design. By integrating teachers' professional learning priorities with their learning preferences, the study provides a basis for developing CPD resources that are concise, structured, practical, interactive, and digitally accessible. Subsequent research should examine the proposed architecture through expert validation, teacher review, and implementation-based evaluation to determine its feasibility and educational effectiveness.

CONCLUSION

This study demonstrates how teachers' perceived professional learning needs and learning preferences can inform the preliminary design of microlearning-based continuing professional development (CPD). Drawing on survey responses from 57 teachers, the findings identified assessment, educational technology, and instructional practices as key professional learning priorities. Teachers also expressed preferences for concise, sequential, interactive, and practically oriented learning experiences. Specifically, 73.7% preferred learning units lasting 3–7 minutes, 70.2% favored sequential learning pathways, and 80.7% selected video as a preferred content format. Time constraints emerged as the most frequently reported barrier to CPD participation (45.6%), highlighting the importance of flexible and accessible professional learning opportunities.

The principal contribution of this study lies in translating empirical evidence about what teachers need to learn and how they prefer to learn into a preliminary instructional design framework. This process resulted in a seven-stage CPD content architecture comprising 143 proposed microlearning units, integrating competency-oriented content, structured learning pathways, interactive activities, and classroom-relevant applications. These findings position microlearning not simply as the delivery of shorter instructional materials but as a potentially systematic and responsive approach to organizing teacher professional development around identified needs and learning preferences.

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The study provides an empirical foundation for the subsequent development of contextually responsive microlearning-based CPD programs. Nevertheless, the findings are limited by the voluntary sample of 57 teachers from different school levels and reliance on self-reported perceptions rather than observed learning outcomes. Consequently, the proposed architecture should be understood as a preliminary design output rather than a validated or effective intervention. Further research should prioritize expert validation, iterative teacher feedback, and classroom-based implementation studies to examine its feasibility, usability, and effectiveness in supporting teachers' professional learning and instructional practices.

AUTHOR CONTRIBUTION

All authors contributed to the conception and development of the study. The research team was involved in instrument development, data collection, and the interpretation of findings. The manuscript was prepared and critically reviewed by the authors. All authors read and approved the final version of the manuscript. The authors declare that they have no conflicts of interest related to the research, authorship, or publication of this article. All authors declare that there are no conflicts of interest, whether financial, personal, or academic, that have influenced the conduct of the research, the analysis of the data, or the publication of this article.

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