Full research paper

WHAT MAKES ONLINE PROFESSIONAL DEVELOPMENT WORK? UNPACKING QUALITY ATTRIBUTES AND THEIR IMPACT ON TEACHER SATISFACTION AND PROFESSIONAL PRACTICE

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ABSTRACT

Professional development (PD) is widely recognised as a crucial factor in fostering the quality of teachers' professional practice. Today, online PD is often chosen over offline PD because it offers advantages related to cost, time, and location efficiency. However, compared with offline PD, less research has examined the quality of online PD. This study aimed to investigate the quality attributes of online PD and their impacts on teachers' satisfaction and changes in their professional practice. A cross-sectional design and an online questionnaire were used to collect data from 206 economics teachers in Indonesia. Structural equation modelling was conducted using SmartPLS 3.0 to examine the research hypotheses. The results show that three elements--collaboration, cognitive activation, and clarity and structure--contribute to explaining and establishing the quality of online PD. Furthermore, from the teachers' perspectives on satisfaction and changes in professional practice, online PD was effective in enhancing teachers' pedagogical knowledge and teaching practice. Finally, the study shows that the quality attributes of online PD positively affect participants' satisfaction and changes in teachers' professional practice. Theoretical and practical implications are discussed.

KEYWORDS

Online professional development, professional practice, quality attributes, teachers' satisfaction

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Highlights

- *The limited empirical evidence on the quality attributes of online professional development (PD) underscores the need to identify the key elements that determine its effectiveness in enhancing teachers' professional practice.*
- *This study uses the Community of Inquiry (CoI) framework to examine three core attributes of online professional development: collaboration, cognitive activation, and clarity and structure.*
- *Collaboration, cognitive activation, and clarity and structure are significant factors in shaping the quality of online professional development.*
- *The quality of online professional development is positively associated with teachers' satisfaction and meaningful changes in their professional practice.*

INTRODUCTION

Professional development (PD) has been recognised as a pivotal element in enhancing the quality of teachers' professional practice. Empirical studies have demonstrated that PD plays a crucial role in fostering teachers' creativity, improving the quality of teaching practices, equipping teachers with new teaching skills and approaches, and introducing challenging learning activities (Stemhagen, 2011; Kalinowski et al., 2020; Sims et al., 2021; Meyer et al., 2023; Wadaani, 2023). Although PD is positively related to high-quality professional practice, most previous studies have been conducted in offline or face-to-face PD contexts.

Today, online learning platforms have been widely adopted worldwide (Bragg et al., 2021; Rafsanjani et al., 2022; Rafsanjani et al., 2023), alongside a concurrent increase in the availability of online PD courses (Lantz-Andersson et al., 2018; Darling-Hammond and Hyler, 2020; Bragg et al., 2021; Donitsa-Schmidt and Ramot, 2022). However, limited evidence is available on how online PD can improve teachers' professional practice or which attributes of online PD contribute to fostering or changing that practice. To address this gap, the current study investigates the quality attributes of online PD.

The current study used the Community of Inquiry (CoI) framework developed by Garrison, Anderson, and Archer (Garrison et al., 1999; Garrison et al., 2003; Carrillo and Flores, 2020) to investigate the quality attributes of online PD. According to the CoI framework, the quality of online learning can be understood through three attributes: cognitive presence, social presence, and teaching presence. We also used the Kirkpatrick model, a training evaluation model, to examine the effectiveness of online PD. According to this model, the effectiveness of training programmes can be assessed through participants' satisfaction and the resulting changes in professional behaviour (Kirkpatrick and Kirkpatrick, 2006; Savul et al., 2021; Khan et al., 2023).

The current study provides two main contributions. First, whereas most previous studies have focused on the quality attributes of offline PD that contribute to improving teachers' professional practice, this study investigates the quality attributes of online PD. Second, the study examines the effectiveness of online PD by analysing the relationship between online PD quality, teachers' satisfaction, and changes in professional practice. Therefore, this study extends knowledge of online PD in relation to quality attributes, satisfaction, and changes in professional practice.

THEORETICAL FRAMEWORK

Online PD

Empirical studies have shown that professional development is crucial for improving instructional quality and students' learning outcomes. However, offline or face-to-face PD presents several challenges: it can be costly, it may have limited capacity to provide broad access (Hill, 2015; Yoon et al., 2020; Bragg et al., 2021), and many teachers work in remote geographical locations (Peltola et al., 2017). Other studies have shown that low expectations regarding PD quality are one reason why teachers do not participate in formal PD (Richter et al., 2018; Zhang et al., 2020). To address these challenges, online delivery has become an increasingly viable mode for facilitating professional development. Online PD offers broader accessibility for teachers at a lower cost, minimises geographical barriers, and provides greater time flexibility (Compen et al., 2019; Dede et al., 2019; Ansyari et al., 2022).

Online PD is conceptualised as a structured online learning experience or training opportunity delivered through information and communication media to improve teachers' teaching skills and support changes in their professional practice (Bragg et al., 2021; Ansyari et al., 2022). In this sense, online PD gives teachers broader opportunities to continue learning and to improve their teaching skills without attending face-to-face courses or training. It offers several benefits, including flexible access to professional development for teachers with limited time or those in isolated locations (Powell and Bodur, 2019; Meyer et al., 2023), as well as reduced time otherwise spent commuting to offline PD (Meyer et al., 2023). These benefits may foster teachers' motivation to choose and engage in professional development according to their interests and needs without location-related barriers.

The literature shows that online PD comprises both formal and informal activities (Carpenter and Krutka, 2014; Kyndt et al., 2016; Aguilar et al., 2021; Meyer et al., 2023). Formal online PD includes synchronous and asynchronous distance learning. Synchronous PD aims to replicate face-to-face PD experiences through live interaction with instructors or other participants, such as live chat or video conferencing. In contrast, in asynchronous PD, participants and instructors do not need to engage in course activities simultaneously; participants can access and complete the material at their own pace. Informal online PD refers to teachers' learning activities that occur outside formal programmes, such as using social media (e.g., Instagram or Twitter) to engage and interact with peers or colleagues.

Despite the benefits of online PD, the literature also identifies several challenges. Online PD that uses digital technologies, such as a learning management system (LMS), may make it difficult for participants to engage actively with the learning material (Meyer et al., 2023). When participants become passive during online PD, they may lose concentration and attention, resulting in distraction and a higher likelihood of dropping out prematurely (Geri et al., 2017; Meyer et al., 2023). Online PD may also provide limited opportunities for teachers to practise new learning methods or approaches (Meyer et al., 2023). In response to these challenges, it is necessary to investigate the quality attributes of professional development, particularly in the context of formal online PD.

Addressing the quality attributes of online PD using the Community of Inquiry framework

The CoI framework was proposed by Garrison, Anderson, and Archer in 1999. This framework identifies the crucial elements of a successful educational experience using computer-mediated communication (CMC) (Garrison et al., 1999). Later, the CoI framework was further developed for online distance education (Garrison et al., 2003; Carrillo and Flores, 2020). According to the CoI framework, online learning includes three crucial elements: social presence, cognitive presence, and teaching presence.

First, social presence refers to interaction among participants during online PD, such as sharing prior experiences or work through real-time forum discussions or video conferencing (Parsons et al., 2019; Meyer et al., 2023). Such interaction helps participants present themselves authentically, express their personal characteristics, and build interpersonal relationships with peers, leading to a collaborative environment during online PD training (Parsons et al., 2019; Carrillo and Flores, 2020). Social interactions in online PD allow participants to engage with the community and to develop and broaden their

professional networks (Salmon et al., 2015; Parsons et al., 2019). Therefore, social presence in online PD may enable participants to establish a meaningful support network of peers and colleagues.

Second, cognitive presence refers to the capacity of participants to connect new knowledge with existing experiences in successful online learning (Garrison et al., 2001; Meyer et al., 2023). Cognitive presence also allows participants to construct meaning through continuous reflection and interaction with peers within a community of inquiry (Garrison et al., 1999; Carrillo and Flores, 2020). Meaning construction depends on individual learning competence and is enhanced by active engagement with peers. Through communication and interaction, participants can collectively exchange experiences and perspectives and shape their insights. Effective online learning can therefore be achieved by integrating material with prior knowledge, reflecting on beliefs, knowledge, and practices, and combining these processes with active community engagement to support deeper understanding.

Third, teaching presence refers to the instructor's role in designing and facilitating online learning activities to help participants achieve learning outcomes (Carrillo and Flores, 2020; Meyer et al., 2023). It includes establishing clear objectives and core course components and helping participants engage in goal-setting (Wendt and Courduff, 2018; Parsons et al., 2019; Carrillo and Flores, 2020). Teaching presence also involves the instructor's role in designing the learning experience, including selecting, organising, and presenting course content (Garrison et al., 1999).

This study used the CoI framework to address the quality attributes of online PD. The three crucial elements of the CoI framework were operationalised as follows: (1) social presence was represented by collaborative activities among participants (teachers) during online PD; (2) cognitive presence was represented by cognitive activation during online PD, such as supporting participants in addressing pedagogical and practical challenges and prompting discussion within the community of inquiry; and (3) teaching presence was represented by the clarity and structure of online PD.

Effectiveness of online PD using the Kirkpatrick model

Training evaluation is crucial for determining the effectiveness of training and its impact on participants' knowledge and skills (Piryani et al., 2018; Savul et al., 2021). Many researchers use the Kirkpatrick model as a standard method for evaluating the effectiveness of training programmes in various fields, including education (Piryani et al., 2018; Alsalamah and Callinan, 2021; Limon, 2022), cybersecurity (Khan et al., 2023), virtual reality (Howard and Gutworth, 2020; Phillips et al., 2023), healthcare (Savul et al., 2021; Chia et al., 2022; Cheung et al., 2023), and the mining industry (de S. Bergamo et al., 2022).

The Kirkpatrick model proposes four levels for examining training effectiveness (Kirkpatrick and Kirkpatrick, 2016): (1) reaction, which gauges trainees' subjective responses to the training programme, such as satisfaction; (2) learning, which gauges trainees' acquisition of knowledge and skills from the training programme; (3) behaviour, which gauges observable changes in trainees' demonstrations resulting from the knowledge and skills acquired after the training programme; and (4) results, which gauges the broader intended impact of the training programme on the organisation through trainees' job performance.

In line with the Kirkpatrick model, other studies have proposed that several levels can be used to measure teacher PD effectiveness: (1) teacher satisfaction with or acceptance of PD; (2) teacher cognition or changes in professional practice, such as changes in beliefs, knowledge, motivation, and classroom practices; and (3) student achievement (Lipowsky and Rzejak, 2015; Kalinowski et al., 2020).

To delimit and simplify the measurement of online PD effectiveness, this study used two levels of the Kirkpatrick model: reaction, represented by satisfaction with online PD, and behaviour, represented by the impact of online PD on changes in professional practice.

Current study

As explained in the background and theoretical framework, this study examines the quality attributes of online PD using the CoI framework, including collaboration to address social presence, cognitive activation to address cognitive presence, and clarity and structure to address teaching presence. Furthermore, it uses satisfaction and changes in professional practice as two levels of the Kirkpatrick model to examine online PD effectiveness. Finally, the study examines the link between online PD quality, satisfaction, and changes in teachers' professional practice. Accordingly, the following research questions (RQs) are proposed:

1. What are the quality attributes of online PD?
2. What is the effectiveness of online PD from teachers' perspectives?
3. What is the link between the quality of online PD and satisfaction?
4. What is the link between the quality of online PD and changes in teachers' professional practice?

METHOD

Procedures and participants

This study was conducted from July to November 2025. It involved senior high school economics teachers in Indonesia representing five major islands: Java, Papua, Kalimantan, Sumatra, and Sulawesi. Research approval was sought from the Indonesian Economics Teacher Association to recruit its members as research participants. After approval was granted, the association provided data containing names, email addresses, and school names. Purposive sampling was employed to identify and recruit teachers who had participated in online PD activities during the previous 12 months, which constituted the eligibility criterion for participation in this study. An online invitation was sent by email to 640 selected teachers. The invitation described the research objectives, ensured anonymity, clarified that the data would be collected for research purposes only, and stated that participation was voluntary. A total of 247 teachers responded and participated in the research (response rate:

38.59%). We excluded 41 participants because they did not fulfil the criteria for TPD attendance and/or had incomplete data sets. Therefore, the final sample comprised 206 teachers, dominated by females (63.39%) compared with males (36.61%). On average, the participants were 38.2 years old and had 12.7 years of teaching experience.

Instruments

The study used instruments developed in previous research. The instruments were slightly modified to fit the research context. All instruments were translated into Indonesian (Bahasa Indonesia) and reviewed by experts in both Bahasa Indonesia and education to prevent misinterpretation by the participants.

The instruments developed by Meyer et al. (2023) were used to measure three quality attributes of online PD (collaboration, cognitive activation, and clarity and structure) and changes in professional practice. The online PD quality attributes comprised eleven items, while changes in professional practice were measured using four items. Finally, satisfaction with online PD was measured using the Online Course Satisfaction Scale (OCSS) developed by Wei and Chou (2020), which consists of four items. All questionnaires used a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Data analysis

After data collection, data screening was performed to prevent biased analysis. Of the 247 research participants, 41 were removed because they did not meet the TPD attendance criterion and/or had incomplete responses. Structural equation modelling (SEM) with the partial least squares approach was then performed to examine the relationships among variables. The multiple-step procedure proposed by Hair et al. (2014) was adopted for the partial least squares approach. This procedure includes model specification, outer model evaluation (validity and reliability of construct measurement), and inner model evaluation (R2, Q2, f2, and path coefficients).

RESULTS

Outer model evaluation

To evaluate the outer model, the validity and reliability of each construct and measurement were examined. First, the convergent and discriminant validity of the constructs were evaluated. The results (Table 1) show that all construct measurement items had loading factors higher than 0.7 and that the AVE of each construct was higher than 0.5, indicating that convergent validity was established (Hair et al., 2014; Hair et al., 2017; Hair and Alamer, 2022). Furthermore, the measurement model test generated the Heterotrait-Monotrait Ratio (HTMT) to evaluate discriminant validity. The results (Table 2) show that all HTMT values were below the conservative threshold of 0.85 (Hair et al., 2017; Sarstedt et al., 2017; Hair and Alamer, 2022), indicating that the measurement model met the discriminant validity criteria.

Constructs	Item	Mean	VIF	Loading	AVE
Collaboration (Col)	Col1	3.273	2.719	0.897	0.791
	Col2	3.455	2.414	0.888	
	Col3	3.545	2.000	0.883	
Overall mean score of construct Col		**3.424**			
Cognitive activation (CA)	CA1	3.455	2.437	0.866	0.802
	CA2	3.636	2.602	0.934	
	CA3	3.545	3.037	0.889	
	CA4	3.455	3.087	0.890	
Overall mean score of construct CA		**3.523**			
Clarity and structure (CS)	CS1	3.955	3.075	0.961	0.760
	CS2	3.591	3.876	0.942	
	CS3	3.591	3.290	0.764	
	CS4	3.545	2.248	0.803	
Overall mean score of construct CS		**3.670**			
Satisfaction (Sa)	Sa1	3.636	2.297	0.727	0.632
	Sa2	3.818	4.085	0.731	
	Sa3	3.909	1.585	0.764	
	Sa4	3.959	2.251	0.939	
Overall mean score of construct Sa		**3.831**			
Changes in professional practices (CPP)	CPP1	3.682	4.110	0.865	0.788
	CPP2	3.818	3.799	0.918	
	CPP3	3.364	3.575	0.972	
	CPP4	3.364	2.744	0.785	
Overall mean score of construct CPP		**3.557**			

Table 1: Mean, VIF, loading factor, and AVE (first-order measurement model)

	Collaboration	Cognitive activation	Clarity and structure	Satisfaction	Change in professional practices
Collaboration	-	-	-	-	-
Cognitive activation	0.484	-	-	-	-
Clarity and structure	0.545	0.517	-	-	-
Satisfaction	0.748	0.714	0.638	-	-
Change in professional practices	0.502	0.508	0.464	0.699	-

Table 2: Discriminant validity (Heterotrait-Monotrait Ratio / HTMT)

Second, the reliability of the construct measurement model was evaluated. The results (Table 3) show that Cronbach's alpha and composite reliability for each construct were higher than 0.7, indicating that all measurement models in this study had internal consistency reliability (Hair et al., 2014; Hair et al., 2017).

	Cronbach's Alpha	Composite reliability
Collaboration	0.868	0.919
Cognitive activation	0.917	0.942
Clarity and structure	0.891	0.926
Satisfaction	0.803	0.872
Change in professional practices	0.909	0.937

Table 3: Reliability

According to the theoretical framework explained previously, the quality of online PD consists of three dimensions: collaboration, cognitive activation, and clarity and structure. Therefore, a second-order measurement model was performed for the online PD quality variable. The results (Table 4) show that the validity indicators (loading factor and AVE) and reliability indicators (Cronbach's alpha and composite reliability) of the measurement model for the online PD quality variable were established.

Variable	Dimensions	Loading factor	AVE	Cronbach's Alpha	Composite reliability
Quality of online PD	Collaboration	0.720	0.517	0.901	0.918
	Cognitive activation	0.827			
	Clarity and structure	0.835			

Table 4: Second-order measurement model

Inner model evaluation

After the measurement model was established, the study proceeded to the next stage: structural model evaluation (inner model). According to Hair et al. (2014), inner model evaluation considers the coefficient of determination (R^2), cross-validated redundancy (Q^2), effect size (f^2), and path coefficients. Nevertheless, the measurement model must first be free from high correlations among constructs (i.e., collinearity bias). The results (Table 1) show VIF values ranging from 1.585 to 4.110, below the threshold value of 5, indicating that collinearity in the measurement model did not reach critical levels (Hair et al., 2017).

Table 5 shows that the R^2 values were 0.579 and 0.501, indicating that the exogenous construct (quality of online PD) had moderate predictive power (Hair et al., 2017; Hair et al., 2019). In other words, the quality of online PD explained 57.9% and 50.1%, respectively, of the variance in satisfaction and changes in professional practice. Furthermore, the predictive accuracy of the research model was assessed through cross-validated redundancy (Q^2). The results show that the Q^2 values for satisfaction and changes in professional practice were 0.326 and 0.242, indicating that the model had medium predictive relevance (Hair et al., 2017; Hair et al., 2019). The f^2 values (effect sizes) of the quality of online PD were 0.526 and 0.418 for satisfaction and changes in professional practice, respectively. These values indicate that the quality of online PD had a large effect size on the endogenous constructs of satisfaction and changes in professional practice (Hair et al., 2017; Hair et al., 2019), with the effect size being larger for satisfaction than for changes in professional practice.

Finally, path coefficients were examined to determine the significant effects of online PD quality on satisfaction and changes in professional practice. The results (Table 6 and Figure 1) show that all path coefficients in the research model had positive values and were significant at $p < 0.01$.

Relationship	R^2	Q^2	f^2
Quality of online PD → Satisfaction	0.579	0.326	0.526
Quality of online PD → Change in professional practices	0.501	0.242	0.418

Table 5: Predictive power/accuracy

Relationship	Coefficients	S.E.	*p*-value
Quality of online PD → Satisfaction	0.720	0.058	0.000
Quality of online PD → Change in professional practices	0.684	0.120	0.000

Table 6: Path coefficients

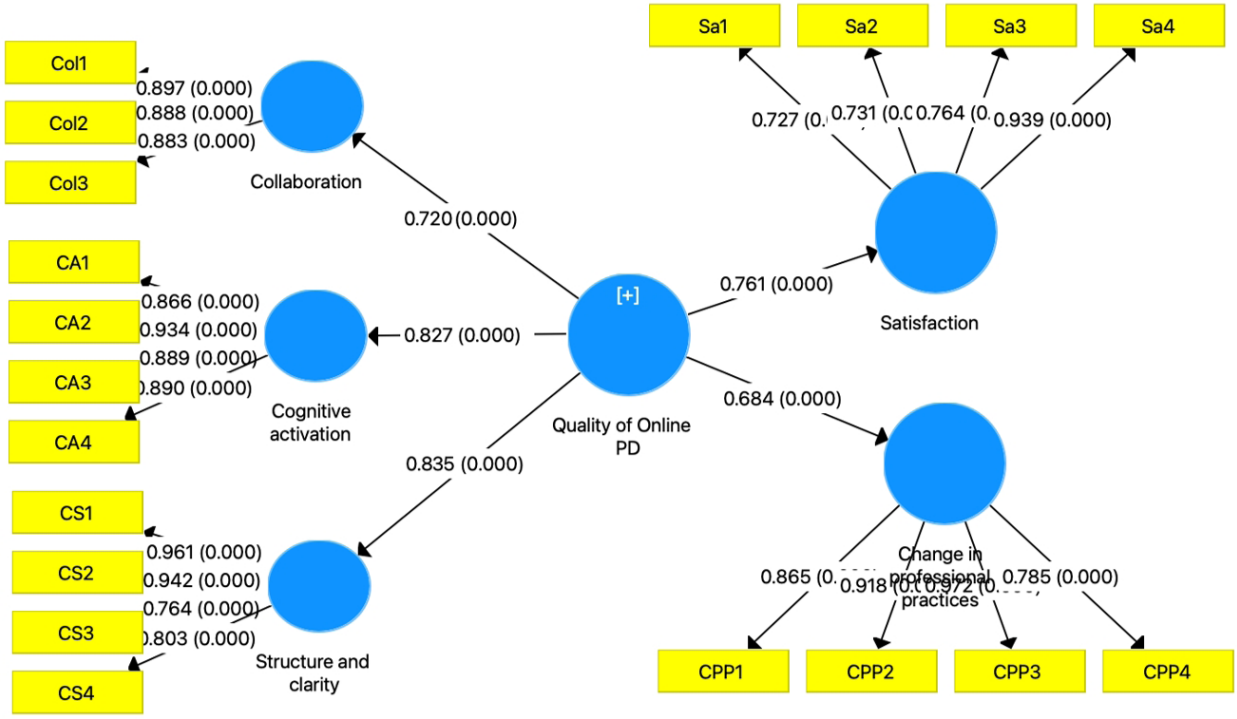

Figure 1: Result of structural model analysis

DISCUSSION

Following the proposed RQs, the study investigated online PD quality attributes using the CoI framework. It also assessed the effectiveness of online PD using the Kirkpatrick model: the reaction level through participants' satisfaction and the behaviour level through changes in teachers' professional practice. Finally, the study examined the influence of online PD quality on satisfaction and changes in professional practice. The findings are discussed below.

What are the quality attributes of online PD?

To address the quality attributes of online PD, the study used the CoI framework from Garrison et al. (1999). According to the CoI framework, online distance education consists of three crucial elements: social presence, cognitive presence, and teaching presence (Garrison et al., 2003; Carrillo and Flores, 2020). Accordingly, collaboration was used to represent social presence, cognitive activation to represent cognitive presence, and clarity and structure to represent teaching presence. The results of the second-order measurement model in Table 4 and Figure 1 show that the three quality attributes of online PD (collaboration, cognitive activation, and clarity and structure) had loading scores above 0.70, AVE greater than 0.5, and Cronbach's alpha and composite reliability greater than 0.7. These findings indicate that collaboration, cognitive activation, and clarity and structure contribute to explaining and establishing the quality of online PD. Statistically, therefore, the current study confirmed the CoI framework, which proposes three crucial elements in online learning: collaboration, cognitive activation, and clarity and structure (Garrison et al., 1999; Garrison et al., 2003).

Collaboration during online PD allows participants to share teaching experiences, discuss best practices and new learning methods, build interpersonal interactions, and broaden their professional networks. This finding aligns with previous studies that viewed collaboration as a crucial feature and effective approach in online learning courses that positively contributes to participants' experiences (Vinagre, 2017; Theelen et al., 2020). As proposed by the communities of practice framework, individuals develop their knowledge, beliefs, attitudes, and skills within social and cultural contexts rather than in isolation (Butler et al., 2004). Therefore, this study confirms that collaboration substantially fosters teachers' professional knowledge in online PD and is crucial to online PD quality.

The current study also found that cognitive activation in online PD stimulates participants' involvement in learning courses by encouraging them to communicate and discuss their teaching experiences and challenges. Cognitive activation also provides teachers with opportunities to construct new knowledge by linking it with their own and their peers' prior experiences through reflection on existing practices. These findings strengthen previous studies suggesting that discussing teaching experiences is crucial for understanding teaching problems and constructing professional teaching knowledge (Fletcher and Bullock, 2015; Carrillo and Flores, 2020). Cognitive activation

in online PD also fosters participants' engagement during the course. When online PD offers new knowledge about professional approaches, high course engagement may make it easier for participants to welcome, improve, or change their beliefs and knowledge. This finding aligns with adult learning theories, which propose that adults learn differently from children and must be active participants in the course learning process to achieve learning goals (Trotter, 2006). Therefore, this study indicates that cognitive activation is crucial in establishing online PD quality.

Finally, this study revealed that clarity and structure in online PD are crucial aspects from participants' perspectives. Online PD may have more weaknesses than offline PD, such as offering limited opportunities for participants to practise new teaching models or share ideas and experiences (Carrillo and Flores, 2020; Meyer et al., 2023). Other studies have indicated that online learning courses often rely primarily on lectures, which can lead participants to receive information passively and reduce their focus (Parsons et al., 2019; Scagnoli et al., 2019; Meyer et al., 2023). This study found that when online PD has clear objectives and structure, for which the instructor or course designer is responsible, participants are more likely to participate actively and remain attentive. This finding aligns with previous evidence showing that participants are more motivated when courses provide clear objectives and facilitate participation during online learning (Parsons et al., 2019; Carrillo and Flores, 2020). Therefore, designing clear objectives and choosing appropriate approaches to help participants achieve learning goals confirms that clarity and structure are quality attributes of online PD.

What is the effectiveness of online PD from teachers' perspectives?

Reaction level (satisfaction with online PD)

This study assessed the effectiveness of online PD using the Kirkpatrick model, specifically the reaction level (satisfaction) and behaviour level (changes in professional practice). For satisfaction, the research scale consisted of four items covering participants' reactions to the trainer/instructor and to the content and delivery of the training. The results in Table 1 show a mean satisfaction score of 3.831, which can be categorised as above moderate. This indicates that the participants were satisfied with the online PD in which they enrolled.

More specifically, the findings (Sa1 and Sa2 in Table 1) show an average score of 3.727, suggesting that participants were satisfied with the instructor during the online PD course. This finding aligns with previous studies proposing that participants' satisfaction is crucial in establishing effective training (Sitzmann et al., 2008; Alsalamah and Callinan, 2021). Another study showed that trainees' reactions to their training instructor, including likes or dislikes, predict satisfaction and motivation during the course (Marsh and Overall, 1980). Furthermore, effective training is also determined by the quality of the trainer or instructor (Boyd et al., 2017; Alsalamah and Callinan, 2020), and participants' perceptions of training are strongly influenced by the instructor's performance (Morgan and Casper, 2000).

Regarding participants' reactions to content and training delivery, the findings (Sa3 and Sa4 in Table 1) show an average score of 3.934, indicating that participants were satisfied. The current study found that participants considered the content and materials of online PD (Sa2) and the delivery methods (Sa3) important. These findings correspond to previous studies suggesting that effective training should combine theoretical and practical content (Gauld and Miller, 2004; Giangreco et al., 2009) and multiple delivery methods (King et al., 2000; Brauckmann and Pashiardis, 2012). Combining theoretical and practical content is more effective for transferring new knowledge and skills and for increasing trainee satisfaction. Furthermore, using multiple delivery methods can sustain participants' interest and curiosity during the course, as individuals have different learning styles.

Behaviour level (changes in professional practice)

At this level, four items were used to measure changes in professional practice. The items addressed gaining new pedagogical and content knowledge, expanding professional networks, feeling more confident in teaching practices, and addressing professional challenges. Table 1 shows that the mean score was 3.557 (moderate). This result indicates that online PD could support changes in professional practice, meaning that teachers can apply new knowledge, teaching methods, and approaches acquired from online PD to their teaching practices. Through online PD, teachers can also expand their professional networks, increase their confidence in teaching practice, and identify challenges in carrying out their duties. These findings correspond to previous studies showing that professional development can facilitate the acquisition of new teaching skills, strategies, and insights (Jacob et al., 2017; Egert et al., 2018; Sims et al., 2021; Abakah, 2023), thereby enhancing teaching performance. Participation in professional development also expands teachers' professional networks (Abakah, 2023), increases teachers' confidence in demonstrating new skills in appropriate situations, and helps them deal with job responsibilities, job demands, and job-related problems (Noe, 1986; Alsalamah and Callinan, 2021). Professional development programmes also help teachers foster their teaching creativity (Alsalamah and Callinan, 2021). In summary, online PD was effective, as reflected in participants' satisfaction with online PD and changes in professional practice. The participants generally reported satisfaction with online PD, including satisfaction with the instructor, content, and delivery method. Furthermore, they also reported changes in professional practice, including the acquisition of new pedagogical knowledge, expansion of professional networks, increased confidence in teaching practice, and support in dealing with professional challenges.

What is the link between the quality of online PD and satisfaction?

This study revealed that the quality of online PD was positively related to satisfaction (Table 6 and Figure 1). This indicates that the higher the online PD quality, reflected in the three attributes of collaboration, cognitive activation, and clarity and structure, the higher the satisfaction of online PD participants. More

specifically, the study identified how each online PD quality attribute affects participants' satisfaction. The first attribute is collaboration. The findings indicate that collaboration among participants during online courses positively fosters satisfaction. Through interaction and collaboration during online PD, teachers receive helpful suggestions, comments, and peer feedback. This finding aligns with previous studies showing that peer interaction is related to learner satisfaction in online learning courses (Kuo et al., 2013; Gameel, 2017; Pham and Nguyen, 2021). Another study also found that peer interaction motivates learners in online learning environments (Ghadirian et al., 2018). Interactions among online participants lead to a collaborative environment during the course and broaden professional networks. Therefore, collaboration, as part of the quality attributes of online PD, plays a crucial role in participants' satisfaction.

The second attribute is cognitive activation. This study found that teachers who perceived that their online PD enabled them to construct meaning through continuous reflection and by linking their experience with new knowledge felt more satisfied than those who did not perceive this. The study also revealed that teachers felt satisfied when online PD presented challenging learning situations. Such situations stimulate teachers' higher-order thinking skills and support the achievement of learning goals, such as enhancing participants' pedagogical and content knowledge. Participants perceived this as a factor that supported their satisfaction with online PD. These findings confirm previous studies identifying the substantial role of perceived instructional quality in online learning and its close relationship with learner satisfaction (Pham and Nguyen, 2021; Taghizadeh and Hajhosseini, 2021; Yang et al., 2023).

The third attribute is clarity and structure. The study found that participants who perceived the online course as having clear objectives and a well-structured design reported higher satisfaction than those who did not. This can be explained as follows: when a course is well organised, with clear objectives, logical progression, and effective communication of information, participants are more likely to feel engaged, understand the content, and experience a sense of accomplishment. A structured course provides a framework that helps participants navigate the learning material, leading to a more satisfying educational experience. Conversely, poorly structured courses may cause participants to feel frustrated, confused, and less satisfied. Therefore, a course's structure and clarity are crucial in shaping participants' satisfaction with the learning experience. These findings confirm previous studies showing that well-structured courses and clear learning goals are associated with higher satisfaction among online PD participants (Swan, 2001; Palmer and Holt, 2009; Reeves and Pedulla, 2011). In summary, the quality of online PD is positively associated with participants' satisfaction: the higher the quality of online PD, the higher the participants' satisfaction.

What is the link between the quality of online PD and changes in teachers' professional practice?

According to Table 6 and Figure 1, online PD quality was positively related to changes in teachers' professional practice. This finding indicates that higher online PD quality is associated with greater changes in professional practice. More specifically, the study explains how each attribute of online PD quality affects the outcome variable. The first attribute is collaboration. The findings show that teachers tend to change their professional practices, such as applying new pedagogical knowledge, when online PD allows participants to collaborate with one another by sharing teaching experiences and discussing best practices and new learning methods. This finding corresponds with previous studies showing that collaboration with peers or communities during professional development programmes makes teachers more likely to apply what they have learned in actual teaching scenarios (Desimone, 2009; Sims and Fletcher-Wood, 2021; Teslo et al., 2023).

The second attribute is cognitive activation. Respondents who perceived online PD as providing challenging learning delivery and enabling them to construct new knowledge by linking it with prior experiences reported greater changes in professional practice, such as using new knowledge in teaching. Engaging in challenging learning experiences enhances the likelihood of constructing and applying new pedagogical knowledge from professional development programmes in actual teaching situations. Furthermore, when online PD is designed to support new knowledge construction by connecting prior experience through reflection and peer discussion, participants are more likely to master course content and apply it in teaching. This finding confirms previous studies showing that cognitive activation in courses or training is positively related to gains in participant achievement (Praetorius et al., 2018), insightful learning processes (Baumert and Kunter, 2013), and cognitive restructuring of science concepts (Fauth et al., 2019).

The final attribute is clarity and structure. This study found that respondents who positively perceived online PD as well structured and guided by clear objectives reported greater changes in their pedagogical knowledge, particularly regarding current teaching methods and strategies. A well-structured course facilitates effective learning experiences for participants. It provides clear learning objectives, appropriate learning material, suitable learning delivery, and assessments. This enhances the learning environment and helps course participants achieve the desired learning outcomes. Achieving learning outcomes after participating in a teacher professional development (TPD) programme increases the likelihood of teaching practice improvement. These findings confirm previous research showing that clarity and structure are important features in establishing effective teaching and enhancing teachers' knowledge and teaching practices (Lipowsky and Rzejak, 2015). The findings also align with research showing that effective TPD is determined by changes in teachers' knowledge and teaching practices (Kalinowski et al., 2020).

In summary, the study shows that the quality of online PD, attributed to collaboration, cognitive activation, and clarity and structure, positively affects changes in teachers' professional practice. These findings align with the literature on transformative TPD approaches, which are a standard

goal in designing TPD. Transformative approaches refer to TPD strategies and methods that focus on changing teachers' knowledge, skills, attitudes, and practices (Kennedy, 2005; Kennedy, 2014; Teslo et al., 2023). The findings also strengthen previous studies proposing that effective teacher professional development can be measured by teacher satisfaction and changes in teacher beliefs, knowledge, motivation, and classroom practices (Lipowsky and Rzejak, 2015; Kalinowski et al., 2020).

Although the current model treats satisfaction and changes in professional practice as two independent outcome variables, a potential relationship between them should also be acknowledged. Conceptually, teachers who are more satisfied with online PD may demonstrate greater motivation, engagement, and willingness to apply newly acquired pedagogical knowledge in their professional practice. Previous training evaluation literature also suggests that positive participant reactions may facilitate behavioural transfer and implementation outcomes. However, the present study did not examine the direct relationship between satisfaction and changes in professional practice because the model focused specifically on the direct effects of online PD quality. Therefore, future studies are encouraged to investigate whether satisfaction mediates or strengthens the relationship between online PD quality and changes in professional practice.

Overall, the current findings imply that the effectiveness of online PD does not reside merely in technology delivery, but rather in the extent to which the online learning environment facilitates meaningful collaboration, cognitive engagement, and instructional clarity. Furthermore, the findings should be interpreted in light of the study's methodological limitations, including the relatively small sample size and the cross-sectional nature of the data. Future studies are recommended to refine the current model, including the possibility that satisfaction is an antecedent or mediator of changes in professional practice.

CONCLUSION AND IMPLICATIONS

In conclusion, the current study confirmed that three attributes establish the quality of online PD: collaboration, cognitive activation, and clarity and structure. Furthermore, the study found that online PD is effective in enhancing teacher knowledge and skills, as seen from the reaction level (participant satisfaction) and behaviour level (changes in professional practice). Finally, the study shows that the quality of online PD positively affects participants' satisfaction and changes in teachers' professional practice.

This study provides both theoretical and practical contributions. Regarding theoretical contributions, it confirmed the CoI framework for successful distance education (Garrison et al., 1999; Garrison et al., 2003), the Kirkpatrick model for training programme evaluation (Kirkpatrick and Kirkpatrick, 2006; Kirkpatrick and Kirkpatrick, 2016), and the relationship between online PD quality, satisfaction, and changes in teachers' professional practice. The study extends understanding of online PD, particularly its quality attributes. As previous research has explained, unlike offline PD, limited evidence is currently available on the quality attributes of online PD (Meyer et al., 2023). This study shows that the quality attributes of online PD consist of collaboration, cognitive activation, and clarity and structure, which represent the three elements of the CoI framework: social presence, cognitive presence, and teaching presence, respectively. It provides evidence supporting the effectiveness of online teacher professional development in augmenting teachers' knowledge and skills. Furthermore, the study found that online PD quality is closely related to satisfaction and changes in teachers' professional practice. The findings strengthen previous research showing that effective teacher professional development is related to teacher satisfaction and changes in teachers' beliefs, knowledge, motivation, and classroom practices (Lipowsky and Rzejak, 2015; Kalinowski et al., 2020).

Regarding practical contributions, the findings indicate that three crucial elements—social presence, cognitive presence, and teaching presence — contribute to the quality and effectiveness of online PD. Therefore, TPD providers, including government and private institutions, should ensure that these three elements are present in online PD. The government should also offer online PD to support teachers who may face barriers to attending offline TPD sessions because of financial constraints, time limitations, or residence in remote areas. By providing online TPD, teachers can stay updated on the latest advancements in knowledge and skills, supporting continuous professional growth. This recommendation is based on the findings that online PD can effectively support teachers' professional learning and professional practice. Nevertheless, further comparative research is needed to examine how its effectiveness differs from or aligns with that of traditional offline PD.

LIMITATIONS

This study has several limitations. First, to evaluate the effectiveness of online PD, it used only two of the four evaluation levels offered by the Kirkpatrick model: the reaction level (satisfaction) and the behaviour level (changes in professional practice). Future research should evaluate the effectiveness of online PD using all four levels of the Kirkpatrick model to provide more robust results. Second, this study used a relatively small sample size of 206 and a complex model (SEM-PLS with higher-order analyses). Although the PLS approach allows for estimation of the proposed structural model with a smaller sample size (Hair and Alamer, 2022), the findings should be interpreted with caution, particularly regarding their generalisability. Therefore, future research should use a larger sample size to improve the robustness, external validity, and generalisability of the research model. Third, this research overlooked participants' gender background, although various studies highlight the impact of gender on both life and job satisfaction (Okpara et al., 2005; Jovanović, 2017; Joshanloo and Jovanović, 2020). Fourth, the study used a cross-sectional design to address the research questions. Future studies should therefore consider demographic factors and employ a longitudinal research design for more robust validation of the findings.

REFERENCES

Abakah, E. (2023) 'Teacher learning from continuing professional development (CPD) participation: A sociocultural perspective', *International Journal of Educational Research Open*, Vol. 4, p. 100242. https://doi.org/10.1016/j.ijedro.2023.100242

Aguilar, S. J., Rosenberg, J. M., Greenhalgh, S. P., Fütterer, T., Lishinski, A. and Fischer, C. (2021) 'A Different Experience in a Different Moment? Teachers' Social Media Use Before and During the COVID-19 Pandemic', *AERA Open*, Vol. 7, p. 233285842110638. https://doi.org/10.1177/23328584211063898

Alsalamah, A. and Callinan, C. (2020) 'Key Barriers to Training Effectiveness for Female Head Teachers in Saudi Arabia: A Qualitative Survey', *Athens Journal of Education*, Vol. 7, No. 4, pp. 397-416. Available at: http://www.athensjournals.gr/education/2020-7-4-5-Alsalamah.pdf.

Alsalamah, A. and Callinan, C. (2021) 'Adaptation of Kirkpatrick's Four-Level Model of Training Criteria to Evaluate Training Programmes for Head Teachers', *Education Sciences*, Vol. 11, No. 3, p. 116. https://doi.org/10.3390/educsci11030116

Ansyari, M.F., Groot, W. and De Witte, K. (2022) 'Teachers' preferences for online professional development: Evidence from a discrete choice experiment', *Teaching and Teacher Education*, Vol. 119, p. 103870. https://doi.org/10.1016/j.tate.2022.103870

Baumert, J. and Kunter, M. (2013) 'The effect of content knowledge and pedagogical content knowledge on instructional quality and student achievement', in: Kunter, M., Baumert, J., Blum, W., Klusmann, U., Krauss, S. and Neubrand, M. (eds.), *Cognitive Activation in the Mathematics Classroom and Professional Competence of Teachers: Results from the COACTIV Project*, Boston, MA: Springer US, pp. 175–205. https://doi.org/10.1007/978-1-4614-5149-5_9

Boyd, M. R., Lewis, C. C., Scott, K., Krendl, A. and Lyon, A. R. (2017) 'The creation and validation of the Measure of Effective Attributes of Trainers (MEAT) ', *Implementation Science*, Vol. 12, No. 1, p. 73. https://doi.org/10.1186/s13012-017-0603-y

Bragg, L. A., Walsh, C. and Heyeres, M. (2021) 'Successful design and delivery of online professional development for teachers: A systematic review of the literature', *Computers and Education*, Vol. 166, p. 104158. https://doi.org/10.1016/j.compedu.2021.104158

Brauckmann, S. and Pashiardis, P. (2012) 'Contextual framing for school leadership training', *Journal of Management Development*, Vol. 31, No. 1, pp. 18–33. https://doi.org/10.1108/02621711211190970

Butler, D. L., Lauscher, H. N., Jarvis-Selinger, S. and Beckingham, B. (2004) 'Collaboration and self-regulation in teachers' professional development', *Teaching and Teacher Education*, Vol. 20, No. 5, pp. 435–455. https://doi.org/10.1016/j.tate.2004.04.003

Carpenter, J. P. and Krutka, D. G. (2014) 'How and Why Educators Use Twitter: A Survey of the Field', *Journal of Research on Technology in Education*, Vol. 46, No. 4, pp. 414–434. https://doi.org/10.1080/15391523.2014.925701

Carrillo, C. and Flores, M. A. (2020) 'COVID-19 and teacher education: a literature review of online teaching and learning practices', *European Journal of Teacher Education*, Vol. 43, No. 4, pp. 466–487. https://doi.org/10.1080/02619768.2020.1821184

Cheung, V. K.-L., Chia, N.-H., So, S.-S., Ng, G. W.-Y. and So, E. H.-K. (2023) 'Expanding scope of Kirkpatrick model from training effectiveness review to evidence-informed prioritization management for cricothyroidotomy simulation', *Heliyon*, Vol. 9, No. 8, p. e18268. https://doi.org/10.1016/j.heliyon.2023.e18268

Chia, N.-H., Cheung, V. K.-L., Lam, M. L.-Y., Cheung, I. W.-K., Wong, T. K.-Y., So, S.-S., So, E. H.-K. and Ng, G.W.-Y. (2022) 'Harnessing power of simulation training effectiveness with Kirkpatrick model in emergency surgical airway procedures', *Heliyon*, Vol. 8, No. 10, p. e10886. https://doi.org/10.1016/j.heliyon.2022.e10886

Compen, B., De Witte, K. and Schelfhout, W. (2019) 'The role of teacher professional development in financial literacy education: A systematic literature review', *Educational Research Review*, Vol. 26, pp. 16–31. https://doi.org/10.1016/j.edurev.2018.12.001

Darling-Hammond, L. and Hyler, M. E. (2020) 'Preparing educators for the time of COVID … and beyond', *European Journal of Teacher Education*, Vol. 43, No. 4, pp. 457–465. https://doi.org/10.1080/02619768.2020.1816961

de S. Bergamo, P.A., Izart, C., Streng, E.S., Rosenkranz, J. and Ghorbani, Y. (2022) 'Use of Kirkpatrick evaluation model in simulation-based trainings for the mining industry - A case study for froth flotation', *Minerals Engineering*, Vol. 188, p. 107825. https://doi.org/10.1016/j.mineng.2022.107825

Dede, C., Richards, J. and Saxberg, B. (eds.) (2019) *Learning Engineering for Online Education: Theoretical Contexts and Design-Based Examples*, New York, NY: Routledge.

Desimone, L. M. (2009) 'Improving Impact Studies of Teachers' Professional Development: Toward Better Conceptualizations and Measures', *Educational Researcher*, Vol. 38, No. 3, pp. 181–199. https://doi.org/10.3102/0013189x08331140

Donitsa-Schmidt, S. and Ramot, R. (2022) 'COVID-19 – a boundary crossing event for teacher educators', *Journal of Education for Teaching*, Vol. 48, No. 4, pp. 407–423. https://doi.org/10.1080/02607476.2022.2088267

Egert, F., Fukkink, R. G. and Eckhardt, A. G. (2018) 'Impact of In-Service Professional Development Programs for Early Childhood Teachers on Quality Ratings and Child Outcomes: A Meta-Analysis', *Review of Educational Research*, Vol. 88, No. 3, pp. 401–433. https://doi.org/10.3102/0034654317751918

Fauth, B., Decristan, J., Decker, A.-T., Büttner, G., Hardy, I., Klieme, E. and Kunter, M. (2019) 'The effects of teacher competence on student outcomes in elementary science education: The mediating role of teaching quality', *Teaching and Teacher Education*, Vol. 86, p. 102882. https://doi.org/10.1016/j.tate.2019.102882

Fletcher, T. and Bullock, S. M. (2015) 'Reframing pedagogy while teaching about teaching online: a collaborative self-study', *Professional Development in Education*, Vol. 41, No. 4, pp. 690–706. https://doi.org/10.1080/19415257.2014.938357

Gameel, B. G. (2017) 'Learner Satisfaction with Massive Open Online Courses', *American Journal of Distance Education*, Vol. 31, No. 2, pp. 98–111. https://doi.org/10.1080/08923647.2017.1300462

Garrison, D. R., Anderson, T. and Archer, W. (1999) 'Critical Inquiry in a Text-Based Environment: Computer Conferencing in Higher Education', *The Internet and Higher Education*, Vol. 2, No. 2–3, pp. 87–105. https://doi.org/10.1016/S1096-7516(00)00016-6

Garrison, D. R., Anderson, T. and Archer, W. (2001) 'Critical thinking, cognitive presence, and computer conferencing in distance education', *American Journal of Distance Education*, Vol. 15, No. 1, pp. 7–23. https://doi.org/10.1080/08923640109527071

Garrison, D. R., Anderson, T. and Archer, W. (2003) 'A theory of critical inquiry in online distance education', in: Moore, M. G. and Anderson, W. G. (eds.), *Handbook of Distance Education*, London: Lawrence Erlbaum Associates, pp. 113–127.

Gauld, D. and Miller, P. (2004) 'The qualifications and competencies held by effective workplace trainers', *Journal of European Industrial Training*, Vol. 28, No. 1, pp. 8–22. https://doi.org/10.1108/03090590410513866

Geri, N., Winer, A. and Zaks, B. (2017) 'Challenging the six-minute myth of online video lectures: Can interactivity expand the attention span of learners? ', *Online Journal of Applied Knowledge Management*, Vol. 5, No. 1, pp. 101–111. https://doi.org/10.36965/ojakm.2017.5(1)101-111

Ghadirian, H., Fauzi Mohd Ayub, A. and Salehi, K. (2018) 'Students' perceptions of online discussions, participation and e-moderation behaviours in peer-moderated asynchronous online discussions', *Technology, Pedagogy and Education*, Vol. 27, No. 1, pp. 85–100. https://doi.org/10.1080/1475939X.2017.1380695

Giangreco, A., Sebastiano, A. and Peccei, R. (2009) 'Trainees' reactions to training: an analysis of the factors affecting overall satisfaction with training', *The International Journal of Human Resource Management*, Vol. 20, No. 1, pp. 96–111. https://doi.org/10.1080/09585190802528417

Hair, J. and Alamer, A. (2022) 'Partial Least Squares Structural Equation Modeling (PLS-SEM) in second language and education research: Guidelines using an applied example', *Research Methods in Applied Linguistics*, Vol. 1, No. 3, p. 100027. https://doi.org/10.1016/j.rmal.2022.100027

Hair, J. F., Hult, G. T. M., Ringle, C. M. and Sarstedt, M. (2017) *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM),* 2nd edn, Thousand Oaks, CA: Sage Publications.

Hair, J. F., Risher, J. J., Sarstedt, M. and Ringle, C. M. (2019) 'When to use and how to report the results of PLS-SEM', *European Business Review*, Vol. 31, No. 1, pp. 2–24. https://doi.org/10.1108/EBR-11-2018-0203

Hair, J.F., Sarstedt, M., Hopkins, L. and G. Kuppelwieser, V. (2014) 'Partial least squares structural equation modeling (PLS-SEM)', *European Business Review*, Vol. 26, No. 2, pp. 106–121. https://doi.org/10.1108/EBR-10-2013-0128

Hill, H. C. (2015) *Review of The Mirage: Confronting the Hard Truth About Our Quest for Teacher Development, National Education Policy Center*. Available at: https://nepc.colorado.edu/thinktank/review-tntp-mirage [Accessed 11 November 2023]

Howard, M. C. and Gutworth, M. B. (2020) 'A meta-analysis of virtual reality training programs for social skill development', *Computers and Education*, Vol. 144, p. 103707. https://doi.org/10.1016/j.compedu.2019.103707

Jacob, R., Hill, H. and Corey, D. (2017) 'The Impact of a Professional Development Program on Teachers' Mathematical Knowledge for Teaching, Instruction, and Student Achievement', *Journal of Research on Educational Effectiveness*, Vol. 10, No. 2, pp. 379–407. https://doi.org/10.1080/19345747.2016.1273411

Joshanloo, M. and Jovanović, V. (2020) 'The relationship between gender and life satisfaction: analysis across demographic groups and global regions', *Archives of Women's Mental Health*, Vol. 23, No. 3, pp. 331–338. https://doi.org/10.1007/s00737-019-00998-w

Jovanović, V. (2017) 'Measurement Invariance of the Serbian Version of the Satisfaction With Life Scale Across Age, Gender, and Time', *European Journal of Psychological Assessment*, Vol. 35, No. 4, pp. 555–563. https://doi.org/10.1027/1015-5759/a000410

Kalinowski, E., Egert, F., Gronostaj, A. and Vock, M. (2020) 'Professional development on fostering students' academic language proficiency across the curriculum—A meta-analysis of its impact on teachers' cognition and teaching practices', *Teaching and Teacher Education*, Vol. 88, p. 102971. https://doi.org/10.1016/j.tate.2019.102971

Kennedy, A. (2005) 'Models of Continuing Professional Development: a framework for analysis', *Journal of In-Service Education*, Vol. 31, No. 2, pp. 235–250. https://doi.org/10.1080/13674580500200277

Kennedy, A. (2014) 'Understanding continuing professional development: the need for theory to impact on policy and practice', *Professional Development in Education*, Vol. 40, No. 5, pp. 688–697. https://doi.org/10.1080/19415257.2014.955122

Khan, N. F., Ikram, N., Murtaza, H. and Javed, M. (2023) 'Evaluating protection motivation based cybersecurity awareness training on Kirkpatrick's Model', *Computers and Security*, Vol. 125, p. 103049. https://doi.org/10.1016/j.cose.2022.103049

King, S. B., King, M. and Rothwell, W. J. (2000) *The Complete Guide to Training Delivery,* 1st edn, New York: AMACOM.

Kirkpatrick, D. and Kirkpatrick, J. (2006) *Evaluating Training Programs: The Four Levels,* 3rd edn, Oakland, CA: Berrett-Koehler Publishers.

Kirkpatrick, J. D. and Kirkpatrick, W. K. (2016) *Kirkpatrick's Four Levels of Training Evaluation*, Alexandria, VA: Association for Talent Development.

Kuo, Y.-C., Walker, A.E., Belland, B. R. and Schroder, K. E. E. (2013) 'A predictive study of student satisfaction in online education programs', *The International Review of Research in Open and Distributed Learning*, Vol. 14, No. 1, pp. 16–39. https://doi.org/10.19173/irrodl.v14i1.1338

Kyndt, E., Gijbels, D., Grosemans, I. and Donche, V. (2016) 'Teachers' Everyday Professional Development:Mapping Informal Learning Activities, Antecedents, and Learning Outcomes', *Review of Educational Research*, Vol. 86, No. 4, pp. 1111–1150. https://doi.org/10.3102/0034654315627864

Lantz-Andersson, A., Lundin, M. and Selwyn, N. (2018) 'Twenty years of online teacher communities: A systematic review of formally-organized and informally-developed professional learning groups', *Teaching and Teacher Education*, Vol. 75, pp. 302–315. https://doi.org/10.1016/j.tate.2018.07.008

Limon, M. R. (2022) 'Assessing knowledge and skills retention of junior high school students on food safety lessons using modified Kirkpatrick's model', *Food Control*, Vol. 135, p. 108814. https://doi.org/10.1016/j.foodcont.2022.108814

Lipowsky, F. and Rzejak, D. (2015) 'Key features of effective professional development programmes for teachers', *Ricercazione*, Vol. 7, No. 2, pp. 27–51.

Marsh, H. W. and Overall, J. U. (1980) 'Validity of students' evaluations of teaching effectiveness: Cognitive and affective criteria', *Journal of Educational Psychology*, Vol. 72, No. 4, pp. 468–475. https://doi.org/10.1037/0022-0663.72.4.468

Meyer, A., Kleinknecht, M. and Richter, D. (2023) 'What makes online professional development effective? The effect of quality characteristics on teachers' satisfaction and changes in their professional practices', *Computers and Education*, Vol. 200, p. 104805. https://doi.org/10.1016/j.compedu.2023.104805

Morgan, R. B. and Casper, W. J. (2000) 'Examining the factor structure of participant reactions to training: A multidimensional approach', *Human Resource Development Quarterly*, Vol. 11, No. 3, pp. 301–317.

Noe, R. A. (1986) 'Trainees' Attributes and Attitudes: Neglected Influences on Training Effectiveness', *The Academy of Management Review*, Vol. 11, No. 4, pp. 736–749. https://doi.org/10.2307/258393

Okpara, J. O., Squillace, M. and Erondu, E. A. (2005) 'Gender differences and job satisfaction: a study of university teachers in the United States', *Women in Management Review*, Vol. 20, No. 3, pp. 177–190. https://doi.org/10.1108/09649420510591852

Palmer, S. R. and Holt, D. M. (2009) 'Examining student satisfaction with wholly online learning', *Journal of Computer Assisted Learning*, Vol. 25, No. 2, pp. 101–113. https://doi.org/10.1111/j.1365-2729.2008.00294.x

Parsons, S. A., Hutchison, A. C., Hall, L. A., Parsons, A. W., Ives, S. T. and Leggett, A. B. (2019) 'U.S. teachers' perceptions of online professional development', *Teaching and Teacher Education*, Vol. 82, pp. 33–42. https://doi.org/10.1016/j.tate.2019.03.006

Peltola, P., Haynes, E., Clymer, L., McMillan, A. and Williams, H. (2017) *Opportunities for Teacher Professional Development in Oklahoma Rural and Nonrural Schools*, REL 2017–273, Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Southwest. Available at: https://files.eric.ed.gov/fulltext/ED575846.pdf

Pham, T. N. and Nguyen, G. H. (2021) 'An Investigation of Student Satisfaction in an Online Language Learning Course', *International Journal of Web-Based Learning and Teaching Technologies*, Vol. 16, No. 5, pp. 121–136. https://doi.org/10.4018/IJWLTT.20210901.oa7

Phillips, J. M., Harper, M. G. and DeVon, H. A. (2023) 'Virtual Reality and Screen-Based Simulation Learner Outcomes Using Kirkpatrick's Evaluation Levels: An Integrative Review', *Clinical Simulation in Nursing*, Vol. 79, pp. 49–60. https://doi.org/10.1016/j.ecns.2023.02.008

Piryani, R. M., Dhungana, G. P., Piryani, S. and Sharma Neupane, M. (2018) 'Evaluation of teachers training workshop at kirkpatrick level 1 using retro–pre questionnaire', *Adv Med Educ Pract*, Vol. 9, pp. 453–457. https://doi.org/10.2147/AMEP.S154166

Powell, C. G. and Bodur, Y. (2019) 'Teachers' perceptions of an online professional development experience: Implications for a design and implementation framework', *Teaching and Teacher Education*, Vol. 77, pp. 19–30. https://doi.org/10.1016/j.tate.2018.09.004

Praetorius, A.-K., Klieme, E., Herbert, B. and Pinger, P. (2018) 'Generic dimensions of teaching quality: the German framework of Three Basic Dimensions', *ZDM - Mathematics Education*, Vol. 50, No. 3, pp. 407–426. https://doi.org/10.1007/s11858-018-0918-4

Rafsanjani, M. A., Pamungkas, H. P., Laily, N. and Prabowo, A. E. (2022) 'Online Learning During the Covid-19 Pandemic: Readiness and Satisfaction among Indonesian Students', *Center for Educational Policy Studies Journal*, Vol. 12, No. 3, pp. 149–165. https://doi.org/10.26529/cepsj.1113

Rafsanjani, M. A., Prakoso, A. F., Nurlaili, E. I., Kurniawan, R. Y. and Wulandari, W. (2023) 'Technostress and Continuance Intention of Online Learning in Higher Education: Evidence from Indonesia', *Journal on Efficiency and Responsibility in Education and Science*, Vol. 16, No. 3, pp. 220–230. https://doi.org/10.7160/eriesj.2023.160306

Reeves, T. D. and Pedulla, J. J. (2011) 'Predictors of teacher satisfaction with online professional development: evidence from the USA's e-Learning for Educators initiative', *Professional Development in Education*, Vol. 37, No. 4, pp. 591–611. https://doi.org/10.1080/19415257.2011.553824

Richter, E., Richter, D. and Marx, A. (2018) 'Was hindert Lehrkräfte an Fortbildungen teilzunehmen? ', *Zeitschrift für Erziehungswissenschaft*, Vol. 21, No. 5, pp. 1021–1043. https://doi.org/10.1007/s11618-018-0820-4

Salmon, G., Gregory, J., Lokuge Dona, K. and Ross, B. (2015) 'Experiential online development for educators: The example of the Carpe Diem MOOC', *British Journal of Educational Technology*, Vol. 46, No. 3, pp. 542–556. https://doi.org/10.1111/bjet.12256

Sarstedt, M., Ringle, C. M. and Hair, J. F. (2017) 'Partial least squares structural equation modeling', in: Homburg, C., Klarmann, M. and Vomberg, A. (eds.), *Handbook of Market Research*, Cham: Springer International Publishing, pp. 1–40. https://doi.org/10.1007/978-3-319-05542-8_15-1

Savul, S., Ikram, A., Khan, M. A. and Khan, M. A. (2021) 'Evaluation of infection prevention and control training workshops using Kirkpatrick's model', *International Journal of Infectious Diseases*, Vol. 112, pp. 76–80. https://doi.org/10.1016/j.ijid.2021.09.005

Scagnoli, N. I., Choo, J. and Tian, J. (2019) 'Students' insights on the use of video lectures in online classes', *British Journal of Educational Technology*, Vol. 50, No. 1, pp. 399–414. https://doi.org/10.1111/bjet.12572

Sims, S. and Fletcher-Wood, H. (2021) 'Identifying the characteristics of effective teacher professional development: a critical review', *School Effectiveness and School Improvement*, Vol. 32, No. 1, pp. 47–63. https://doi.org/10.1080/09243453.2020.1772841

Sims, S., Fletcher-Wood, H., O'Mara-Eves, A., Cottingham, S., Stansfield, C., Van Herwegen, J. and Anders, J. (2021) *What Are the Characteristics of Teacher Professional Development That Increase Pupil Achievement? A Systematic Review and Meta-Analysis*, London: Education Endowment Foundation. Available at: https://educationendowmentfoundation.org.uk/education-evidence/evidence-reviews/teacher-professional-development-characteristics

Sitzmann, T., Brown, K. G., Casper, W. J., Ely, K. and Zimmerman, R. D. (2008) 'A review and meta-analysis of the nomological network of trainee reactions', *Journal of Applied Psychology*, Vol. 93, No. 2, pp. 280–295. https://doi.org/10.1037/0021-9010.93.2.280

Stemhagen, K. (2011) 'Democracy and school math: Teacher belief-practice tensions and the problem of empirical research on educational aims', *Democracy and Education*, Vol. 19, No. 2, pp. 1–13. https://doi.org/10.65214/2164-7992.1015

Swan, K. (2001) 'Virtual interaction: Design factors affecting student satisfaction and perceived learning in asynchronous online courses', *Distance Education*, Vol. 22, No. 2, pp. 306–331. https://doi.org/10.1080/0158791010220208

Taghizadeh, M. and Hajhosseini, F. (2021) 'Investigating a Blended Learning Environment: Contribution of Attitude, Interaction, and Quality of Teaching to Satisfaction of Graduate Students of TEFL', *The Asia-Pacific Education Researcher*, Vol. 30, No. 5, pp. 459–469. https://doi.org/10.1007/s40299-020-00531-z

Teslo, S., Jenssen, E. S., Thurston, M., Mandelid, M. B., Resaland, G.K., Chalkley, A. E. and Tjomsland, H. E. (2023) 'It's the journey, not the arrival that matters – Teachers' perceptions of their practice after participating in a continuing professional development program in physically active learning', *Teaching and Teacher Education*, Vol. 136, p. 104377. https://doi.org/10.1016/j.tate.2023.104377

Theelen, H., Willems, M. C., van den Beemt, A., Conijn, R. and den Brok, P. (2020) 'Virtual internships in blended environments to prepare preservice teachers for the professional teaching context', *British Journal of Educational Technology*, Vol. 51, No. 1, pp. 194–210. https://doi.org/10.1111/bjet.12760

Trotter, Y.D. (2006) 'Adult learning theories: Impacting professional development programs', *Delta Kappa Gamma Bulletin*, Vol. 72, No. 2.

Vinagre, M. (2017) 'Developing teachers' telecollaborative competences in online experiential learning', *System*, Vol. 64, pp. 34–45. https://doi.org/10.1016/j.system.2016.12.002

Wadaani, M. (2023) 'The influence of preservice education and professional development in mathematics Teachers' attitudes toward nurturing creativity and supporting the gifted', *Journal of Creativity*, Vol. 33, No. 1, p. 100043. https://doi.org/10.1016/j.yjoc.2023.100043

Wei, H.-C. and Chou, C. (2020) 'Online learning performance and satisfaction: do perceptions and readiness matter? ', *Distance Education*, Vol. 41, No. 1, pp. 48–69. https://doi.org/10.1080/01587919.2020.1724768

Wendt, J. and Courduff, J. (2018) 'The relationship between teaching presence and student course outcomes in an online international population', *International Journal on E-Learning: Corporate, Government, Healthcare, and Higher Education*, Vol. 17, No. 1, pp. 111–129.

Yang, G., Shen, Q. and Jiang, R. (2023) 'Exploring the relationship between university students' perceived English instructional quality and learner satisfaction in the online environment', *System*, Vol. 119, p. 103178. https://doi.org/10.1016/j.system.2023.103178

Yoon, S. A., Miller, K. and Richman, T. (2020) 'Comparative Study of High-Quality Professional Development for High School Biology in a Face-to-Face versus Online Delivery Mode', *Educational Technology and Society*, Vol. 23, No. 3, pp. 68–80. https://doi.org/10.30191/ETS.202007_23(3).0006

Zhang, S., Shi, Q. and Lin, E. (2020) 'Professional development needs, support, and barriers: TALIS US new and veteran teachers' perspectives', *Professional Development in Education*, Vol. 46, No. 3, pp. 440–453. https://doi.org/10.1080/19415257.2019.1614967