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Mobile-Based Training and Certification Framework for Teachers' Professional Development

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Abstract: This study highlights the challenges faced in providing professional development programs for teachers, including limited resources and conventional training methods. Mobile technology, with its flexibility and cost-effectiveness, is increasingly being used as a part of professional development programs, but existing frameworks do not adequately support the integration of technology. This study proposes a mobile-based training certification framework that includes support for mobile phones, a training curriculum and assessment, expert support, and CPD evaluation. The framework was piloted with 35 participants from Pakistan and Saudi Arabia, with positive results indicating that mobile-based training is effective in enhancing teachers' learning outcomes. According to the teachers' responses, 100% agreed that this was a groundbreaking endeavor and expressed excitement to use it. Additionally, 98% found mobile learning easier and more enjoyable than traditional methods. The study recommends the implementation of the mobile-based training certification framework to improve teachers' professional development and bridge the gap between traditional training methods and the needs of modern-day educators. The study also highlights the potential of mobile-based training to improve student outcomes by developing the knowledge and skills of teachers.

Keywords: sustainability; mobile learning; teachers' professional development

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1. Introduction

The role of teachers is critical in ensuring the quality of education. Teachers' professional development (TPD) is essential to improve their competencies and ultimately enhance the quality of education. Mobile-based learning has emerged as a promising solution to the challenges of providing accessible, flexible, and effective teacher professional development (TPD) opportunities in Saudi Arabia and Pakistan [1].

Over the last 15 years, Pakistan's poverty has decreased due to good economic development and structural changes. Nevertheless, development results, particularly in education, are uneven. While the average years spent in school have risen in tandem with life expectancy and per capita income, inequality remains high, and the educational record is abysmal according to other criteria. Illiteracy is pervasive, with over 23 million children aged 5 to 16 years out of school—an alarming number in a nation where the present workforce is young, primarily unskilled, and ill-prepared for productive labor [2–4]. For the most part, previous reform initiatives have focused on boosting access to basic education [3,5–7]. Enhancing education results in Pakistan and Saudi Arabia requires investing in and reforming secondary education and improving the quality of teaching and governance at all levels [8]. While teaching is a career that requires the development of skills and competencies to educate future generations to meet the needs and expectations

of society, those who choose to enter this profession must undergo training via the teaching and learning process. Teacher education improves and increases the quality of the educational system in both countries. Teachers' continuous professional development refers to all the training activities offered to teachers to improve their professional competence [9,10]. In-service education, individual development, professional development, staff development, and ongoing or lifelong education are all terms that may be used to describe these activities. Professional development allows teachers to keep their knowledge and abilities up-to-date in order to meet the demands of the moment and fulfill educational goals in a timely manner [11–13]. Guskey et al. defined teacher professional development as follows: "Professional growth entails training, practice, and feedback, as well as sufficient time and follow-up assistance" [14,15].

Today's workplaces in Saudi Arabia require continuous professional development for career progress [16]. This is difficult to implement due to a lack of government rules, inadequate training, a lack of current technology, and political influence on hiring processes, etc. [3,11,17,18]. Many institutes fail to improve teachers' learning outcomes because they rely on poor in-service CPD programs [19].

Smartphones are widely used in academia to communicate sustainable practices. M-learning is becoming more popular in Saudi educational institutions and in developing countries [8,20–22]. As mobile technology has advanced, the number of learning opportunities available both inside and outside of the classroom has increased [3,22,23]. While mobile learning is suitable for end users and organizational requirements, most existing research focuses on the benefits of mobile-based training for teachers. However, mobile learning for teachers' professional development is in its infancy, and a research-informed theoretical framework for integrating mobile learning into teacher professional development is required [24,25]. Franklin and others described mobile learning as "learning that takes place anywhere, at any time" [12,14,26–29]. This concept highlights learners' ability to engage with other professionals despite economic, geographical, cultural, or socio-political disparities, as well as their flexibility, empowerment, and learning ability. UNESCO discussed how mobile devices could support teacher development and overcome teachers' technophobia. Mobile learning supports teacher training, professional development, and teaching practices; encourages interaction and collaboration; provides job support; etc. [30].

Nikou and Economides (2018) [31] investigated the impact of mobile-based microlearning and assessment on the learning performance and motivation of high school students. The study found that students in the mobile-based microlearning and assessment group had higher learning performance and motivation compared to those in the traditional classroom instruction group. The students in the mobile-based micro-learning and assessment group also showed more engagement with the learning material and had higher levels of satisfaction with the learning experience. This study also discussed the benefits of mobile-based micro-learning and assessment, such as its flexibility, personalized learning experience, and ability to provide instant feedback to students. The study suggested that incorporating mobile-based micro-learning and assessment in high school education could lead to improved learning outcomes and increased student motivation [31].

According to Naismith et al. [32], mobile technologies are associated with six forms of learning: behaviorist, constructivist, situational, collaborative, informal/lifelong, and support/coordination learning [32]. Each of these forms of learning may implemented with mobile technology, demonstrating its educational potential [33–35]. According to [9,36], m-learning is a new style of learning enabled by mobile devices and incorporating ubiquitous communication technologies and advanced user interfaces. Because of the emergence of m-learning, students may now enjoy personalized learning on their mobile devices. A slew of new mobile services has arisen in recent years that integrate mobile technology with university educational systems as a long-term solution [37].

Wijaya et al. [38] focused on microgames, which are defined as small, interactive games designed to reinforce mathematical concepts and skills. These games are intended to supplement traditional teaching methods and provide students with a more engaging and

interactive learning experience. The study examined the factors that influenced the adoption of microgames by secondary school mathematics teachers. The findings revealed that mathematics teachers were more likely to adopt microgames and use them effectively [38].

The possibility of a mobile learning system being used in a training set was studied by [39,40]. According to the authors' findings, mobile learning is effective for delivering training and provides the benefits of individualized instruction at any time and place. Martin et al. used a mobile performance-centered, self-directed platform for training and education in engineering to carry out a study on mobile collaborative learning [41]. The subject of teacher training is one of the least studied in mobile learning research [42,43]. Teachers are frequently trained in three ways: using mobile learning tools as teaching tools, using mobile learning packages as teaching instruments, and using mobile learning for student assistance and administrative purposes [44].

Mobile learning initiatives for teacher education are divided into two categories. The first set of programs attempted to educate instructors on how to use mobile learning in the classroom, while the second set aimed to improve teacher education [42]. Sri Lankan researchers further studied mobile learning in the classroom, providing a series of workshops for instructors [43]. Similar studies in the Philippines (Text2Teach) and Tanzania (Bridge IT) positioned mobile learning as a classroom supplement and teacher support tool [45]. Another Malaysian research study for pre-service teachers employed iPads for online learning [46]. Some mobile learning studies have aimed to improve teacher training in rural areas [47,48]. These programs employed question–answer training, training materials, and self-assessment, allowing participants to participate in group conversations. However, the training was not structured, and the instructor's qualifications were unclear.

Evrim Baran (2014) provided a comprehensive overview of the research conducted on mobile learning in teacher education. The study analyzed 39 articles published between 2006 and 2016 and examined the types of mobile devices used, the pedagogical approaches employed, and the outcomes of mobile learning in teacher education. The paper highlighted the potential of mobile learning to enhance teacher education by providing access to learning resources, promoting collaboration and communication among teachers and students, and facilitating reflective practice. The study identified several pedagogical approaches used in mobile learning, such as collaborative learning, situated learning, and game-based learning. The review also identified the challenges of implementing mobile learning in teacher education, including the lack of institutional support, technical issues, and resistance from teachers [42]. Wang (2003) examined the factors that contribute to learner satisfaction with asynchronous electronic learning systems (AELSs). The study involved a survey of students enrolled in an online master's program and collected data on their satisfaction with various aspects of the AELS, including the ease of use, content quality, interaction with instructors and other students, and overall satisfaction. The study found that students' satisfaction with the AELS was positively correlated with their perceptions of its usefulness and ease of use. Additionally, students who had more interaction with instructors and other students through the AELS reported higher levels of satisfaction [49].

In the context of Saudi Arabia, teacher professional development (TPD) has been recognized as a crucial factor in enhancing the quality of education. Despite the efforts made by the Saudi Ministry of Education to provide TPD opportunities to teachers, there are still challenges in terms of accessibility, flexibility, and effectiveness. One possible solution to address these challenges is mobile-based training and certification frameworks, which offer the advantage of providing on-the-go and personalized learning experiences [24,25,50].

Despite a growing trend toward using mobile technology to aid student learning, there is little research in this area in Pakistan and Saudi Arabia [3,51]. To the best of our knowledge, none of the platforms has primarily focused on teachers' continuing professional development at the provisional or national level in Pakistan [18,30,51]. The literature reveals that enhancing learning outcomes through mobile-based professional development is a new trend that needs specific attention in Sindh, Pakistan. According to the research literature, new techniques, models, and frameworks for developing mobile

learning content to assist instructors' learning and enhance their effectiveness in teaching practices are lacking. To construct mobile learning experiences for teachers' professional development, pedagogical and theoretical frameworks must be developed for effective and efficient CPD. Thus, in this paper, we propose a mobile-based training certification framework for TPD in the context of Saudi Arabia and Pakistan. The framework aims to enhance teachers' competencies in various areas, such as pedagogy, subject matter knowledge, and digital skills. The framework is designed to be accessible and flexible, allowing teachers to learn at their own pace and convenience. Moreover, the proposed framework integrates certification mechanisms to incentivize and recognize teachers' efforts in improving their competencies.

The paper presents a comprehensive review of the literature on mobile learning, TPD, and certification frameworks, providing the theoretical background for the proposed framework. The paper also discusses the methodology used in the development of the framework, including the selection of competencies, the design of learning activities, and the integration of certification mechanisms. Finally, the paper concludes with a discussion of the potential impact of the proposed framework on enhancing the quality of education in Saudi Arabia and suggests future research directions. The primary purpose of this study was to develop a conceptual framework for the professional development of educators through the use of mobile devices, most notably smartphones. A few different training sessions or activities relating to the incorporation of technology were developed and evaluated with the use of a conceptual framework.

2. Theoretical Frameworks for Mobile Learning

To fully incorporate mobile-based systems for enhanced learning, several researchers have looked into the development of theoretical frameworks, including mobile education (FRAME), which is based on activity theory [52]; the construction of knowledge through the exchange of knowledge via pervasive mobile devices [53], which is based on Pask's 1975 conversation theory; a modification of transactional distance education theory for mobile learning [54]; and educational research on mobile communities [55]. Regardless of the already available frameworks, there is still a lack of transferable design frameworks for mobile learning that can better integrate mobile technologies into learning environments in an effective manner and make these technologies more beneficial to users [54]. To develop any m-learning framework, its key components must be identified and considered for incorporation; e.g., Ozdamli et al. presented an m-learning framework for education purposes by identifying key components such that each component had a unique role to play in the process [56], see Figure 1.

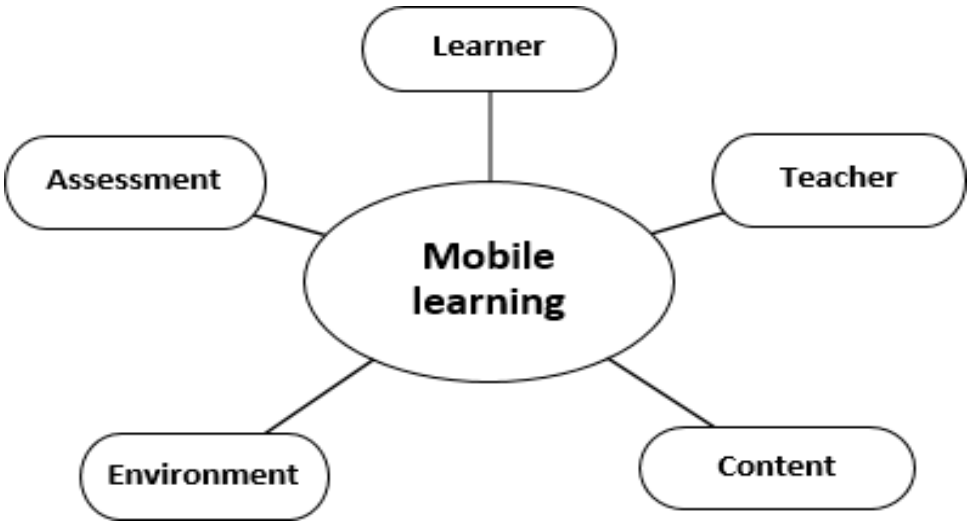

Figure 1. Elements of mobile learning [56].

The learner is the initial component of mobile learning. All mobile learning activities revolve around the learner [57]. The other aspects of mobile learning work for the student, assisting them in determining their objectives and completing the assessment stage as determined by the student [56]. The instructor is the second component. Teachers have a consulting function in a mobile learning environment. Teachers must assess their students' interests to develop learning objectives and then assist them in achieving those goals based on their own talents [56,58]. Content is another aspect of mobile learning. Content is what learners are supposed to learn and should be addressed by all stakeholders, including instructors and students [56,58]. The material provided in mobile learning is influenced by the pedagogical requirements of learners [1,59–61].

The environment and evaluation are the last two aspects of mobile learning. The learning environment is a location where students may acquire knowledge. The learning environment must encourage more contact between students and instructors [1,60,61]. The environment for mobile learning must be created for mobile phones, personal digital assistants, and other portable devices. Mobile learning enables individuals and groups to collaborate in the educational process, resulting in cooperative learning settings [58]. Assessment is an important part of mobile learning, since it checks the learners' abilities and offers analysis and supervision to help them succeed [62]. A quick feedback element should be included in the design of a mobile learning course [56]. Learners may use this tool to assess their own understanding of the course. On the other hand, an assessment approach can only help learners if they actively employ it [63]. The text to follow discusses several theoretical models deemed significant for constructing a mobile-based learning model.

Al-Emran et al. [64] presented an integrated model for understanding the factors that influenced students' continuous intentions to use mobile learning (m-learning) in an educational setting. Conducted a survey among university students in Saudi Arabia and collected data on their perceptions of m-learning, attitudes toward using mobile devices for learning, perceived ease of use, perceived usefulness, social influence, and satisfaction. The study provided insights into the factors that influence students' continuous intentions to use m-learning [64]. Besides the above-discussed m-learning model and theories, literature studies present many other models and theories based on m-learning. Table 1 summarizes these developed models, describing the core aspects, pedagogical approach, and experimental view.

Table 1. M-learning frameworks.

References	Core Aspects/Characteristics of the Framework	Theoretical Background/ Pedagogical Approach	View of Mobile Learning
[65]	Mobile usability, wireless technology, e-learning system	User studies, e-learning	Natural evolution of e-learning
[62]	Technological layer, semiotic layer	Cultural-historical activity theory	Learning mediated by knowledge and technology
[66]	Push and pull mechanisms, personalization, collaboration	Constructive and conversational learning	An extension of e-learning
[55]	Generic mobile environment issues, learning contexts, learning experiences, learning objectives	Game metaphor	Portable communication devices as central to learning environments, providing access to the learning content

Table 1. *Cont.*

References	Core Aspects/Characteristics of the Framework	Theoretical Background/ Pedagogical Approach	View of Mobile Learning
[67]	M-learning activity design, requirements and constraints analysis, m-learning scenario design, m-learning technology environment design, mobile learner support services design	Action research results	To enrich people's learning experiences anytime and anywhere in the most convenient way with their mobile phones
[52]	Device aspect, learner aspect, social aspect, context of information	Activity theory constructivism	A process resulting from the convergence of mobile technologies, human learning capacities, and social interaction
[54]	Transactional distance, social nature of an activity	The transactional distance theory	Mobile technologies as a learning tool in the distance learning environment
[68]	Learner, location, time, content, device	Adaptive learning	Formal learning environment: on the other hand, mobile learning is described as learning anytime and anywhere
[69]	The main system criteria, mobile devices, quality of services, application, and learners' requirements and constraints	System criteria, just-in-time learning	Learning through a relatively small, low-weight device to accompany users anytime and anywhere
[70]	Integration of tools, pedagogical approaches, assessment techniques, teacher training	Constructivism, blended learning, collaborative learning, and active learning	Applying mobile technology to learning
[71]	Authenticity, collaboration, personalization, unique time-space contexts of mobile learning	Socio-cultural perspective	Process of learning mediated by a mobile device
[72]	Self-regulation as an agency; mobile devices as social, cognitive, metacognitive tools; learning process as exercises of agency; social and pedagogical support for learner autonomy	Self-regulated learning	To learn anywhere and anytime; entails learners being motivated and able to self-regulate their learning
[73]	External level (social, cultural, and technical factors); intermedium level (content, context, and device); internal level (learner attitude and experiences)	Situated learning and contextual learning	Mobile learning is not only about the mobility of the learners and devices, but also the mobility of learning across contexts
[74]	Impacting factors, the mobile learning environment, learning outcomes	Social constructivist theory, activity theory	Mobile learning is the mode for teaching and learning to deliver content to learners; mobile learning can aid both formal learning in traditional classrooms and informal learning outside classes

Table 1. *Cont.*

References	Core Aspects/Characteristics of the Framework	Theoretical Background/ Pedagogical Approach	View of Mobile Learning
[75]	Mobile learning activity, context, content, technical support, learning process	Dependability evaluation	Mobile learning supplies a a learner with electronic information and content that aids in the acquisition of knowledge regardless of location and time
[76]	Key elements are places, tasks, tools, social support, time, and learning journey	Incidental learning	Mobile devices, with their portability, provide the flexibility to learn wherever and whenever; however, the provision of learning support also needs to consider the context

Theoretical models of mobile learning have been developed to understand the key aspects of mobile learning, its pedagogical approaches, and ways to support teaching and learning. The most prominent models include those of Motiwala, Parsons, Liu, Koole, Park, Tan, Issa, and Ozdamli, each with its own core aspects, theoretical background, pedagogical approach, and view of mobile learning. While these models vary in their emphasis, they all highlight the importance of considering the unique characteristics of mobile devices, the social nature of learning, and the contextual factors that influence mobile learning experiences. The mobile-based training and certification framework for teachers' professional development presented in this article builds upon these models by proposing a comprehensive framework that focuses on the integration of mobile learning into teacher training programs, providing a practical approach to enhancing teachers' professional development.

Mobile-based TPD has been recognized as an effective approach to providing flexible and accessible learning opportunities for teachers. A study by Almogren et al. found that mobile-based learning can enhance teachers' knowledge and skills and improve their teaching practices [24]. Similarly, Alismaielet al. investigated the impact of mobile-based learning on teachers' professional development in Saudi Arabia and found that it can be an effective approach for enhancing teachers' competencies [1].

Certification frameworks have been used to incentivize and recognize teachers' efforts in improving their competencies. A study by Adwan et al. examined the impact of a certification program on teachers' professional development and found that it can enhance teachers' knowledge and skills and improve their confidence in using technology. Additionally, certification frameworks can provide a standardized approach to TPD and enhance the credibility of TPD programs [61].

There is limited research on mobile-based certification frameworks for TPD in the Saudi Arabian context. However, a study by Almogren et al. proposed a mobile-based TPD program for English language teachers in Saudi Arabia. The program included mechanisms for certification and was found to be effective in enhancing teachers' competencies [24]. Overall, the literature suggests that mobile-based TPD and certification frameworks can be effective approaches for enhancing teachers' competencies in Saudi Arabia. The proposed mobile-based training certification framework in this paper builds upon these findings, offering an accessible, flexible, and effective approach for TPD in the Saudi Arabian context. Further research is needed to evaluate the effectiveness of the proposed framework and explore its potential impact on improving the quality of education in Saudi Arabia.

3. Mobile-Based Training Certification Framework

Mobile technology is increasingly used in educational institutions, but there have been few studies on how teachers might use it to improve learning. No platform we have investigated focused on provincial or national teacher professional development

in Pakistan [23,77–79]. Teacher professional development (TPD) in Sindh, Pakistan, has traditionally been conducted in person, failing to recognize the critical role of technology in supporting learning, providing ongoing support for teachers, encouraging interaction between colleagues, and receiving help from educators anywhere and anytime [11].

In Ref. [17], based on the critical use of technology as an effective and sustainable approach to providing quality education, we built a mobile-based training certification framework for teachers' professional development as an alternative to the old approach. It is cost-effective, flexible, contextualized, collaborative, resourceful, and facilitates learning. Figure 2 shows the CPD certification framework for designing, implementing, and evaluating mobile-based professional development activities.

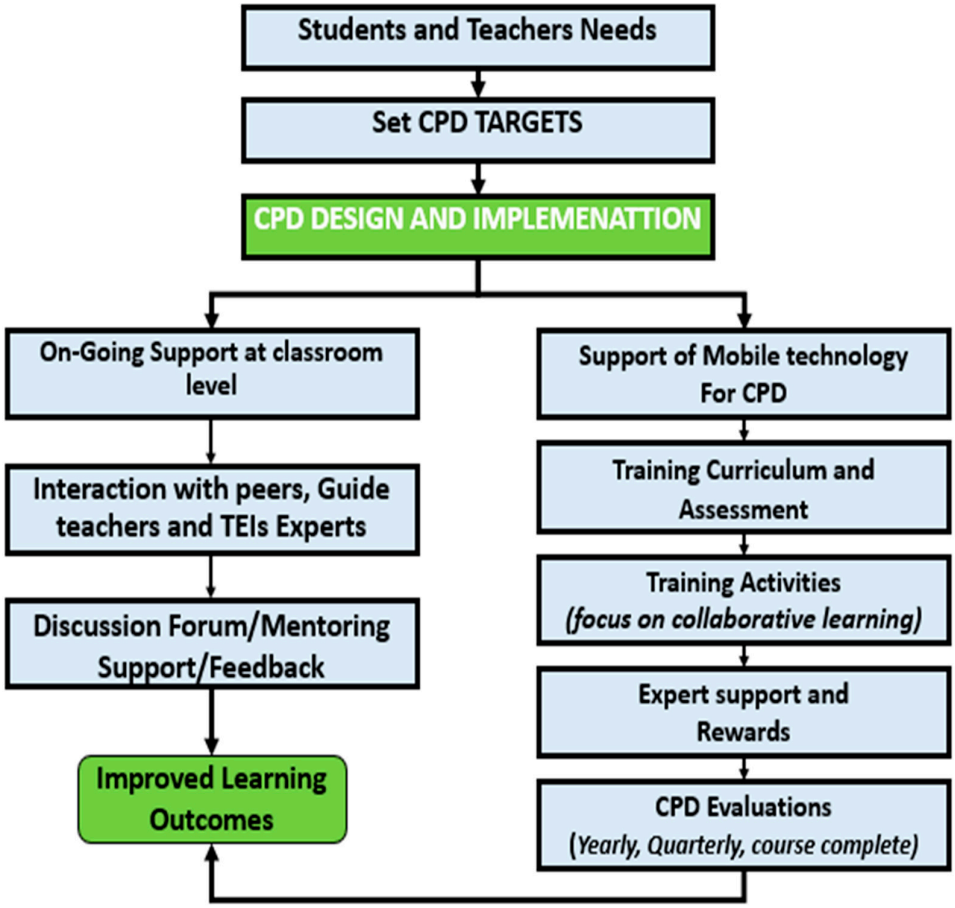

Figure 2. Proposed mobile-based training certification framework.

As shown in Figure 2, the framework presents two macrostrategies for the continuous professional development of teachers.

1. Training design and implementation.
2. Ongoing support at the classroom level.

3.1. Training Design and Implementation

The design and implementation of mobile-based training certification comprise five main components: the support of a mobile phone for CPD, a training curriculum and assessment, training activities, expert support and reward, and CPD evaluation. A brief description of each component is presented below.

3.1.1. Support of Mobile Technology

The support of mobile phones for teachers' professional development is the primary tool for an enhanced CPD framework. Mobile-based support allows teachers, guide

teachers, and experts to use the mobile device for participation in training activities. The mobile app features ongoing support, a fast-track assessment and feedback system, quick mentoring tools, polls and quizzes, group projects, discussion forums, live meetings, certifications, and so on to help and support teacher professional development activities at the cluster level.

3.1.2. Training Curriculum and Assessment

The training curriculum and assessment are the second important component of the CPD framework and involve the sub-components shown in Figure 3.

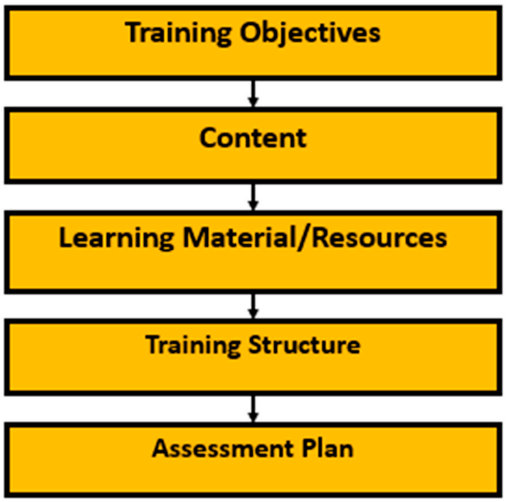

Figure 3. Training components.

The first stage in building a training or PD course is to determine the objectives, which emphasize what learners will be able to accomplish at the end of the training and what they want to gain from the course. With pedagogical and contextual considerations in mind, the objective should be aligned. The objectives need to be designed so that they are easily measured. Next, content refers to what is taught in the course or training and the materials or resources gathered based on the objectives.

Third, regarding the learning materials and resources, the app contains all kinds of supporting material for teachers, such as training modules; handouts; worksheets; workbooks; video lectures; audio recordings; textbooks; a curriculum for each subject; and all instruction materials, such as lesson plans, schemes, syllabuses, assessments (tests and exam papers). This includes training modules, handouts, worksheets, workbooks, audio recordings, and video lectures. The fourth component is the structure, which determines the different competency levels of courses among teachers. Based on the competency levels of the teachers, the CPD activities are structured into different levels, from beginner to advanced. The training structure specifies when content will be supplied to achieve the objective in the appropriate context. Participants would have access to the next level once they had finished the preceding one. In the training framework, a test level was also proposed so that a teacher with high skills could bypass a level they already knew. As a result, the information created for this training should be not only organized but also systematic, allowing training participants to explore and follow the content consistently and easily.

Assessment is an essential part of training; many techniques, such as formative, summative, and authentic assessments, are used in order to evaluate a teacher's level of learning during the training process. Summative assessment is used at the end of training to grade, certify, and evaluate teachers' success. It includes post-test and final certification exams, for which grades or marks are issued to judge a teacher's development. Formative assessment, on the other hand, is used to help teachers learn more effectively. It is used to evaluate teachers' learning outcomes on a regular basis during the training session. The

findings are used to improve the teaching and learning process right away, as well as to ensure accountability. Session tests and quizzes, group activities, conversations, and/or teacher learning portfolios are all examples of formative assessment.

We planned to evaluate the CPD program at various levels and for various purposes, including training module evaluation, weekly assessments, tracking teachers' progress levels, identifying teachers' needs, identifying students' needs, assessing students' learning outcomes, and assessing teachers' knowledge, among other things. Teacher and student performance are both improved as a result of CPD.

3.1.3. CPD Training Activities

The training activities should be based on the training material and consider the characteristics of the mobile phone and training app that will be utilized during the CPD training. The training is based on discussion questions, group work, individual reading, an inquiry approach, and active learning strategies. Furthermore, the training activities are based on an interactive and collaborative approach with various teaching and assessment techniques, including brainstorming, reflective and thought-provoking questions, think-pair-share, and online quizzes and post-tests.

Teachers receive the content and resources that are tightly organized and systematic via their mobile phones, following the mobile learning slogan "anywhere, anytime." In addition, all training activities have a time limit. Participants can set and manage their time for the training activities by providing an accurate time for each activity in the session. Prior to the training, participants should be informed about the amount of time allotted for each activity. The time range for each activity should be reasonable and appropriate to participants' flexibility in executing the activities at their own pace while developing the training activities.

3.1.4. Expert Support and Reward

Teachers can access expert assistance via a variety of delivery methods, including webinars, conferences, online meetings, and workshops. The teachers discuss their current tasks, brainstorm solutions to problems, and share their best practices with experts. The teachers require assistance in the form of training reminders to assist them in remaining up-to-date with the training progression. In designing mobile learning for teacher training, this model identified training incentives as critical concerns. According to Liao et al., offering a reward is a tactic for attracting target audiences, and the incentive should be meaningful to them [80].

Participants may acquire a certificate of training completion from the training provider when they have completed a training course and passed the test for a particular level of training. Teachers who join the program will benefit from the certificate, which will aid in their professional growth. They need the certificate as a supporting document to advance their level or apply for teacher certification [15,81]. Additionally, teachers will feel recognized for the time and effort they put into completing their own CPD training.

3.1.5. Evaluation

A system of follow-up, review, monitoring, and the evaluation of work is also necessary. The evaluation also includes feedback, which is required to guarantee the successful, effective, and efficient implementation of the CPD and ensure alignment with the training outcomes. Various feedback tools, evaluation rubrics, and review forms are used to measure the overall impact of CPD on pedagogical practices. Subject matter knowledge, school learning culture, and learning environments are the indicators that are used to measure progression.

3.2. Ongoing Support System

Mentoring helps teachers apply techniques learned in the classroom. Using the app, teachers can post material, pedagogy, or assessment problems for on-the-job coaching.

The teachers and their mentors share techniques and ideas. They highlight successes, discuss needs, and link professional capacity-building activities. Teachers can enhance their performance and overcome deficiencies by using the mobile app's ongoing help feature.

4. Piloting a Training Certification Course for Teachers

The training course was designed and piloted using the mobile app by following six key steps, as mentioned in Figure 2. Based on these steps, a three-day training course (understanding lesson planning concepts) was designed for in-service teachers.

5. Designing Training Module through Mobile App

The TechCertify training app provides the most effective tools to support the design of training for teachers' professional development; it offers recorded video lectures; personalized teacher trainee accounts; automated assessments (tests, quizzes, and polls); automatic teacher evaluation reports; discussion forums; a go-live feature; messaging tools (a chat box); and a safe and user-friendly app. It also facilitates real-time feedback and collaboration and combines peer-evaluation approaches to create effective training sessions. Enabling collaboration helps in sharing ideas and building on peers' ideas, allowing participants to express themselves freely.

6. Procedure of Piloting Course

The execution of the training prototype consisted of three sequential actions: registration, a CPD course, and an online survey (see Figure 4), as explained below:

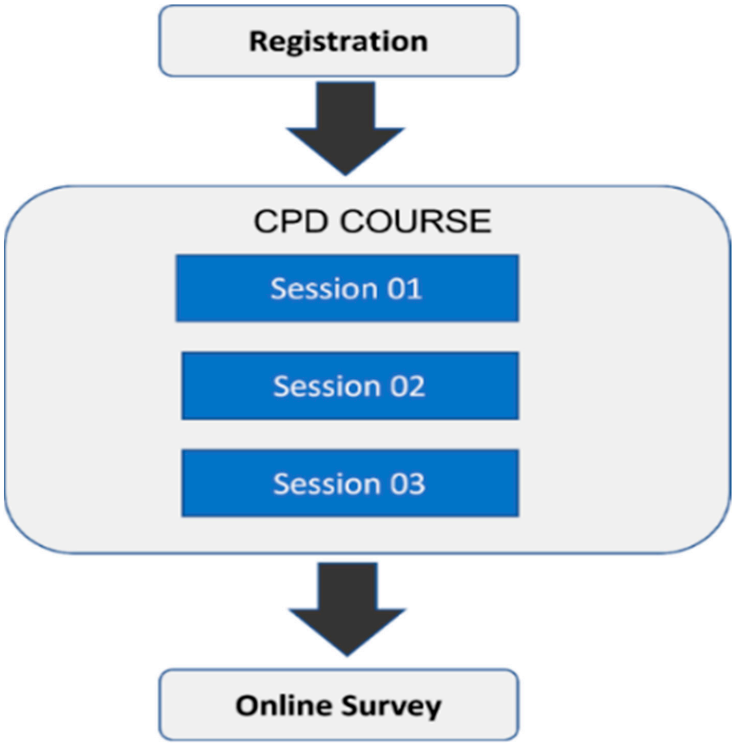

Figure 4. Trial course procedure.

6.1. Registration

It was necessary for the interested teachers to register for the trial study by selecting the sign-up option of the mobile app. It was not necessary to ask teachers who were not interested in participating to register. As soon as instructors finished the registration procedure, they received access credentials via email or SMS, as well as confirmation of their registration and information on the course's start date.

6.2. Course Structure

The trial activity was designed for three days, with each session lasting for a single day. The app offered training sessions with numerous activities (recorded videos, live sessions, and online discussions). Table 2 illustrates the training sessions' topics, content, and activities. Writing lesson plans was the topic of the first session, which was conducted through a recorded video lecture, group discussions, readings, quizzes, and reflective questions (open-ended).

Table 2. Training course structure.

Session	Topic	Content/Activities	App-Based Activities	Time
		Pre-Test 10 min		
Session 01 (3 h)	Writing lesson plans	Lead in (discussion activity)	Recorded video lecture 1 Collaborative discussion Reflective question 1	30 min
		Why write a lesson plan	Reading handout 1 Discussion Quiz 1	30 min
		Components of a lesson plan	Card matching Group discussion Recorded video lecture 2 Reflective questions 2 Quiz 2	60 min
		Stages of lesson plans	Group discussion Recorded video lecture 3 Reflective question 3 Quiz 3	60 min
Session 02 (3 h)	Classroom activities and techniques	Scavenger hunt activities	Recorded video lecture 4 Reading handouts 2 Reflective question 4	30 min
		Classroom teaching activities	Go live 1	30 min
		Discussing approaches to get attention at the end of activities	Group discussion Recorded video lecture 5 Reflective questions 4 Quiz 4	60 min
		Planning and setting activities	Group discussion Recorded video lecture 6 Reading handouts 3 Reflective question 6 Quiz 5	60 min
Session 03 (3 h)	Tips for lesson planning and reflection	Discuss teacher attitude toward the lesson	Peer discussion in forum on reflective question 7 Reading activity 4	30 min
		Identify and evaluate tips for effective lesson planning	Group discussion Recorded video lecture 5 Reflective question 8 Quiz 6	60 min
		Planning activities for the textbook lessons and microteaching	Go live 2 Discussion Upload recorded micro lesson Quiz 7 Open-ended reflective questions 7	90 min
		Post-Test, 10 min		

The application helps teachers and teacher educators talk about teaching and learning. The text, audio, and video are real-time. The app has polls, quizzes, and more. The App's continuous assistance function allows teachers and experts to engage and share ideas. The app also includes a live meeting option; an activity calendar; a discussion forum for group and peer discussion; a chatbot for private discussion; resources (such as textbooks, curricula, training manuals, lesson plans, worksheets, videos, and audio); classroom observation tools; assessment tools; online assignment submission; help and FAQs; rewards; and an exporting reports option.

6.3. Online Survey

At the completion of the trial training program, participants received an email with a link to an online survey. The survey was created to collect information on participants' training experiences, including when and where they completed the course, as well as their comments and ideas about the mobile-based training.

6.3.1. Sample Selection and Data Collection

The population of this research study consisted of teachers working in Pakistan and Saudi Arabia. The sample consisted of 40 in-service teachers who were selected using a random sampling technique. A three-day training session was conducted for teachers using mobile learning under the mobile-based teachers' certification framework, after which an online questionnaire was distributed to the participants. Participants were given detailed instructions about the study's purpose and how to complete the questionnaire. Participants were asked to fill out the questionnaire honestly and provide accurate information. Following the screening of completed questionnaires, a total of 35 correctly completed questionnaires were selected for analysis, while other questionnaires were excluded due to missing or incomplete data.

6.3.2. Instrument Development Methodology

In this study, a questionnaire was developed based on a comprehensive review of the relevant literature. The questionnaire consisted of two sections. The first section included demographic questions to collect participants' demographic information. The second section comprised constructs related to the learner's satisfaction with the mobile-based learning framework adopted from [49]. The questionnaire consisted of 26 items, with each construct comprising three to five items scored using a five-point Likert scale ranging from strongly disagree to strongly agree.

The questionnaire items were reviewed and revised based on feedback from experts in the field and a pilot study involving ten teachers. The pilot study was conducted to test the clarity and comprehensibility of the questionnaire items and to identify any potential problems with the research tool. Cronbach's alpha method was used to check for data consistency, and the results showed that the overall Cronbach's alpha values were higher than 0.7, indicating acceptable levels of internal consistency [63,82]. As a result, the questionnaire was deemed reliable and valid for use in the study. Next, semi-structured interviews were conducted with participants to gather their opinions and experiences related to the mobile-based learning framework. The interview questions were developed based on the research objectives and a literature review, and the responses were analyzed thematically.

6.3.3. Pre and Post-Test Tool

To assess the effectiveness of mobile-based training for teachers, a quasi-experimental approach was used with pre- and post-test questionnaires. A standardized multiple-choice questionnaire comprising 30 questions was used to evaluate learning outcomes before and after the training, which was designed by content developers and training experts from teacher training institutions. The test served as a control variable to assess the initial levels of knowledge and skills of the group. Test validity was ensured by involving content

developers and training experts, and test reliability was established through the consistent administration of the same questions to the group.

The study also aimed to determine if there was a difference in teachers' learning outcomes before and after the training. A 40-item achievement test was developed with the help of test development specialists, pre-tested on 14 instructors, and revised based on feedback to maintain test validity and reliability. After statistical analysis using the TAP tool, 10 items with poor uniqueness were removed, resulting in a 23-item KR-20 test with a reliability coefficient of 0.84, indicating high trustworthiness. The test items had a good distinctiveness index of 0.49 and average difficulty (0.63).

6.3.4. Data Analysis

The data collected from the study were analyzed using statistical software, including SPSS 29. The data were summarized using descriptive statistics [63,82–85].

6.3.5. Ethical Considerations

The study was conducted in accordance with ethical principles and guidelines, and informed consent was obtained from all participants before they participated in the study. Participants were assured of the confidentiality and anonymity of their responses, and the data were used solely for research purposes.

7. Results

Based on the surveys, Table 3 shows the sample demographics, with 15 (42.9%) male teachers and 20 (57.1%) female teachers. According to the age categories of teachers, 5 (14.3%) were between the ages of 25 and 30, 20 (57.1%) were between the ages of 31 and 40, and 10 (28.5%) were between the ages of 41 and 50. According to the data, 10 out of the 35 teachers (28.6%) had a bachelor's degree, 20 (57.1%) had a master's or MPhil degree, and just 1 (2.9%) had a doctoral degree. According to the length of teaching experience, 27 (77.1%) had between one and five years of experience, 7 (20.0%) had between six and ten years, and 1 (2.9%) teacher had more than ten years of experience. Notably, 90 (84%) of teachers or respondents had already attended one to five CPD training sessions in the traditional professional development model.

Table 3. Demographic information.

Description	Sample	%
Gender		
Male	15	42.9
Female	20	57.1
Age		**%**
20–30	5	14.3
31–40	20	57.1
41–50	10	28.6
51–60	0	0.0
Education		**%**
Bachelor's	10	28.6
Master's	20	57.1
PhD	1	2.9
Other	4	11.4
Teaching Experience		**%**
1–5	27	77.1
6–10	7	20.0
11–20	1	2.9

7.1. The Successful Completion of the Training Program

Of the 35 participants who responded to the survey, 85.7% said that they had completed all training sessions, while 12.0% revealed that they had not completed all training sessions. Figure 5 further demonstrates that 5% and 8% did not complete sessions 2 and 3, respectively.

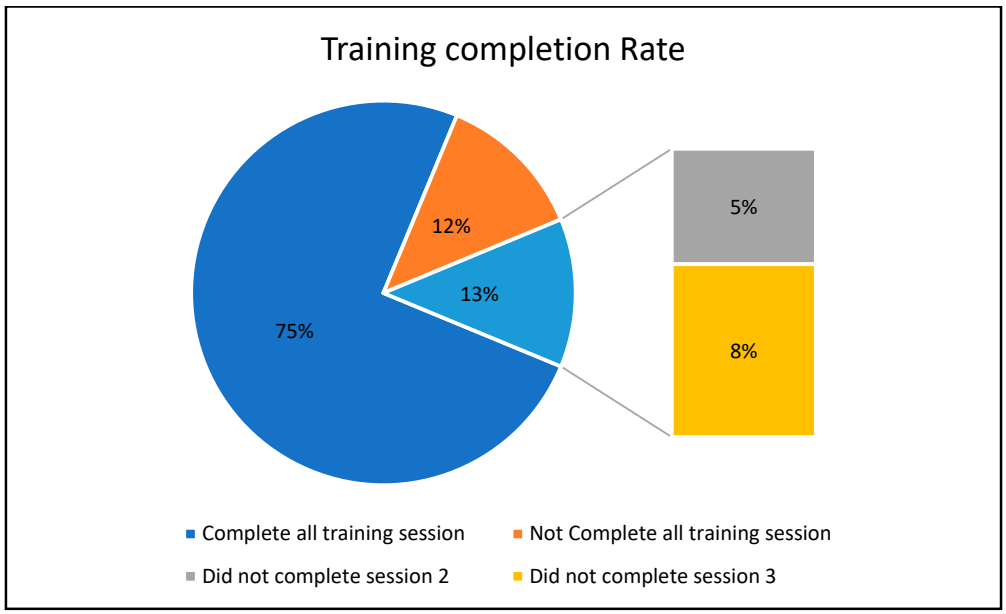

Figure 5. Training completion rate.

As shown in Figure 6, the preferences of participants concerning the time and place of the training sessions were taken into consideration. It was seen as most convenient by the majority of participants to undertake the activities during their free time at school and home (8% and 80%, respectively), such as at lunch (8%), between their school classes (4%), and before meetings (21.56%).

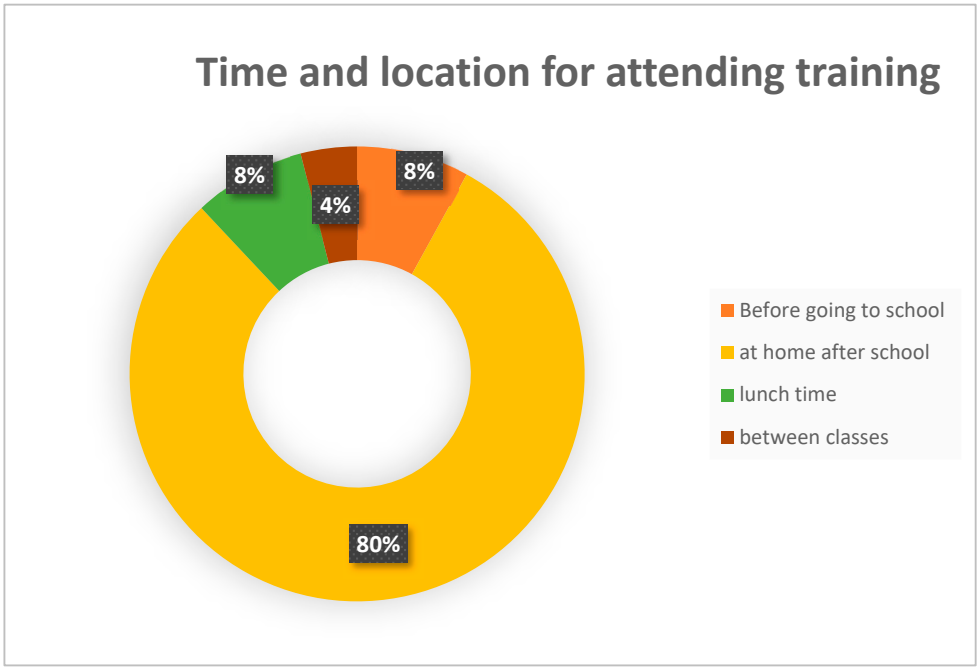

Figure 6. Time and location for attending training.

Table 4 shows the perceived usefulness: only one participant (3%) was neutral, while the majority either agreed (29%) or strongly agreed (69%) that the mobile-based training certification system was useful. Learner interface: all participants either agreed (14%) or strongly agreed (86%) that the mobile-based training certification system had a good interface for learners.

Table 4. Online survey results.

Variable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Perceived usefulness	0 (0%)	0 (0%)	1 (3%)	10 (29%)	24 (69%)
Learner interface	0 (0%)	0 (0%)	0 (0%)	5 (14%)	30 (86%)
Content	0 (0%)	0 (0%)	1 (3%)	4 (12%)	30 (86%)
Personalization	0 (0%)	1 (3%)	0 (0%)	6 (17%)	28 (80%)
Learning satisfaction	0 (0%)	0 (0%)	0 (0%)	7 (20%)	29 (83%)

Content: only one participant (3%) was neutral, while the majority either agreed (12%) or strongly agreed (86%) that the mobile-based training certification system had good content. Personalization: only one participant (3%) disagreed, while most participants either agreed (17%) or strongly agreed (80%) that the mobile-based training certification system was personalized to their needs. Learning satisfaction: no participants strongly disagreed or disagreed with the statement, while most participants either agreed (20%) or strongly agreed (83%) that they were satisfied with the mobile-based training certification system. The results in Table 5 indicate that the control group's average pre-test score was 14.5, and the average post-test score was 24.5. According to the post-test results, mobile-based training greatly affected teachers' learning outcomes. This was in line with the findings from [22,46,80–82,86] that mobile-based training increases learner success and improves cognitive capacities.

Table 5. Achievement tests mean score results.

Test	Group	N	Mean
Pre-test score	Control	35	14.5
Post-test score	Control	35	24.5

7.2. Feedback from Training Participants

Teachers were also asked to remark on the training prototype. Some teachers remarked that they believed the training was difficult at first, but it was not. At first, there was some confusion about what mobile learning was. Some teachers said that the training helped them review the content. During this training, participants were reminded of work completion deadlines. Some teachers said the training reminders helped them. The reminders encouraged them to participate. Course material: All teachers were highly satisfied with the content and its sequencing. They noted that the objectives were clear and defined, including the training activities. The videos were also connected to the session objectives and course subject.

Activities: Despite having fast replies, most of the teachers said the interactive exercises were simple to complete. They acknowledged the necessity of activities that foster higher-order thinking and challenge them. All teachers emphasized the importance of using a discussion forum to encourage sharing and collaboration among their students. The results of the pop quiz were available immediately. Some teachers voiced the need for a more creative method of providing feedback.

Interface: Of the teachers, 95 percent expressed great satisfaction with the interface, which they found to be easy and appealing. It featured an appropriate screen structure as

well as font and media size. Others expressed the need for a more professional and visually appealing design. Positive feedback was received from participants in general on their experiences throughout the course assessment process. All of the teachers (100%) thought that this was a groundbreaking educational project, and they were enthusiastic about the prospect of using this platform. Of the participants, 98 percent expressed satisfaction with learning via the use of a mobile device, stating that it was simpler and more enjoyable than studying through the use of a computer or face-to-face training programs. They also said that the screen designs were appealing, fascinating, and effective, and their learning process was more impactful as a result of the screen designs. One respondent expressed the desire that future courses spanning a variety of subjects might be offered in a similar manner.

It was important to gather feedback from Saudi and Pakistani teachers on the proposed mobile-based training certification framework for teachers' professional development in the context of both countries. The feedback provided insights into the framework's effectiveness, relevance, and practicality, allowing for the further improvement and refinement of the framework. Below is the feedback obtained from teachers.

Feedback from Saudi Teachers:

- Many teachers found the mobile-based approach convenient and flexible, as it allowed them to access learning materials on the go and at their own pace.
- The integration of certification mechanisms was seen as a positive aspect of the framework, as it incentivized teachers to engage in the learning process and provided recognition for their efforts.
- Some teachers suggested that the framework could benefit from more interactive and collaborative learning activities to enhance engagement and facilitate knowledge sharing among peers.
- Additionally, some teachers noted that the framework could be adapted to address specific needs and challenges faced by teachers in different regions of Saudi Arabia.

Feedback from Pakistani Teachers:

- Pakistani teachers found the framework to be relevant and applicable to their context, as it addressed competencies that were important for teaching in Saudi Arabia and could also be relevant for teaching in Pakistan.
- The mobile-based approach was seen as a promising solution for providing TPD opportunities to teachers in remote areas of Pakistan who may have limited access to traditional face-to-face TPD programs.
- Some teachers suggested that the framework could benefit from incorporating more cultural sensitivity training to enhance teachers' understanding of the Saudi Arabian context.
- Additionally, some teachers noted that the framework could be adapted to address specific needs and challenges faced by teachers in different regions of Pakistan.

Overall, the feedback suggested that the mobile-based training and certification framework for teachers' professional development has the potential to be an effective approach for enhancing teachers' competencies in both Saudi Arabia and Pakistan. The feedback also highlighted the importance of adapting the framework to address specific needs and challenges faced by teachers in different contexts.

8. Conclusions

Teachers play a key role in providing quality education; however, the quality of the teaching and learning process is affected by many challenges, such as inadequate facilities, a lack of training opportunities, and dependency on conventional methods. The current CPD programs were developed for traditional training and are not aligned to support the use of technology. Due to its numerous advantages, the use of technology has received much attention in the teaching and learning process. The proposed mobile-based training and certification framework for teachers' professional development has the potential to enhance the quality of education in both Saudi Arabia and Pakistan. The framework

addresses the challenges of accessibility, flexibility, and effectiveness in providing TPD opportunities to teachers. The mobile-based approach offers on-the-go and personalized learning experiences, and the integration of certification mechanisms incentivizes and recognizes teachers' efforts to improve their competencies.

The mobile-based TPD and certification frameworks were found to be effective approaches for enhancing teachers' competencies, and the feedback from Saudi and Pakistani teachers further supported this notion. However, it is important to note that the framework should be adapted to address specific needs and challenges faced by teachers in different regions and cultural contexts. The suggested framework is cost-effective, flexible, contextual, and collaborative. Resourcefulness and ease of use are quality parameters. The framework comprises five main components: the support of a mobile phone for CPD, a training curriculum and assessment, training activities, expert support, rewards, and CPD evaluation. The framework helps teachers optimize their professional skills and improve their knowledge and skills to impart quality teaching and learning at the school level.

The piloting results of the study suggested that the training course evaluations were positive. Of the teachers, 100% agreed that the framework was a groundbreaking endeavor in education and were thrilled to use it. Ninety-eight percent found mobile learning to be easier and more fun than other traditional modes of learning. Teachers found that the screen designs were attractive, interesting, and helpful for their students' learning. The proposed system could be used to develop pedagogical and technological mobile learning courses in Saudi Arabia and Pakistan and a worldwide teaching community. In addition, the framework could help instructional designers construct relevant mobile learning lessons. Rapid app development and easy network connections allow people to self-develop, share expertise, and access information anytime. The findings of this study serve as a guideline for the adoption of mobile learning for professional development, with the purpose of empowering teachers in their professional growth. Further research is needed to evaluate the effectiveness of the proposed framework and explore its potential impact on improving the quality of education in Saudi Arabia and Pakistan. Additionally, the framework could be further refined by incorporating more interactive and collaborative learning activities and incorporating cultural sensitivity training. Overall, the proposed framework presents a promising approach for enhancing teacher professional development and ultimately improving the quality of education in Saudi Arabia and Pakistan.

Limitations: The mobile-based training and certification framework for teachers' professional development had a few limitations. Firstly, the study only focused on teachers in Saudi Arabia and Pakistan, limiting the generalizability of the results to other contexts. Secondly, the sample size was relatively small, and future studies should scale up to increase the reliability of the findings. Finally, the study did not provide a detailed analysis of the framework's effectiveness in improving teacher knowledge and skills, which hindered the assessment of its impact.

Future works: In the future, in order to enhance the effectiveness and adoption of the mobile-based training certification framework for teachers' professional development, certain steps should be taken. These include testing the framework in different educational contexts, conducting an in-depth analysis of its impact on teacher knowledge and skills using rigorous evaluation methods, exploring the perceptions of all stakeholders involved, identifying factors that may hinder adoption, developing a comprehensive training program for teachers and school leaders, conducting longitudinal studies to assess its long-term impact, and exploring the potential for gamification and other innovative approaches to enhance the engagement and motivation of teachers. These research directions would aim to refine and improve the framework and increase its potential for widespread adoption in diverse educational contexts.

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