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PAPER

A Mobile Training Context for In-Service Teachers: Methods of Training and Task Practice to Enhance E-Content Production Skills

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ABSTRACT

Mobile training is one of the modern training systems resulting from the integration of innovations in information and communication technology (ICT), which can be used to solve the problems of traditional training in educational institutions. Therefore, it is important to study the design variables of such training that enhance its effectiveness. Thus, the present study aims to design a mobile training context (MTC) and to investigate the effect of interaction between the training method, i.e., whole task (WT) versus part task (PT), and the task practice method, i.e., massed practice (MP) versus distributed practice (DP), on the skills of e-content production of 52 public education teachers in Jeddah, Saudi Arabia, through using the semi-experimental approach and the factorial design (2 × 2). Furthermore, an application-oriented knowledge test was used to measure the participant teachers' skills through their application of 208 items related to e-content design, production, and publishing. Findings showed the effectiveness of part-task training (PTT) compared to whole-task training (WTT) and the effectiveness of the massed practice method (MPM) compared to the distributed practice method (DPM). In addition, there was a preference for the massed practice for part-task (MPPT) treatment in comparison to other treatments. This result encourages the possibility of providing a successful MTC for training in different skills. However, further research is still required to optimize the expected future potential of the mobile training context.

KEYWORDS

mobile training, training method, task practice method, e-content production skills

1 INTRODUCTION

The COVID-19 pandemic prompted educational institutions around the world to gradually expand the use of e-learning contexts. Educational institutions were to focus on providing in-service teachers with qualitative skills that enable them

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to adapt to the renewed requirements of new learning contexts [1, 2]. The competency of e-content production skills is one of the competencies that are required to enhance the teacher's performance in e-learning environments. These skills can be categorized as complex psychomotor skills that require the time and effort of the teacher to acquire and practice them and consequently design, produce, and publish the e-content and control its educational and technical quality [3, 4]. In addition, e-content production skills are difficult to be trained on via regular training programs because of some factors related to the length of the training period, adherence to a specific time and place, and the use of traditional training tools and methods that make creating modern and flexible training contexts an important case for educational institutions to provide their teachers with the required skills [5, 6].

The rapid development of information and communications technology (ICT) helped the emergence of non-traditional training patterns based on the use of mobile devices such as laptops, smart phones, and tablets, which is nowadays known as mobile training [7, 8]. This pattern provides a flexible training context with no constraints on time or place; takes into account the trainees' characteristics and provides them with multiple opportunities to interact; saves time, effort, and cost; and expands the self-training culture [9, 10]. Mobile training can be an ideal solution that fulfils the organizations' need for flexible and effective training environments to improve their outputs and achieve their goals in line with the trainees' needs and capabilities. It may also be a suitable context for training on many qualitative skills because of its ability to provide multiple methods and tools to facilitate communication and interaction between trainees and provide opportunities to access various examples and learning resources related to the subject of training. Besides, mobile training is consistent with the recent trends of educational institutions and research priorities that focus on improving the contexts and systems of education and training and relying on digital resources after the dissemination of the COVID-19 pandemic [11]. Therefore, designers of the training programs should have a clear perception regarding the design variables affecting the effectiveness of the mobile training context (MTC), such as feedback, training method, presentation sequence, and task practice method, because good instructional design can provide a flexible and effective environment for training. Nevertheless, the present study is limited to these two main variables, i.e., the training method and the task practice method.

The training method is considered one of the variables that affects the efficiency and results of training [12]. There are many methods of training for both simple and complex tasks. Whole-task training (WTT) is one of the common training methods that deals with each task as a single unit and depends on assigning trainees to complete a whole task (WT) in each training session [13]. Part-task training (PTT) method, which depends on dividing the task into parts, i.e., sub-tasks, and then training on each part separately to enable the trainee to perform the WT [14]. In general, previous literature has shown the advantage of WTT in simple tasks and the advantage of PTT in complex and dangerous tasks [15], despite the fact that the majority of studies, for instance [16, 17], showed the advantage of PTT in comparison with WTT. Nevertheless, the choice of the most appropriate training method depends on a number of factors, among which the most important are the characteristics of tasks, trainees, individual differences, and training context [15]. Therefore, there is a need to compare them across the context of mobile training, which is different in nature from other training contexts.

Within the same context, the method of task practice is one of the design variables related to time duration for task practice and rest periods during training sessions, which might affect its success and trainees' continuity in it. Task practice methods,

in general, can be classified into massed practice methods (MPM) and distributed practice methods (DPM) [18]. MPM refers to training that occurs through consecutive and intensive sessions where trainees continuously practice a number of tasks with little or no rest periods. DPM, on the other hand, is defined as non-intensive training where participants work more comfortably by being assigned fewer tasks and having rest breaks during and between sessions [19]. In addition, the determination of the optimal practice pattern depends on various factors, such as training context, type of skills, and task nature. Therefore, MPM is more likely to be used in complex tasks that require long time periods and continuous practice and in late training stages that seek speed and mastery [20, 21]. Moreover, DPM is expected to be more appropriate in the initial stages of skill learning and when practicing difficult tasks that require great effort so that trainees do not feel bored and unwilling to continue [22].

The research gap of the current study lies in the fact that teachers suffer from poor e-content production skills, which requires searching for solutions to improve these skills. This weakness was found during teachers' enrollment in the "Development and Publication of E-Content" course. The course includes integrated skills for producing e-content, such as dealing with various multimedia, creating navigation systems within the content, and publishing the content. Teachers were followed up on and monitored while carrying out tasks related to e-content. Then it was practically evaluated during the educational lessons. There was a clear weakness, which prompted the researcher to think of training solutions to improve these skills.

In addition, there is a need to conduct more studies regarding the variables influencing the design of MTC. The training method and its relationship to the task practice method are among the variables that can play a vital role in enhancing the efficiency and flexibility of MTC. The training method determines how the task is carried out, either at once or in several stages, and consequently, it may affect the trainee's ability to complete the tasks and the cognitive load that he may be exposed to during training. In addition, it may control the trainee's training content understanding and comprehension. It also may control information organization in their memory, their ability to link it to their previous information, and the ease of retrieving it when needed [14, 23].

On the other hand, the task practice method plays a significant role in psychomotor skill acquisition through controlling rest periods within and between sessions [24]. Thus, it affects training flexibility and the cognitive load to which the trainee may be exposed. In addition, it affects their ability to perform and re-perform skills and the extent to which experiences provided to them are connected and interdependent [25, 26]. Consequently, it is expected that there is relationship between the training method (WT/part task (PT)) and the task practice method (massed practice (MP)/distributed practice (DP)), but it still needs further study.

In addition, interviews with an exploratory sample of 70 intermediate school teachers in Jeddah Governorate, Saudi Arabia, to determine the extent to which they possess e-content production skills and their ability to use them in learning contexts revealed that 90.23% of them had some basic skills related to e-content production. They learned it by using programs such as Lecture Maker 2, Course Lab, and Articulate Storyline through participation in previous face-to-face training courses. However, 93.45% of them were not good at practicing and using them effectively to support their academic courses. Moreover, 98.56% of them expressed their need and willingness to receive training regarding these skills if a flexible training program that takes into account their individual characteristics and working hours is provided.

Based on what has been mentioned and in light of the e-content production skills of public education teachers and their need to acquire them, mobile training was a solution proposed to develop in-service teachers' skills, mainly in light of their ownership of all its requirements, such as mobile devices and applications. Because the training method (WT vs. PT) is one of the variables affecting the trainee's ability to complete the tasks, it was important to study the effect of its interaction with the task practice method (MP vs. DP) as one of the influential design variables related to training flexibility and trainees' continuity in light of work pressure and the limited time they have. Accordingly, the present study attempts to answer the following question:

RQ 1: To what extent do the training method (WT vs. PT) and task practice method (MP vs. DP) besides their interaction affect the development of in-service teachers' domain-specific skills related to e-content production?

No significant differences between both treatments and their interaction in the post measurement of the application-oriented knowledge test were expected.

2 LITERATURE REVIEW

2.1 E-content production skills for in-service teachers

COVID-19 pandemic has made teachers' coping with e-learning environments mandatory. Accordingly, educational e-content production skills have become one of the most important professional competencies for in-service teachers [27, 28]. E-content is one of the basic elements that make up the e-learning environment. It is known as a multimedia digital version of the educational course that is designed, produced, and published in accordance with pedagogical and technical standards to provide students with the knowledge and skills required to achieve the goals of e-learning. Nevertheless, good production of e-content is a difficult and complex process that requires teachers to deal with many multimedia such as texts, images, sounds, videos, etc. It also needs the use of various tools to create navigation and interaction systems within the content. Furthermore, it is important to account for the educational foundations that ensure the content's appropriateness to students mental and cognitive processes. It takes into account the student's characteristics and needs and increases their motivation to learn, in addition to the technical foundations associated with the e-content design and production, such as pages, navigation tools, and interaction, that enable the student to interact with the content and increase his activity and opportunities to achieve the educational goals [3, 29]. There is no doubt that the teacher's lack of the required skills to produce the e-content in an appropriate way for their students will negatively affect the content quality and cause many problems such as stagnation, navigation difficulty, and lack of novelty [30].

In brief, e-content production skills are one of the basic skills that educational institutions are keen to enable in-service teachers to acquire through specialized training programs. However, such programs are often presented in a traditional way that does not allow trainees to regularly attend them. They also do not take into account the individual differences between teachers, which negatively affects their effectiveness [31]. Therefore, the present study aims to improve the e-content production skills of in-service teachers through a proposed mobile training context.

2.2 The MTC to enhance e-content production skills

Mobile training is one of the modern training systems for in-service teacher training that depends on the use of mobile devices and their applications, as well as the variation in interaction methods and tools to meet trainees' needs and account for the individual differences between them. It is also a promising alternative to overcome the challenges related to face-to-face training, such as large numbers of trainees, a lack of needed competencies and basic information, a need for motivation, and trust and care factors. These challenges also involve challenges related to training time, place constraints, and high cost, with the result that educational institutions nowadays are highly interested in mobile training [31, 32]. The importance of mobile training lies in its flexibility and ability to achieve the optimal investment of trainees' time. It also provides integrated media content that gives the trainee the ability to interact and navigate between its parts. In addition, it gives the trainee the ability to control the speed of its presentation according to his needs. Furthermore, it protects the privacy of trainees and provides them with many opportunities to interact, learn, and exchange experiences with their peers and trainer [9].

The context of mobile training consists of several integrated components to achieve the desired goals. The first of these components is the objectives, which define the outcomes the trainee is expected to achieve at the end of training. The second one is the content that represents the scientific material, including knowledge and skills trainees should acquire to achieve the training objectives. Besides, the training context is comprised of individual and group tasks within the training sessions. Training strategies such as individual and collaborative learning and discussions are also another component of MTC. Through such strategies, trainees' privacy and active participation can be achieved, their needs can be fulfilled, and their motivation and continuity in training can be increased. In addition, evaluation is another important component to identify the points of strength and weakness and ensure that training is progressing in the right direction towards achieving its goals. As well as individuals, the human component is represented in the trainers and trainees. Besides, mobile devices and their applications, such as WhatsApp and YouTube, and mobile software such as MS Office and Articulate Storyline are also essential components of the MTC [33].

Among the empirical evidence that proved the effectiveness of using mobile devices in education and training is the study of Zervas and Sampson [34], which provided an effective framework to support, share, and reuse language learning resources in a mobile learning context. The study of Gloria and Oluwadara [33] is another study that demonstrated the effectiveness of mobile training in improving the self-efficacy of pre-service social studies teachers associated with the use of mobile phones in education. Another study by Seppälä and Alamäki's [9] also confirmed the effectiveness of using mobile technology in training teachers to perform educational activities related to solving some problems related to teaching methods, in addition to providing trainees with support and facilitating communication and interaction between them to provide innovative solutions to problems.

In short, the empirical evidence has provided positive indications about the possibility of providing in-service teachers with e-content production skills through mobile training. However, the focus of the present study was on investigating the effect of two main variables, namely training method and task practice method, because of the large number of design variables associated with the mobile training context.

2.3 Training method and task practice as approaches to developing MTC

The present study focuses on two main variables that greatly control the flexibility and effectiveness of the MTC and its ability to meet the trainees' needs. The first is the training method, which determines the way in which tasks are presented to the trainees, either in the form of a WT or divided into subtasks, PT, where the trainee deals with each of them separately. Therefore, it is a factor that affects both the trainee's ability to complete the tasks and the cognitive load to which they may be exposed during training. In addition, it determines the extent to which the trainee understands and comprehends the training content, organizes information in their memory, and links it to their previous information, besides the ease of retrieving it when needed [14, 23]. The second variable the present study has focused on is the task practice method, which plays a significant role in the acquisition of psychomotor skills, either through intensifying work periods without allowing trainees breaks during sessions (MP) or by distributing work and allowing trainees sufficient breaks in each session (DP) [24]. Thus, it may affect the flexibility of training, the cognitive load to which trainees may be exposed, their ability to practice and re-practice skills, and the extent to which experiences provided to trainees are connected and interdependent [25, 26].

Training method (WT vs. PT). The present study focuses on two basic methods of training: the WTT, where the task is a single unit that should not be broken down and should be completed in the same session, and the PTT, which depends on dividing the complete task into subtasks, and then trainees practice each sub-task independently in each session as a preparation for practicing the WT later [15]. PTT has three main forms: (1) segmentation, which targets trainees' focus on the task's most important components and then arranges them in a backward or forward chaining; (2) fractionation, which relies on training participants on two tasks or more independently; and (3) the simplification method, which depends on simplifying complex tasks by reducing the difficulty degree performed by the trainee [35].

In general, the literature review indicated that WTT is the preferred method when the task is simple. The trainee can appropriately deal with and accomplish it to save cost and effort for tasks' division and re-integration tasks, as in the case of PTT. But if the task is complex or dangerous, it is better to divide it into sub-tasks, and PTT will be the most appropriate choice, given the importance of introducing the trainees to the whole task before starting training on its parts [15]. With reference to the related literature, multiple attempts to compare the two methods and then determine the most effective one have been identified. For example, McGeoch's [36] ascertained the superiority of WTT when training on whole syllables of poetry in comparison with training independently on (8) parts of one syllable. In addition, Briggs, Naylor, and Fuchs [37] compared the three forms of PTT and WTT in terms of task complexity level and level of organization, i.e., degree of interdependence between task components. Results showed that WTT was better in the case of tasks of organization at higher levels, regardless of their complexity levels. Meanwhile, PTT was better in the case of tasks of high complexity and low organizations.

On the other hand, many studies revealed that PTT was superior to WTT [16, 38, 39]. For example, Wightman and Sistrunk [16] showed the superiority of PTT to WTT when training participants to fly at different altitudes using a desktop flight simulator. In general, the majority of studies indicated a preference for PTT over WTT. However, other studies showed contrary results. Inconsistency and contradiction in these results are attributed to various factors such as nature of the task, the trainees' individual characteristics, and the training context used [12, 15].

This, of course, assures that the issue is not settled if a comparison between the two methods in the MTC is held. Therefore, the present study aims to compare WTT and PTT and determine the optimal training method via MTC to develop in-service teachers' e-content production skills.

Task practice method (MP vs. DP). The present study deals with two methods of training task practice, i.e., MPM and DPM, where the difference between both lies in the factors of work intensity and rest periods within sessions [40]. MPM depends on increasing and intensifying the trainees' work to accomplish the required tasks within the session, i.e., learning, practicing, and applying a greater number of skills, in addition to reducing or not allowing rest periods. Therefore, each trainee gets more practice opportunities in a short time, which increases his ability to learn faster, helps to link acquired information and ideas, and reduces the possibility of forgetting them [25]. On the other hand, MPM may lead to boredom, fatigue, and trainees' dispersion as a result of the large amount of information they receive in a short time. While DPM depends on work distributing and not condensing it within the session, i.e., learning, practicing, and applying fewer skills, and allowing trainees sufficient rest periods during sessions, the learning process needs more time and at the same time limits trainees' exposure to distraction, boredom, and cognitive overload. Moreover, it helps them store and retrieve information faster and reduces inhibition [41]. The findings of previous studies varied and did not show any absolute preference for any of the two task practice methods. Some studies showed the superiority of MPM [26, 42], others indicated preference for DPM [19, 21], while other studies did not reveal any significant differences in favor of any of them [43]. In addition, there is a clear shortage in the studies that dealt with both of them in the MTC. Thus, the present study is a trial to bridge this gap and determine the most appropriate practice periods to enhance the effectiveness of mobile training.

3 THEORETICAL FRAMEWORK

In accordance with the cognitive theory of multimedia learning, presenting information to learners through visual and audio multimedia elements together increases their ability to build meaningful connections and better form and organize their cognitive structure [44, 45]. This is exactly what is expected to be achieved and supported through MTC, which is characterized by the diversity and integration of information forms that make it easy for the learner to connect and store in his cognitive structure. Social learning theory, on the other hand, confirms that the learner receives his learning and builds his knowledge through his interaction with the surrounding environment, experiences, and knowledge exchange with others [46]. In line with the orientations of this theory, it can be argued that MTC can provide learners with multiple opportunities for communication and interaction to enhance their experiences and build their skills. Furthermore, constructivism learning theory claims that the construction of knowledge takes place in an active manner that depends on the learner's positivity, and thus he can create subjective self-meaning resulting from knowledge [47]. This claim is consistent with the nature of mobile training, which not only puts the trainee at the center of the training process but is also positive in his interactions with others and while practicing the training tasks. The gestalt theory also believes that the individual's way of realizing things lies in form and the public structure as a whole, not in parts or details. The individual perceives the whole as an integrated unit and then progresses to details. His understanding of the task occurs through understanding and organizing relationships

between its parts to get the full meaning of what is called insight [48]. In this sense, field theory, on the other hand, asserts that behavior is an integrated whole, and splitting it into parts causes it to lose its meaning and be difficult to analyze [49]. Therefore, both the gestalt and field theories show preferences for WTT and MPM that depend on training intensification and WT accomplishment during one training session. Nevertheless, behavioral theory believes that behavior is a complex unit that should be easily understood [50]. Cognitive load theory indicates that whenever information in short-term memory increases, the greater the learner's cognitive load is, which may lead to negative learning outcomes [51]. Information processing theory, through the chunking principle, emphasizes the division of content into smaller units that are easy for memory to retain, remember, and retrieve [52]. In this context, behavioral theory, cognitive load theory, and information processing theory show preference to PTT and DPM, which depend on non-condensation, distribution to several sessions, and division of complex tasks into sub-tasks that trainees are trained on before practicing the task as a whole.

4 METHODOLOGY

4.1 Approach

The quantitative method has been followed, where the research requires implementing quantitative approaches and thereby reaching results that reflect the effect of both treatments and their interaction through MTC on the skills of e-content production. The descriptive method and quasi-experimental method were adopted (see Table 1), which are the most commonly used methods in human research to investigate the effect of a particular technique on one or more dependent variables [53].

Table 1. Quantitative approaches used in the research

No	Approach	Objective
1	Descriptive Approach	• To analyze previous studies related to the mobile training context, its design variables (training method and task practice method), and e-content production skills • To analyze and develop MTC
2	Quasi-Experimental Approach	To study the causal relationship of the results of the quantitative effect of the independent variables (training method and task practice method) on the dependent variable (e-content production skills)

4.2 Design

An experimental design known as factorial design 2 x 2 was used for the training method (WT vs. PT) and the task practice method (MP vs. DP) as independent variables. Training was conducted across all experimental conditions through a MTC. The first condition (C1-MPWT) performed WTs during intensive training sessions, while the second condition (C2-DPWT) performed the same WTs but in a distributed way through non-intensive sessions. On the other hand, the third condition (C3-MPPT) performed PTs during intensive training sessions, while the fourth condition (C4-DPPT) performed the same PTs through distributed practices (see Table 2).

Table 2. The experimental design of the study

		Training Method	
		WT	PT
Task Practice Method	MP	(C1-MPWT)	(C3-MPPT)
	DP	(C2-DPWT)	(C4-DPPT)

4.3 Participants

The basic sample of the present study consisted of 52 intermediate school teachers in Jeddah Governorate, Saudi Arabia, in the first semester of the academic year 2021–2022. All of the participant teachers were male. The mean score of their ages was (M = 27.00, SD = 0.71). The sample was selected in two stages: the first stage involved purposefully selecting teachers based on their enrollment in the "*Development and Publication of E-Content*" course offered by the instructional technology department at the College of Education, University of Jeddah, their regular attendance of lectures, and their desire to train in e-content production skills. In the second stage, the sample was randomly divided and equally distributed among the four research conditions, with 13 teachers in each condition. Their task in the present study was to go over the training content, which consisted of four modules (8 lessons) and was related to e-content production skills. Moreover, they were requested to design, produce, and publish an integrated e-content project in their area of specialty using Articulate Storyline 2.4 software.

Participants' needs and ethics. The sample consisted of all graduate students who studied the course "*Development and Publication of E-Content*" as a part of the instructional technology program at the University of Jeddah during the first semester of the academic year 2021–2022. At the same time, they worked as middle school teachers in Jeddah Governorate. They had a desire and interest in acquiring e-content production skills as they related to their work as teachers. They found it difficult to master these skills through traditional lectures due to the limited official time available for studying graduate courses. In addition to the difficulties associated with their work pressures and the limited time available, which prevented them from participating in traditional training programs. Therefore, there was a need to find a training context that provided them with sufficient flexibility and met their training needs. MTC was an ideal and desirable option for all participants, as all the necessary equipment and applications were available to them. Since the training method and task practice method are factors that affect the success of the training context and the regularity of trainees in it, it was necessary to investigate their impact on the e-content production skills of teachers. With respect to ethics, the research team applied the ethical rules of scientific research adopted by the University of Jeddah. The team explained to the participants the purpose and scope of the research, as well as the rules of participation, including the option to withdraw without giving any reasons if they were dissatisfied with the training. The team also ensured the confidentiality of the sample's information and encrypted it in all research groups by assigning a code for each condition and a number for each participant within the condition as follows:

- C1-MPWT: 13 teachers from A1: A13.
- C2-DPWT: 13 teachers from B1: B13.
- C3-MPPT: 13 teachers from C1: C13.
- C4-DPPT: 13 teachers from D1: D13.

4.4 Dependent variable and instrument

To evaluate the trainees' results, a posttest was conducted to measure the individual skills of each trainee in accordance with e-content design, production, and publishing. An application-oriented knowledge test was adopted to evaluate the participants' practice of the various functions of the Articulate Storyline software, whose values ranged between (0) indicating that the skill could not be practiced, (1) showing that there was an error but corrected with the help of the trainer, and (2) indicating that the skill was correctly practiced. Furthermore, the test consisted of 208 items representing skills and practice aspects. Accuracy, clarity, and brevity were taken into consideration when formulating each item to measure only one function. The application-oriented knowledge test was presented to nine experts and educators who are proficient in e-content production to verify the validity of the statements. The reliability coefficient of the test was sufficient ($\alpha = .87$). Besides, the test total score was 416 grades, i.e., 208 items × 2 points max for each item = 416.

4.5 Procedure

Mobile training context consisted of mobile devices represented in trainees' smart phones and laptops that were mainly used to study content and practice e-content production skills, besides three mobile applications. The WhatsApp application was used for quick communication between the trainer and the trainees in matters related to instructions and technical support. The Blackboard application was used to manage training-related processes such as presenting content and conducting discussions among trainees. The YouTube application was also used to provide enrichment training resources related to the required skills. With regard to laptop software, trainees were restricted to using Articulate Storyline 2.4 software to produce e-content (see Table 3).

Table 3. Mobile devices and applications used in MCT

No	MCT Components	Objective
1	Smart Phones	They were used as basic devices in training for the purpose of studying content, carrying out some tasks, conducting discussions in small groups, and communicating with the trainer to obtain support and feedback.
2	Laptops	They were mainly employed during the practical practice of e-content production skills. They were also available for use when studying content and carrying out training activities (e.g. discussions with peers, sending projects to the trainer for feedback).
3	Mobile Applications	• **WhatsApp App.** To provide directions, respond to inquiries, provide technical support, and remind the schedule of training sessions • **Blackboard App.** To display training content lessons, conduct discussions between trainees, and upload projects files to the trainer for feedback. • **You Tube App.** To display and share enrichment videos to support trainees' acquisition of required skills
4	Laptop Software	• **Articulate Storyline 2.4 Software.** To design, produce and publish e-content

The hierarchical analysis of the training content was adopted in the present study to determine the training goals. Eight goals related to the use of the Articulate Storyline software in the design, production, and publishing of the e-content were identified. Then the appropriate content to achieve each goal was identified and represented in the form of a multimedia lesson. After that, one basic task for each lesson that trainees were to achieve to fulfill its objectives was identified. Every two integrated lessons were compiled into one module, and thus the content consisted of four modules divided into eight lessons. The list of training tasks consisted of eight basic tasks and included 208 skills trainees were to acquire at the end of the training program (see Table 4).

Table 4. Distribution of the content, tasks and skills

No	Module Title	Number of Lessons	Tasks	Number of Skills
1	*First steps to producing E-content*	2	Adjusting working environment	21
			Adding content items	18
2	*Dealing with the digital content*	2	Dealing with content elements	35
			Adding improvements and effects	20
3	*E-evaluation*	2	Building e-tests (part 1)	33
			Building e-tests (part 2)	35
4	*E-content preview and publish*	2	Project preview and adjusting player settings	25
			Project publishing	21
Total		8		208

The duration of all training sessions was uniform. Each session lasted for 90 minutes. To accomplish the required task. Trainees were to be trained during three basic stages. The first stage, called "*Learning and Practice*," included an introduction to the session, a definition of its objectives, and the presentation of multimedia lesson(s) as training content, i.e., the duration of one lesson is five minutes maximum to show trainees the correct practice of the e-content skills, and then allowing trainees the opportunity to practice the skills individually. The second stage, i.e., "*Project Building*," was assigned to produce a preliminary project related to the lesson(s) topic(s) presented in the first stage. The project in that stage was part of the final project each trainee should have submitted at the end of the training program. The second stage began by defining the project by the trainer and clarifying its relation to the previous and subsequent projects. Trainees were then provided with examples of good and bad ready-made projects to analyze based on standard criteria for e-content building [54, 55]. After that, trainees started designing and producing the project in its initial form and sending it within the group assigned for discussions via blackboard before starting discussion. The third stage "*Project Finalization*," targeted trainees' discussion of the individual projects within small groups, comparing them, and providing feedback and proposals for improvement. Each trainee was allowed the opportunity to modify his project and present it in its final form.

The trainer's role was limited to session introduction, introducing its importance and work mechanism, following up on trainees' task practice, providing them with

the necessary materials such as lessons, projects, and examples of ready-made projects, providing instructions and technical support during sessions, in addition to evaluating trainees' final projects and providing appropriate feedback for each trainee.

The time allotted for carrying out tasks differed according to the training method and method of task practice (as shown in the experimental conditions below). In the WTT groups, the three stages together comprised the WT to be completed by trainees within the same session. Therefore, the total session time was divided equally over the three task stages. In PTT groups, the WT was divided into sub-tasks based on the forward-chaining segmentation method, and so training on the task parts was carried out sequentially. The trainee had to finish the first part of the task at first, and then the second part of the task could be added to the first part, and so on until the task was completed. Thus, each of the three task stages was a sub-task to be trained on separately in an independent session of 90 minutes so that trainees could practice the WT at the end. With regard to massed practice method (MPM) groups, trainees practiced the WT or subtasks intensively without rest periods during sessions. While in the distributed practice method (DPM) groups, trainees practiced tasks in more comfortable ways by distributing work in a balanced way and having rest periods within all sessions. To achieve this, the times allotted for the skills of one lesson in the DPM method were equal to or more than the times allotted for the skills of the same lesson in the MPM method.

With regard to the training mechanism in each experimental condition, it was as follows:

Condition 1: Massed practice for whole task (C1-MPWT). The training program for the C1-MPWT consisted of four sessions, one session per day for four consecutive days. Trainees carried out the three task stages, i.e., *learn and practice*, *building a project*, and *finalize the project* sequentially in the same session. Carrying out each stage lasted for 30 minutes. In each session, trainees had to learn, practice, and apply the skills related to the whole module (two lessons together) without having rest breaks, as presented in Figure 1.

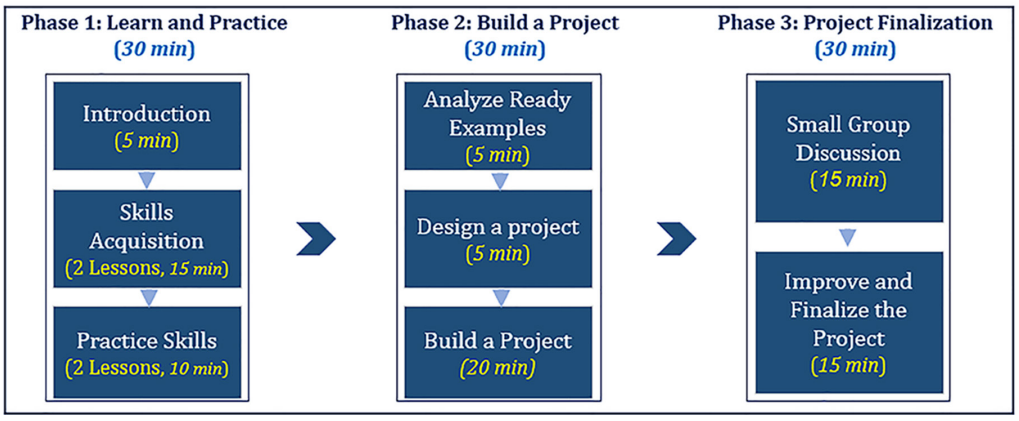

Fig. 1. The stages of carrying out an entire task during one session in the C1-MPWT

Condition 2: Distributed practice for the whole task (C2-DPWT). The training program for the C2-DPWT consisted of eight sessions, with a maximum of three

sessions weekly. The trainee completed the three stages of task application during the same session and three rest periods. The practice period for each stage lasted 25 minutes, interspersed or followed by five minutes of rest, so the total rest time was 15 minutes per session. The intensity of training in this group was lower in comparison with the intensity of C1-MPWT, as trainees in this condition had to learn, practice, and apply the skills of only one lesson per session, as presented in Figure 2.

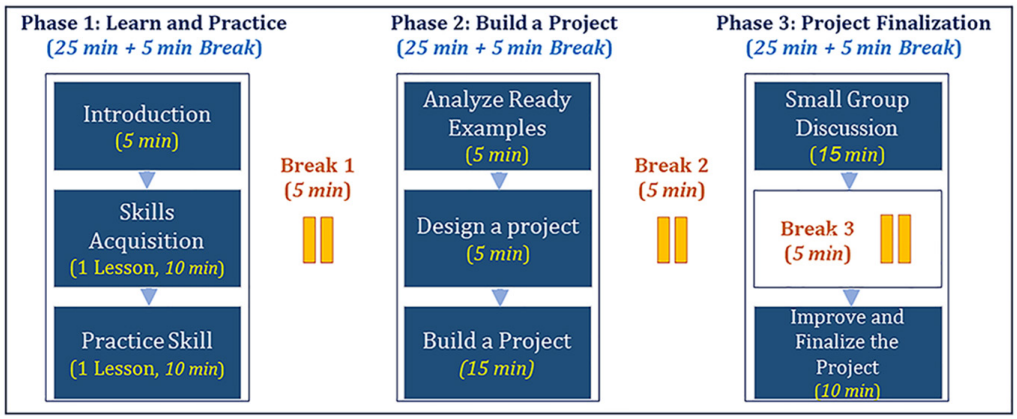

Fig. 2. The stages of performing an entire task during a single session in the C2-DPWT

Condition 3: Massed practice for part task (C3-MPPT). The training program for the C3-MPPT included 12 sessions. The three task stages were carried out in three sessions, one session for each stage. Sessions were presented sequentially on a daily basis, with intensification practice periods within each session, one module over three sessions, and no rest periods within sessions, as indicated in Figure 3.

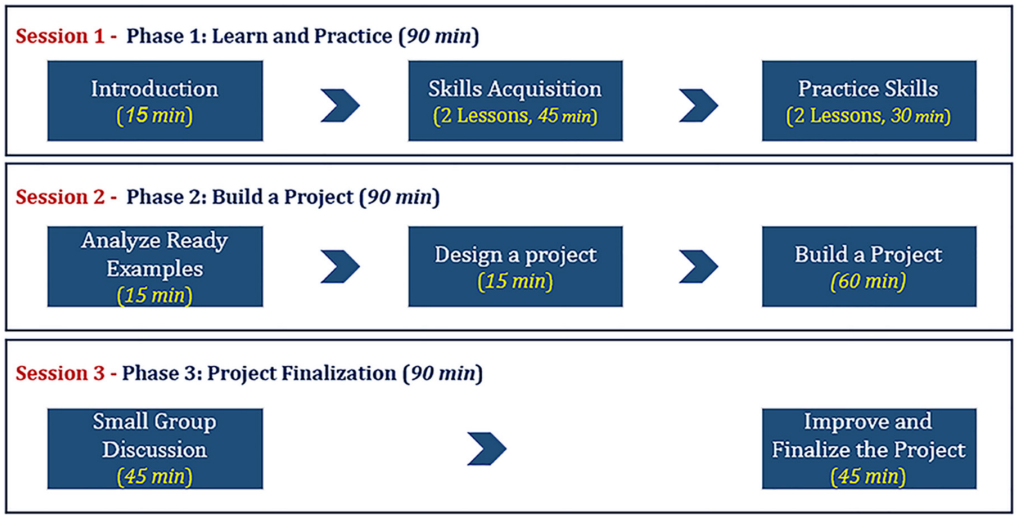

Fig. 3. The stages of executing a massed task during three sessions in the C3-MPPT

Condition 4: Distributed practice for part task (C4-DPPT). The training program for the C4-DPPT consisted of 24 sessions presented in a non-intensive way,

i.e., three sessions per week. Practice periods were distributed within each session, one lesson over three sessions, with a 15-minutes rest period for each session. In addition, an independent session was assigned to each of the task's three stages, as depicted in Figure 4.

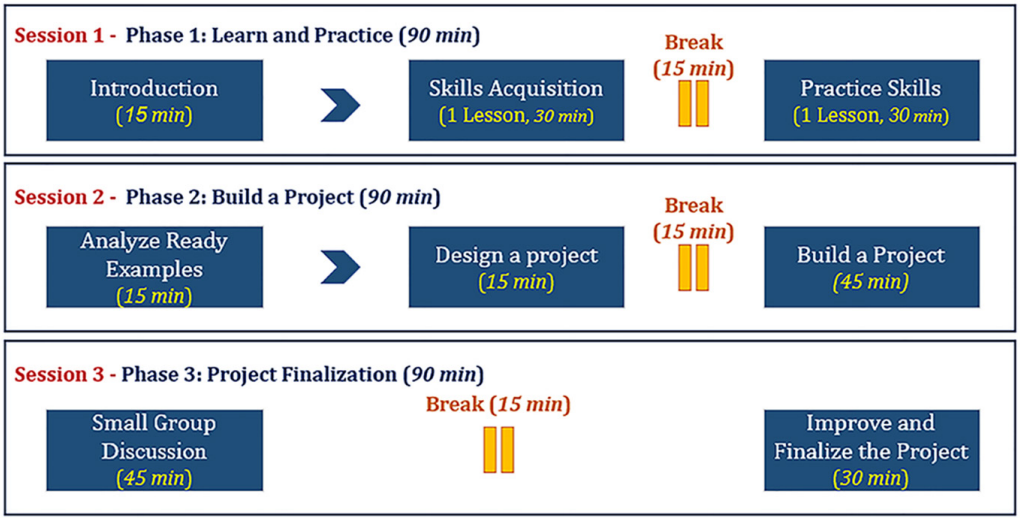

Fig. 4. The stages of conducting a complete task during three sessions in the C4-DPPT

With respect to the experimental procedures, before starting the experiment, a pre-test was conducted to form a clear picture of the trainees' pre-skills associated with e-content design, production, and publishing and to ensure the homogeneity of participants in the experimental conditions. After that, each experimental condition was introduced to the training context, the session's time schedule, the program as a whole, and the work mechanism. Then, trainees began participating in the sessions and completing the required tasks according to the training method and task practice in each condition. To accomplish a whole task, each trainee had to work individually to acquire and practice skills and to build and formulate the required project in its final form. He also had to work in small groups of 2–3 trainees to discuss and improve the individual project and to communicate with the trainer when needed. At last, trainees had a test on domain-specific skills related to e-content design, production, and publishing.

5 RESULTS

Table 5 shows the mean scores and standard deviations of the participant teachers' post-skills in e-content design, production, and publishing. To show the significance of differences between the four groups, a two-way analysis of variance was used, with the training method and task practice as fixed factors and the trainees' skills in e-content design, production, and publishing as a dependent variable. Results reflected significant positive effects of the two independent variables and of their interaction together (F (1.48) = 22.17, $p < .005$, $Eta^2 = 0.32$ for the training method, F (1.48) = (4, 49), $p < .005$, $Eta^2 = .09$ for the task practice method, and F (1.48) = 81.57, $p < .005$, $Eta^2 = .63$ for their interaction together).

Table 5. Mean scores and standard deviations (in parentheses) for participants' post-measurement scores of the e-content production skills

		Training Method		Total M (*SD*)
		WT M (*SD*)	PT M (*SD*)	
Task Practice Method	**MP**	331.00 (*10.33*)	380.38 (*18.95*)	355.69 (*29.29*)
	DP	355.85 (*7.86*)	340.31 (*12.00*)	348.08 (*12.71*)
Total		343.42 (*15.54*)	360.35 (*25.68*)	351.88 (*22.68*)

The results revealed that there was a statistically significant difference between the mean scores of participants in the experimental conditions, especially regarding the practice of e-content production skills due to the training method (WT vs. PT). Findings in Table 5 reveals that the mean score (M = 360.35) of trainees who received training through PT was greater than the mean score (M = 343.42) of trainees who received training via WT (see Figure 5). This result indicates that PTT was more effective in comparison with WTT in developing e-content production skills.

Results also indicated that there was a statistically significant difference between participants' mean scores in accordance with the practice of e-content production skills due to the task practice method (MP vs. DP). Table 5 reveals that the mean score (M = 355.69) of trainees in the MP groups was greater than the mean score (M = 348.08) of trainees in the DP groups (see Figure 6). This result indicates that the effect of MPM was stronger than the effect of DPM in developing participants' e-content production skills.

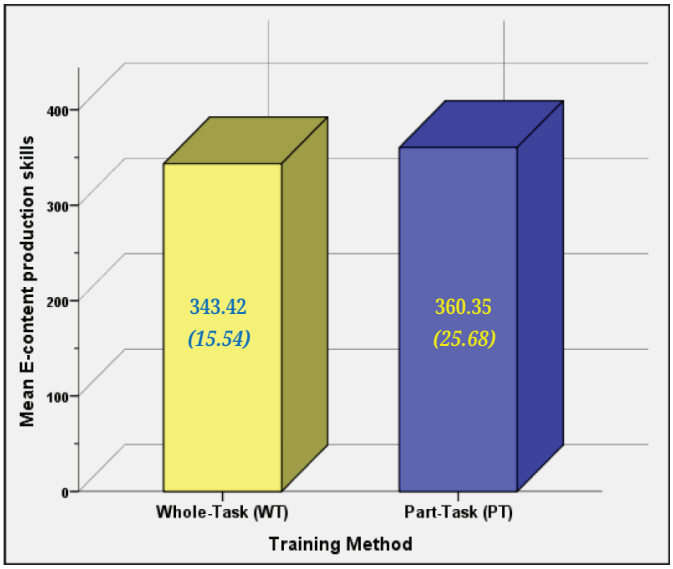

Fig. 5. Deference between (WT) and (PT) in the test on domain-specific e-content production skills

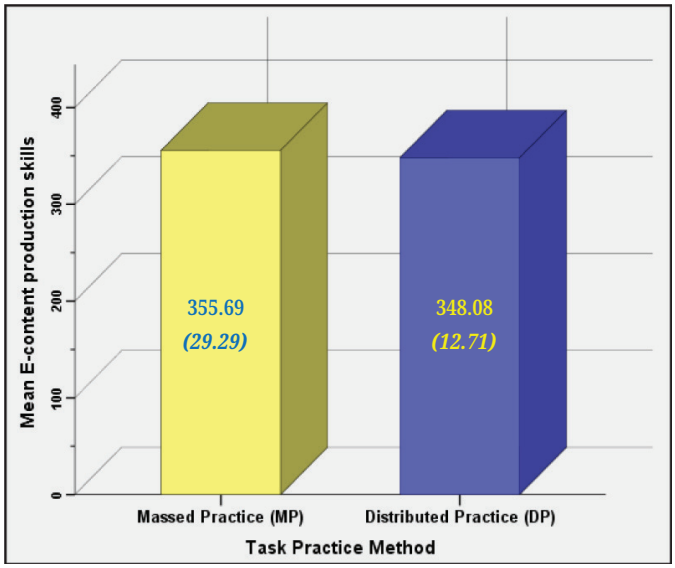

Fig. 6. Deference between (MP) and (DP) in the test on domain-specific e-content production skills

Moreover, results showed a statistically significant difference between the mean scores of participants' practice of e-content production skills due to the interaction between the training method and task practice method, as shown in Figure 7.

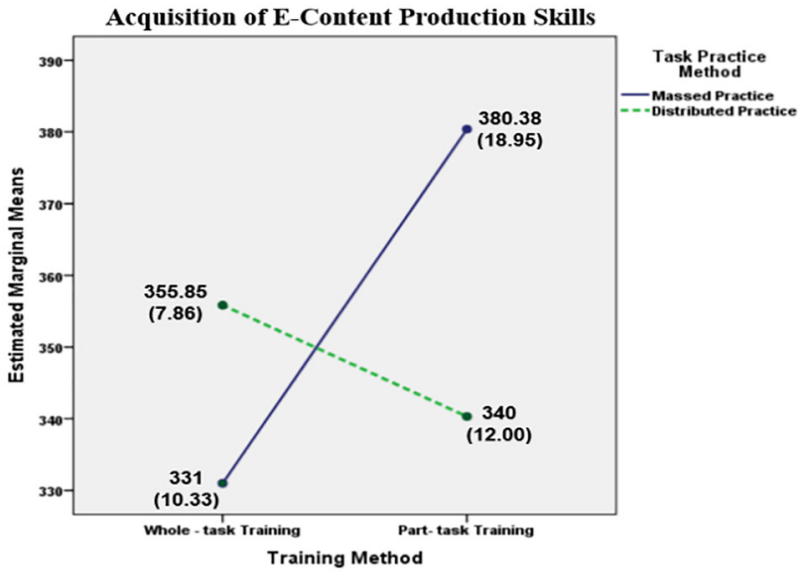

Fig. 7. Mean scores (standard deviations provided within brackets) in the test on domain-specific e-content production skills across the four experimental conditions

To determine the location and direction of differences between the mean scores, post hoc tests using Tukey's method were used. Findings revealed statistically significant differences ($\alpha = 0.05$) regarding the participants' practice of e-content production skills between the C3-MPPT and the other experimental conditions in favor of the C3-MPPT. In addition, there were statistically significant differences between the C2-DPWT and both the C1-MPWT and the C4-DPPT in favor of the C2-DPWT condition. However, there were no statistically significant differences between the C1-MPWT and the C4-DPPT.

6 DISCUSSION

On the whole, results confirm the ability of mobile training to develop trainees' skills through appropriate adjustment of its design variables. Results have shown that the training method and task practice method can affect the development of trainees' e-content production skills. Along with previous studies' results that revealed preference for PTT [16, 39], the present study showed that PTT empowered trainees to practice e-content production skills in a more effective way than WTT. The complex nature of the e-content production skills and the concentration of each training session on practicing a specific set of related skills might have helped trainees progress towards practicing the whole skill. Each skill was a requirement for the next one. PTT might have prevented trainees' cognitive overload, which is in line with the principles of cognitive load theory and information processing theory. In addition, PTT might have helped trainees steadily progress, which increased their motivation and self-confidence to acquire skills. Whereas, WTT might have caused a kind of cognitive overload and difficulty besides trainees' slow progress towards achieving the desired goals.

The massed practice method, according to the results of the present study, seems to be an effective means for developing trainees' e-content production skills. This result is in agreement with the results of a number of previous studies [26, 42, 56]. MPM also seems to have helped trainees concentrate on skill practice, repetition,

and mastery, in addition to making good use of the allotted periods to practice them without delay. It also seems that MPM has provided trainees with a continuous framework of experiences that contributed to building their knowledge in a more organized way and consequently reflected positively on their skill practice [56]. This result is in line with the principles of the gestalt and field theories regarding the fact that learning should be presented in an integrated and non-distributed manner. It is an encouraging one, as the results of many previous studies related to MPM have not shown the superiority of DPM in achieving many learning outcomes [21, 25]. Characteristics of tasks and individual differences between trainees and the design of the present training program, such as the training schedule, stages of session conduct, etc., might have made it more flexible and suitable for trainees, which reinforced this positive result.

Furthermore, results on the effect of interaction between the training method and task practice showed a connection between MPM and PTT, which made treatment in C3-MPTT more effective in developing e-content production skills. It seems that PTT was more compatible with MPM through breaking skills down into parts, which helped trainees to focus more on all sub-tasks without having cognitive overload that could have impeded their acquisition of skills. It also enhanced trainees' progress and urged them to continue and persevere during the intensive training sessions. Results also showed that C2-DPWT was in second place. This result can be attributed to the fact that the WTT method is compatible with the nature of DPM, which depends on task practice non-intensification in addition to allowing trainees to have enough rest periods within and between sessions. Besides, trainees were granted enough time and rest for training on skills, and they were able to form a visual integrated representation for each skill separately and to perceive relations between skills without intervention or cognitive overload. The fact that there were no significant differences between the C1-MPWT and the C4-DPPT can be attributed to the incompatibility between the training method and task practice in both. An interpretation of such a result can be found in the fact that the C1-MPWT might have caused a cognitive overload for trainees, which consequently affected their skill practice. Besides, it is probable that the C4-DPPT allowed trainees many rest periods within and between sessions that limited their concentration and abilities to practice and link the skills, besides decreasing their motivation to go on enthusiastically in training.

7 LIMITATIONS

The present study was limited to training male teachers of the intermediate stage in Jeddah, Saudi Arabia, during 2020–2021. The proposed training program is recommended to be applied to samples of different educational stages, particularly higher education, as a trial to reach standard criteria for the design of MTC. One form of PTT, i.e., forward-chaining segmentation for task practice, was adopted in the present study. Therefore, backward chaining was recommended to be used in addition to using other forms of PTT to achieve more comprehensive results for the optimal MTC. The present study was limited to tasks related to e-content designing, production, and publishing skills classified as complex psychomotor skills. Therefore, it is recommended to conduct future studies that compare simple and complex tasks and seek to explore other tasks that are more cognitive. Measuring other psychomotor skills through different programs, techniques, tasks, roles, and training periods may be alternative proposals for implementing the proposed training program in the present study.

8 CONCLUSION

The present study has explored the design of a MTC to improve in-service teachers' e-content design, production, and publishing skills. It also explored its effectiveness by controlling its design variables, particularly the training method (WT vs. PT) and task practice method (MP vs. DP). Results, in general, support the possibility of developing an effective MTC for training teachers through appropriate control of its design variables. The importance of the present study lies in making in-service teacher training more flexible without being restricted to a specific place and time, which all educational institutions desperately need after the COVID-19 pandemic. For this sake, the present study introduced four different forms for the mobile training context. The positive effects of both MPM and PTT reflected promising results that can increase the possibility of future expansion in the design and use of MTC. Findings revealed that the PTT method was more effective than the WTT. The MPM method was superior to the DPM method in developing trainees' skills in e-content production. Trainees who were subjected to C3-MPPT were more superior to peers in other experimental conditions in demonstrating E-content practice skills. This means that intensive training through mobile devices should be in accordance with a strategy to reduce cognitive loads. For massed practice to be effective, it should be accompanied by fragmented tasks. This is in line with the cognitive theory of multimedia learning, which showed the necessity of fragmentation in order to reduce the cognitive load on the trainees.

In light of these findings, it can be strongly argued that MTC should be carefully designed to enable trainees to complete complex design and production tasks. Training sessions have been designed with great care, namely stages of implementation, duration of time, and rest periods within and between sessions, to allow trainees to complete the required tasks. Future studies can investigate other design variables of the MTC, such as training activities, interaction between trainees, and the cognitive and practice aspects associated with teachers' professional development. Measurement of task performance should not be limited to measuring immediate practice only; there should also be interest in measuring the ability to retain actual practice for different periods of time after training.

On the whole, the present study presents a practical model for MTC that is applicable to educational institutions. MPPT in the context of mobile training can help trainees acquire and improve their practice skills. A good design of MTC can contribute to supporting the major shift towards technology-based training as a modern and flexible solution to many problems associated with the traditional training environment, besides its ability to increase trainees' abilities to access information and acquire skills.

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