Journal for Re Attach Therapy and Developmental Diversities
eISSN: 2589-7799
2023 August; 6 (9s): 1195-1208

Opportunities and Challenges of Using Micro-learning during the Pandemic of COVID-19 from the Perspectives of Teachers

[1]Ali Ahmed Al-Nasheri, [2]Waleed Salim Alhalafawy
[1]Amohammedalnasheri@stu.kau.edu.sa
Department of Educational Technology, King Abdulaziz University, Jeddah 21859, Saudi Arabia
[2]welhlafawy@kau.edu.sa
Department of Educational Technology, King Abdulaziz University, Jeddah 21859, Saudi Arabia
Department of Educational Technology, Ain Shams University, Cairo 11566, Egypt

Received: 24- June -2023
Revised: 27- July -2023
Accepted: 21- August -2023

Abstract

The pandemic of COVID-19 required a sudden shift to online distance education all over the world. In Saudi Arabia, like other countries, teachers had to move from face-to-face education to distance education to deliver and share the educational materials. Thus, the present study has investigated the teachers' perceptions, practices, and encountered challenges while using micro-learning applications to deliver micro-learning contents as a tool for teaching and basic learning during the pandemic of COVID-19. Therefore, the qualitative approach depending on the phenomenological approach was used to determine the perceptions, practices and encountered challenges of ten public education teachers in the directorate of education in Al Qunfothah province. Findings showed that micro-learning opportunities were based on the fields of cost, fitness to students' nature, self-learning, reuse, cognitive retention, interaction and attraction, individual differences, cognitive achievement, in addition to practical skills. Whereas, the most important challenges were centered on the lack of resources, effort required to produce resources, the need for educational training, and the need for digital skills. In conclusion, the study recommended taking into account the results of the present study as starting points for developing micro-learning in the stage of post-Covid-19 pandemic.

Keywords: Micro-learning applications; COVID-19 pandemic; public education; Saudi Arabia

Introduction

The pandemic of Coronavirus (COVID-19) caused an unprecedented crisis in all fields of life. In the field of education, for instance, it caused a widespread closure of all direct activities in the educational institutions in more than 190 countries in order to stop the spread of this virus and mitigate its impact. Data of the United Nations Educational, Scientific and Cultural Organization (UNISCO, 2020), show that by mid-May 2020, more than 1.2 billion students in different education stages all over the world stopped attending face-to-face education. In Saudi Arabia, as well as other countries, such turmoil certainly forced the educational institutions to resort to distance education as a solution to bridge the gap resulting from the cessation of face-to-face education (Code et al., 2020).

Therefore, it was very important to bring about a qualitative shift in education to allow all conducting all activities of teaching and learning via distant teaching practices in emergent conditions (Hodges et al., 2020). This directive implies "a temporary shift in educational delivery to an alternative delivery format due to the crisis conditions" (Hodges et al., 2020). Consequently, this change in education from face-to-face to distance education suddenly changed the work of teachers. It required them to quickly identify digital teaching methods that provide flexibility and fulfil the needs of students, and adopt and implement these methods (Bailey & Lee, 2020; Cruickshank, 2020; Kaden, 2020) in order to make shift to online learning successfully completed (Elfeky & Elbyaly, 2016; Elfeky, 2017).

This, of course, requires teachers to redesign their way of delivering the educational content that not only influences the curriculum, but also the content and choice of the teaching strategies. Digital education although is well established, many teachers and educational institutions face a major challenge in terms of using modern technologies and learning across diverse environments during emergency (A. Gill et al., 2020; Elbyaly & Elfeky, 2016; Elfeky & Elbyaly, 2023a). During the Covid-19 pandemic, many teachers resorted to micro-learning

applications to broadcast educational materials that support the teaching and learning processes (Elfeky & Elbyaly, 2023b). These applications witnessed a great diversity among which were formal use-based applications, such as the Madrasati platform and Microsoft Teams, and informal use-based application such as WhatsApp and Telegram.

Due to the great momentum witnessed during the crisis, this experience requires examining to clarify the opportunities and challenges resulted from its use by teachers, mainly because the interest in the micro-learning model during the crisis generated a context worthy of study (A. S. Gill et al., 2020). Therefore, the present study aims to identify the opportunities and challenges encountered by teachers while using micro-learning as a tool for basic teaching and learning to deliver the educational content during the COVID-19 pandemic. It also aims to identify the teachers' perceptions regarding their opinions and ideas about their use of micro-learning. Results are also expected to indicate that the use of micro-learning applications may be an important tool fit for teaching and learning taking in addition to discussing the considerations that increase the effectiveness of micro-learning in teaching and learning. In short, the study aims to answer these questions,

1. What were the micro-learning opportunities for public education teachers during the COVID-19 pandemic?
2. What were the micro-learning challenges encountered by public education teachers during the COVID-19 pandemic?

Literature Review

Micro-learning is that learning, which occurs in small steps. It is a learning that fits the learner, goal, and delivery method and often takes place outside traditional arenas (Hug & Friesen, 2007). It can be viewed as a response to fragmentation of information and learning (Langreiter & Bolka, 2005). Environments of micro-learning should be focused, self-sufficient, use multiple forms of media, and support a large number of learning styles (Hug, 2005). Micro-learning sessions should be relatively short (6 to 10 minutes) (Koedinger et al., 2012), and available upon request. While the general consensus is that duration of micro-learning should be less than 15 minutes (Kapp & Defelice, 2018). Regardless the duration of micro-learning sessions, delivering the right information to eligible learners at the right level of detail and at the precise moment they need is the most important (Emerson & Berge, 2018).

The essence of micro-learning is characterized by the requirement of short-term engagement; it has less content; its contents are derived from course components; it has separate units; it consists of coherent and self-sufficient contents; it is rich in media; and it supports different learning styles (Wang et al., 2021). Micro-learning can be of many forms, staring from short videos, a presentation, audio recording, a screen, a PowerPoint slide presenting a single and focused topic, a short text, interactive or non-interactive infographics, mobile apps, QR, gamification, quizzes, or augmented and virtual reality (Allela, 2021; Wang et al., 2021).

The main aim of micro-learning is to provide focused and important information on a specific topic requested by the user to easily apply information (Kapp & Defelice, 2018). The following four basic tools of micro-learning can be referred to as follows (Mali et al., 2021):

1. The Video, which is the most important tool for delivering micro-learning, it is a multimedia device, which is easy to build and time efficient. It helps students understand the content for a long time. In short, it is the learner's most interactive form of learning.
2. The blogs that are the best way for micro-learning as everyone writes something every day about different topics. Blogs are small, but they give big information to many people at one time.
3. The podcast, which is an audio tool that helps improve learning in the form of audio and content retention. It is considered the most versatile audio tool that helps improve learning retention.
4. Social media that are important tools that learners use them mostly. Information is available and requires less time to watch. Tools like Facebook, Twitter, WhatsApp, Signal and LinkedIn are the most suitable for accurate learning content.

The use of digital learning environments generated many qualitative learning models that are self-based on the use of technology. Micro-learning is one of the most important contemporary e-learning models that are exposed to the digital content structure and how it is designed it. Micro-learning a good educational approach that depends

on dividing the educational content into very small and multiple educational units that present one concept or skill in a short time where it ensures the delivery of accurate and rich educational content in which the student takes sequential steps that enable him to deal with all concepts and skills related to the educational content (Zhang & West, 2019).

Related literature mentions many reasons for the spread of micro-learning, and why it is a subject of discussion by many specialists in the field. One of these reasons is the fact that micro-learning emphasizes the main points the teacher wants to deliver clearly to learners. That is, the teacher may make a long lecture on a specific topic, and at the end of the lecture, he may put the main points into small parts based on the micro-learning method to reinforce the main lesson objectives (Scaglione, 2019). Besides, micro-learning contributes to saving the learner's time through the quick and easy access of the problematic subject and reviewing the related content and activities to reach deeper understanding (Paul, 2019 & Scaglione, 2016). Moreover, it contributed to the development, spread and use of mobile sets like mobile calculators, smart phones and other tablets in micro-learning use via the learner's access to the desired content without time and place constraints (Perry, 2017).

Among the most important reasons that contributed to the spread of micro-learning is the learners' ability to memorize and remember information more as information can not be delivered to the learner in one piece, but it should be divided into smaller units to be easily organized and connected in a way that simplifies retention when needed (Giurgiu, 2019). Micro-learning also contributes to the enhancement of learners' individual learning by allowing the learner to transfer and progress in lessons according to his abilities and readiness that, in turn, promotes his motivation to learning (Sweet, 2014 and Sawarynski & Baxa, 2019) and finally results in building an integrative e-course that takes a long time. Therefore, micro-learning is the ideal solution for the development of a digital content in a short time and little cost for the teacher and learner (Scaglione, 2019).

Theoretical framework

Micro-learning is related to the cognitive theories (Khong & Kabilan, 2020), mainly the "Cognitive Load Theory", "Cognitive Theory of Multimedia Learning" (Mayer's, 2014), (Self-Determination Theory (Ryan & Deci, 2017), and Constructivism (Nicole, 2012). The proposed cognitive theories support the conceptual properties of micro-learning. For example, the "cognitive load theory" is more consistent with the design and development of micro-content and manipulation of micro-activities. Studies show that the average human brain retains more information when the content is organized into small chunks (Allela, 2021; Khong & Kabilan, 2020). With regard to Richard Mayer's Cognitive Theory of Multimedia Learning (CTML), the principle of division indicates that learning occurs better when delivering the contents in the form of pieces that allows the learners to move between them when he likes instead of presenting them in a continuous and automatic way (Mayer, 2005). That is, it is better to display the video tapes in a miniature form than to display them in continuous streams (Spanjers et al., 2010). Presenting the content at a rapid pace and in continuous streams without fragmentation may exceed the cognitive capacity of the learner and lead to cognitive overload (Mayer, 2005). The working memory capacity is, of course, limited, and if the cognitive demands of an educational task exceed the memory capacity, an excessive cognitive load will result. Therefore, mini-learning units in this case are one of the solutions through which it is possible to control the amount of information that the learner processes without any cognitive load. (Cheon et al., 2014 and Lusk et al., 2009).

The constructivist theory is one of the theories that support the micro-learning method. It indicates that learning is an active constructive process carried out by the learners and knowledge consists of the activities that they perform, which can be referred to as the basis for designing micro-learning environments that provide a content accompanied by activities and tasks in an organized sequence (Nicole, 2012). Once we look at the components of the micro-learning concept such as personality, adaptation, autonomy and self-regulation, we can see that they clearly highlight the importance of the motivational aspect of micro-learning, which on the other part, supports Self-Determination Theory to be the basis for effective micro-learning that results in building accurate knowledge (Khong & Kabilan, 2020).

Methodology

Approach

Due to the lack of information on this topic, the phenomenological approach was used in the present study to investigate the quality of the participants' live experience about the opportunities and encountered challenges of using micro-learning. This approach was used to fully study and describe the teachers' experience because it studies the personal views of participants and the meaning of their experience through describing the phenomenon under a set of questions that may lead us to a better understanding of the nature or the meaning of life experience. It also seeks strives to capture the essence of "live experience" (Creswell & Poth, 2016).

Participants

Intentional samples were selected due to the researcher's knowledge, easiness of reaching them, and their exposure to the experiment. Their total number was (10) participant teachers of different schools in the public education. The basis for their choice was their use and application of micro-learning in their schools after addressing more than one teacher. Responses were analyzed using MAXQDA software. Table 1 shows the distribution of participants according to the study variables.

Table 1: Distribution of participants to study variables

No.	Specialty	Experience	Teaching stage	Code
1.	Biology	23 years	Secondary	B1
2.	Biology	15 years	Secondary	B2
3.	Computer science	20 years	Secondary	C1
4.	Computer science	18 years	Secondary	C2
5.	Computer science	18 years	Intermediate	C3
6.	Science	24 years	Intermediate	S1
7.	Science	17 years	Intermediate	S2
8.	English language	25 years	`secondary	E1
9.	English language	20 years	Intermediate	E2
10.	English language	19 years	Intermediate	E3

Interview Mechanism

Interviews were conducted through the use of semi structured interviews and were carried out face-to-face, on phone, zoom application and google meeting after the consent of participants in the present study. The meeting protocol of four open-ended questions that generated some sub-questions was used. Each participant was requested to talk about what he sees and feels about the opportunities and challenges of using micro-learning application in education. Illustration and probing questions were used in need. Each interview lasted about 20-30 minutes (Creswell & Poth, 2016). Table 2 illustrates the focus of the Interview questions.

Table 2: Initial questions of the semi-structured interviews

Main question	Sub-question
1. How did you apply the micro-learning in the distance education?	• How did you use micro-learning through its applications?
2. How did the micro-learning affect students?	• How did the micro-learning affect students' cognitive achievement? • How did the micro-learning contribute to increasing students' motivation to learning? • Explain the positive things that resulted from students' use of micro-learning?
3. What were the challenges you encountered while using the micro-learning?	• How did the infra structure limit your use of the micro-learning? • How did your digital skills limit your use of the micro-learning? • How did students' digital skills limit your use of the micro-learning? • How did the educational training limit your use of the micro-learning? • How did platforms and social media limit your use of the micro-learning?

Findings

Depending on the semi-structured interviews that were carried out to identify the opportunities and encountered challenges of micro-learning during the pandemic of Covid-19, participants' answers were coded. The interconnected codes were grouped into interconnected groups to illustrate the opportunities and challenges of micro-learning. After conducting the grouping process, one theme was attached to every homogeneous group, as shown in Figure (1).

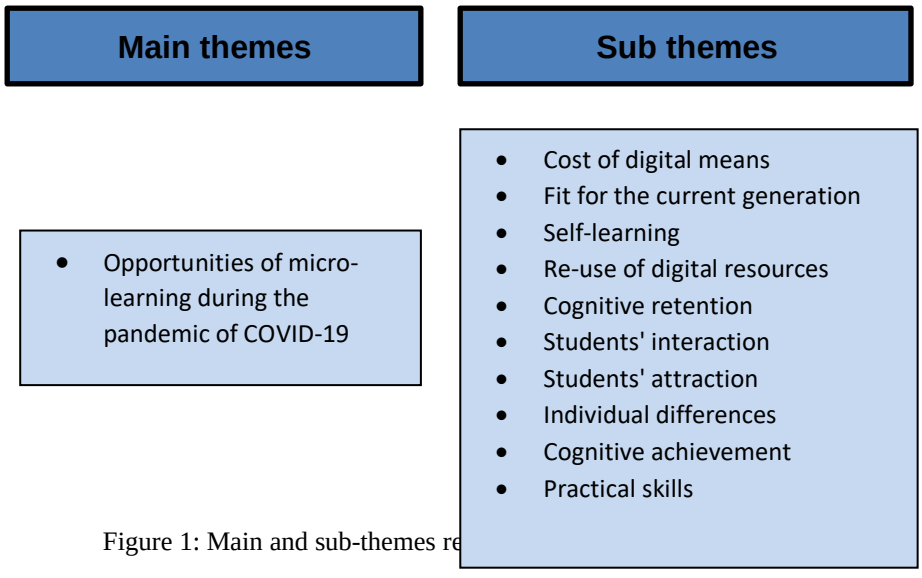

Figure 1: Main and sub-themes re

As shown in figure 1the process of coding revealed the following main themes:

The first main theme: Opportunities of micro-learning d

This theme addressed the opportunities stated and identified by participant teachers during their use of micro-learning during the pandemic of Covid-19 that had the prominent role in the promotion of students' learning process.

The second main theme: Challenges of micro-learning during the pandemic of Covod-19

This theme tackled the challenges that participant teachers encountered while using micro-learning during the pandemic of Covid-19, which teachers tried to overcome despite being serious challenges during the crisis.

Results

First: Opportunities of micro-learning

Participants' interviews showed that reliance on micro-learning during the pandemic of COVID-19 revealed a set of opportunities related to the following themes:

1. The cost

Participant teachers believe that the production of digital means and disseminating them to their students was easy and in the same time of low cost, which indicates that the opportunities micro-learning use can be expanded. For instance, one participant stated:

"I can produce whatever I like of the digital means that fit a specific topic through using video composing programs, image processing, sound, and PowerPoint presentations. Then I can save them on my device, and after that share them with my students" (E1).

2. Fitness for the second generation

Students nowadays are described as the generation of the 21_{st} century, i.e. the generation of modern technology. They prefer to cope with with digital sources rather than paper ones. Furthermore, micro-learning enhances the vision of current generation students who are accustomed to browsing short and fragmented content via their mobiles, as stated by one participant:

"Students are good at and prefer to cope with everything that is digital. So, in micro-learning, I find a way to help them learn using the digital means that they prefer over a paper book" (S1).

3. Self-learning

Education legislators seek to promote self-learning, which was adopted by the Ministry of Education through Madrasati platform in the Kingdom of Saudi Arabia. This, of course, applies to micro-learning, where the student can learn whenever and wherever he wants. In this regard, one participant said:

"Micro-learning allowed self-learning for my students. They can watch the video clip or infographic, learn from it and then build their knowledge. In fact this is what distinguishes the good teacher from others" (B2).

4. Re-use of digital resources

Digital resources are distinguished by the fact that they can be saved and then reused. They can be even developed or modified when a need arises. Moreover, micro-learning is one of the digital repositories that allow resources to be reused when needed. In this context, one of the participants stated:

"I had a special file for each lesson and kept all related digital means inside so that I can use them again in the coming years, with a different stage where the curriculum is similar, or even share it with my colleagues" (S2)

5. Cognitive retention

Students' understanding of the lesson, keeping it in their minds, and calling information back when needed help achieve the outcomes. Mental capacity of the student's memory that should be accounted for when presenting the learning processes plays a significant role in achieving these outcomes. In brief, micro-learning can help doing so as argued by one participant:

"After using micro-learning and varying the digital means, I noticed that not only my students' learning has improved, but also their information retention increased. In addition, I found that the performance and retention of the majority of them improved after each quiz." B2

6. Interaction of students

Development in the educational platforms, social media and e-programs helped in enhancing the role of micro-learning in creating an interactive environment that promotes the opportunities of communication and interaction between students and teachers, on one hand and between students themselves, on the other hand. In this sense one participant teacher said:

"After using micro-learning whether via MS teams or social media such as WhatsApp, I noticed a rise in my students' oral or text interaction whether with me or with each other, and in fact this enriches the lesson topic." E1

7. Attraction of students

Students usually get bored of repetition and sameness in the learning environment. The successful teacher is the one who renews and changes this environment and makes it attractive for students. He for instance, renews their enthusiasm and desire to learn. It can be strongly argued that micro-learning environments have provided the teacher with many tools that helped him attract students to the learning environment. In this context, one participant said:

"What distinguishes the micro-learning is its enrichment of the distance learning environment, and its changing of its traditional type, which attracts students. Students, in the micro-learning, started asking about the new, express their views and take part in the proposed development." E3

8. Accounting for individual differences

Taking the individual differences into account is very important for the teacher because students differ regarding their learning styles and speed. Micro-learning can help the teacher to create varied learning tracks that fit the individual differences between their students. One participant teacher expressed this idea saying:

"Micro-learning helped me consider the individual differences between my students. Thus, I used to vary the digital resources using for example videos, sounds, images, and mind maps to reach them all and to deliver the piece of information as possible as could be." E3

9. Increase in the cognitive achievement

Environments of micro-learning include small educational units that focus on accurate and specified objectives, which in turn contribute to raising the achievement levels related to these units. They, although they are very small in size, are intensive and involve various approaches to ensure students' success in knowledge acquisition. One participant, for example said:

"Micro-learning improved my students' learning. It helped their information retention, which was reflected on their performance in the test whether short, mid-term, or final. Improvement was mainly in their grades." B2

10. Skills

Micro-learning depends on using small learning units that mostly focus on video tapes and multimedia. They all have a significant role in enhancing the skill performance, which makes micro-learning more effective in developing students' skills. One teacher said:

"Micro-learning helped me train my students on programming skills in the third intermediate class. It also helped me train them the skills of Office programs as programs of text writing and PowerPoint presentations by sending successive short clips at different intervals, where each clip explained part of a skill accurately. On the opposite, students sent clips of their work and sharing them with each other" (C1).

Second: Challenges of micro-learning

Teachers, while using micro-learning during the pandemic of Covid-19, faced some challenges among which were:

1. Lack of ready-made resources

Micro-learning depends on the availability of a large number of ready-made resources and means. Nevertheless, this is a real challenge for teachers because of the lack of the appropriate number of the suitable resources for the qualitative and unique learning content, as one participant pointed out:

"Among the challenges that I faced was the lack of some resources related to some lessons on "Ain platform" that affected the completion of the lesson parts. Therefore, I had to look for other resources that might differ from the previous one regarding elaboration and language." S2

2. Effort and time of producing digital means

The teacher, in the absence of digital resources by the formal authorities, had to produce his own resources that consume much effort and time of him. In this regard, one teacher mentioned:

"Among the challenges that I face in the absence of the digital resources by the educational institution is the production of digital resources for my lessons as they consume much time and effort of me. However, my enjoyment increases when I produce such resources and share it with my colleagues and learners." E1

3. Lack of educational training

Teacher training on modern skills and methods in education, mainly training on the use of micro-learning, is very important because it enable them to continue teaching effectively and proficiently in the environments of mobile learning. One participant mentioned that:

“Frankly, we lack training on such modern methods and necessary skills to produce digital resources and modify the existing ones. In fact, many of my colleagues do not know micro-learning, and so I explained its method and importance in my students’ learning to them." (B1).

4. Weakness of digital teacher skills

The teacher in micro-learning environments should be aware and knowledgeable of the skills of using some programs that allow him to use and process digital multimedia. Much of this load falls on the training institutions as mentioned by one teacher:

Among the biggest challenges I encountered is the fact that I did not find any useful video clip. Most clips were very long with information that does not fit my lesson. Such a clip represents a serious challenge for me because I could not break it down and save it in a way that suits my lesson. Hence, I had to visit the computer stores or consult a colleague to break it down and then save it." S2

Discussion

Micro-learning is a modern approach that can be applied flexibly regarding the expected learning objectives. It fits the types of the educational needs, supports lifelong learning, and can be integrated with various learning theories and approaches. Moreover, it can be used with all learning systems and with a variety of learning objectives. Thus, it can be connected to multiple learning theories and approaches. Furthermore, it can be applied online, on various learning platforms, with face-to-face learning, with flipped classrooms, and with blended learning (Semingson et al., 2015).

There are certain factors that caused the spread of micro-learning, and made it the subject of interest for many specialists in the field. One of these factors is its emphasis on the main points the teacher wants to clearly deliver to learners. In other words, the teacher may give a lengthy lecture on a specific topic, but at the end he may put the main points in small parts based on the method of micro-learning to reinforce the lesson main objectives (Scaglione, 2019). Another factor is that it contributes to saving the learners' time because of the fast and easy access to the problematic topic besides the review of the related content and activities to reach deeper understanding (Paul, 2016; Scaglione, 2019). Moreover, the development and spread of mobile devices such as laptop computers, smartphones, and other tablets have also contributed to the use of micro-learning through the learner’s access to the desired content without time or place restrictions (Perry, 2017).

The learners' ability to remember and retain information better is another reason why micro-learning has widely spread. Information, as we know, can not be delivered to the learner as a whole. It should be broken down into smaller units or pieces to help him organize, connect the pieces of information in a simple way, and later on retain them when needed (Giurgiu, 2017). Besides, micro-leaning fosters the learners' individualized learning because it allows them to move forward and progress according to their abilities and readiness, which in turn promotes their motivation to learning (Sawarynski & Baxa, 2019; Sweet, 2014). It enhances previously acquired knowledge and skills and meanwhile encourages the application of some practical exercises and drills (Emerson & Berge, 2018). It also helps in building an integrated e-course that may take time and effort.

Therefore, micro-learning is the ideal solution for developing digital content in a short time and at a lower cost for the teacher and learner (Scaglione, 2019), and in the same time can be stored in repositories of the digital objects located in various learning management systems (Emerson & Berge, 2018; Sweet, 2014). It provides learners with the opportunity to understand and comprehend delivered information and interact with the content and activities it contains better that interaction with any other educational content in a traditional way. It also involves a large amount of information. Through micro-learning, students can retain easily and for longer periods what they have learnt. It is really a learning dose that is delivered in a short period and that is easy to comprehend (Giurgiu, 2017). Likewise, it relies on the interaction between the learners and Internet means as it is used as a frequent source of information in the context of e-learning (Javorcik & Polasek, 2019).

Studies that have addressed micro-learning are numerous. Some of them studied like for instance Gross, et al. (2019) and Mohammed, et al. (2018) showed a significant role for micro-learning in improving the cognitive achievement while Halbach & Solheim (2018) indicated a role for micro-learning in improving the students' Learnability. Major & Calandrino (2018) revealed an improvement in the school performance of students with both behavioral and cognitive problems as a result of using micro-learning. With regard to the skill aspect, Skalka & Drlík (2018) emphasized the effectiveness of micro-learning in developing students' skills. Nikou (2019); Olivier (2019); and Osaigbovo & Iwegim (2018) proved the effectiveness of micro-learning in the provision of learners" motivation attraction and reinforcement.

In short, it can be argued that this distinction of micro-learning is because its design and application are related to some theories. It, for example, has a close relationship with the cognitive theories, mainly the cognitive load theory (CLT), which supports the conceptual characteristics of micro-learning. This theory is more consistent with the design and development of mini-content and manipulation of micro-activities. Many studies have indicated that the average person brain keeps more information when the content is organized into small chunks (Allela, 2021 and Khong & Kabilan, 2020). The online student's working memory is overburdened by the amount of reading, where Knowledge acquisition may slow down or even completely stop. Thus, long-term memory is left blank despite all this effort. Nevertheless, when information is broken down into repeated micro-learning opportunities, the cognitive load significantly goes down for the long term making information retention and use easier (Major & Calandrino, 2018). The constructivist approach, on the opposite, is one of the theories that support micro-learning. It indicates that learning is an active constructive process carried out by learners and knowledge is made up of activities learners perform, which is the basis for designing micro-learning environments that provide content accompanied by sequential activities and tasks in an organized manner (Nicole, 2012). Once we consider the definition of micro-learning such as personality, adaptation, autonomy and self-regulation, we can clearly discover the importance of the motivational aspect of micro-learning that is in agreement with the theory of self-determination that can be the basis for effective micro-education that results in building accurate knowledge (Khong & Kabilan, 2020).

Nevertheless, it is very important to be aware of the great number of challenges that affect the system of micro-learning. It, first of all requires a teacher with numeral educational and digital skills (Kovachev, et al., 2011 and Sankaranarayanan et al., 2022). In addition, the production of multiple digital media that can be relied upon to manage the goal learning-based-educational processes is an urgent necessity and is among the great challenges facing the teacher when using mobile learning (Khong & Kabilan, 2022; Sun et al., 2015). According to the presented results, it becomes necessary to investigate how to employ microlearning through other digital technologies (Alanzi & Alhalafawy, 2022a, 2022b; Alhalafawy, Najmi, Zaki, & Alharthi, 2021; Alhalafawy & Tawfiq, 2014; Alhalafawy & Zaki, 2019, 2022; Alshammary & Alhalafawy, 2022, 2023; Alzahrani & Alhalafawy,

2023; Alzahrani & Alhalafawy, 2022; Alzahrani, Alshammary, & Alhalafawy, 2022; Najmi, Alhalafawy, & Zaki, 2023; Zeidan, Alhalafawy, & Tawfiq, 2017; Zeidan, Alhalafawy, Tawfiq, & Abdelhameed, 2015)

Conclusion

Micro-learning is an important technology that was effective during the pandemic of COVID-19. Therefore, its study is important to establish the post-Covid-19 phase. The present study is important because of its ability to frame the most important opportunities and challenges associated with the use of micro-learning, especially during educational emergencies. It could identify the most important micro-learning opportunities based around the aspects of cost, appropriateness to students' nature, self-learning, re-use, cognitive retention, students' interaction and attraction, individual differences, cognitive achievement in addition to practical skills. Through the results, the most important challenges, which were based on the lack of resources, the effort required to produce the resources, the need for educational training, and the need for digital skills were identified. Thus, these results may show Saudi educational institutions how to develop the stature of micro-learning and increase its effectiveness to positively affect learning outcomes. Moreover, future studies can be conducted to address the effect of micro-learning on learners of special needs. Other studies can be carried out using certain design variables to check its effect on the learning outcomes, attitudes of teachers and students toward the expansion of using this type of learning within the educational environments.

References

1. Aguilera-Hermida, A. P., Quiroga-Garza, A., Gómez-Mendoza, S., Villanueva, C. A. D. R., Alecchi, B. A., & Avci, D. (2021). Comparison of students' use and acceptance of emergency online learning due to COVID-19 in the USA, Education and Information Technologies, 3(4), 1-23.
2. Alanzi, N. S., & Alhalafawy, W. S. (2022a). Investigation The Requirements For Implementing Digital Platforms During Emergencies From The Point Of View Of Faculty Members: Qualitative Research. 2022, 9(6), 4910-4920.
3. Alanzi, N. S., & Alhalafawy, W. S. (2022b). A Proposed Model for Employing Digital Platforms in Developing the Motivation for Achievement Among Students of Higher Education During Emergencies. Journal of Positive School Psychology (JPSP), 6(9), 4921-4933.
4. Alhalafawy, W. S., & Tawfiq, M. Z. (2014). The relationship between types of image retrieval and cognitive style in developing visual thinking skills. Life Science Journal, 11(9), 865-879.
5. Alhalafawy, W. S., & Zaki, M. Z. (2019). The Effect of Mobile Digital Content Applications Based on Gamification in the Development of Psychological Well-Being. International Journal of Interactive Mobile Technologies (iJIM), 13(08), 107-123. doi:10.3991/ijim.v13i08.10725
6. Alhalafawy, W. S., & Zaki, M. Z. (2022). How has gamification within digital platforms affected self-regulated learning skills during the COVID-19 pandemic? Mixed-methods research. International Journal of Emerging Technologies in Learning (iJET), 17(6), 123-151.
7. Alhalafawy, W. S., Najmi, A. H., Zaki, M. Z. T., & Alharthi, M. A. (2021). Design an Adaptive Mobile Scaffolding System According to Students' Cognitive Style Simplicity vs Complexity for Enhancing Digital Well-Being. International Journal of Interactive Mobile Technologies, 15(13).
8. Allela, M. (2021). Introduction to Microlearning. Commonwealth of Learning .
9. Alshammary, F. M., & Alhalafawy, W. S. (2022). Sustaining Enhancement of Learning Outcomes across Digital Platforms during the COVID-19 Pandemic: A Systematic Review. Journal of Positive School Psychology, 6(9), 2279-2301.
10. Alshammary, F. M., & Alhalafawy, W. S. (2023). Digital Platforms and the Improvement of Learning Outcomes: Evidence Extracted from Meta-Analysis. Sustainability, 15(2), 1-21. doi:https://doi.org/10.3390/su15021305
11. Alzahrani, F. K. J., & Alhalafawy, W. S. (2022). Benefits And Challenges Of Using Gamification Across Distance Learning Platforms At Higher Education: A Systematic Review Of Research Studies Published During The COVID-19 Pandemic. Journal of Positive School Psychology (JPSP), 6(10), 1948-1977.
12. Alzahrani, F. K. J., Alshammary, F. M., & Alhalafawy, W. S. (2022). Gamified Platforms: The Impact of Digital Incentives on Engagement in Learning During Covide-19 Pandemic. Cultural Management: Science and Education (CMSE), 7(2), 75-87. doi:10.30819/cmse.6-2.05

13. Alzahrani, F. K., & Alhalafawy, W. S. (2023). Gamification for Learning Sustainability in the Blackboard System: Motivators and Obstacles from Faculty Members’ Perspectives. Sustainability, 15(5), 4613. doi:doi.org/10.3390/su15054613
14. Badeleh, A., Khodabandelou, R., & Sherafat, S. (2021). The Effects of Blended Learning and a WebQuest Learning Designed based on the Merrill Instructional Design Model for Children's Learning. Psychology and Education Journal, 58(2), 8502-8517.
15. Cheon, J., Crooks, S., & Chung, S. (2014). Does segmenting principle counteract modality principle in instructional animation? British journal of educational technology, 45(1), 56-64 .
16. Code, J., Ralph, R., & Forde, K. (2020). Pandemic designs for the future: perspectives of technology education teachers during COVID-19. Information and Learning Sciences, 121(5/6), 419-431. doi:10.1108/ILS-04-2020-0112
17. Code, J., Ralph, R., & Forde, K. (2020). Pandemic designs for the future: perspectives of technology education teachers during COVID-19. Information and Learning Sciences, 121(5/6), 419-431. https://doi.org/10.1108/ILS-04-2020-0112
18. Corbeil, J. R., Khan, B. H., & Corbeil, M. E. (Eds.). (2021). Microlearning in the Digital Age: The Design and Delivery of Learning in Snippets. Routledge.
19. Creswell, J. W., & Poth, C. N. (2016). Qualitative inquiry and research design: Choosing among five approaches. Sage publications .
20. Emerson, L. C., & Berge, Z. L. (2018). Microlearning: Knowledge management applications and competency-based training in the workplace. UMBC Faculty Collection .
21. Elfeky, A. I. M., & Elbyaly, M. Y. H. (2016). The impact of learning object repository (lor) in the development of pattern making skills of home economics students. *British Journal of Education, 4*(2), 87-99.
22. Elfeky, A. (2017). Social Networks Impact factor on Students' Achievements and Attitudes towards the" Computer in Teaching" Course at the College of Education. *International journal on E-learning*, *16*(3), 231-244.
23. Elbyaly, M. Y. H., & Elfeky, A. I. M. (2023). THE IMPACT OF BLENDED LEARNING IN ENHANCING THE SKILL PERFORMANCE OF PRODUCING DIGITAL CONTENT AMONG STUDENTS OF OPTIMAL INVESTMENT. *Ann. For. Res*, *66*(1), 2031-2043.
24. Elfeky, A. I. M., & Elbyaly, M. Y. H. (2023). EXAMINING THE EFFECTS OF VIRTUAL CLASSROOM USE INSIDE LEARNING MANAGEMENT SYSTEMS ON ENHANCING STUDENT SATISFACTION. *Ann. For. Res*, *66*(1), 1980-1990.
25. Elfeky, A. I. M., & Elbyaly, M. Y. H. (2023). THE IMPACT OF VIRTUAL CLASSROOMS ON THE DEVELOPMENT OF DIGITAL APPLICATION SKILLS AMONG TEACHERS OF DIGITAL SKILLS IN NAJRAN REGION. *Ann. For. Res*, *66*(1), 2044-2056.
26. Gill, A. S., Irwin, D. S., Ng, R. Y.-k., Towey, D., Wang, T., & Zhang, Y. (2020). The Future of Teaching Post-COVID-19: Microlearning in Product Design Education. Paper presented at the 2020 IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE).
27. Gill, A. S., Irwin, D. S., Ng, R. Y.-k., Towey, D., Wang, T., & Zhang, Y. (2020). The Future of Teaching Post-COVID-19: Microlearning in Product Design Education. 2020 IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE) ,
28. Gill, A., Irwin, D., Towey, D., Walker, J., & Zhang, Y. (2020). Reacting to the coronavirus: A case study of science and engineering education switching to online learning in a Sino-foreign higher education institution. Paper presented at the 2020 International Conference on Open and Innovative Education (ICOIE 2020).
29. Gill, A., Irwin, D., Towey, D., Walker, J., & Zhang, Y. (2020). Reacting to the coronavirus: A case study of science and engineering education switching to online learning in a Sino-foreign higher education institution. 2020 International Conference on Open and Innovative Education (ICOIE 2020) ,
30. Giurgiu, L. (2017). Microlearning an evolving elearning trend. Scientific Bulletin-Nicolae Balcescu Land Forces Academy, 22(1), 18-23 .
31. Giurgiu, L. (2019). Microlearning an evolving elearning trend. Scientific Bulletin-Nicolae Balcescu Land Forces Academy, 22(1), 18-23.

32. Gross, B., Rusin, L., Kiesewetter, J., Zottmann, J. M., Fischer, M. R., Prückner, S., &Zech, A. (2019). Microlearning for patient safety: Crew resource management training in 15-minutes. PloS one, 14(3), e0213178.
33. Gross, B., Rusin, L., Kiesewetter, J., Zottmann, J. M., Fischer, M. R., Prückner, S., & Zech, A. (2019). Microlearning for patient safety: Crew resource management training in 15-minutes. PLoS ONE, 14 .
34. Halbach, T., & Solheim, I. (2018). Gamified Micro-Learning for Increased Motivation: An Exploratory Study. International Association for Development of the Information Society .
35. Hegerius, A., Caduff-Janosa, P., Savage, R., & Ellenius, J. (2020). E-Learning in Pharmacovigilance: An Evaluation of Microlearning-Based Modules Developed by Uppsala Monitoring Centre. Drug safety, 43(11), 1171-1180.
36. Hodges, C. B., Moore, S., Lockee, B. B., Trust, T., & Bond, M. A. (2020). The difference between emergency remote teaching and online learning .
37. Hodges, C. B., Moore, S., Lockee, B. B., Trust, T., & Bond, M. A. (2020). The difference between emergency remote teaching and online learning .
38. Hug, T. (2005). Microlearning: a new pedagogical challenge (introductory note): na.
39. Hug, T. (2005). Microlearning: a new pedagogical challenge (introductory note). na .
40. Hug, T., & Friesen, N. (2007). Outline of a microlearning agenda. Didactics of Microlearning. Concepts, Discourses and Examples, 15-31 .
41. Hug, T., & Friesen, N. (2007). Outline of a microlearning agenda. Didactics of Microlearning. Concepts, Discourses and Examples, 15-31 .
42. Humphries, B., & Clark, D. (2021). An examination of student preference for traditional didactic or chunking teaching strategies in an online learning environment. Research in Learning Technology, 29.
43. Jahnke, I., Lee, Y. M., Pham, M., He, H., & Austin, L. (2020). Unpacking the inherent design principles of mobile microlearning. Technology, Knowledge and Learning, 25(3), 585-619.
44. Javorcik, T., & Polasek, R. (2019). Practical Application of MicroLearning in Education of Future Teachers. Proceedings of the European Conference on E-Learning ,
45. Jomah, O., Masoud, A. K., Kishore, X. P., & Aurelia, S. (2016). Micro learning: A modernized education system. BRAIN. Broad Research in Artificial Intelligence and Neuroscience, 7(1), 103-110.
46. Khong, H. K., & Kabilan, M. K. (2022). A theoretical model of micro-learning for second language instruction. Computer Assisted Language Learning, 35(7), 1483-1506 .
47. Khong, H.-K., & Kabilan, M. K. (2020). A theoretical model of micro-learning for second language instruction. Computer Assisted Language Learning, 1-24 .
48. Koedinger, K. R., Corbett, A. T., & Perfetti, C. (2012). The Knowledge-Learning-Instruction framework: Bridging the science-practice chasm to enhance robust student learning. Cognitive science, 36(5), 757-798 .
49. Koedinger, K. R., Corbett, A. T., & Perfetti, C. (2012). The Knowledge-Learning-Instruction framework: Bridging the science-practice chasm to enhance robust student learning. Cognitive science, 36(5), 757-798 .
50. Kovachev, D., Cao, Y., Klamma, R., & Jarke, M. (2011). Learn-as-you-go: new ways of cloud-based micro-learning for the mobile web. Advances in Web-Based Learning-ICWL 2011: 10th International Conference, Hong Kong, China, December 8-10, 2011. Proceedings 10 ,
51. L angreiter C, and Bolka, A. Snips & spaces: Managing microlearning. In T Hug, M Lindner, and P A. Bruck, editors, Microlearning: Emerging concepts, practices and technologies after e-learning. Proceedings of Microlearning 2005, pages 79–97, Innsbruck, Austria, 2005. Innsbruck University Press.
52. Langreiter, C., & Bolka, A. (2005). Snips & spaces: managing microlearning (on microlearning and microknowledge in a microcontent-based web). na .
53. Lee, Y. M., Jahnke, I., & Austin, L. (2021). Mobile microlearning design and effects on learning efficacy and learner experience. Educational Technology Research and Development, 1-31.
54. Lusk, D. L., Evans, A. D., Jeffrey, T. R., Palmer, K. R., Wikstrom, C. S., & Doolittle, P. E. (2009). Multimedia learning and individual differences: Mediating the effects of working memory capacity with segmentation. British journal of educational technology, 40(4), 636-651. https://doi.org/10.1111/j.1467-8535.2008.00848.x

55. Major, A., & Calandrino, T. (2018). Beyond chunking: Micro-learning secrets for effective online design. FDLA Journal, 3(1), 13 .
56. Mali, M., Sonawane, S., & Jadhav, V. (2021). Micro-learning (ML): An effective way of learning in Teacher Education .
57. Mali, M., Sonawane, S., & Jadhav, V. (2021). Micro-learning (ML): An effective way of learning in Teacher Education .
58. Manning, K. D., Spicer, J. O., Golub, L., Akbashev, M., & Klein, R. (2021). The micro revolution: effect of Bite-Sized Teaching (BST) on learner engagement and learning in postgraduate medical education. BMC medical education, 21(1), 1-11.
59. Mayer, R. E. (2005). The Cambridge handbook of multimedia learning. Cambridge university press .
60. Mezirow, J., & Dirkx, J. (2006). Musings and reflections on the meaning, context and process of transformative learning. Journal of Transformative Education, 4(2), 123-139 .
61. Mohammed, G. S., Wakil, K., & Nawroly, S. S. (2018). The effectiveness of microlearning to improve students' learning ability. International Journal of Educational Research Review, 3(3), 32-38 .
62. Najmi, A. H., Alhalafawy, W. S., & Zaki, M. Z. T. (2023). Developing a Sustainable Environment based on Augmented Reality to Educate Adolescents about the Dangers of Electronic Gaming Addiction. Sustainability, 15(4).
63. Nikou, S. (2019). A micro-learning based model to enhance student teachers' motivation and engagement in blended learning. Society for Information Technology & Teacher Education International Conference ,
64. Olivier, J. (2019). Short instructional videos as multimodal open educational resources in a language classroom. Journal of Educational Multimedia and Hypermedia, 28(4), 381-409 .
65. Osaigbovo, I., & Iwegim, C. (2018). Instagram: A niche for microlearning of undergraduate medical microbiology. African Journal of Health Professions Education, 10(2), 75-75 .
66. Paul, A. M. (2016). Microlearning 101. HR Magazine, 61(4), 36-42 .
67. Perry, M. (2017). Learning trend: Microlearning. Canadian Journal of Medical Laboratory Science, 79(2), 7 .
68. Sandoval, Z. V. (2018). Design and Implementation of a Chatbot in Online Higher Education Settings. Issues in Information Systems, 19(4).
69. Sankaranarayanan, R., Leung, J. C. K., Abramenka-Lachheb, V., Seo, G. Z., & Lachheb, A. (2022). Microlearning in Diverse Contexts: A Bibliometric Analysis. TechTrends, 67, 260 - 276 .
70. Sawarynski, K. E., & Baxa, D. M. (2019). Utilization of an online module bank for a research training curriculum: development, implementation, evolution, evaluation, and lessons learned. Medical education online, 24(1), 1611297 .
71. Scaglione, C. (2019). Reasons Why You Should Use Microlearning in Your Training Program. EHS Today, 12(7), 17 .
72. Semingson, P., Crosslin, M., & Dellinger, J. (2015). Microlearning as a tool to engage students in online and blended learning. Society for Information Technology & Teacher Education International Conference, Association for the Advancement of Computing in Education (AACE), Waynesville, NC USA.
73. Skalka, J., & Drlík, M. (2018). Educational model for improving programming skills based on conceptual microlearning framework. The Challenges of the Digital Transformation in Education: Proceedings of the 21st International Conference on Interactive Collaborative Learning (ICL2018)-Volume 1
74. Skalka, J., Drlik, M., Benko, L., Kapusta, J., Rodríguez del Pino, J. C., Smyrnova-Trybulska, E., ... & Turcinek, P. (2021). Conceptual Framework for Programming Skills Development Based on Microlearning and Automated Source Code Evaluation in Virtual Learning Environment. Sustainability, 13(6), 3293.
75. So, H. J., Lee, H., & Roh, S. Z. (2020). Examining the Design of Microlearning for Korean Adult Learners. New York: Routledge
76. Spanjers, I. A. E., van Gog, T., & van Merriënboer, J. J. G. (2010). A Theoretical Analysis of How Segmentation of Dynamic Visualizations Optimizes Students' Learning. Educational Psychology Review, 22(4), 411-423. https://doi.org/10.1007/s10648-010-9135-6

77. Sun, G., Cui, T., Guo, W., Beydoun, G., Xu, D., & Shen, J. (2015). Micro learning adaptation in MOOC: A software as a service and a personalized learner model. Advances in Web-Based Learning--ICWL 2015: 14th International Conference, Guangzhou, China, November 5-8, 2015, Proceedings 14 ,
78. Sweet, D. (2014). Microlectures in a flipped classroom: Application, creation and resources. Mid-Western Educational Researcher, 26(1), 52-59 .
79. Veneri, D. A., & Mongillo, E. M. (2021). Flop to Flip: Integrating Technology and Team-Based Learning to Improve Student Engagement. Internet Journal of Allied Health Sciences and Practice, 19(2), 10-22.
80. Wang, T., Towey, D., Ng, R. Y.-k., & Gill, A. S. (2021). Towards Post-pandemic Transformative Teaching and Learning. SN Computer Science, 2(4), 1-7 .
81. Xia, P. (2019, June). Application scenario of artificial intelligence technology in higher education. In International Conference on Applications and Techniques in Cyber Security and Intelligence (pp. 221-226). Springer, Cham.
82. Yin, J., Goh, T. T., Yang, B., & Xiaobin, Y. (2021). Conversation technology with micro-learning: the impact of chatbot-based learning on students' learning motivation and performance. Journal of Educational Computing Research, 59(1), 154-177.
83. Yulianto, B., Prabowo, H., & Kosala, R. (2016). Comparing the effectiveness of digital contents for improving learning outcomes in computer programming for autodidact students. Journal of e-Learning and Knowledge Society, 12(1), 12-33.
84. Zeidan, A. A., Alhalafawy, W. S., & Tawfiq, M. Z. (2017). The effect of (macro/micro) wiki content organization on developing metacognition skills. Life Science Journal, 14(12), 114-120.
85. Zeidan, A. A., Alhalafawy, W. S., Tawfiq, M. Z., & Abdelhameed, W. R. (2015). The effectiveness of some e-blogging patterns on developing the informational awareness for the educational technology innovations and the King Abdul-Aziz University postgraduate students' attitudes towards it. Life Science Journal, 12(12), 53-61.
86. Zhang, J., & West, R. E. (2020). Designing Microlearning Instruction for Professional Development Through a Competency Based Approach. TechTrends, 64(2), 310-318.