The Effect of Microlearning on Programing Skill Enhancements and Learning Motivation among the Secondary School Students

Ali Suwayid Alqarni†

Umm Al-Qura University, Makkah, Makkah, SA

Summary
This study intends to uncover the effects of microlearning (ML) on programing skill development as well as its impact on the learning motivation among high school students in Jeddah. The sample of the study consisted of seventy-eight students. Forty students were assigned to the control groups and thirty-eight students to the experimental group. The semi-experimental research design was adopted to answer the research questions. Data were collected via two tools: an observational form that includes a set of programing skills and a learning motivation scale. Besides, appropriate technical tools (e.g. Screencast-o-Matic) were used to create the digital content and deliver it to the learners. Findings showed that microlearning contributed to development of the learners' programing skills. It also increased their motivation to learn. Based on the findings, the researcher put forwards some recommendations for improving the learning environment and boosting the learners' motivation through microlearning in public or university educational settings. To extrapolate ML to some other uses, it is recommended for particular educational purposes, such as mastering specific skills, not merely the cognitive skills.

Key words:
Computers, educational technologies, e-learning, teaching strategies

1. Introduction

The development in communication technologies and computer networks gave rise to electronic learning environments that provide interaction between learners and their teachers to such a degree that is not far from learner-teacher interaction in face-to-face learning situations. This is because of the enormous support and services it provides to teachers to ease the lesson planning and choices of teaching styles and methods. Learning management systems (LMS), both open-source and commercial, enables learners to continue their learning outside the school environment through the flexibility it provides for helpful overcomes [1]. The place and time restrictions [2] and the intensity of competition between the providers have increasingly attracted a large number of educational agencies and institutions. They have provided learners with services that make the educational process attractive and motivating. This is achievable through easy access to educational content, effective communication with their colleagues, communication with their teachers, providing teachers with evaluation tools for their students, and statistics that facilitates mentoring students' progress in the course of their study.

Certainly, the development of electronic learning environments casts a shadow over the elements of the educational process in general. The teacher, who used to be the focus of the educational process, has become a guide to the educational process rather than a mere knowledge transmitter. The learning process is centered on the learner, and the teacher's role is to build and organize the learning experiences. In light of this development, certain strategies were invented to ensure the use of modern communication means. Teachers interested in delivering their lectures online benefited from available strategies used in the traditional environment. They modified such strategies to fit the electronic settings. Al-Abeed and Al-shaya [3] indicated the possibility of applying some strategies of the traditional environment in the electronic environments, including brainstorming, small groups, and project-based learning.

Besides these strategies, the technical development has instigated some technology-dependent strategies. The newly-devised strategies include the participatory learning strategy, which is based on the interaction of learners with each other or with their teachers in online environments through accessible technical tools and applications [4]. For instance, the flipped classroom strategy is based on viewing the digital educational content at home before attending the lecture. After that, the learners and their teachers have a virtual discussion on the topic at hand in order to invest the time of the lecture for more various activities. This provides learners with adequate knowledge and skills and reduces levels of anxiety [5,6]. Moreover, the Web Quest is another strategy that came into existence because of unreliable information and digital distractions on the Web. In this strategy, the teachers plan and design their educational content through knowledge trips over the Internet with an aim to provide learners skills and information from reliable sources and websites [7].

The educational content, too, has developed. It is one of the most important elements of the educational process that requires high quality to ensure desirable outcomes. This is why the vested interests direct technology to prepare and develop the content. Prior to digital development, the traditional learning content was limited to printed textbooks — static texts, pictures and drawings that did not achieve

Manuscript received October 5, 2021
Manuscript revised October 20, 2021
https://doi.org/10.22937/IJCSNS.2021.21.10.23

the required interaction with the learner. The digital content, however, is more attractive to learners owing to the digital tools and applications involved in its preparation. It is worth mentioning that the digital content does not materialize in converting a hard copy of the textbook into a digital file with PDF extension. It is rather the entire entities of multimedia designed in such a way to ensure interaction of learners and enhance their motivation. The most important components of digital content, Ghazal [4] conceded, include videos, recordings, photos and graphics that altogether attract learners. Additionally, learning objects, which are independent learning units reusable in different educational situations available through websites or in repositories of digital objects have greatly contributed to the creation of high-quality and low-cost digital content [8]. Further, flexibility is a characteristic feature of the digital content and is one of the strengths that contributed to its pervasiveness. Bal [9] argued that the digital content in the form of a digital game motivates learners to continue learning. Bal's study identified the effect of a digital educational game on writing skills for middle school students. The study concluded with a positive note on its effect on the students' level, apart from increasing the spirit of cooperation among them.

The diversity of digital content forms has attracted learners and increased their motivation to learn. For instance, the social media tools boost the students' motivation to learn. Studies have indicated that presenting the digital content and interaction with students through an array of social media applications has a positive effect on their motivation to learn. Nevertheless, the overuse of such applications may have negative effects [10,11]. In a similar vein, the interactive e-book is considered one of the technologies that have been introduced in the educational environment and contributed to a very large degree in supporting and enhancing the learning motivation of students [12,13]. Studies have also shown that juxtaposing electronic and traditional environments in an interactive and integrative manner enhances students' motivation. This means that blended learning environments increases students' desire and willingness to learn [14-16].

Some other studies reported positive impact of the digital content on students' scores. For example, Yulianto, Prabowo, and Kosala [17] examined the results of a group of students who adopted the individual learning. The study recommended using the digital content in individual learning, despite outperformance of the students who were educated in traditional classrooms. Some other researchers ascertained the impact of digital content on developing some skills. The findings of Al-tatari [18] and Abu Afifah [19] showed that digital stories positively enhanced reading comprehension and listening skills among the third-grade students. Despite the positive impact of digital content as surfaced from experimental studies, some researchers went a step further exploring the appropriate mechanism for presenting the content in a way that achieves great educational benefits for learners. Giurgiu [20] studied a course of sixteen units. The author divided learners into three groups. The digital content of each group was introduced differently from the other. In the first group, a question was presented after each unit. In the second group, students were asked to answer four questions after four units. In the third group, students answered eight questions after reviewing half of the course. The results showed that the participants in the first group outperformed their counterparts in the other two groups. It may be concluded from this study that presenting long sequenced content may make it difficult for learner to interact with the information. It may also exceed the capacity of learners' memory so that they cannot absorb all the information. Dinmore [21] recommended avoiding the use of long visual lectures. The author suggested replacing them with a short video lecture, dealing with a specific goal or topic. The author justified these suggestions that they are doable in similar educational situations.

Touched on above, the use of ML is a solution to the problem of whole display of the digital content. The principle of ML depends on splitting content into small units. Each unit covers one educational goal and may contain video files, text, pictures or sound presented in a short period [22,23]. The duration of presenting the ML has been a controversial issue in the literature. Some researchers stated that ML could be presented in fifteen minutes [22,24] or ten minutes [25]. Some other researchers thought that it could be presented within a range of time — from five to fifteen minutes [26]. Some others argued that it should not exceed five minutes [20,27,28,29].

In terms of theory, ML is based on a solid theoretical foundation. It is based on the most well-established theories of learning and teaching. It is based on the principles of the behavioral theory as it creates the stimulus through which it ensures learner's response. that guarantees learners' correct path towards learning [30]. Micro learning, as previously defined, is based on small digital units provided to learners to acquire knowledge or skills related to a specific topic. The units are often presented outside the classroom setting. Therefore, it is prepared and developed in such a way that attracts learners and ensures their interaction so that learning takes place with feedback that shows the learners' extent of learning progress.

In addition, ML draws on the principles of programed teaching [31] characterized by dividing information into small parts and presenting it to the learner in a linear manner so that the learner moves from one information to another after mastering the previous one. Skinner stressed on giving freedom to the learners in order to move on in their learning according to their abilities and aptitudes.

Just as the principles of behavioral theory are present in the design of ML, so is the case for cognitive theory that deals with the mental processes that occur during the learning process. One of the most important applications of the latter is building knowledge gradually taking into account the learners' characteristics. According to this theory, Learning moves hierarchically from simple to complex and from easy to difficult. This ensures building the learners' knowledge of in a smooth and clear manner [30]. In ML, the micro units are built to achieve the goals one by one until each one is completed with a move to the next one until the end of the course.

In its construction, ML depends on the principles of the Constructivism Theory that emphasizes that the learner should be active during the learning process, and build his current experience according to his/her previous experiences [32]. This is done by focusing on some activities, tests, and short videos that enable learners to build their self-knowledge, and the teacher's role in them is a guide to the learner.

ML has been growing rapidly throughout the past two years [33]. This is because of its suitability for todays' generation who deal with technology preferring to obtain information quickly and from multiple digital sources instead of reading printed books. In addition, other features such as learner centeredness, low cost, quality of preparation distinguish this mode of learning [26,34]. There are also additional features that led to its spread and have made it the subject of discussion by many specialists in the field. A salient features is that it emphasizes the main points that the teacher wants to deliver clearly to learners. That is, the teacher may give a lengthy lecture on a specific topic, but at the end of the lecture. The teacher may collect the main points in small parts based on the micro-learning method to reinforce the main objectives of the lesson [36]. Besides, it saves learners' time through the speed and ease of access to the topic that has been problematic and reviewing the content and activities related to it to reach a deeper understanding of it [28,35]. The development and spread of portable devices such as laptops, smartphones and other tablets contributed to the use of ML through the learner's access to the desired content without being restricted by time or place [36]. One of the distinguishing features of ML that has facilitated its omnipresence is learners' ability or memorizing and recalling information. This is because information is divided into smaller units, making it easy for learners to organize and link the information in a way that facilitate information retrieval when needed [20]. As well, ML enhances individuals' learning for it allows learners to move and advance in lessons according to their abilities and aptitudes, which in turn enhances their motivation to learn [25,37]. Finally, as an integrated electronic course takes time and effort, ML represents the ideal solution to developing digital content in a short time and at a lower cost for the teacher and the learner [35].

Teachers and learners' acceptance of ML and their willingness to modify and develop the content makes it an effective method for transferring knowledge and skills to students. Numerous studies have discussed the teachers and students' positive attitudes towards ML [38] and assigned syllabi [37,39]. This belief increases the chances of advantages of ML in the educational process in general. Producing content of a high quality that guarantees the achievement of the desired goals is a challenge for those interested in developing digital content in the public and private sectors.

Research into the contributions of ML varied remarkably. Some researchers studied the impacts of ML on increasing academic achievement, and some others examined its role in enhancing the learners' skills. In light of these two variables, Ahmed [38] uncovered the effect of using video-based content as an ML tool in an integrated learning environment at Sultan Qaboos University in Oman. The study indicates that ML leads to a deeper understanding of the course. The mean values of students' results in the experimental group were higher than their counterparts' results. Within this framework, Mahmoud [40] investigated the effect of interaction between the magnitude of ML content and the level of mental capacity on the development of immediate and delayed achievement among students. The study concluded on a positive note of ML effect on students' academic achievement regardless of the size of the learning content and mental capacity. The results also showed differences in the immediate and delayed achievement in favor of students who had a small content volume over students who used medium or large content. Gross et al [26] studied the feasibility of a training program for medical staff resources management. The ML was used in the training for fifteen minutes (five minutes for each stage. It included video, simulation, and then information presentation. The content in the first group was presented through a recorded video of a practical example on the topic. The content in the other group was presented through a videotaped lecture. After that, the participants were asked to simulate and realize what they saw in the video. Again, the information they obtained were discussed. The results showed the effectiveness of ML in training, as the two groups demonstrated the skills in the content at the stage of simulation and information display. The group in which the content was presented through an applied example outperformed the other group who had a videotaped lecture. Mohammed et al [41] supported the results of the aforementioned studies that reported efficiency and effective learning stimulated by ML that also increased the primary school students' abilities to recall knowledge.

The literature has also showed a remarkable development in learners' skills under the auspices of ML-based programs. For instance, Alshamry and Ali [42] showed that students who were exposed to content based on ML performed better in designing presentations than their peers who were taught non-fragmented digital content. In a similar vein, Skalka and Drlík [43] confirmed the findings of the previous study whose results affirmed the effectiveness of an ML-based educational model to improve students' programing skills.

Educators encourage learners to learn and numerous studies conducted on this topic through various teaching methods, strategies, and technical tools aimed at stimulating learners and draw their attention to learning. Not surprisingly, learning often occurs when the learner is provoked either by an internal or external influence that makes learners in an active state that pushes them to learn and interact with the educational situation. Such learning situations are accompanied by activities and training that require referring to other sources related to the learning subject. This subsequently leads to skill/knowledge acquisition that self-satisfy learners [15,45,45].

Some studies have shown that ML in the educational process attracts and motivates learners to learn. Osaigbovo and Iwegim [46] fragmented the content of the Pathology Course and then presented it through the social media in which students were subscribed. At the end of the experiment, 91.6% of students thought that ML enhanced their learning and 50% stated that it reinforced their relationship with peers and teachers. Similarly, in Olivier's [47] study, short videos used as part of ML and open educational resources were employed to teach a language class. The results showed that students had a positive tendency to use short videos in the educational process.

Despite what has been discussed on ML effectiveness in education, this learning mode is not devoid of limitations that might hinder its omnipresence in the field. A striking disadvantage relates to its unsuitability for complex knowledge and skills with multiple themes associated with concepts or sub-ideas [48]. Therefore, it may be appropriate for additional activities after the school day in order to review a specific idea or for more information about a specific topic. It may add value to the course by reinforcing the important points.

What is more, ML derives its strength from its independence and ability to deliver focused and complete information to the learner on a specific topic. At the same time, such fragmentation should be linked – separate educational units should form an overall picture of knowledge/skills about a specific subject that should be possessed [49]. Failure to achieve interconnection between educational units leads to distorted or unclear knowledge/skills to learners and thus failure to achieve the desired goals.

Another challenge that may affect the utilization of ML is the lack of diversification in data formats. Learners plausibly have a diversity of learning styles. Some learners prefer visual data, some prefer audios, and others prefer texts. The digital content built around ML has short duration and the content may lose some form of data.

ML is a recent trend that employs technology in education. That is why eLearning Guild, an organization that pays attention to e-learning environments by organizing specialized conferences in the field, organized conferences in the past two years under the title, Microlearning Summit. It was about the latest technology in this field. Additionally, educators' attention of ML has increased in recent years [33]. Hence, ML is still in its early stages and needs more research to help draw a clear picture of the extent of its educational contributions and the positive effects that it may add to the educational elements in general and for the teachers and the learners in particular.

A thorough review of the literature, in addition to the researcher's conclusion drawn from Arabic databases, there are few Arab studies on the effect of ML on different learning domains: cognitive, emotional and skills. One of such a few studies in the Arabic context is Alshamari and Ali [42] that examined the effect of context organization (total or partial) in flipped classroom on the development of presentation skills for second-grade students. The results concluded that partial content organization provided students with more skills than the wholeness of content. Equally important, Gerges [50] identified the impact of the total and partial content presentation pattern based on augmented reality technology on the development of self-organization and learning efficiency of first-grade middle school students. The results showed that the organization of content, in its total and partial patterns, had positive effects on students. Due to the dearth of research studies on ML in the Arabic context in addition to divergence of results ensued from the previous studies, it is necessary to conduct the present study. It digs into the research problem with an aim to come to a conclusion that either supports or discards previous findings on ML in our educational environment.

Research Questions & Assignments

The study seeks to find out the effect of using microlearning on developing the programing skills and learning motivation of students in the course of computer and information technology at the first secondary school class. The study aims to answer the following two research questions:

Research Question#1:

What is the effect of using microlearning on developing programing skills in the computer and information technology course undertaken by the first-grade secondary school students?

To answer this question, it is necessary to formulate the following two hypotheses:

- There are no statistically significant differences at the level of 0.05 in programing skills between the experimental and control groups in the pretest.
- There are no statistically significant differences at the level of 0.05 in programing skills between the experimental and control groups in the posttest.

Research Question#2:

What is the effect of using microlearning on developing students' motivation to learn?

To answer this question, the following hypotheses were attested:

- There are no statistically significant differences at the level of 0.05 in motivation to learn between the experimental and control groups in the pretest.
- There are no statistically significant differences at the level of 0.05 in motivation to learn between the experimental and control groups in the post-test.

2. Materials and Methods

The researcher adopted the semi-experimental research design — one of the types of quantitative approach. It is popular in educational research that compare two groups of participants. It has been adopted in the current study for its suitability to measure the impact of ML on developing programing skills and motivation of high school students. Gliner, Morgan, and Leech [51] stated that the quasi-experimental approach is similar to the experimental randomized approach. However, it differs in that the participants are assigned to groups in advance as in the classroom groups. Gliner et al. [51] prescribed four designs for the approach at hand. One of them is the pretest-posttest design, which was adopted in the present study. For this purpose, the study consisted of two groups: the control group and experimental group.

3. Population and Sampling

The population of the study encompassed all secondary school students at Jeddah Bureau of Education. The sample was chosen randomly– a random selection of the educational offices in Jeddah. Again, one of the schools affiliated to the nominated head-office was randomly selected to conduct the study. In the selected school, two groups of students enrolled in the first grade of the secondary school level were singled out. Seventy-eight students who took the course of Computer and Information Technology were assigned to two groups: the control group (n=40) and the experimental group (n=38). To ensure the parity of the two groups, all the participants sat for a pretest of skills. The results showed no statistically significant differences at the level of 0.05 between the two groups (see Table 1).

Table 1: The Pretest Result and the Significance Level at 0.05 for programing Skills of the Two Groups

Group	Students No.	Mean	SD	F	t	*P* value	
control	40	64.2	14.1	76	-1.18	0.24	Not Sig.
Experimental	38	68.16	15.4				

Prior to experiment, the motivation scale was piloted to ensure that students' level of motivation was equal. The results showed no statistically significant differences between responses of the two groups at the level of 0.05 (see Table 2). As data in the table shows, there are no differences between responses of the two groups at the level of 0.05 in the four dimensions and at the overall level of the tool. The levels of significance for the four dimensions were 0.72, 0.59, 0.7, and 0.85, respectively for the dimensions of perseverance and seriousness, value and benefit of learning, the responsibility of the learner, and self-efficacy. The overall significance level was 0.73, and all of these results were greater than 0.05. Thus, the results indicate that there were no statistically significant differences at the level of 0.05 in the level of motivation among members of the control and experimental groups.

Table 2: The Pretest Result and the Significance Level at 0.05 for Learning Motivation of the Two Groups

Dimension	*Group*	*Students No.*	*Mean*	*SD*	*F*	*t*	*P value*	
Perseverance and seriousness	control	40	2.04	0.49	76	0.36	0.72	Not Sig.
	Experi-mental	38	2.0	0.47				
The value and utility of learning	control	40	4.87	0.12		-0.54	0.59	Not Sig.
	Experi-mental	38	4.88	0.09				
The responsibility of the learner	control	40	1.8	0.35		0.38	0.7	Not Sig.
	Experi-mental	38	1.77	0.34				
Self-efficacy	control	40	1.77	0.29		0.18	0.85	Not Sig.
	Experi-mental	38	1.75	0.3				
Total	control	40	2.58	0.23		0.34	0.73	Not Sig.
	Experi-mental	38	2.56	0.22				

The researcher used two tools to answer the research questions: observation and questionnaire. The observational form consisted of 40 items representing the total skills required for the Visual Basic course in the Computer and Information Technology at the first level. These skills were outlined after analyzing lessons. The form was given to specialized referees for a validity check. In light of the validation committee's comments, it was amended to ascertain the inclusion of all the required skills. The experiment was carried out on a pilot sample before the start of the real (intended) experiment. The Cronbach Alpha reliability coefficient was calculated and it was 0.96, which means the tool was reliable enough to be used for the purpose of the study at hand.

As for the questionnaire, it was developed in the form of a motivation scale consisting of thirty-four items categorized into four main dimensions. The first one, persistence and seriousness, includes nine items, namely 1, 5, 9, 13, 17, 21, 25, 29, and 33. The second, the value and benefit of learning, encompassed eight items: 2, 6, 10, 14, 18, 22, 26, and 30. The third, the responsibility of the learner, consisted of eight items: 3, 7, 11, 15, 19, 23, 27, and 31. The fourth, self-efficacy, comprised nine items: 4, 8, 12, 16, 20, 24, 28, 32, and 34. The tool was validated by a group of specialists who approved it. In addition, the reliability was measured and the coefficient of Cronbach's alpha was 0.82, which means that the tool was reliable.

The software called Screencast-o-Matic was used as a medium of the content. This electronic environment was employed in such as way to create short videos explaining each programing skill in the Visual Basic language. This software is free and allows recording videos up to 15 minutes. Besides, a free educational platform was used to upload the videos with activities and practices for each skill. Upon completion of the digital content preparation, a group of experts in educational technologies and computer teaching methods checked weaknesses in the content and recommended fixing the flaws before conducting the experiment. According to the experts' feedback, the digital content was prepared in its final form.

4. Results

Descriptive and inferential statistics were used to answer the research questions.

Research Question #1:

What is the effect of microlearning on developing programing skills in the computer and information technology course undertaken by the students of the first-year of the secondary school?

To answer this enquiry, the t-test was used to compare the results of the control group and the experimental group after implementing the experiment (see Table 3). The data displayed in the table shows statistically significant differences between the responses of the two groups at the level of 0.05 (t value = -2.3). The differences were in favor of the experimental group. Therefore, the null hypothesis was rejected. It states that there are no statistically significant differences at the level of 0.05 in programing skills between the experimental and control groups in the post-test. As for the size of effect of using ML on developing students' programing skills, the results of Omega-Square showed effects less than average when used in developing skills (0.33).

Table 3: The Posttest Result and the Significance Level at 0.05 for Programing Skills

Group	***Students No.***	***Mean***	***SD***	***F***	***t***	***P value***	
Control	40	112.1	11.5	76	- 2.3	0.02*	Sig.
Experimental	38	116.7	4.36				

Research Question #2:

What is the effect of microlearning on developing students' motivation to learn?

The results of the descriptive and inferential statistics used to answer this question are displayed in Table 4. The table evidently shows that there are statistically significant differences between the control and experimental groups at the level of 0.05 in the dimensions of perseverance and seriousness, responsibility of the learner, and self-efficacy in addition to the existence of differences with regard to the tool as a whole.

Table 4: The Posttest Result and the Significance Level at 0.05 for Learning Motivation

Dimension	***Group***	***Students No.***	***Mean***	***SD***	***F***	***t***	***P value***	
Persev-erance and serious-ness	Control	40	3.3	0.2	76	-26.9	<.0001*	Sig.
	Experi-mental	38	4.54	0.21				
The value and utility of learning	Control	40	4.88	0.11		-0.02	0.98	Not Sig.
	Experi-mental	38	4.88	0.1				
The responsi-bility of the learner	Control	40	3.96	0.27		- 15.94	<.0001*	Sig.
	Experi-mental	38	4.73	0.14				
Self-efficacy	Control	40	3.45	0.23		-23.3	<.0001*	Sig.
	Experi-mental	38	4.57	0.19				
Total	Control	40	3.87	0.14		-30.5	<.0001*	Sig.
	Experi-mental	38	4.67	0.09				

The differences were in favor of the experimental group as its total mean value is 4.67, compared to 3.87 mean value of the control group. In other words, the differences in the informants' responses regarding motivation were on the side of the experimental group the dimensions that showed statistical differences: perseverance and seriousness (M= 4.54), responsibility of the learner (M=4.73), and self-efficacy (M=4.57) respectively. The results showed no differences between the responses of the two groups at the level of 0.05 in the dimension of the value and benefit of learning wherein the mean score of each of the two groups was 4.88.

5. Discussion

The results revealed that students who were exposed to ML-based digital content demonstrated more programing skills than their peers in the other group did. This could be attributable to the content provided to them in separate short videos for each skill, followed by activities and exercises related to the same skill. It believingly makes it easier for the learners to emphasize on programing skills and thus increases their chances of mastering such a skill. This result is consistent with the study of Alshamari and Ali [42] that examined the effect of ML on designing short exposition skills, and Ahmed's study [39] that explored the use of short videos as part of ML in developing learners' programing skills.

Moreover, the results showed that ML-based digital content improves the educational process and increases the chances of acquiring knowledge and skills at a rate lesser than the average compared to the traditional content. This result comes in harmony with the study of Mohammed et al [41] that showed a slight advantage (about 18%), in achievement of students who underwent the ML mode.

Furthermore, ML boosts learners' determination and ambition and thus increases their motivation to learn. It also bolsters their confidence in dealing with different educational situations confidently. This is what distinguishes ML-based digital content fragmented to understandable topics. It drives learners to learn more and it maximizes their confidence to overcome difficulties they encounter throughout their learning situations. This result is in line with the results of previous studies that scrutinized the relationship between motivation and ML style [46,47].

Expectedly, the present study revealed that both groups were cognizant of the importance of learning and career opportunities it provides for them in the future. This is because the participants have been informed about the importance of education and its role in improving their social lives and career. They were educated about this through various means of communication. Besides, the parents play roles in directing and motivating their children to obtain the best degrees.

6. Recommendations & Suggestions

In light of the results of the current study, the researcher recommends the following:

- Applying ML in public or university educational settings in order to improve the learning environment and increase motivation to learner.
- Using ML for various educational purposes, e.g. mastering particular skills — not only applying it on the cognitive skills.
- Despites its advantages, ML should not be emphasized too much at the expense of other methods of learning.

The researcher also puts forward the following suggestions for further research:

- Conducting a similar study targeting a sample of different ages. It may be a sample of primary schoolchildren or university students in order to determine the impact of ML on such learning environments.
- Conducting a study to unfold the effect of ML on developing other skills, such as the critical thinking skills.
- Conducting a study to find out the effect of ML on the development of some values among the learners.

References

[1] Tyurina, Y., Troyanskaya, M., Babaskina, L., Choriyev, R., Pronkin, N. (2021). E-Learning for SMEs. International Journal of Emerging Technologies in Learning, 16(2), 108-119.

[2] Vai, M., Sosulski, K. (2011). Essentials of online course design. New York, Routledge.

[3] Al-Abeed, A. & Al-shaya, H. (2015). Educational technology: Foundations and applications. Riyadh, Al-Rasheed Library.

[4] Ghazal, A. (2011). Publication methods and accessibility mechanisms of academic websites and educational digital content: An evaluative study. A Proceeding to the Conference of the Arab Federation for Libraries and Information – Sudan. Arab Federation for Libraries and Information, 22, 2828-2793.

[5] MacDonald, J. L. J. (2018). Teaching and learning via technology (translator, Youssef Arouri). Amman: House of Thought.

[6] Abdullah, M., Hussin, S., Ismail, K. (2021). Does Flipped Classroom Model Affect EFL Learners' Anxiety in English Speaking Performance?. International Journal of Emerging Technologies in Learning, 16(1), 94-108.

[7] Chang, C. S., Chen, T. S., & Hsu, W. H. (2011). The study on integrating WebQuest with mobile learning for environmental education. Computers and Education, 57, 1228-1239.

[8] Al-Sayed, Y. M. (2019). The use of two types of feedback (detailed - brief) during the description of the repositories of digital learning objects and its effect on the quality of digital content design and the motivation towards educational materials among students of educational technology. The Educational Journal, 63, 349-483.

[9] Bal, M. (2019). Use of digital games in writing education: an action research on gamification. Contemporary Educational Technology, 10(3), 246–271.

[10] Jamal, M. (2019). The effect of using social media on learning motivation and decision-making among high school students in Amman. An-Najah University Journal, 33 (9), 907-932.

[11] Kurniawan, Y., Jingga, F. & Prasetyo, A. (2017). The impacts of social media Facebook as learning media towards learning motivation for students: A case study approach. A proceeding of the International Multi-conference of Engineers and Computer Scientists. March 15-17, Hong Kong.

[12] Akram, H. (2017). The effect of using the interactive e-book in teaching magic on the development of

achievement and motivation to learn among third-grade intermediate students. Arab Studies in Education and Psychology, 84.

[13] Alfiras, M., Bojiah, J. (2020). Printed Textbooks Versus Electronic Textbooks: A Study on the Preference of Students of Gulf University in Kingdom of Bahrain. International Journal of Emerging Technologies in Learning, 15(18), 40-52

[14] Al-Mutairi, S. (2016). The effect of using blended education on developing learning motivation and academic achievement among students of the College of Education at King Saud University: An experimental study. Specialized Educational International Journal, 5(5), 126-142.

[15] Al-Aswad, A. A. (2019). The effectiveness of using blended learning in the teaching of educational guidance and counseling course on developing the achievement and motivation of the second year students of Education Sciences at the Valley University. Arab Journal of Educational and Psychological Sciences, 7, 97-120.

[16] Stahl, G. (2021). Redesigning Mathematical Curriculum for Blended Learning. Educ. Sci.. 11(4), 165.

[17] 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).

[18] Al-Tatari, M. A. S. (2016). The effect of employing digital stories on developing reading comprehension skills among third-grade students (Master's thesis). Islamic University, Gaza Strip, Palestine.

[19] Abu Afifah, H. M. J. (2016). The impact of teaching Arabic language using digital story for the third grade of primary school on developing active listening skills and creative thinking (Master's Thesis). Middle East University, Jordan.

[20] Giurgiu, L. (2017). Microlearning an evolving e-learning trend. Buletin Stiintific, 22(1), 18–23.

[21] Dinmore, S. (2019). Beyond lecture capture creating digital video content for online learning: A case study. Journal of University Teaching and Learning Practice, 16(1).

[22] Janjua, N. (2017). Piloting surgical near-peer microlearning sessions: Lessons learnt from students and teachers.

[23] Kamilali, D., & Sofianopoulou, C. (2015). Microlearning as innovative pedagogy for mobile learning in MOOCs. International Association for Development of the Information Society (p. 14).

[24] Kelleci, O., Kulaksiz, T. & Pala, F. K. (2018). The effect of social network-supported micro-learning on teachers self-efficacy and teaching skills. World Journal on Educational Technology, 10(2), 115-129.

[25] Sweet, D. (2014). Microlectures in a flipped classroom: Application, creation and resources. Mid-Western Educational Researcher, 26(1), 52–59.

[26] Gross, B., Rusin, L., Kiesewetter, J., Zottmann, J. M., Fischer, M. R., Prueckner, S., & Zech, A. (2019). Microlearning for patient safety: Crew resource management training in 15-minutes. PLOS ONE, 14(3).

[27] O'Neill, J. L. (2016). Weeding with ADDIE: Developing training for deselection at an academic library. Reference & User Services Quarterly, 56(2), 108-115.

[28] Paul, A. M. (2016). Microlearning 101. HR Magazine, 61(4), 36. Retrieved from https://search-ebscohost com.proxy.lib.siu.edu/login.aspx?direct=true&db=

[29] Buhu, A., & Buhu, L. (2019). The applications of microlearning in higher education in textiles. ELearning & Software for Education, 3, 373.

[30] Ornstein, Allan C., Hunkins, Francis P. (2009). Curriculum: Foundations, principles, and issues (5th ed). Pearson, the U.S.

[31] Skinner, B. F. (1958) Teaching machines. Science, 128, 969-77.

[32] Sager, M & Greenbow, T. (1997). Common student misconceptions in electrochemistry: Galvanic, electrolytic and concentration cells. Journal of Research in Science Teaching, 34(4).

[33] Winger, A. A. W. ed. (2018). Supersized tips for implementing microlearning in macro ways. Distance Learning, 15(4), 51-55.

[34] Jomah, O., Masoud, A. K., Kishore, X. P., & Aurelia, S. (2016). Microlearning: A modernized education system. Broad Research in Artificial Intelligence & Neuroscience, 7(1), 103–110.

[35] Scaglione, C. (2019). Nine reasons why you should use Microlearning in your training program. EHS Today, 12(7), 17.

[36] Perry, M. (2017). Learning trend: Microlearning. Canadian Journal of Medical Laboratory Science, 79(2).

[37] 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), 1–5.

[38] Ahmad, N. (2017). Video Podcasts as a Micro Learning Tool in a Blended Learning Environment. E-Leader Macao

[39] Hesse, A., Ospina, P., Wieland, M., Yepes, F. A. L., Nguyen, B., & Heuwieser, W. (2019). Short communication: Microlearning courses are effective at increasing the feelings of confidence and accuracy in the work of dairy personnel. Journal of Dairy Science, 102(10), 9505–9511

[40] Mahmoud, I. (2016). The effect of interaction between the magnitude of micro-learning content (small - medium – large) and mental capacity (low – high) on the development of students of immediate and deferred learning technology of information technology concepts. Arab Studies in Education and Psychology, 70, 17-77.

[41] 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.

[42] Alshamry, F. & Ali, A. (2017). The effect of different content organization in the flipped classroom on the development of designing presentation skills among second-grade intermediate students in the computer

curriculum. Arab Studies in Education & Psychology, 88, 77-108.
[43] Skalka, J., & Drlík, M. (2019). Educational model for improving programing skills based on conceptual microlearning framework. In M. E. Auer & T. Tsiatsos (Eds.), the challenges of the digital transformation in education (pp. 923–934).
[44] Ismail, R. (2009). The effectiveness of e-learning on sixth grade pupils' achievement and their motivation toward learning science. Journal of Scientific Education - Egypt, 12 (1), 17-71.
[45] Nofal, M. (2019). The effectiveness of a counseling program based on the ARCs model on developing learning motivation among a sample of third-grade intermediate students in the Kingdom of Saudi Arabia. An-Najah University Journal, 33 (9), 1567-1602.
[46] Osaigbovo, I. I., & Iwegim, C. F. (2018). Instagram: A niche for microlearning of undergraduate medical microbiology. African Journal of Health Professions Education, 10(2), 75.
[47] 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.
[48] Fox, A. (2016). Why training fails and what to change: A case for microlearning and ongoing management. Employment Relations Today (Wiley), 43(1), 41.
[49] Major, A. A. M. & Calandrino, T. T. C. (2018). Beyond chunking. Distance Learning, 15(2), 27-30.
[50] Gerges, M. M. M. (2017). The effect of the total / partial content display style based on augmented reality technology on the development of self-organization and learning efficiency of first-grade middle school students. Education Technology - Studies and Research, 30, 1-55.
[51] Gliner, J. A., Morgan, G. A., & Leech, N. L. (2009). Research methods in applied settings. New York, USA: Taylor & Francis.

Ali Alqarni received the B.E. from Teacher College in Jeddah in 2004, and M.E. degree from Umm Al-Qura Univ. in 2010. He received the PhD. from Southern Illinois Univ. in 2016. After working as a computer teacher from 2005 to 2010, an assistant professor (from 2016) in the Dept. of Curriculum and Instruction, Umm Al-Qura Univ., he has been an associate professor at Umm Al-Qura Univ. since 2020. His research interest includes educational technology, e-learning, using computer in education.