Original article

A Comparative analysis of learning, retention, learning and study strategies in the traditional and M-learning systems

Une analyse comparative des stratégies d'apprentissage, de rétention, d'apprentissage et d'étude dans les systèmes traditionnels et M-learning

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A B S T R A C T

Introduction. – Learning and study strategies are important issues that have attracted the attention of many researchers in recent decades. The importance of strategies is well known as a way of improving the level of learning.

Objective. – This research aimed to compare the effect of learning via mobile devices on learning, retention, learning, and study strategies, with traditional instructional methods.

Method. – The present study is a quasi-experimental design with a static group comparison design. The study comprised all primary education students of Taybad Branch, Islamic Azad University ($N = 54$) in the second semester of the academic year 2018–2019 who chose the language course. These students were considered as a research sample and divided them non-randomly into two groups (27 people as experimental and 27 people as the control group). Before the beginning of the research, a researcher-made learning pre-test questionnaire was developed for both groups in similar conditions. Then, we used the traditional method for the control group and implemented the M-Learning method for the experimental group. At the end of sixteen weeks of training, a researcher-made learning post-test and also the standard learning strategies test were performed in both groups, and after two months of learning tests; the retention test was performed for both test and control groups. Independent t-test analyzed data in Statistical Product and Service Solutions (SPSS) software.

Results. – Findings showed that the rate of learning and retention among trainees by the M-learning method is more than the traditional method. However, in the traditional method, the motivation for progress was more than M-Learning.

Conclusion. – Since mobile learning has a high degree of interoperability, personalization, and participation, compared to traditional learning, it allows students to learn at any time and place they wish. Language teachers and education planners with regard to the importance of learning various skills, apply e-learning in training increase personal motivation and interest in learning.

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R É S U M É

Introduction. – Les stratégies d'apprentissage et d'étude sont des questions importantes qui ont attiré l'attention de nombreux chercheurs au cours des dernières décennies. L'importance des stratégies est bien connue comme moyen d'améliorer le niveau d'apprentissage.

Objectif. – Cette recherche visait à comparer l'effet de l'apprentissage via des appareils mobiles sur les stratégies d'apprentissage, de rétention, et d'étude, avec les méthodes d'enseignement traditionnelles.

Méthode. – La présente étude est un plan quasi-expérimental avec un plan de comparaison de groupe statique. L'étude comprenait tous les étudiants de l'enseignement primaire de la branche de Taybad, Université islamique d'Azad ($n = 54$) au deuxième semestre de l'année universitaire 2018-2019 qui ont choisi

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le cours de langue. Ces étudiants ont été considérés comme un échantillon de recherche et les ont répartis de manière non aléatoire en deux groupes (27 personnes en tant qu'expérimental et 27 personnes en tant que groupe témoin). Avant le début de la recherche, un questionnaire de pré-test d'apprentissage conçu par les chercheurs a été développé pour les deux groupes dans des conditions similaires. Ensuite, nous avons utilisé la méthode traditionnelle pour le groupe témoin et mis en œuvre la méthode M-Learning pour le groupe expérimental. Au terme de seize semaines de formation, un post-test d'apprentissage réalisé par des chercheurs ainsi que le test de stratégies d'apprentissage standard ont été réalisés dans les deux groupes, et après deux mois de tests d'apprentissage; le test de rétention a été réalisé pour les groupes test et contrôle. Un test t indépendant a analysé les données dans le logiciel SPSS.

Résultats. – Les résultats ont montré que le taux d'apprentissage et de rétention des stagiaires par la méthode M-learning est plus que la méthode traditionnelle. Cependant, dans la méthode traditionnelle, la motivation pour progresser était plus que le M-Learning.

Conclusion. – Étant donné que l'apprentissage mobile présente un degré élevé d'interopérabilité, de personnalisation et de participation, par rapport à l'apprentissage traditionnel, il permet aux étudiants d'apprendre à tout moment et à tout endroit de leur choix.

1. Introduction

Today, mobile education has improved the ability of learners to connect with the world around them and to have easy access to the data they need (Koole et al., 2010). By definition, mobile education is the learning of all kinds of knowledge, attitudes, and skills by using mobile device technologies and places that will change behavior. Mobile Learning (M-Learning) or education is defined as e-learning that can be performed and place through the implementation of any small mobile device. High search capacity, rich interactions, performance-based analysis, and effective learning are other features of mobile learning (Keegan, 2005; Mellow, 2005; Razavi, 2013). M-Learning, having the characteristics of learning, mobility and the portability of its related devices, enables learners to engage in educational activities, without limitation of a physical location (Yeh, Chang and Chen, 2019). Also, communication and co-operation in education are facilitated (Kukulska-Hulme & Traxler, 2005). Therefore, M-Learning, in comparison with traditional classrooms, allows learners to choose the time, place, and way of study. Therefore, the high flexibility of mobile technologies provides favorable conditions for achieving educational goals; accompanying the learner, and facilitating its performance at each point of the learning process. It also teaches people to learn what they want, where they want it and when they want it. Therefore, the use of M-Learning in university environments is an innovation (Chris, 2008). Mobile phones are popular devices as mobile technology for learning because of many reasons, such as photographic and video capture capabilities, short message service, Bluetooth, location, multimedia messaging, the Internet, and e-books (Mohammadi Sichani et al., 2018). Studies show that although both traditional and mobile education has a positive effect on learner learning, mobile education has had a greater effect on learning than traditional learning (Alrasheedi and Capretz, 2015; Bhattacharjee et al., 2018). It requires the proper design of relevant theories for the effectiveness of mobile education (Al-Hunaiyyan et al., 2018).

In recent years, along with advances in all areas of science (Sadeghi and Razavi, 2020), M-learning, or, more easily, knowledge transfer using information technology platforms has emerged (Ladauceur and Dong, 2001; Razavi et al., 2008), so that traditional teaching is now being replaced by M-learning methods. Brown (2005) examined the role of mobile education of M-learning in Africa and concluded that, given the high potential of mobile education, this technology is rapidly being adopted in developing countries in Africa.

Ineffective learning, besides economic losses, will lead to problems such as frustration, reduced self-esteem, feelings of humiliation, depression, and, as a result, the lack of full prosperity of the talents and abilities of the disadvantaged student (Cho and Powers, 2019). The extent of the problems of educational systems is significant, especially in higher education institutions or universities ineffective and continuous learning and education. The results of various studies show that many learners of universities have not had effective and sustainable learning that academic failure and the psychosocial problems that result from it are a threat to any society. In general, one of the main reasons for students' academic failure is poor study and poor learning skills. In recent years, information processing as one of the learning theories has received much attention (Weinstein, Palmer, and Acee, 2016). According to this theory, some strategies can facilitate learning. New approaches to research in education emphasize the utilization of study and learning strategies to facilitate the learning process (Weinstein, Husman, and Dierking, 2000).

In recent decades, many researchers have done some attention and research on the topic of study and learning strategies (Zheng, Li, and Chen, 2016). This study confirms the relevance of learners' study and learning strategies to their performance and academic achievement (Vrugt and Oort, 2008; Broadbent and Poon, 2015; Razavi, 2018). Study and learning strategies, by applying these strategies, learners are eagerly and actively engaged in the mobile education and learning process and can link new knowledge with their previous knowledge and ultimately have a higher, better, and longer-term learning rate (Hubalovsky et al., 2019). Study and learning strategies are generally presented at three levels (self-regulation, skill, and will) (Fig. 1).

Self- regulated learning (SRL), reflects the pervasive ability to actively participate in the mobile education process according to metacognitive, motivational, and behavioral aspects (Zimmerman and Schunk, 2001). This type of learning includes strategies that learners used to get the information they need and adjust their cognitive aspects. These include the scales of Concentration (maintenance of academic tasks), Self-Testing (reviewing and self-assessment), Using Academic Resources (how to use resources comprehensively), and Time Management (avoiding time-wasting) (Weinstein et al., 2016). According to recent studies, it has confirmed the pivotal role of this strategy in using mobile education for achieving higher educational attainment (Lehman, 2000; Yukselturk and Yildirim, 2008). Studies show a high impact of self-regulation during mobile learning on learners' high academic achievement (Bembenutty, 2008). Eftekhari et al., 2013, found that
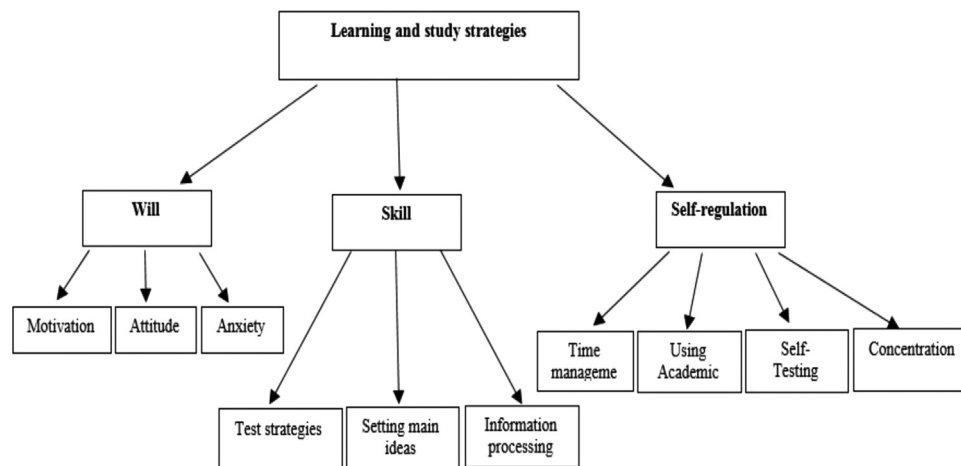
Fig. 1. Learning and study strategies.

compared to the traditional teaching method, mobile education is more match with the individual needs and learners' learning, with features such as ease of use, and unlimited use of time and space. In this regard, García-Moya et al., 2020 found a student-teacher connectedness. Sha et al., 2012 found that self-regulation in mobile learning environments affects learners' learning and academic achievement. In this regard, some studies indicate the positive impact of self-regulation on students' learning achievements and skills (Zheng et al., 2016). Therefore, the motivational self-regulation strategy is of particular importance in the learning process and can influence the learners' level of motivation and will for learning.

Skills is another study and learning strategy that, according to Pintrich (2000), refers to the overwhelming desire to gain mastery of content or educational skills. This component comprises three scales of Information Processing (ability to use reasoning skills), Selecting Main Ideas (ability to select important information), and Test Strategies (effective preparation and taking for testing) (Weinstein et al., 2016). By using the self-regulation strategies, the learner will feel positive and enjoy while learning, and therefore, will lead to academic success in him/her (Midgley, Kaplan & Middleton, 2003). So it doesn't feel satisfying to learn until it has the skills (Middleton, Kaplan & Midgley, 2001). D'Zurilla, Nezu, and Maydeu-Olivares (2004) found that students who could highly use problem-solving processes also had higher self-regulation learning skills and better motivational behaviors for solving problems and challenges than others. Studies confirm the direct impact of problem-solving skills training on students' academic motivation (Wenzel and Wigfield, 2009: Guerrero et al., 2011; Voogt and Roblin, 2012: Chauhan, 2017; Hamidi and Jahanshaheefard, 2019) and its relationship to high academic achievement (Groen and Pabiloniab, 2019; Chuang, 2015; Crompton, 2015; Gray and Perkins, 2019; Hong et al., 2019; Partovi et al., 2019).

Will: Learners' willingness to control and maintain inclusive motivation to achieve learning goals (Wolters, 2003). The passion component shows widespread concern about academic performance, attitude, and desire for classroom activities. Therefore, this component includes the scales of Anxiety (concerned about academic performance in school), Attitude (Interest in education and school environment), and Motivation (focused on perseverance level and willingness to persevere in academic tasks) (Weinstein et al., 2016). In this regards, Albertini, Kelly, and Matchett (2012) found self-regulation and will components to be effective in their research on the primary predictor components of student semester Grade Point Average (GPA). Also, Hanlon O'Connell (2014) identi-

fied the component of will as the only meaningful component in the GPA. Zhou, Graham, and West (2016) acknowledged that the component of the will and intention was highly influential in learners' academic achievement and their performance. Smith et al. (2010) declared that in mobile learning, both the teacher and the learner are more motivated to learn and search for content. Therefore, provide better and deeper learning. So far, there have been many studies on the effect of mobile learning on learning, retention, and study strategies, which mainly confirms the effectiveness of this training. Maleki (2005), found that teaching strategies had an effective and important impact on students' performance in various academic courses. Nordin, Izham Hamzaha, Yunus, and Amin Embi (2010), in their study of the impact of mobile education on in-service coaching, learning, found that in contrast to traditional methods, mobile learning approach in learning processes and teaching was accepted by most students and mobile education was the most widely used methods. It is good for motivating students and enhancing their level of interaction. Rovers et al. (2018), found that the application of problems-based strategies (learning and retention) had a significant impact on students' learning. Van Merriënboer and Kirschner, 2018 acknowledged that strategies that have a meaningful effect on the understanding level and, also the transfer of learning and retention may hurt learning in the short run. Roediger, Nestojko, and Smith (2019) acknowledged that learning-retention strategies apply in many learning environments because of their scientific support and can lead to enduring and flexible knowledge and skills if used properly. Surveys by Guerrero et al., 2020 on learning using Mobile Learning Tools (MLOs) also showed the effectiveness, efficiency, and orbital satisfaction of these tools. According to studies by De Cecco, 1974, the more educational tools used to teach a subject, the more the learner's different senses become involved in learning, and this content can be transferred to short-term memory with better understanding and then transfer to his long-term memory and ultimately lead to real learning and more effective memory retention. On the other hand, according to Atkinson, Atkinson, Smith, Bem, and Nolen-Hoeksema (1999), any kind of training that is instrumental, and especially associated with illustrating images, results in a more identification and understanding of the learning content and such a form of learning called image stabilization, which in turn leads to a real learning event and more effective memorization. According to (Laurillard, 2009a; Laurillard, 2009b), the reason for this more effective learning and retention is that mobile learning, by controlling students' learning goals, enhances their learning motivation and at the same time provides effective communication and activity. This increased motivation for learning can

come about when the application of mobile device learning is parallel with the learning goals of students (Roblyer and Doering, 2010).

A review of previous sources shows that very few studies have been conducted on the learning performance of Iranian students through mobile education, especially cell phones. This study attempts to compare the two educational methods by comparing traditional and mobile learning on learning, retention, and study strategies. For this study, the following three hypotheses have been considered:

- there is a difference between study and learning strategies at three levels (self-regulation, skill, and will) of students trained in M-Learning versus students trained in traditional ways;
- there is a difference between the amounts of learning and retention in trained students in M-Learning with training students traditionally.

2. Research method, data collection, and implementation

The present study is a quasi-experimental design. The study comprised all primary education students of Taybad Branch, Islamic Azad University (*N* = 54) in the second semester of the academic year 2018–2019 who chose the language course. These students were considered as a research sample and divided them non-randomly into two groups (27 people as experimental and 27 people as the control group). Before the beginning of the research, a researcher-made learning pre-test questionnaire was developed for both groups in similar conditions. Then, we used the traditional method for the control group and implemented the M-Learning method for the experimental group. At the end of sixteen weeks of training, a researcher-made learning post-test and also the standard learning strategies test were performed in both groups, and after two months of learning tests; the retention test was administered to both groups (Fig. 2).

3. Research tools

Data collection tools were standard questionnaires and researcher-made tests.

3.1. Researcher-made Learning Style Questionnaire (learning post-test, retention test)

To control and measure the amount of learning and retention of subjects in the subject, three tests were designed by the researchers. The learning test is a score of each student that is obtained by the researcher-made test after the end of the course. The retention test aimed to measure the researcher's test scores, which was performed in both groups after eight weeks from the end of the course. Both of these tests consist of 20 questions and the validity of research questionnaires confirmed by relevant professors. The reliability of these two tests was calculated by the researchers using Cronbach's alpha method (learning questionnaire 0.73 and retention questionnaire 0.69).

3.2. Self-regulated Learning and Study Skills Inventory (LASSI)

LASSI is a self-reporting questionnaire developed by Weinstein et al. (1987, 1988) "that ask students to respond to Likert-type items concerning their level of cognitive strategy use and their regulation of cognition." (Pintrich et al., 2000). The LASSI is an 80-item, 10-scale assessment of students' knowledge of study strategies which, measured by a five-point Likert scale (Never applies to me, Usually does not apply to me, Sometimes applies to me, Usually applies to me, Often applies to me). Each question has a value between

Table 1
Strategic learning components (LASSI scale) and their normal Cronbach alpha (Weinstein et al., 2016).

Strategic learning components	Scale	No. of items	Alpha
Self-regulation	Time Management	5	0.80
	Self-testing	5	0.80
	Concentration	8	0.85
	Using Academic Resources	8	0.76
Skill	Selecting main ideas	4	0.86
	Information processing	17	0.81
	Test Strategies	8	0.77
Will	Anxiety	10	0.87
	Attitude	4	0.76
	Motivation	14	0.77

Table 2
Results of Descriptive Statistics.

Subjects	Frequency	Percentage (%)	Age average
Girl	23	42	20
Boy	31	58	21

1 and 5. LASSI measures, the study and learning strategies, using some questions like: "My mind wanders a lot when I study; If I get distracted during class, I am able to refocus my attention; I try to find relationships between what I am learning and what I already know; I set goals for the grades I want to get in my classes". Strategic learning has three components include Skill, Will, and Self-regulation (Table 1). Strategic learning components of the LASSI scale include three main levels of Self-regulation (Time management, self-testing, concentration, using academic resources), skill (selecting main ideas, information processing, test strategies), and Will (anxiety, attitude, motivation). The ten domains of this questionnaire include:

- time management;
- self-testing;
- concentration;
- using academic resources;
- selecting main ideas;
- test strategies;
- information processing;
- anxiety;
- attitude;
- motivation.

3.3. Research instrument assessment

3.3.1. Reliability (internal validity) and Validity

Weinstein et al., 2016, determined the reliability of different domains between 0.76 and 0.87. In this study, the *reliability* of the questionnaire in ten domains was determined by calculating the Cronbach's alpha coefficient from 0.71 to 0.84. The *validity* of the questionnaire was also evaluated through the obtaining of correctional views by five educational planners, professors, and experts in this field.

3.3.2. Data analysis

After collecting and scoring the papers of each test and questionnaire, the resulted data were assessed by descriptive statistics (mean and standard deviation) and inferential statistics (independent *t*-test).
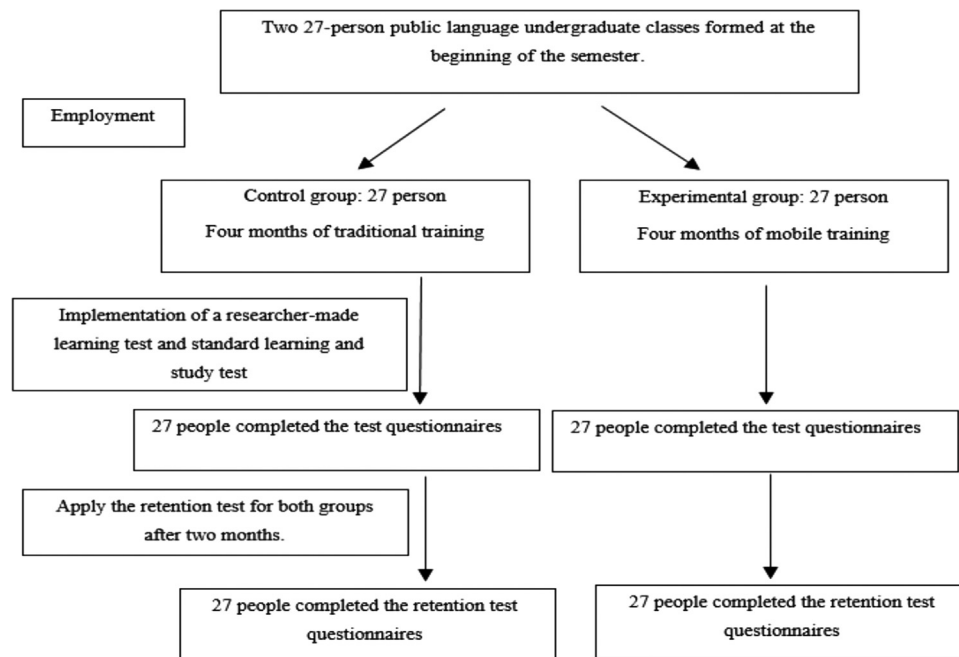
Fig. 2. Study implementation process.

4. Results

Table 2 shows the demographic characteristics of the participants. According to the results, out of all students (54), 23 (42%) were girls and 31 (58%) were boys. The age range of the participants was between 18 and 28 years and their average age was 21 years

The results of the independent t-test on the data from the standard questionnaire of study and learning strategies related to the comparison of traditional and mobile education (Table 3) show that in the mobile education method, the maximum means allocated to scales of self-test (32.73 ± 2.12), attitude (32.66 ± 3.22) and Time management (32.46 ± 2.16) as well as minimum mean was allocated to anxiety control (18.93 ± 2.25). Also in the traditional training method, the maximum means allocated to scales of anxiety (31.66 ± 3.22) and attitude (31.20 ± 3.74) as well as minimum mean was allocated to test strategies (17.73 ± 2.21) and concentration (18/33 ± 2.66).

Fig. 3 shows the comparison of the effect of traditional and mobile education on the study and learning strategies. Scores between the 50th and 75th percentiles show good skills in study and learning strategies and scores above 75 show excellent skills in study and learning strategies and scores below 50 show poor subject skills in study and learning strategies in any of the traditional and mobile teaching methods.

Table 4 shows the scores for the mean and standard deviation of the three learning, retention tests, and study and learning strategies in traditional and mobile learning methods.

Table 5 shows the results of the independent group t-test by separating the three learning, retention, and study and learning strategies tests in traditional and mobile learning methods.

In this study, three hypotheses were investigated that compared learning, retention, and study and learning strategies at three levels (self-regulation, skill, and will) between two groups of traditional and mobile education.

Regarding the evaluation of the first level of study and learning strategies namely self-regulation, according to Table 5 and the significance of the Leven test, the significant level of t-test shows that there was a meaningful and important difference between mobile

learning and the traditional methods in the level of self-regulation (Sig = 0.014). Therefore, the H1-1 hypothesis is confirmed. A comparison of the means in Table 4 shows that the average of the traditional method is 94.73 and the mean of mobile training is 95.66. As a result, it can be said that the level of self-regulation among people trained in mobile learning is higher than the traditional one.

Regarding the evaluation of the second level of study and learning strategies namely skill, according to Table 5 and the non-significance of the Leven test, the significant level of t-test shows that there was a meaningful and important difference between mobile learning and the traditional methods in the level of self-regulation (Sig = 0.026). Therefore, the H1-2 hypothesis is confirmed. A comparison of the means in Table 4 presents that the average of the traditional method is 60.50 and the mean of mobile training is 70.50. As a result, it can be said that the level of skill among people trained in mobile learning is higher than the traditional one.

Regarding the evaluation of the third level of study and learning strategies namely will, according to Table 5 and the significance of the Leven test, the significant level of t-test shows that there was a meaningful and important difference between mobile learning and the traditional methods in the level of self-regulation (Sig = 0.002). Therefore, the H1-3 hypothesis is confirmed. A comparison of the means in Table 4 illustrates that the average of the traditional method is 60.50 and the mean of mobile training is 70.50. As a result, it can be said that the level of will among people trained in mobile learning is higher than the traditional one.

Concerning the evaluation of learning rate in both mobile and traditional training groups, according to Table 5 and the significance of the Leven test, the significant level of t-test shows that there was a meaningful and important difference between mobile learning and the traditional methods in the level of self-regulation (Sig = 0.045). Therefore, the H2 hypothesis is confirmed. A comparison of the means in Table 4 indicates that the average of the traditional method is 50.73 and the mean of mobile training is 65.20. As a result, it can be said that the rate of learning among the people trained by the mobile education method is higher than the traditional one.

Table 3
The results of comparing the mean and standard deviation of the 10 scales of study and learning strategies in three levels (self-regulation, skill, and will) related to the independent *t*-test.

| Strategic learning components	Scale	Group	Mean	Standard deviation	Mean difference	f	t	Sig.
Self-regulation	Time Management	Mobile	32.46	2.16	13.7	1.9	14.41	0.00
		Traditional	18.73	2.98				
	Self-testing	Mobile	32.73	2.12	12.6	1.36	10.97	0.00
		Traditional	20.06	3.93				
	Concentration	Mobile	29.20	5.30	5.4	0.307	2.84	0.00
		Traditional	23.80	5.08				
	Using Academic Resources	Mobile	30.13	3.48	11.8	0.438	10.42	0.008
		Traditional	18.33	2.66				
Skill	Selecting main ideas	Mobile	21.53	3.48	8.33	0.229	7.19	0.00
		Traditional	22.20	2.83				
	Information processing	Mobile	32.33	3.49	14.6	0.783	13.65	0.00
		Traditional	17.73	2.21				
	Test Strategies	Mobile	28.26	5.00	9.06	6.42	6.25	0.00
		Traditional	19.20	2.54				
Will	Anxiety	Mobile	18.93	2.25	12.7	0.209	12.54	0.00
		Traditional	31.66	3.22				
	Attitude	Mobile	32.66	2.25	1.46	3.069	1.29	0.205
		Traditional	31.20	3.74				
	Motivation	Mobile	28.46	4.55	9.2	5.95	6.79	0.00
		Traditional	19.26	2.60				
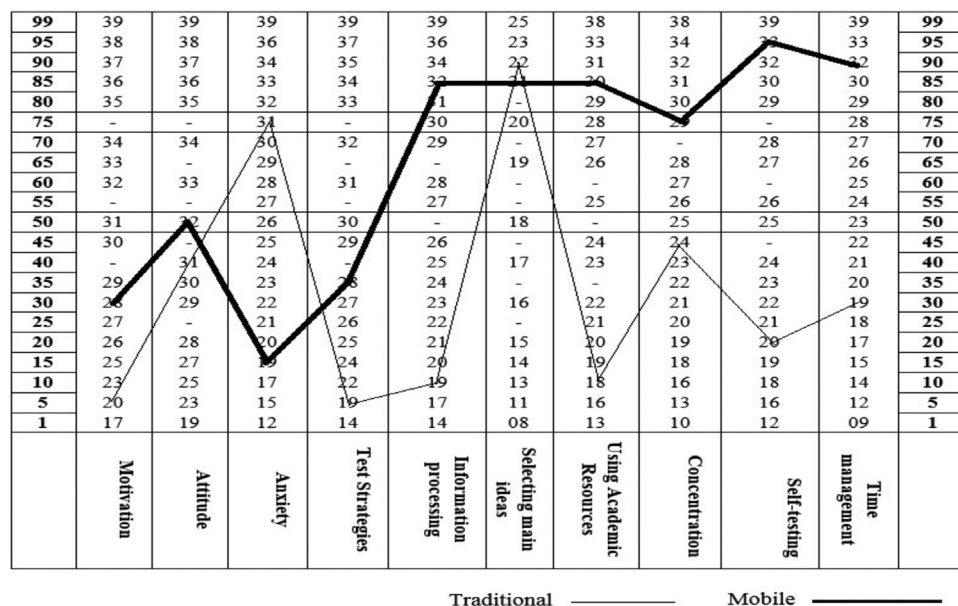
Diagram 1: Comparison of the effect of traditional and mobile education on the study and learning strategies.

Fig. 3. Comparison of the effect of traditional and mobile education on the study and learning strategies.

Table 4
The scores for the mean and standard deviation of the three learning, retention tests, and study and learning strategies in traditional and mobile learning methods.

Test		Test score			
		Traditional		Mobile	
		Mean	Std. Dev.	Mean	Std. Dev.
Learning and study strategies	Self-regulation	94.73	9.28	95.66	9.13
	Skill	66.50	5.72	70.50	7.94
	Will	67.30	7.34	69.85	8.24
Learning		50.73	5.25	65.20	5.97
Retention		40.80	4.61	59.40	6.02

Concerning the evaluation of the amounts of retention in both mobile and traditional training groups, according to Table 5 and the significance of the Leven test, the significant level of t-test shows that there was a meaningful and important difference between mobile learning and the traditional methods in the level of self-regulation (Sig = 0.021). Therefore, the H2 hypothesis is confirmed. A comparison of the means in Table 4 shows that the average of the traditional method is 40.80 and the mean of mobile training is

Table 5
Independent group's *t*-test by type of test.

Test	Equality of Variances	Independent t-test			95% confidence intervals		Levene's Test of Equality of Error Variances	
		Sig.	df	t	Lower	Upper	Sig.	F
Learning and study strategies	Self-regulation	Equality	0.001	28	2.51	6.13	10.53	0.001	8.12
		Non-equality	0.014	22.41	−3.04	11.97	17.22		
	Skill	Equality	0.026	28	2.33	5.28	12.84	0.919	0.011
		Non-equality	0.025	21.49	2.34	−14.81	−10.65		
	Will	Equality	0.033	28	−3.17	−0.88	3.81	0.004	6.54
		Non-equality	0.002	23.15	2.14	−12.57	−5.82		
Learning		Equality	0.045	28	1.81	11.40	16.05	0.614	0.261
		Non-equality	0.041	27.54	1.81	9.94	15.39		
Retention		Equality	0.021	28	2.45	1.63	9.10	0.253	1.36
		Non-equality	0.021	26.22	2.45	14.01	11.41		

59.40. As a result, it can be said that the rate of retention among the people trained by the mobile education method is higher than the traditional one.

Discussion and conclusion

This research aimed to compare the effect of traditional and mobile education on learning, retention, and study and learning strategies. Accordingly, the first hypothesis of this study was that there is a difference between study and learning strategies at three levels (self-regulation, skill, and will) of students trained in mobile learning versus traditional students trained in learning. The research findings confirm this hypothesis. Concerning the first level of these strategies, self-regulation, the findings of this study are in line with the findings of Bembenutty, 2008 who stated that self-regulation during mobile learning had a great impact on learners' high academic achievement. In this regard, some studies indicate the positive impact of self-regulation in mobile learning environments on learners' learning achievements and skills (Zheng et al., 2016). Also, Eftekhari et al., 2013 and Biwer et al., 2020 stated that the positive effect of this type of training on learner self-regulation and academic achievement is that, compared to the traditional (face-to-face) teaching method, it has features such as ease of use and also, unlimited use of time and space is more in line with individual learners' needs and learning. Sha et al., 2012 found that self-regulation in mobile learning environments affects learners' learning and academic achievement.

Concerning the second level of these strategies, namely, skill, the findings of this study are in line with the findings of Midgley et al., 2001 and Middleton et al., 2003. In this regard, D'Zurilla, Nezu, & Maydeu-Olivares (2004), found that students with a high ability to apply problem-solving processes also had higher learning skills and better motivational behaviors than others to solve their problems and challenges. On the other hand, studies confirm the direct impact of skills such as motivation, attitude and problem-solving on students' academic motivation (Wenzel & Wigfield, 2009: Voogt & Roblin, 2012: Chauhan, 2017) and its relationship to high academic achievement (Groen and Pabiloniab, 2019). In this regard, it can be said that one of the reasons for students' academic failure can be due to weak reading and learning skills as well as their intellectual skills and mental strategies.

Concerning the third level of these strategies, namely, will and will, the findings of this study are consistent with the findings of Wolters, 2003; Albertini et al., 2012, in their research on the primary predictor components of students' GPAs, found the level of self-regulation and the level of *will* of the set of study and learning strategies to be effective. Also in this regard, Hanlon O'Connell, 2014, identified only the significant level of will (anxiety, attitude,

and motivation). Zhou, Graham, and West (2016) acknowledged that the level of *will* affects students' academic achievement and performance. Smith et al. (2010) believe that in M-learning both learners and teachers are more motivated to learn and search for content. Therefore, better and deeper learning is provided.

In explaining these three levels of learning and study strategies, some studies, such as Pintrich et al., 2000 and Kim, 2020 have shown that learners will have high academic achievement during the process of mobile education that has self-regulatory characteristics about their cognitions, self-control, and self-monitoring at different stages of learning; and have high metacognitive skills. At the same time, they can be actively engaged in the learning process from a variety of behavioral and cognitive aspects.

Regarding the second and third hypotheses of this study, meaning that there is a significant difference between the two methods of traditional and mobile learning in terms of learning and retention, it can be said that there is a meaningful difference between the amount of learning and retention of learners in both traditional and mobile learning methods. This finding is consistent with studies by Brown, 2005, Papzan & Sulaimany (2010), and finally Nordin et al. (2010), which showed that there is a significant statistical difference between traditional learning and mobile learning. In other studies by Thornton and Houser (2005), Noraza et al. (2009), Guerrero, Ochoa and Collazos (2011), Lin (2014), Suwantarathip and Orawiwatnakul (2015), Guerrero et al. (2020), the emphasis is also placed on the most positive and effective role of learning through mobile technologies on learning. Rovers et al. (2018), on the reason why students use learning and retention strategies, found that the application of these problem-based strategies had a significant impact on students' learning. Roediger et al., 2019 acknowledged that learning-retention strategies are applicable in many learning environments due to their scientific support and can lead to durable and flexible knowledge and skills if used properly. Gurrero et al.'s (2020) study of learning using mobile learning tools (MLO) also showed the effectiveness, efficiency, and orbital satisfaction of this tool. In terms of explaining the cause of increased learning and retention during mobile learning, according to Seif's (2006) studies, it has been found that the more educational tools used to teach a subject, the more the learner's different senses become involved in learning. This learning can be transferred to short-term memory and then transferred to long-term memory with better and more meaningful recognition and ultimately leads to real learning and more effective memory retention. On the other hand, according to Atkinson et al. (1999), any kind of training that is instrumental, and especially associated with illustrating images, results in a more identification and understanding of the content and a kind of learning called *image stabilization*. This process, in turn, will be very effective in real learning and more effective

learner retention. According to Laurillard (2007), the reason for this more effective learning and retention is that mobile learning, by controlling students' learning goals, enhances their learning motivation and at the same time provides effective communication and activity. This increased motivation for learning can be realized when the use of mobile technology is aligned with the learning goals of students (Roblyer and Doering, 2010). Since mobile learning has a high degree of interoperability, personalization, and participation, compared to traditional learning, it allows learners to educate at any time and place they wish (Cavus, 2011). Recently, mobile education has been introduced as a new style of M-learning (Sha et al., 2012), so it can play a constructive role in effective learning and retention. Ultimately, this process, in turn, motivates him to learn more and more effectively (Guey, 2010).

To the best of our knowledge, this was one of the first studies (if not the first) that used Learning, Retention, Learning and Study Strategies in the traditional and M-learning Systems to predict academic achievement (AA) at a national level, i.e., including virtually every (primary education) student. Language teachers and education planners with regard to the importance of learning various skills, apply e-learning in training increase personal motivation and interest in learning.

Disclosure of interest

The authors declare that they have no competing interest.

Ethical approval

All procedures performed in this research were following the ethical standards.

Informed consent

Informed consent was obtained from all individual participants included in the study.

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