Chapter

Using Wearable Devices in Educational Assessment: Smartphone Exams

Oytun Sözüdoğru and Nazime Tuncay

Abstract

We are residing in a planet where technology is contemporary in our life routines. Today, smartphones are one of the vastest revolutions in individuals' lifespans. Smartphones are becoming increasingly popular, both in formal and informal educational environments. This chapter discusses the benefits and obstacles in using smartphones as an assessment tools and it compares the achievement of exams delivered via smart phones to paper-based exams. The result of the study indicates that; there was a significant difference between three groups of English Paper Exams, however there was not any significant difference between these groups on English Language Mobile Exams.

Keywords: mobile exam, students, English exam, assessments, success

1. Wearable technology

Wearable technology is a group of devices that can be worn by people and track and communicate the colorful information with the outside world. The first known wearable computing device was invented in 1961 by MIT Edward Thorp and Claude Shannon, and the world's first calculator wristwatch was released in 1975. Wearable technology specially Fitbit, smart watches, and smart phones is attracting more interest of many consumers in the finance, gaming, health, music fields, as well as educators specially after the 2010s. They are specially designed to address the majority of the population who are still inactive [1]. These devices can be integrated into clothing, recognizable personal accessories (glasses, contact lenses, and watches), or additional devices (pocket device to count steps) [2]. Revenues in this segment are forecast to grow even faster than unit shipments, more than tripling in value to over $32 billion by 2019 up from $10 billion in 2013 (see **Figure 1**) [3].

As wearable devices become smaller, inexpensive, and more feature packed, the opportunity for use in various applications grows alongside [4]. People have tactile and kinesthetic senses to feel the objects' properties like its size, shape, weight (light or heavy), and temperature (hot or cold), and these ensures them about the existence and the reality. In this meaning, using wearable devices in education motivates students more than the other devices.

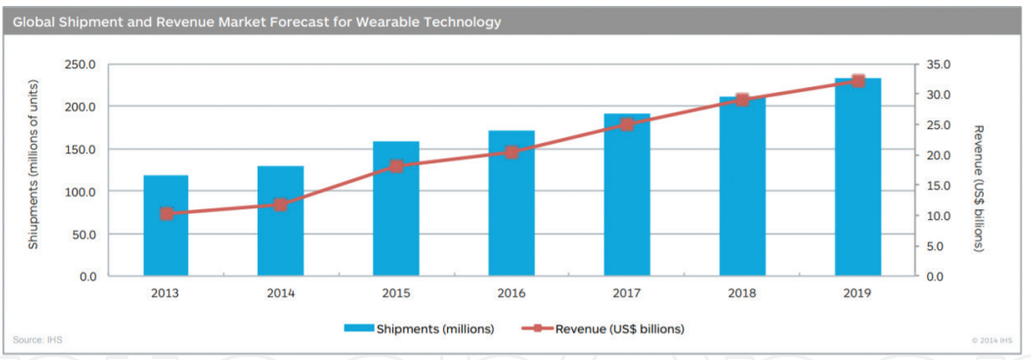

Figure 1.
Global shipment and revenue market forecast for wearable technology [3].

2. Switch to wearable devices in education: smartphone case

We are residing in a planet where technology is contemporary in our life routines. The achievement of personal goals of needs leads the individual to attain the activities voluntarily [5–8] which is also necessary to achieve their goals [5, 9]. These lead to the result that students and their motivation are the most significant part of the achievement of our courses. In this sense, choosing the best technological device brings the best possible outcome!

Today, smartphones are one of the vastest revolutions in individuals' life spans. They give mobility and excitement to its users that these modern technological devices become the most significant part of many people's lives. From online banking to watch the news on TV, we are confronting the progressions and affects that convey to our lives. The school could not stay out of these progressions, and a range of classrooms had been altered, from special spaces for the perusing of scholarly messages, to sight and sound spaces, where the utilization of data and correspondence innovation had accomplished incredible significance. Students of the twenty-first century prefer the lightest, the simplest, and the most popular way of communal and educational communication. They record everything in their smartphones for future use and are not volunteers for paper works.

Lots of students at universities have smartphones and are using its facilities like taking pictures, recording videos, and using social media. According to eminent pedagogy expert Scott P. Simkins, as far as technological innovations are alarmed, it is not pedagogy itself that mattered, but how pedagogic innovation is exploited by taking into account the specific environment in which it is implemented [10]. In the educational model where education process is carried out fully or partially with mobile technologies, students use mobile devices in wireless environments and engage in formal and informal learning [11–13]. Mobile learning model is also differentiated from other learning models by its mobility [14]. Universities and institutions have been utilizing advances, for example, synchronous videoconferencing (SV), online courses, and other kinds of technological innovations to convey language courses for the part of their educational modules. This is an open door, which is constantly important to the quickly developing requirement for understudies to end up able in utilizing innovative applications and comprehend the part of learner-focused engagement in language learning [15]. With backing of such innovations, most of these language related courses have begun being delivered online. The use of mobile phone is very popular these days specially in language learning. Mobile devices helps language teachers to use a variety of

teaching methods and techniques according to students' different needs, interests, motivations and learning styles. While there have been many researches on using or integrating the mobile technology into language teaching in literature, very few of them is about the devices in wireless environments [11, 12]. The most important difference between mobile learning and other learning activities is that learners are continually on the move [14]. Universities and institutions have been utilizing advances, for example, synchronous videoconferencing (SV), online courses, and other kinds of technological innovations to convey language courses for the part of their educational modules. This is an open door, which is constantly important to the quickly developing requirement for understudies to end up able in utilizing innovative applications and comprehend the part of learner-focused engagement in language learning [15]. With backing of such innovations, most of these language-related courses have begun being delivered online. Nowadays, the use of mobile phone has received considerable attention in education as well as in language learning. Language teachers use a variety of teaching methods and techniques by considering students' different needs, interests, motivations, learning styles, and strategies as well as their pace in learning. While there have been many researches on using or integrating the mobile technology into English language teaching in literature, very few of them dwell on the usefulness of smartphones as an assessment tool from students' perspectives. Several studies have investigated the impact of mobile phones on learning outcomes in adult learning programs among rural populations and poor communities in developing countries [16, 17]; and some examined the use of mobile devices to support intentional informal learning among experienced users [18]. Ranieri and Bruni [19] stated that mobile phones are used for storytelling as well. Ranieri and Pachler [20] delivered a research study and collected data through formal and informal meetings, direct and indirect observations, interactions with participants, and focus groups and concluded in their research study that adults have great trust in the power of the media but were somewhat disappointed at their own lack of skills.

Mobile education has been delivered to university students for decades, and lots of researchers have delivered researches to discuss its efficiency and students' perspectives about it [21–25]. However, using mobile technologies like smartphones in education is relatively a new concept, and several educators and researchers start discussing this new technology in their reports [26–30]. There are lots of portable equipments like smartphones m-learning feasible at anytime and anyplace compared to the use of a notebook that can easily be damaged and does not last long [26–28]. Some research studies among Islamic education teachers are delivered for using mobile phones in secondary schools, and it is found that there is a potential for m-learning produced for Islamic education in secondary schools [29, 30].

Mobile phones have been used to provide access to contextually relevant information in clinical education [31], to create digital narratives to be used in adult education [32], and as vehicles for interactive museum guidebooks [33]. There are also studies which have been focused on developing assistive, mobile, experiential language learning applications to enhance daily literacy education anywhere and at anytime [34, 35]. Some researchers stressed that mobile media are commonly exploited in both more and less conscious modes [36–38]. Jankovića [39] examined the simultaneous impact of Facebook and smartphone usage on leisure activities and college adjustment of students in Serbia. Rheea and Kimb [40] delivered a survey with a total of 450 workers in Korea to see if there were differences in the effects of breaks with smartphones (e.g., browsing the Internet or using social network services) which have a different association with "conventional breaks" (e.g., walking or chatting face-to-face with friends).

3. Some problems on the way

There are some obstacles in using mobile phones in education. Some of these are students not having smartphone, slow Internet access, and insufficient smartphone usage awareness. Also, administrators', teachers', and students' negative attitude toward smartphone usage in education may present an obstacle in this new technology's usage. Some research studies show that there was no significant difference between the traditional, blended, and mobile groups of students' paper and mobile exam results [41]. Also, studies show that there is not a significant difference between male and female students' exam results [41]. The only difference was between the students who were familiar with the mobile technology exams and between those who were novice.

Students' perspectives are vital guides for upcoming directions in teaching and learning [22]; therefore, research studies aimed first by finding students' attitudes to smartphone usage; delivered education to three different groups of students to measure if there is any significant difference between students having mobile courses or other courses; and then the research is directed to students' perspectives of mobile education. The increasingly widespread use of new communication methods via smartphones occupies an important place in the lives of young people and influences their leisure activities [39, 42]. A high percentage of students at universities have the latest technology smartphones and are professionals using its facilities like taking pictures, creating albums, and using Gmail, Viber, WhatsApp, and Facebook perfectly with their phones. Due to the reasonable price of mobile Internet connection plans, this usage increases day by day. Smartphones are today's handheld computers for configuring the daily schedules, saving large documents, watching videos, listening music, using Internet, using World Wide Web, video conferencing, and much more than a human mind can imagine.

There are also some researchers which state that using smartphones in a classroom is supported by data suggesting that the use of such technology (e.g., text messaging during class) is negatively related to sustained attention, and sustained attention itself is positively related to academic performance. On the other hand, the use of mobile technologies in the classroom also stimulates students while they learn new material [43]. Due to strong mobile technology infrastructure in communication and Internet connections, students can benefit from both formal and informal learning methods [44]. Sometimes, social media tools may not fit into the configurations of all mobile devices. Some of the functions may be disabled, and frequent update of software is required [45].

4. Using wearable devices in assessment: mobile assessment

Computer-assisted learning environments made use of branching based on learner interactions that were the same for all learners in that same situation [46], and mobile phone-assisted learning environments take learning a step forward. Mobile phones are being used in a variety of assessing purposes. Self-assessment and peer assessment can be meaningful forms of formative feedback [47]. It is critical to a teacher's ability to adapt lessons and check for student understanding [48]. Using suitable technology for a successful implementation is important for assessing students' performance about the key concepts related to the unit [49, 50], and in a current research, a new method of assessment via smartphones is used. Smartphone exams are being used in some universities for assessments. **Figure 2** is a screenshot of two pages in an exam (the first page and the last page).

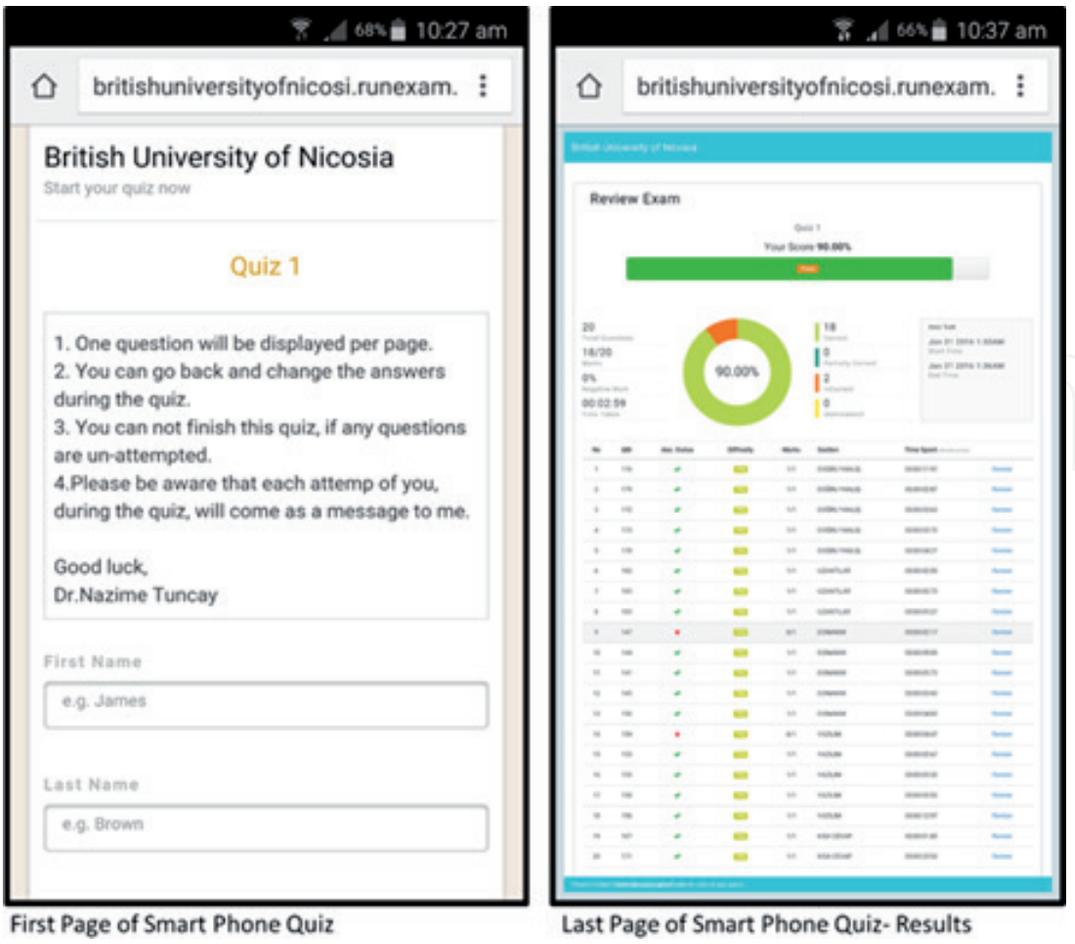

Figure 2.
An exam with smartphones [41].

In the exam, students and teachers were getting their results as soon as they finish the exam. This method claims to be the fastest method of assessing and evaluating students' progress.

5. A recent research with smartphones

Three groups of students have attained to the smartphone exams at Cyprus Science University. The first group of students are the students who were liking coming to classroom and listening to teachers in the classroom. The second group of students were preferring to come to some of the courses and to follow the other courses from mobile technologies. The third group of students were mostly working and were not able to come to class; therefore, they were following the courses from their smartphones. This research is based on a qualitative research design that meanings, perceptions, and awareness of the prospective teachers have a potential impact to retrieve the qualitative findings within an inductive process.

Seventy-five volunteer students who enrolled English I course in Guidance and Psychological Counseling program became part of this research. Volunteer participation provided a ground for confidentiality and trustworthiness within the process. In this research, trustworthy mobile phones and mobile exam programs were used as instrument tools. The mobile exam questions were distributed to students on the exam time. Students who took the exam and teachers who were the invigilators during smartphone exams had been given special training about how to

use smartphones and how to access to the mobile exam via smartphones. Therefore, there were not any problems with the usage of smartphones.

At the end of mobile exams, the average scores of mobile and paper exams were compared, and students' results were driven from these comparisons. Blended course students' English paper exam results (M = 87.76; SD = 12.81) were higher than the English mobile course students' English paper exam results (M = 84.48; SD = 14.44), which was higher than the traditional course students' paper exam results (M = 83.24; SD = 14.60). Traditional course students' English mobile exam results (M = 73; SD = 16.46) is higher than the blended course students' English mobile exam results (M = 72.60; SD = 23.14), which is slightly higher than the mobile course students' English mobile exam results (M = 72.53; SD = 19.28). These results can be seen in **Table 1**.

Students had *English paper exams* in three different classes: traditional, blended, and mobile. There was a normal distribution between the marks and an equal number in three groups; one-way ANOVA was used to check if there was a meaningful difference between these three groups. According to the results of this test, there was not a significant difference between the three groups of $F(2, 72) = 1.86$, $p = 0.16$. The achievement of students in traditional, blended, and mobile classes in *English mobile exams* was also calculated statistically. There was not meaningful significant difference between three groups on $F(2, 72) = 0.53$, $p = 0.95$ (see **Table 2**).

These results can be interpreted as mobile exams which are also possible in education, and it's just a choice of the examiners whether they want to make paper exams or mobile exams.

Paper exam results of the two courses are used to make comparisons. In these comparisons, students belonging to three different groups are taken into consideration.

Blended course students' *English paper exam results* (M = 87.76; SD = 12.84), which are higher than the mobile course students' *English paper exam results* (M = 84.48; SD = 14.44), are higher than the *English paper exam* results of traditional class (M = 83.24; SD = 14.60).

Traditional course students' *computer paper exam* results (M = 94.44; SD = 5.88) are higher than the blended course students' *computer paper exam* results (M = 89.04; SD = 11.17), which are slightly higher than the mobile course students' *computer paper exam results* (M = 86.76; SD = 14.23). These results can be seen in **Table 3**.

Blended course students' English paper exam results and *traditional course students' computer paper exam results* were the highest among the students' groups.

		N	Mean	Std. deviation	Std. error
English paper exams	Traditional	25	83.24	14.60	2.92
	Blended	25	87.76	12.81	2.57
	Mobile	25	84.48	14.44	2.89
	Total	75	85.16	13.96	1.60
English mobile exams	Traditional	25	73.00	16.46	3.29
	Blended	25	72.60	23.14	4.63
	Mobile	25	72.00	18.43	3.69
	Total	75	72.53	19.28	2.27

Table 1.
English paper exams and English mobile exams.

		Sum of squares	Df	Mean square	F	Sig.
English paper exams	Between groups	706.16	2	353.080	1863	0.163
	Within groups	13643.92	72	189.499		
	Total	14350.08	74			
English mobile exams	Between groups	40.67	2	20.33	0.053	0.948
	Within groups	27478.00	72	381.64		
	Total	27518.67	74			

Table 2.
One-way ANOVA results for English paper exams and English mobile exams.

		N	Mean	Std. deviation	Std. error
English paper exams	Traditional	25	83.24	14.60	2.92
	Blended	25	87.76	12.84	2.57
	Mobile	25	84.48	14.44	2.89
	Total	75	85.16	13.93	1.61
Computer paper exams	Traditional	25	94.44	5.88	1.18
	Blended	25	89.04	11.17	2.23
	Mobile	25	86.76	14.23	2.85
	Total	75	90.08	11.31	1.30

Table 3.
English and computer paper exams.

A one-way ANOVA was conducted to compare the *English paper exam results and computer paper exam results of traditional, blended, and mobile groups of students.* There was a significant effect of three groups of $F(2, 72) = 0.70$, $p = 0.50$ in English paper exams as well as computer paper exams.

$F(2, 72) = 3.23$, $p = 0.046$ (see **Table 4**).

Although there was a meaningful difference in paper exams of computer and English courses; there was not any significant difference in their mobile exams as it can be seen in **Table 5**.

Three groups of students have attained to mobile, blended, and traditional courses for 3 months. Results of the questionnaires bring out the conclusion of compatibility and standardization. The results show that students are as good at paper exams as they are at mobile exams. Therefore, we can conclude that smartphones can be used as assessment tools in mobile English exams and the choice does not affect the students' success at the end-of-course exams. This gives a huge flexibility to the courses and freedom to teachers and students. The positive side of using smartphones is for teachers, who do not need to grade numbers of exam papers at the end of each exam. Neither should they have huge amounts of papers for examinations; thus, they save time and money. When we integrate mobile learning environments into our classrooms, teachers are required to know how to use and support that technology [51]. This may be a negative side in a smartphone usage for some teachers. Some of the limitations of this study are that it assumes that there is not an effect of sex on the results and it is restricted only with 75 first form psychology department students. Further studies about this can also be delivered to measure effect of mobile exams on other courses and with different groups of students.

		Sum of squares	Df	Mean square	F	Sig.
English paper exam results	Between groups	272.72	2	136.36	0.70	0.50
	Within groups	14077.36	72	195.52		
	Total	14350.08	74			
Computer paper exam results	Between groups	777.84	2	388.92	3.23	0.046
	Within groups	8681.68	72	120.58		
	Total	9459.52	74			

Table 4.
One-way ANOVA results.

		Sum of squares	Df	Mean square	F	Sig.
Computer mobile exams	Between groups	60.67	2	30.33	0.24	0.784
	Within groups	8939.00	72	124.15		
	Total	8999.67	74			
English mobile exams	Between groups	40.67	2	20.33	0.053	0.948
	Within groups	27478.00	72	381.64		
	Total	27518.67	74			

Table 5.
One-way ANOVA results for computer mobile and English mobile exams.

This research was significant in its own ways of research and its findings; and it aims to compare the success of students in English paper exams and English mobile exams, as well as discussing smartphone pros and cons as assessment tools.

5.1 Internet access problems

From the previous experiences, it was observed that there were Internet accessibility problems when all the students tried to access the exam at the same time. Therefore, students are divided into groups and entered the exam. Even with smaller groups, it was observed that the questions were emerging slowly. By increasing the speed of Internet access, this problem was elevated.

5.2 Print screen and copy problems

Mostly, students had tried to find a way to cheat or to disobey the given rules; and they tested the programs by their own ways. They tried to take screenshots of the program, and this was prevented successfully. The students who tried to do this were warned by the course teacher. One student tried to shade the questions and cheat; this was also successfully prevented by displaying him a warning message.

5.3 Translation problems

The exam started when the teacher had made an active link on the Internet. Since the students used translation programs in their daily lives, their smartphones

instantly converted the exam to the students' native language, which was a critical problem for a language exam. Technicians corrected the problem quickly; however, it was a nasty thing. There are several possible solutions to this problem: additional codes can be included to the exam software to prevent such a case; the software can be distributed to students offline and can be programmed to send the results to the teachers' smartphone. Another possible solution to this may be instead of distributing exam papers to the students, teachers can distribute smartphones with restricted facilities to students, and they can collect these at the end of the exams to be used for future exams.

6. Wearable devices in future

We are residing in a planet where technology is contemporary in our life routines. The more that you know, the more that you want to know! Knowledgeable people are generally more keen on learning new technological devices. People's relatively high rates of prior experience with computers and smartphones may partially explain the sample's high willingness to accept smart wearable devices [4]. Today, smartphones are one of the vastest revolutions in individuals' life spans. Smartphones are becoming increasingly popular, both in formal and informal educational environments. Although benefits and obstacles in using smartphones as assessment tools can be discussed, "70 percent of students and teachers agree that they prefer to write work and notes on their computers rather than writing on paper" [52], and recent studies shows that students are as successful in smartphone exams as they are in written exams.

There are different students with different social needs: some are keen on being virtually social, and some are keen on being physically social (see **Figure 3**). Some research studies show that the younger physically social students are more successful than the younger virtually social ones [53, 54]; a solution to these would be improving wearable technologies in a way that students can both be physically and virtually social!

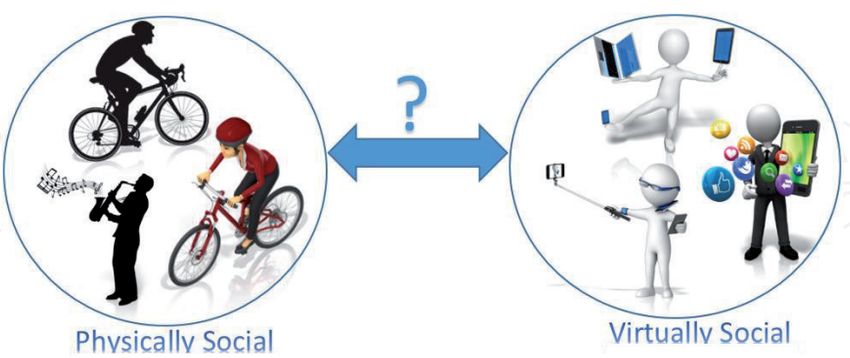

Figure 3.
Physically virtual and virtually social [53, 54].

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