# The Effectiveness of Mobile Learning Technology at the Tertiary Level During Conflicts

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**Abstract**—The paper investigates the effectiveness of personal smartphones and other mobile devices for learning English at the tertiary level during not normal situation in Ukraine. The research methods included 1) general theoretical methods (analysis and synthesis); 2) empirical methods (quasi-experiment, observation, interpretation); 3) methods of mathematical statistics (Pearson's criterion). The material of the research involved 80 students of the first year of Yaroslav Mudryi National Law University (Kharkiv, Ukraine) during the spring semester of 2021/2022 academic year. There were two samples: the experimental group (N = 40) that learned the course of "Legal English" exclusively through mobile devices and the control group (N = 40) that had only traditional forms of learning. The results revealed that academic progress of the students of the experimental group have improved by 15%, while achievements of the students of the control group have deteriorated by 10%. The reliability of the results is confirmed by the methods of mathematical statistics (p-value = 0.25; the significance level was chosen as 0.05). The conclusion is that mobile learning technology, which is able to provide students with access to systematic online training; platforms containing different textbooks and other local and remote educational content; as well as various educational services may become a great teaching and learning tool.

**Keywords**—mobile learning, university students, military conflict, learning English

## 1    Introduction

Mobility is one of the main characteristics of modern society. Due to mobile technology people could continue communications, work, learning and solving a lot of everyday problems during Coronavirus restrictions. And now mobility is developing in all aspects of our life day by day. Educational sphere is not an exception. Today the potential of telecommunications, information and mobile technologies for educational purposes can hardly be overvalued. It is actively investigated by researchers [1]-[4]

and is becoming stable global pedagogical practice. Utilising mobile teaching and learning in addition to traditional forms and methods has already demonstrated increasing students' progress [5]. So, it is not surprising that new educational applications for mobile devices are constantly appearing [6]-[8].

Moreover, mobile teaching and learning have become an increasingly important part of the educational process in recent years. If educators mostly considered it as a complemented form of training before Coronavirus broke out, during quarantine measures mobile learning was often equal to distance learning through ordinary computers. That period enriched academic staff of Ukrainian Universities with the necessary experience as well as effective methodology and prepared them for teaching during the current conflict applying mobile learning technology, as in many cases mobile devices (mostly personal smartphones) appeared to be the only teaching and learning tools accessible for teachers and students from the zone of warfare.

Unfortunately, different hot spots appear in the world from time to time. What is more, some countries remain at conflicts for a long time and their citizens cannot and must not stop their living but have to continue its different spheres (including education both secondary and higher) in such circumstances so, it is relevant to study the role of mobile learning technology during military aggression when neither academic staff nor students have access to traditional forms and methods of teaching and learning or to ordinary computers. Studying the effectiveness of utilising mobile learning technology at the tertiary level during conflicts, which is proposed in the paper, may shed some light on the problem as well as be not only interesting from scientific point of view but also useful.

## 2 Literature review

### 2.1 Development of the phenomenon

As the study is focused on using mobile learning technology it seems appropriate to clarify the meaning of the concept "mobile learning technology", as well as to trace the emergence and development of this phenomenon. So, under mobile learning technology researchers understand the use of mobile technology in the learning process [9], [10]. It is widely used to provide distance education [11], [12] effectively complements traditional learning and training [13].

The start of mobile learning technology may be traced from the beginning of the millennium. Its concept is attributed to Keegan [14] who analysed a big amount of global experience of applying mobile devices for learning and teaching. Kukulska-Hulme and Traxler [15] created a handbook on mobile learning on the basis of the best investigated cases of mobile learning at the tertiary level. Kaliisa and Picard [16] reviewed the development of certain mobile learning methodology in Africa. Katsaris and Vidakis [17] surveyed 42 manuscripts focusing on individualised styles of e-learning to provide deliberated circumstances according to the needs and requirements of the students. The authors concluded that adaptive e-learning platforms for the stated purposes are not only efficient but also can improve the content of the les-

sons. Dahal et al. [18] touches upon the problems of developing teachers' skills in using ICT tools as well as qualitative engagement of students in distance learning. According to the researchers, autonomy and engagement of students are even more important than technology. Besides, the authors believe that distance teaching is not only one of the teaching forms but a "transition from paper to the digital world" of education.

In addition to numerous reviews there are several empirical studies. So, professional development of teachers in computer technology is also considered with application of empirical approach by Lazarinis et al. [19]. Analysing digital activism in students Aguayo et al. [20] found out that the students were less concentrated than in the traditional classroom and the teachers had to teach them to process the information. Some researchers studied motivation to use mobile learning and teaching technology [21]-[23] and revealed a certain increase in the students' interest in learning and a wish to develop innovative professional skills on the part of the teachers; others surveyed the attitude of teachers and students toward mobile learning [24]-[26] and found some distrust of the teachers as well as mostly positive attitude of the students. Considering teachers' opinions on distance education, Can and Bardakci [27] note a number of negative aspects, namely: lack of interaction between the subjects of the educational process, technological problems, and insufficient teaching content. Teachers' attitude to ICT in general in the context of the Greece programme "Further Education of Educators in the Use and Development of ICT (Information and Communication Technologies) in the educational process" was investigated by Kalogiannakis and Papadakis [28]. The findings can be described as some uncertainty of the teachers according to the use of ICT in their teaching experience but strong desire to develop their technological skills.

Theoretical papers on the problem have also been introduced into scientific circulation. For instance, necessary requirements for applying mobile devices in the educational process were determined by Thomas et al. [29]. Among manuscripts on mobile learning there are papers describing findings of academic staff from different countries [26], [30], [31], as well as results of asynchronous e-learning [32], [33].

However, all reviewed studies concern the use of mobile learning technology in peaceful settings, which differs to some extent from utilising this technology in military conflicts and which we tried to shield some light on.

## 2.2    Mobile learning technology in teaching English

As the research was conducted while teaching English as a foreign language and was aimed at testing the effectiveness of the mentioned technology, it is significant to focus on the papers related to the productivity of utilising mobile applications for learning foreign languages. So, Zhang [34] examined the advantages of applying different movies, short videos, animations, and others for teaching and learning English. Klimova [35] studied the impact of educational applications in smartphones on students' achievements in English vocabulary learning. Alwafi et al. [36] investigated developing English speaking skills through social virtual reality mobile application. All the researchers concluded that mobile learning technology is a useful complemen-

tary method of teaching and learning foreign languages as it contributes positively to the language learning, enhances students' performance and encourages them.

However, among the papers devoted to mobile learning technology in teaching English there have been no studies that would describe any aspects of application of mobile learning in zones of military action.

Thus, the *purpose* of the paper is to examine the efficiency of utilising mobile learning technology at the tertiary level during conflict.

The *hypothesis* of the authors is that mobile learning technology can be an effective learning tool compared to traditional training in the context of military actions, despite the difficult conditions for living and learning and full absence of access to classroom-based technologies as well as traditional forms of learning.

## 3      Methodology

### 3.1      Methods

In order to reach the stated purpose the following methods were used: 1) general theoretical methods such as: analysis and synthesis of researches describing mobile learning technology for understanding the essence of the notion and peculiarities of mobile learning and teaching, following necessary requirements, applying the best findings of pedagogical experience; 2) empirical methods such as: quasi-experiment, observation, interpretation; 3) methods of mathematical statistics (Pearson's criterion $(\chi^2)$), built into MS Excel. We chose the non-parametric $\chi^2$ Pearson's criterion consistency method to analyse the obtained data in two groups: experimental and control. This method allows us to assess the significance of the differences between the actual (observed in the experimental group) number of outcomes and the theoretical number that we have in the control group under a fair null hypothesis. As a null hypothesis, we accept the fact that there are no advantages during the conduct of various forms of education in the conditions of conflict in the country. In this way, we are trying to determine whether there are any advantages to the diversity of learning between categories (which we determine by evaluating the quality of the material learned), or the proportions differ from one category to another. Because we are testing a simple hypothesis and using asymptotically optimal clustering, the $\chi^2$ Pearson consistency test has a robustness advantage over other nonparametric consistency tests.

The reliability and the validity of the experimental data are ensured by the equivalence of the selected groups in terms of number, age, and level of academic performance (we took the performance results of the students, who participated in our experiment, for the previous semester).

### 3.2      Participants

The research was conducted at the Yaroslav Mudryi National Law University (Kharkiv, Ukraine) during the spring semester of 2021/2022 academic year. The study involved 80 students of the first year who learned the course of "Legal English".

The experimental group (EG) consisted of 40 students who appeared inside the zone of military conflict (Kharkiv). They were living in bomb shelters with more or less stable electricity and Internet access and that is why those students could study only with the help of their personal smartphones but did it systematically. Moreover, mobile learning provided the academic staff with the ability to monitor real-time learning, and consequently, find and eliminate students' weaknesses and the students with high content saturation and immediate feedback from the teachers.

The control group (CG) had 40 students from occupied territories, which practically appeared in isolation. Those students did not have Internet access and had to study fully individually using only printed textbooks and exercise-books. Before the conflict they managed to get information about which material should be learned and which assignments and tests should be done during the semester and managed to pass photos of their results through the people who found the possibility to move to free Ukrainian territory and send those photos.

### 3.3    Instruments and research procedure

The research included three stages: preparatory, experimental and assessment.

At the *preparatory* stage the authors were sampling the members for the experimental and control groups. From 436 first year students of Yaroslav Mudryi National Law University (who were taught by the authors) the authors made up experimental and control groups according to the following principles: 1) students' results obtained at the final test of the previous term (by choosing the students with approximately similar results: equal number of members for experimental and control groups with satisfactory, good and excellent language proficiency, according to the final test results); 2) learning opportunities connected with places where the students appeared in the spring term when military aggression started (bomb shelters – for the experimental group, whose participants used mobile learning technology as the only learning tool; and occupation – for the control group, in which the students could only have printed textbooks and exercise-books and studied independently). So, we got two equal samples: the experimental group N = 40 and the control group N = 40. Each group included 12 students (30%) with satisfactory results after the first term, 16 students (40%) with good results and 12 students (30%) with excellent results. Thus, the authors suppose that the members of both samples had approximately similar language proficiency and level of motivation.

At the *experimental* stage during four months of the spring term the students of both groups were learning the same program material, completing similar assignments and at the end they had the same test. However, the students of the control group had to work fully individually using only printed textbooks and exercise-books without immediate feedback from the teachers. What is more, the authors are not sure that the students were working systematically and paid enough attention to the material. The students of the experimental group due to mobile learning technology had different educational opportunities: 1) access to systematic video Conferencing used not only as a learning tool improving the quality of learning, but also as a tool for working together, for closing the gap between learners and teachers, for reducing psychological stress caused by constant bombing; 2) access to the University's portal "Educa-

tional Electronic Information Complex" (EEIC) (https://neik.nlu.edu.ua/moodle/), which became a platform for off-line (asynchronous) education and contained e-textbooks, exercise-books, various methodical kits created by the academic staff of the department in order to help the students to develop different kinds of language activity; 3) access to cloud educational services (Quizlet, Kahoot!, Quizizz, Vocabulary etc.) where the teachers placed special lexical material for developing active vocabulary; 4) access to translation services, other local and remote content for completing assignments and preparing for lessons. But those students did not have any printed textbooks or exercise-books. Such a learning feature was unusual for the students and at first, they complained about the inconvenience associated with the lack of printed textbooks and exercise-books. Moreover, any traditional forms of education were inaccessible to them.

At the *assessment* stage the authors' hypothesis about effectiveness of mobile learning technology was checked. For this purpose, at the end of the term students of the experimental and control groups had to complete the same test. It is important that the test contained only the material learned during the term and verified the level of development of *reading and comprehension* skills and *use of English* skills. The results of the test in experimental and control groups were compared that allowed us to prove the productivity of mobile learning technology as the only teaching and learning tool in the zone of conflict. Although the participants of the experiment completed the same test the instruments for data gathering were different in the experimental and the control groups. As the teachers could not provide the students from occupied territories with a specially developed test for monitoring final results, the decision was made to use one of the final tests for self-control, included into the textbook which those students were applying for learning "Legal English" during the term. The teachers got photos of the test in the manner described above. For the experimental group that test was placed in Google Form.

## 4 Results

The results of the final test proposed to both experimental and control groups at the end of the term are demonstrated in comparison with the students' achievement before the beginning of the experiment (in number and per cent of students with satisfactory, good and excellent academic performance) in Table 1.

**Table 1.** Comparison of the students' results in the control and experimental groups at the beginning and at the end of the experiment

| Results | CG* | | | | EG** | | | |
|---|---|---|---|---|---|---|---|---|
| | *Before* | | *After* | | *Before* | | *After* | |
| | N | % | N | % | N | % | N | % |
| Satisfactory | 12 | 30 | 14 | 35 | 12 | 30 | 9 | 22.5 |
| Good | 16 | 40 | 14 | 35 | 16 | 40 | 17 | 42.5 |
| Excellent | 12 | 30 | 12 | 30 | 12 | 30 | 14 | 35 |

* Control group
** Experimental group

The analysis of data given in Table 1 reveals that in general the achievements of the experimental group have improved by 15%. So, the students with satisfactory language proficiency have managed to raise their level to good results (7.5%), the students with good academic performance have succeeded in levelling up (2.5%), consequently, the number of the students with excellent grades has increased (5%).

At the same time the results of the control group have deteriorated by 10%, namely: the number of students with satisfactory results has increased from 30% at the end of the first term to 35% at the end of the spring term; the number of students with good results has decreased from 40% to 35%. The number of students with excellent results remained stable. In our opinion, such decrease in the level of progress of students may be explained by absence of immediate feedback from the teachers and access to additional materials, translation services etc. Another reason may be not very high motivation among students with satisfactory and good language proficiency to work fully independently.

The comparative analysis of the students' performance in the two groups of our experiment participants is presented in the diagram (see Figure 1).
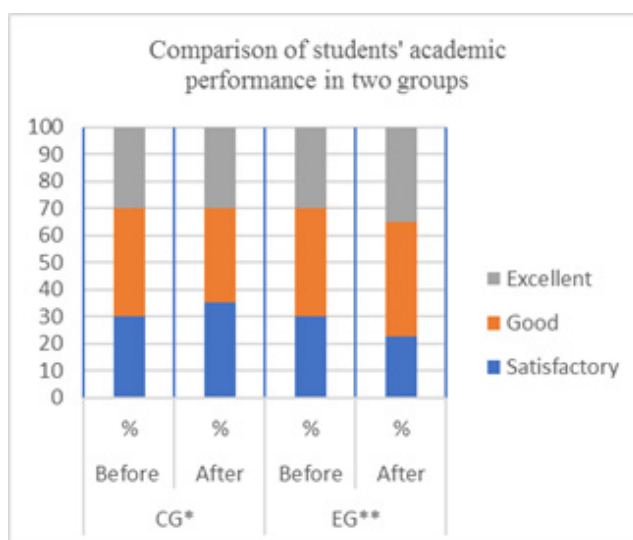


**Fig. 1.** Comparison diagram of students' academic performance

As we see in Figure 1, there were no significant changes in performance in the control group, while in the experimental group we observe a decrease in the number of students with satisfactory performance and an increase in the number of students with Excellent and Good results.

We carried out a statistical test of the hypotheses regarding the pedagogical experiment results using Pearson's criterion ($\chi^2$-criterion) and estimated the probability of the obtained results. According to the proposed procedure, the null and alternative hypotheses were formulated to test the identified differences in students' achievement based on mobile learning and traditional learning. The test results of the students of

the two groups were ranked by performance levels into three categories "satisfactory, good, and excellent" and entered a free Excel spread sheet. The null hypothesis was defined as the absence of differences in the performance of students in both groups. An alternative hypothesis is that the deviations in performance categories are beyond random fluctuations, such discrepancies are statistically visible. To test this hypothesis, we used Microsoft Excel, namely a function $\chi^2$ TEST. The significance level was chosen as 0.05. According to the obtained calculation results, the observed value was $\chi^2 = 2.76$, and the critical value for 2 degrees of a freedom was $\chi^2_{(0,05;2)} = 0.10$, so, we got that $\chi^2 > \chi^2_{(0,05;2)}$. Also, the p-value was 0.25. Thus, p-value is greater than 0.05 and this testifies in favour of the existence of differences between frequencies. Consequently, we reject the null hypothesis and accept the alternative hypothesis. It means that the authors' hypothesis was confirmed.

Thus, the mentioned signifies that mobile learning applied in the experimental group was more efficient according to the students' results during "Legal English" than traditional learning, which was utilised in the control group. The obtained results of our experiment do not contradict the research findings of Zhang [34], Klimova [35] and Alwafi et al. [36], who investigated mobile learning technology is a complementary method of teaching and learning English.

## 5 Discussion and limitation

Numerous aspects of mobile learning (benefits of the technology, requirements of its utilisation, motivation to use mobile learning, attitude of both teachers and students towards the mentioned form of learning, findings of academic staff, etc.) were proposed in recent papers.

The authors fully agree with the researchers who analysed the benefits of different Apps for learning English [34], [36], [37]. Moreover, we have verified the evidence of some apps efficacy for developing reading and comprehension skills and use of English skills. Being in alignment with the findings of Purnomo et al. [38] that due to mobile learning educational space is not limited to university auditorium but shifted into virtual form, the authors also have proved that study space may even appear in very unsuitable and unnatural conditions like bomb shelters. Completely sharing the opinions of the researchers [35], [36], [39] about the outcome of mobile learning technology for words, idioms boosting and other language skills developing, we have witnessed several supplementary possibilities provided by smartphones, which became no less important during the conflict. They are associated with closing the gap both inside academic groups and between academic staff and students when learners feel the need to be with their teachers and group mates, there is a psychological need to distract from the military action and that is mobile learning which helps in it. In addition, we strongly support the research results of Golonka et al [40] about the efficiency of using charts in teaching and learning foreign languages. What is more, the authors' experience has shown that during the conflict chats may sometimes become the only means of communication between learners and teachers enhancing students' productivity and interaction, motivating them and supporting psychologically as well

as providing feedback in the educational process. What is more, we can assume that online quizzes proposed as a primary learning tool by Mykytiuk et al. [1] result in the higher achievements of the students as we also used them in our mobile learning and teaching practice but unlike the stated authors, we considered them as an additional tool in the study of the English language. It is necessary to note also that we fully agree with Papadakis et al. [41] about the existence of a great number of mobile apps, which are created for learning, but their educational potential is different and not always sufficient. Although, the mentioned authors evaluated mobile apps for young children development, we came to the similar conclusion having done our investigation.

The limitations of the research are associated with the fact that the experiment was conducted based on the only University and the only academic subject. Moreover, the number of members of the experiment was limited to 80. But it was extremely difficult to select students for the control and experimental groups, on the one hand, because of changing situation on the front and capturing new territories, on the other hand, due to constant pressure of bombing, shelling, and missile attacks.

## 6 Conclusions

Thus, the study has examined the efficiency of utilising mobile learning technology at the tertiary level during conflict and has proved that mobile learning technology is effective not only as a complementary form of education but can be efficiently utilised at the tertiary level as the only training technique in zones of conflict. Moreover, mobile learning is a useful tool that provides psychological support to students in the context of military actions as well as motivates them to enhance their productivity and interaction. In addition, due to application of mobile learning technology teachers could monitor real-time learning that is especially important during military action. The experiment has shown that the students (the control group learning without application of personal mobile devices) who did not have feedback from the teachers and had to learn the subject completely independently could not improve their achievements. While academic performance of the students, who had the mentioned choice as well as different educational opportunities offered by mobile learning, has increased.

Accordingly, mobile learning technology that is able to provide students with access to systematic online training, platforms containing different textbooks and other local and remote educational content, as well as various educational services may become a great teaching and learning tool.

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