M-learning in Teaching ESP: Case Study of Ecology Students

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Abstract

The paper presents research results on mobile learning of English for specific purposes to ecology students with the help of the Quizlet learning platform.

The study was conducted in four stages: the students were surveyed about their mobile devices, and then they underwent an experimental mobile learning process during one term. The next stage was to work with authentic texts, during which the skills developed for reading comprehension of authentic specialized texts were assessed. In order to incorporate subject-specific vocabulary into professional discourse, in-class discussions were organized with students at the same stage of the study. The students were assigned to agree or disagree with the statements, prove their point, make arguments using familiar vocabulary on these topics. Such classroom discussions have shown that the subject-specific vocabulary the students mastered in the process of mobile learning is active. In our opinion, this is a very important result of mobile learning. The students also note that it is now easier for them to make up statements on professional topics and participate in conversations after mobile training. At the final stage, the students were surveyed once again in order to clarify their impressions of mobile learning.

The paper shows the students are sufficiently equipped with mobile technologies and highly motivated to m-learning. The objective test results and a high level of accuracy when doing follow-up activities and final tests indicate that mobile learning has increased the effectiveness of teaching ESP. Mobile devices and, above all, smartphones can form a personalized learning environment which is motivating and challenging at the same time. Employment of m-learning tools in ESP instruction, besides increasing foreign language proficiency, enhances the levels of students' satisfaction and motivation which are crucial for professional foreign language communication throughout life.

Keywords: m-learning, mobile application, ecological education, ESP, vocabulary learning, specialized texts.

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1. Introduction

It is impossible to imagine modern students without mobile phones and other digital devices. Obviously, teachers should pay attention to a number of advantages that these devices provide, as well as to the constant desire of students to browse contents of various mobile applications. Why not use students' technical skills to solve educational problems? According to experts, «in education, emerging technology- and mobile-based ways and tools for learning gain currency, focus being laid on differentiated instruction, cooperation and collaboration, but also autonomy and personalized learning. The general educational attributes of mobile devices, i.e. keeping students engaged, connected, as well as functioning as continuous data-collection tools make them ideal candidates for language learning» (Pop, 2014). We support the idea that mobile learning can be defined as the application of portable mobile computing devices, such as mobile phones, tablets, smartphones to access learning resources, collaborate, communicate, and share learning experiences. In addition, mobile learning involves all the activities that occur between teachers, learners, learning environments, learning theories, and support for anywhere, anyone, anytime learning (Sharples et al., 2007). According to fair experts, «the proliferation of mobile devices in our society has allowed mobile devices to be employed to deliver content and activities in which learning can be situated in a broader range of contexts than it has traditionally (e.g., in outdoor settings, in augmented reality, as well as 'just in time' or 'bite-sized' learning such as whilst travelling on public transport, etc.)» (Uther, 2019).

The use of mobile devices is of particular relevance when studying ESP (Douglas, 2000), (Hutchinson, Waters, 1982), (Šimonová, 2015). As known, a big problem in teaching ESP is mastering specialized vocabulary because «it is difficult to learn words especially ESP words because they are low-frequency words and are not encountered very often» (Xhaferi, 2010). However, there are some Web-based learning platforms for mobile devices which greatly facilitate the process of lexical units learning. One of these platforms is Quizlet (Quizlet), which has simple navigation: students sign up with Google, Facebook or email, and teachers create online classes where students are invited to join via a special link. The teacher creates a study set of terms on any topic. For example, for ecology students, the teacher offers such study sets as Deforestation, Climate Change, and Soil Pollution. Students, looking through these sets, can themselves choose study modes to work with vocabulary: Flashcards, Learn, Write, Spell, Test, and Play. The platform is personalized, non-judgmental, and is not designed to be an assessment tool, so students can practice as much as they would like without the fear of making mistakes or getting bad grades, which contributes to the most comfortable interaction between the student and the platform. Due to its versatility, Quizlet is perfect for ESP training because the material used in the platform is chosen by the teacher, so it can be professionally linked through integration with vocational subjects based on the use of specialized texts.

2. Research design

This paper presents research results from the case study of ecology students (Nigmatzyanova et al., 2019). The study consisted of four stages.

The first stage (preparatory) was a simple monitoring of mobile devices which 2nd and 3rd year students of Ecology faculty had. During the survey, it was found out which mobile devices and for what purposes students used every day.

The second stage presented data based on experimentation with m-learning and direct observations gathered during class activities. The students were offered some study sets created using the Quizlet platform. The student's book of Career Paths series was taken as a basis. This student's book is an educational resource for environmental science professionals who want to improve their English communication in a work environment. Incorporating career-specific vocabulary and contexts, each unit offers step-by-step instruction that immerses students in the four key language components: reading, listening, speaking and writing. The resource addresses topics including the parts of the environment, natural resource management, biodiversity, pollution and climate change (Career Paths...).

The third stage consisted of working with authentic texts, including specialized vocabulary on such topics as Climate change, Ecosystems, Energy, Forests, Oceans and Seas, Resource efficiency, Technology, Chemicals and waste, Water.

Authentic texts were selected from the websites of international environmental organizations, as well as from scientific journals (Environmental Research Letters, Journal of Animal Ecology, Functional Ecology, Ecosphere, etc.).

The fourth stage consisted in questioning the students and evaluating their impressions after applying mobile learning.

At first, we planned to form an experimental group and a control group of 10-12 people for each study year to compare the results of mobile and traditional learning. We intended to form groups randomly without considering the students' level of language proficiency. The first (experimental) group was supposed to go through mobile training; the second (control) group was supposed to master subject-specific vocabulary as part of traditional classroom training. However, at the very beginning of the experiment, the 2nd- and 3rd-year students expressed a desire to leave the control groups and join the experiment. We appreciated students' enthusiasm, noting that mobile learning was of great interest to them. It is also a powerful motivating factor for studying ESP. In addition, we needed to maintain a democratic communication style with students (Ilyinova, Tsinkerman, 2019). After all the students had become participants in the experiment, we had to make adjustments to the original research plan. To assess the results of mobile learning in the 2018–2019 academic year, we decided to compare the results of mobile learning we obtained with the academic results of students who studied in the previous 2017–2018 academic year using the traditional methodology.

Thus, the control sample consisted of student test results for the 2017–2018 academic year, and the experimental sample consisted of test results of second- and third-year students of the 2018–2019 academic year. Since we had tests of 75 (second year) and 77 (third year) students studying in 2017–2018 according to the traditional methodology, to ensure comparability of results, the experimental group of the 2018–2019 academic year included 68 second-year students and 70 third-year students. In this study, the Fisher angular transformation method was employed to benefit from the opportunity to compare small samples with high accuracy of calculations. The calculation was carried out according to the formula:

$$\varphi^* = (\varphi_1 - \varphi_2) \cdot \sqrt{\frac{n_1 \cdot n_2}{n_1 + n_2}}$$

where:

• φ_1 is the angle corresponding to a larger percentage,

• φ_2 is the angle corresponding to a smaller percentage,

• n_1 is the number of observations in the first sample,

• n_2 is the number of observations in the second sample.

Mobile learning was organized according to the following cycle: learning of study sets - interactive work with lexical material in class – work with authentic specialized texts, feedback, and evaluation. As criteria by which it was possible to assess the effectiveness of mobile learning using the Quizlet platform, the following indicators were established: the time spent on learning the study set, the percentage of correct answers while learning the vocabulary, and the time spent on reading and understanding authentic specialized texts. In order to evaluate the results obtained, the students were asked to complete the questionnaire on their impressions about mobile learning at the end of the term.

3. Results

3.1. Monitoring of ecology students' mobile devices use

At the first stage of the study, a survey of the 2nd- and 3rd-year ecology students was conducted within the first academic week of September 2018. During the survey, it was determined whether the students were sufficiently equipped with mobile devices, which mobile devices were at their disposal and for what purposes they used them. The survey was conducted in oral form. The results are shown in Table 1.

Table 1. The results of ecology students' mobile devices use monitoring

Study year	smartphones	smartphones +tablets	smartphones + netbooks
2	100%	25%	10%
3	100%	27%	12%

The data show (Table 1) that smartphones are currently the most frequently owned mobile devices (100 % of respondents possess them). Moreover, the students have other mobile devices – tablets (from 25 % to 27 %) and netbooks (from 10 % to 12 %) As expected, students do not have one type of mobile devices only, but simultaneous possession of smartphones, tablets, netbooks was proved. The survey also shows that mobile devices such as iPods, MP3 players, e-book readers that were widely used several years ago are not popular among students anymore. In addition, as expected, none of the students mentioned learning as the purpose of using mobile devices. Among the main purposes of using mobile devices, the students mentioned communication and entertainment.

Thus, the monitoring showed more than enough supply of the students with mobile devices and their lack of mobile learning experience, which stimulated us to start implementing the idea of mobile learning as soon as possible.

3.2. Mobile learning experience and its results

At the second stage of the study, an experimental mobile learning process based on the Quizlet platform took place from September to December 2018. During the period of 17 weeks, classes on lexical topics were held for 30 minutes a week using Quizlet for organizing interactive studying. In addition, the students had the opportunity to learn subject-specific vocabulary through Quizlet mobile applications running on mobile devices (tablets and smartphones) all 17 weeks long.

The following actions were performed in the process of mobile learning:

face-to-face instruction, in other words, the students attended lessons and the teacher tested their knowledge of lexical material through collaborative classroom game Quizlet Live thus reactivating new vocabulary;

after-lesson autonomous learning exploiting mobile applications. The students had access to new terminology and could choose different study modes to work with terms: Flashcards, Learn, Write, Spell, Test, and Play.

The process was evaluated by means of weekly follow-ups as well as monthly quizzes (Rudneva, Valeeva, 2017).

Students' activity monitoring shows most of them followed the m-learning trajectory presented in Figure 1.
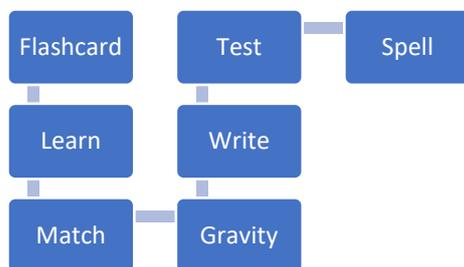
Fig. 1. Students' Quizlet use trajectory

Figure 1 shows that the students, as a rule, begin their mobile learning from exploring new lexical material with the help of flashcards. Working with flashcards can be organized in various ways: new words are presented in L1 or L2 or simultaneously in L1 and L2. Then the students continue with the Learn mode, which involves several sets of terms. The first one offers multiple choice questions; in the second one, the students are supposed to type the correct answer. Lexical

units are also given in L1 and L2. If the students do not remember the word or have some doubts, they can click on Don't know to see prompts and then copy the correct answer. The students can easily control how words are distributed into groups of familiar and mastered words. Next, the students go to the Match game, during which you need to drag corresponding items (a word and an image) onto each other to make them disappear against the clock. The students are usually filled with enthusiasm if they can show excellent results, for example, complete the task for no more than 6 seconds and become Match champions. After that the students move on to the Write mode and then again to the game, in which they can also select the difficulty level. Thus, the students, at a comfortable pace, independently alternate more intense types of work with playful activities, use prompts if necessary, control their results with the help of tests and get good academic scores.

So, observations indicate that the students are most interested in working with flashcards, in learning vocabulary anytime and anywhere, and in testing their knowledge. The students are least interested in the Spell mode due to the lack of quality audio models.

In general, subject-specific vocabulary mobile learning has demonstrated the following advantages:

firstly, it increased students' motivation to study specialized vocabulary, intensified interest in further independent learning of career-specific terms;

secondly, it contributed to reducing the time spent on vocabulary learning;

thirdly, it helped to improve reading skills of authentic specialized texts;

fourthly, it allowed involving almost all students in active classroom work with lexical material;

fifthly, it stimulated teamwork in class, promoted interpersonal skills improvement; added a competitive component to training;

sixthly, it improved lexical test results in comparison with the traditional learning model group.

However, the widespread use of mobile learning has raised many questions among teachers: 'Why mobile?', 'Do mobile devices help or hinder learning?' and 'How can mobile learning be evaluated?' (Uther, 2019). Mobile learning has acquired supporters and opponents. Some experts believe that the use of mobile devices worsens the quality of the educational process due to the fact that students' concentration decreases; they are distracted by other applications and messengers that they have on their smartphones. Of course, such a situation cannot be completely ruled out, but our study does not confirm these fears. On the contrary, the results of mobile learning look very optimistic. It is also important to note that several reliable and detailed studies aimed to establish the net effect of using mobile language learning technologies prove the positive effect of mobile device usage on language acquisition and language-learning achievement (Cho et al., 2018; Uther, Ylinen, 2019).

Let us consider the mobile learning results obtained in teaching ESP to ecology students.

The statistical data obtained using the Fisher angular transformation method (Table 2 and Table 3 below) have proved the hypothesis on the effectiveness of mobile learning in studying subject-specific vocabulary since the empirical value of the Fisher criterion is consistently higher than the critical value when comparing samples of test results in the experimental and control groups. Table 2 also shows the results of the empirical value of the Fisher criterion when studying the Weather topic are in the so-called Area of insignificancy, but as known, this fact is not the basis for rejecting the hypothesis on the effectiveness of mobile learning.

Table 2. Comparative results of 2nd year ecology students subject-specific vocabulary mastering: mobile and traditional learning

Ecosystems			
Group	"There is an effect": the problem is solved	"No effect": the problem is not solved	Total
	Number of test subjects	Number of test subjects	
Experimental	52 (76.5 %)	16 (23.5 %)	68 (100 %)
Control	42 (56 %)	33 (44 %)	75 (100 %)
φ*EMP=	2,616		

Axis of Significancy
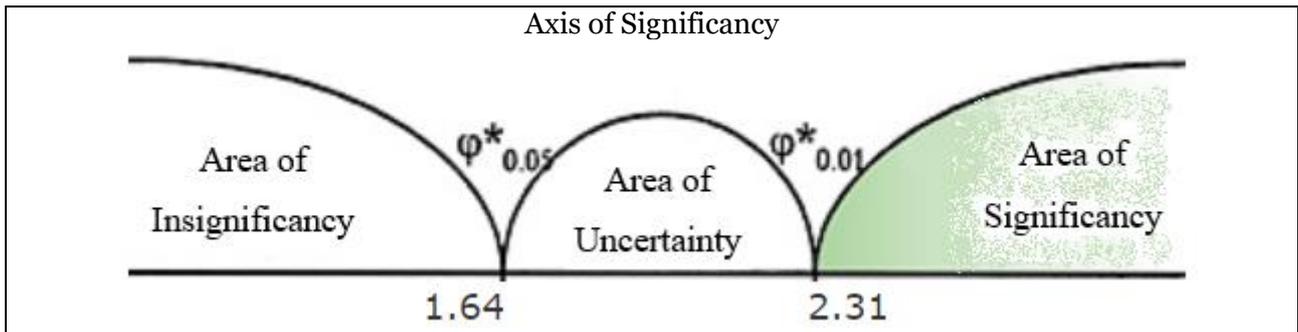
Climate			
Group	"There is an effect": the problem is solved Number of test subjects	"No effect": the problem is not solved Number of test subjects	Total
Experimental	59 (86.8 %)	9 (13.2 %)	68 (100 %)
Control	51 (68 %)	24 (32 %)	75 (100 %)
φ*EMP=	2.741		

Axis of Significancy
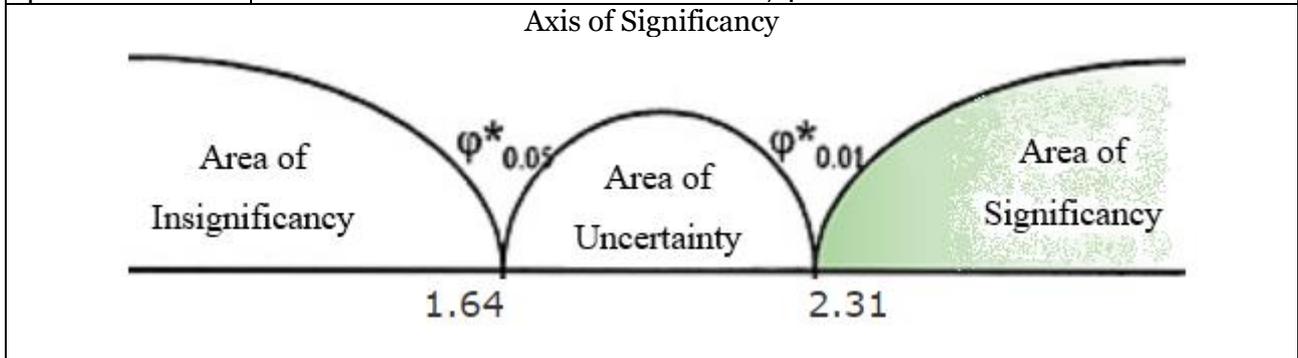
Weather			
Group	"There is an effect": the problem is solved Number of test subjects	"No effect": the problem is not solved Number of test subjects	Total
Experimental	62 (91.2 %)	6 (8.8 %)	68 (100 %)
Control	59 (78.7 %)	16 (21.3 %)	75 (100 %)
φ*EMP=	2.132		

Axis of Significancy
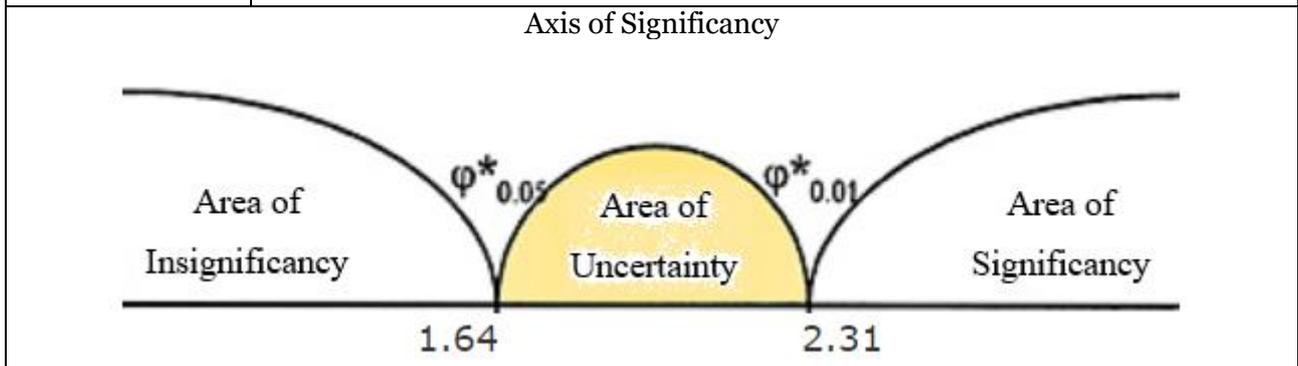
Energy			
Group	"There is an effect": the problem is solved Number of test subjects	"No effect": the problem is not solved Number of test subjects	Total
Experimental	55 (80.9 %)	13 (19.1 %)	68 (100 %)
Control	47 (62.7 %)	28 (37.3 %)	75 (100 %)
φ*EMP=	2.443		

Axis of Significancy
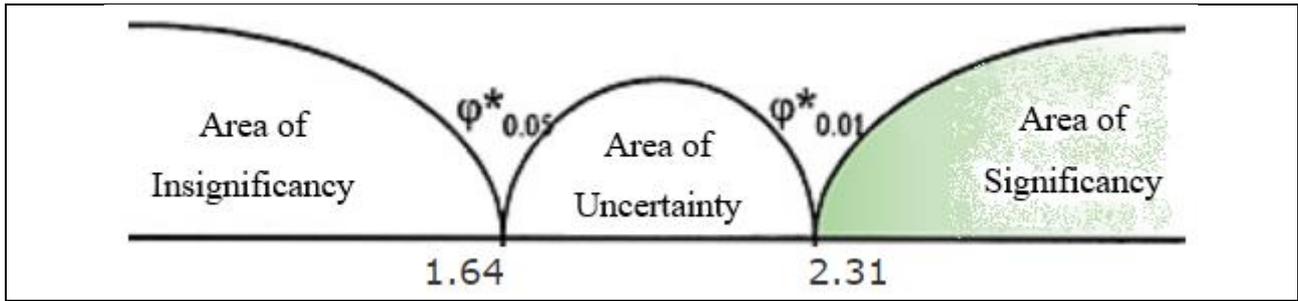
The academic results of the 3rd year students from the experimental group were more stable.

Table 3. Comparative results of 3rd year ecology students subject-specific vocabulary mastering: mobile and traditional learning

Deforestation			
Group	"There is an effect": the problem is solved	"No effect": the problem is not solved	Total
	Number of test subject	Number of test subject	
Experimental	57 (81.4 %)	13 (18.6 %)	70 (100 %)
Control	48 (62.3 %)	29 (37.7 %)	77 (100 %)
φ*EMP=	2.61		
Axis of Significancy			

Soil pollution			
Group	"There is an effect": the problem is solved	"No effect": the problem is not solved	Total
	Number of test subject	Number of test subject	
Experimental	55 (78.6 %)	15 (21.4 %)	70 (100 %)
Control	47 (61 %)	30 (39 %)	77 (100 %)
φ*EMP=	2.343		
Axis of Significancy			

Air pollution			
Group	"There is an effect": the problem is solved	"No effect": the problem is not solved	Total
	Number of test subjects	Number of test subjects	
Experimental	57 (81.4 %)	13 (18.6 %)	70 (100 %)
Control	47 (61 %)	30 (39 %)	77 (100 %)

φ*EMP=	2.767		

Axis of Significancy

Climate change

Group	"There is an effect": the problem is solved	"No effect": the problem is not solved	Total
	Number of test subjects	Number of test subjects	
Experimental	61 (87.1 %)	9 (12.9 %)	70 (100 %)
Control	50 (64.9 %)	27 (35.1 %)	77 (100 %)
φ*EMP=	3.234		

Axis of Significancy
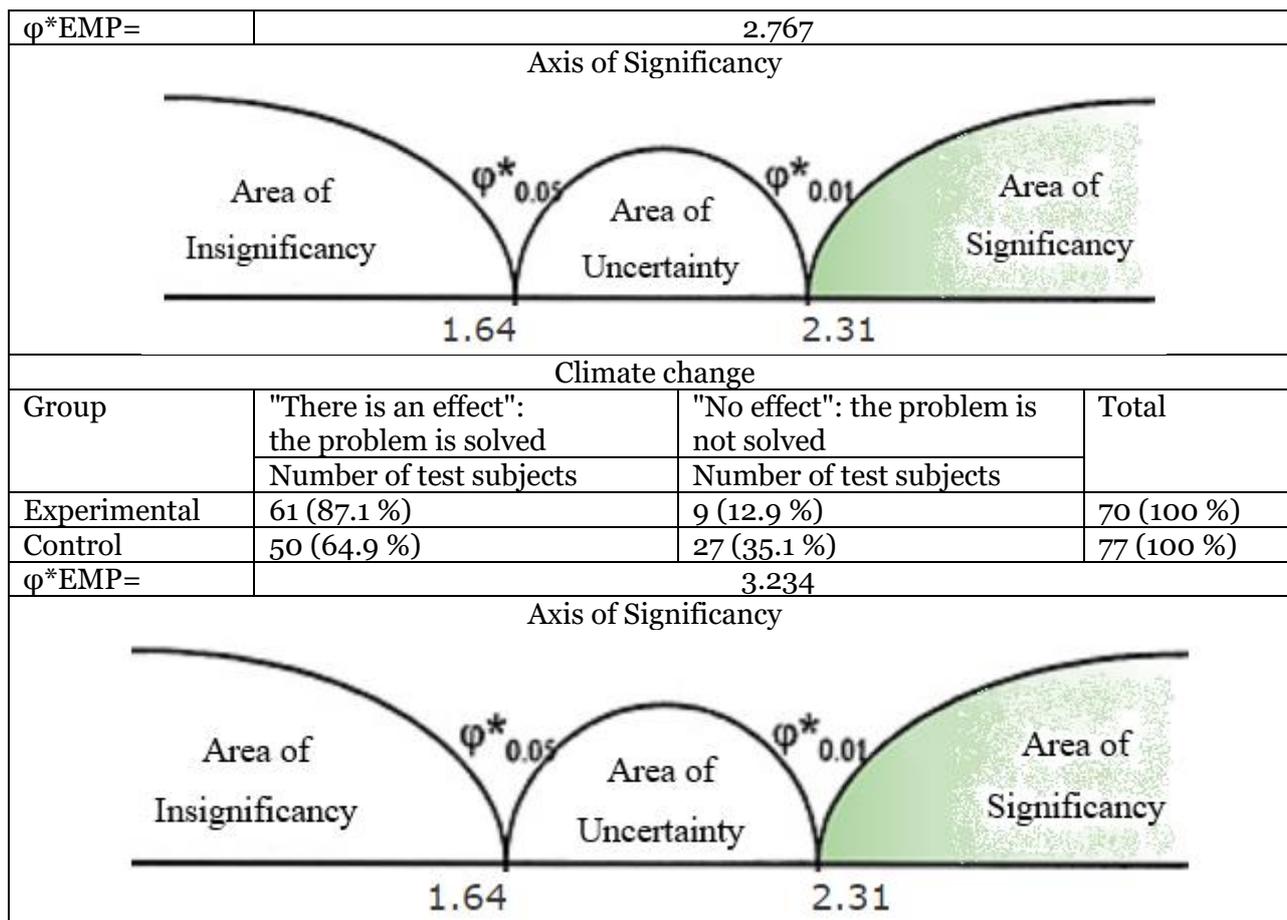
These data demonstrate the educational effectiveness of mobile learning and confirm the existing data on the effects of integrating mobile devices with teaching and learning on students' learning performance (Sung et al., 2016).

3.3. The effectiveness of mobile learning to increase the motivation to learn ESP

We believe the development of students' reading skills of authentic specialized texts is one of the criteria for the effectiveness of mobile learning in ESP. We also agree with the statement that reading practices help learners enhance their vocabulary, and vocabulary knowledge, in turn, helps them promote reading comprehension (Chen, Hsu, 2008). For example, «the experimental results of the study indicated that English news reading learning along with unfamiliar vocabulary learning with self-assessing feedback response are very effective in prompting reading comprehension and reading abilities of the learners» (Mosavi Miangah, Nezarat, 2012).

We assumed that mobile learning of vocational vocabulary would improve students' skills for reading comprehension of authentic specialized texts. As known, there are discussions about the use of authentic texts in teaching a foreign language. Some experts believe that the great disadvantage of any authentic text is that the amount of information outweighs the amount of learnable language; in this sense, adapted texts help learners focus their attention on the main language features and use. Other experts emphasize the importance of using authentic texts. We join those who believe that such authentic materials «should be taken from the real world and not primarily created for pedagogical reasons. Such materials are particularly important for communicative purposes since they reproduce an immersion environment and provide a realistic context for tasks that relate to learner's needs» (Torregrosa Benavent, Sánchez-Peñamaría, 2011). However, «some ESP areas are particularly sensitive to in-house materials due to the lack of published materials available. In any case, following Krzanowski, as far as possible good self-designed ESP materials should:

- balance informative, language and communicative content (i.e., "adequacy of content");
- be based on topics of general academic and professional interest;
- be directly linked to related degree/course/curriculum;

- be recyclable and evergreen;
- be evaluated against length and time available;
- be set in a memorable context;
- meet the criterion of authenticity;
- ideally cover both language and skills;
- offer students the opportunity to gain transferable skills;
- not over-promote one discrete skill;
- lend themselves to being adapted and/or extended;
- stimulate student interaction;
- adapt preferences to learners' needs and knowledge;
- be professionally printed and edited;
- help practitioners develop their own teaching style (Bocanegra-Valle, 2010).

Of course, special requirements are imposed on authentic texts. According to M. Rudneva and N. Valeeva, they «should meet the following basic criteria:

- be focused on the future specialty of students, be informative and relevant;
- be polemic, stimulate debate and discussion;
- be authentic, unadapted, logically built, rich in scientific terminology, with complex grammatical structures» (Rudneva, Valeeva, 2017).

A detailed discussion on educational or adapted and authentic texts in this study is explained by the fact that mobile learning of specialized vocabulary, which gave good results, is not an end in itself. We dare say that the vocabulary without a specialized text is dead, as it is also dead without professional discourse. That is why one of the stages of the study was the work with authentic texts.

At the third stage of the study, the students who experienced mobile learning were offered authentic specialized texts from environmental journals and texts selected from the content of international environmental organizations websites.

Working with authentic specialized texts showed that the time of the pre-reading stage of text analysis, which prepares students for text perception, removes the barrier of language difficulties, activates previously learnt vocabulary, was reduced by 25 %. On average, reading time and adequate understanding of an authentic text was reduced by 10 %. Thus, the use of mobile vocabulary learning tools proves its educational effectiveness in developing reading skills of authentic specialized texts and motivates students to further ESP studying.

In order to incorporate subject-specific vocabulary into professional discourse, in-class discussions were initiated at the same stage of the study. The discussion was based on statements from authentic texts that address climate change and water scarcity, for example:

- On a medium- to long-term basis, we absolutely believe that climate change will cause increasing water stress across the globe.
- Climate volatility will continue to drive research into water-from-air technologies.
- With global demand for water expected to increase by nearly one third by 2050 (United Nations Environment Programme...).

The students were assigned to agree or disagree with the statements, prove their point, make arguments using familiar vocabulary on these topics. Such classroom discussions have shown that the subject-specific vocabulary the students mastered in the process of mobile learning is active. In our opinion, this is a very important result of mobile learning. Thus, the students have become more prepared to participate in professional discourse. The students also note that it is now easier for them to make up statements on professional topics and participate in conversations after mobile training. So, we can move on to analyzing students' feedback from mobile learning in ESP.

3.4. Student survey results

At the fourth stage of the study, the students were asked to complete the following questionnaire to evaluate the results of mobile learning:

1. Have you become interested in mobile learning?
2. Have m-learning helped you in studying ESP?
3. Have you experienced any difficulties in m-learning? If yes, provide examples, please.
4. Would you like to continue using m-learning in studying ESP in the future?
5. Would you like to use mobile devices in learning other subjects in the future? If yes, provide examples, please.
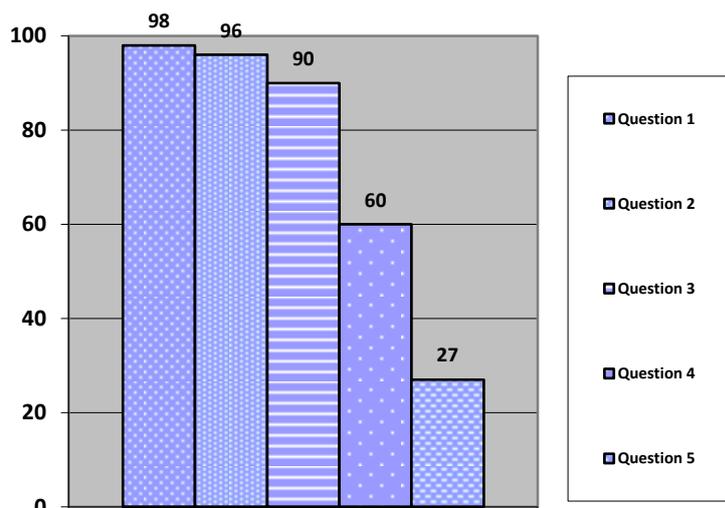
Fig. 2. Student survey results

Our student survey shows that 98 % of the students are interested in mobile learning, 96 % of the students noted the usefulness of a mobile application when studying subject-specific vocabulary and expressed a desire to continue the experience of using mobile devices in ESP training.

When asked about the difficulties of mobile learning, 90 % of respondents indicated none of them; only 10 % of the students indicated the need to sign up, as well as the limited charge of a mobile device among the inconveniences of using a mobile application.

60 % of the students expressed their willingness to use mobile learning when studying ESP in the future and 27 % of the students expressed their readiness to experience mobile learning when studying other subjects, but none of them specified what kind of subjects it might be.

4. Conclusion

The study shows that mobile learning increases the motivation of students to learn ESP. The objective test results and a high level of accuracy when doing follow-up activities and final tests indicate that mobile learning has increased the effectiveness of teaching ESP.

The students demonstrated improvements in reading comprehension of specialized text and active participation in discussions on professional topics thus indicating positive results of mobile learning.

The high assessment of the students also proves the effectiveness of mobile learning: over 90 % of the students positively evaluated the use of mobile devices for educational purposes.

Mobile devices and, above all, smartphones can form a personalized learning environment which is motivating and challenging at the same time.

Employment of m-learning tools in ESP instruction, besides increasing foreign language proficiency, enhances the levels of student satisfaction and motivation which are crucial for professional foreign language communication throughout life.

We believe that mobile learning in teaching ESP should develop. New practical studies are needed to confirm the results of mobile learning, as well as the analysis of these results by experts in the field of theoretical approaches to teaching ESP.

5. Acknowledgments

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