MICROLEARNING OF HEI's STUDENTS IN THE STUDY OF FOREIGN LANGUAGES

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Abstract: The article aims to find out, ground, and checkup experimentally the effectiveness of foreign language studying by students in the context of increasing foreign language lexical competence level based on using individualized educational technology of micro–environments. According to the results of the analysis of the quantitative data of the experiment, there was an increase in the arithmetic mean value (M, Mean Average) of the results of the current control (from 73 to 95) with a decrease in the standard deviation (SD, Standard Deviation) (from 14,2 to 2,9), which illustrates the expediency of the microlearning technology for the formation of foreign–language vocabulary competence.

Keywords: education, student, teacher, individualization of learning, infographics, posters, foreign language lexical competence.

1 Introduction

The system of higher education in a dynamically changing world should form new qualities of a university graduate – initiative, mobility, flexibility, dynamism, and constructiveness. The person must have the ability to the intellectual, cultural, moral, physical, and professional self–development and self–improvement; to improve his qualifications and skills; to work in a team, lead and subordinate people; to strive to achieve goals and critically rethink the experience; to possess a culture of thinking. Learning a foreign language in higher education institutions (HEIs) is part of the overall task of training highly qualified personnel. Language learning is a rather time–consuming process that requires a lot of information, the access to which is limited under the traditional approach to learning.

Therefore, one of the modern formats of e–learning is microlearning, that is, focal or point–based learning. As is clear from the name, the key factor here is a small amount of content or a limited time of mastering training materials. The duration of a single session may even be a few minutes. Such a lesson is easy to build into modern training formats. Specialists point out that it is important to organize effective learning interaction between the participants of the educational process, joint work, and cooperation. Apply interactive forms of an educational interaction – webinar and forum, collaboration tools – network services Web 2.0, technologies – "flipped learning," gamification, BYOD (Bring Your Own Device), scribing. Thus, short classes that can be stopped and resumed at any time are replacing grueling traditional activities. Multitasking and lack of time dictate their own rules, so the duration of learning is constantly being shortened.

Considering the above, the scientific novelty of the research is as follows: introduction of microlearning tools (infographics and posters) into the educational process to increase the level of HEIs students' foreign language lexical competence.

The theoretical significance of the work lies in the fact that it highlights the most important aspects of the formation of foreign language lexical competence and offers an individual trajectory of e-learning – microlearning in foreign language studying as a technology for solving the highlighted problems. The practical use of the research lies in the fact that the theoretical provisions, results, and conclusions contained therein create real prerequisites for the foreign language studying by students' improvement in domestic institutions of higher education.

Allocation of scientific novelty, theoretical and practical importance allowed formulating the research's hypothesis: individualization of foreign language studying will be effective if its pedagogical design is based on the model of reverse pedagogical design. That is, it is carried out based on educational results and at the same time:

- pedagogical design of individualized subject foreign language studying is implemented, which ensures that the student manages his educational trajectory;
- the educational content is structured to the level of micro–portions, which increases the flexibility of adaptation strategies in building individual educational trajectories (implementation of microlearning technology);
- the level of foreign language lexical competence of students is increased.

2 Literature review

Nowadays, traditional teaching cannot lead students to innovation and creativity because it is not able to encourage them to learn new things. In addition, the knowledge that students acquire through traditional teaching methods is easily forgotten (Hug, 2010). Thus, students in higher education institutions need to have the ability to maintain concentration throughout the lecture, but in the first 10–15 minutes their attention span is the highest (Xia, 2016). According to research (Renard, 2017), the traditional learning process decreases a student's attention span. The average duration of concentration on a single object or stream of information decreased from 12 seconds to 8 seconds between 2000 and 2016. It seems that by giving the student information that is necessary and relevant now, directly related to its subsequent practical application, the likelihood that the student will remember it will increase. Therefore, microlearning is a new type of e–learning, a new educational technology, which will allow us to work and teach in the new realities, given the lack of concentration. We should note that the specified technology attracts a lot of attention. At the same time, it is most actively discussed by Western European scientists (Baumgartner P., Cole M., Giurgiu L., Souza M. I., Torres T. Z., Carvalho J. R., Evangelista S. R., Amaral S. F.), on the contrary, there are almost no works on this topic in the domestic science. Since the term "Microlearning" is new and not yet established, it is necessary to clarify its meaning. Microlearning is a form of learning that includes aspects of learning and education, where the focus is on the micro–level, in particular, micro–contents or micro–media (micro–sized media resources). Microlearning refers to relatively small learning units and short–term educational activities (Souza & Amaral, 2014).

The researcher (Almazova, 2018) argues that microlearning is an educational technology that involves the acquisition of knowledge in the form of small independent units, where each of them presents the information that is important at a particular point in the learning process and presented in the most structured, concise and accessible form. The scientist (Alqurashi, 2017) focuses on the pedagogical dimension, describing it as a learning strategy developed using a series of short learning materials and short activities, making a mini–course. The most widespread assumption (Hug, 2006) is based on seven dimensions:

- time (limited effort that results in short time requirements) content (short sections with clearly delineated subjects and relatively simple tasks) curriculum (parts of modules or parts of curriculum content, short didactic elements, etc.)
- format (variety of formats such as units, lab assignments, etc.); process (activities that are independent or integrated into a broader context, iterative processes, etc.)
- media (learning in the classroom or distance learning based on different multimedia content);
- models of learning (repetitive, reflective, pragmatic, constructivist, conceptual, conectivist, etc.). There are several studies conducted in the field of microlearning. The author (Freeman, 2016) used technology–friendly tools in the form of video content. He offered such videos to

introduce microlearning (basic terms, explanations, examples, potential, and experiences of the said technology). Researchers (Ozdamlı, Kocakoyun, Sahin & Akdag, 2016) tried to give students' opinions on infographics as another tool for microlearning.

To support the microlearning approach, it is necessary to provide actions and facilitate the development of adequate learning sequences. Regarding microlearning strategies, the academic literature offers a wide range of options: independent learning (Kizilcec, Pérez–Sanagustín & Maldonado, 2017), situational learning (Lave & Wenger, 1991), and community–based learning (Wenger, 1998). For collaborative content creation and sharing, collaborative learning and process–oriented learning are also worth mentioning (Davenport, Barry, Kelliher & Nemirovsky, 2004). The literature also recommends that microlearning processes should be designed to combine sessions (microcontent) of no more than 15 minutes each, which can be organized as loosely connected cycles of three sessions: introduction, exercise, and conclusion. Moreover, the microlearning material should be attention–grabbing, very concrete, and clear; there should also be supplementary materials that allow students to participate directly in their creation, collection, and modification. It is important to find a balance between a short format and additional information (Salomonsen, 2018; Souza, Torres, Carvalho, Evangelista & Amaral, 2015). Finally, it is particularly interesting to promote microlearning in HEIs, where materials from the learning events themselves are made available to the student community in a way that can serve as a basis for discussion, as support material for new events, or simply as a reference for consultation (Cole, 2017; Giurgiu, 2017; Kamilali & Sofianopoulou, 2015; Mohammed, Wakil & Nawroly, 2018; Sun, Cui, Beydoun, Chen, Dong & Xu, 2017; Sun, Cui, Yong, Chen & Shen, 2018). According to (Cates, Barron & Ruddiman, 2017), most microlearning efforts are directed specifically toward foreign language studying.

Although in the foreign study of the formation of microlearning a large number of scientific works but it is worth more attention to the problems of its development in the territory of Ukraine in the process of teaching foreign languages. Therefore, in our opinion, studying the influence of the above–mentioned educational technology on the level of formation of foreign language lexical competence among students of domestic HEIs is urgent and timely.

The research aims to identify, substantiate and experimentally verify the effectiveness of improving foreign language studying of students in the context of increasing the level of foreign language lexical competence based on the application of individualized educational technology of microlearning.

According to the aim set, the following tasks are formulated:

▪ to reveal the essence and content of the concept of "microlearning";
▪ to carry out an experiment aimed at the pedagogical design of individualized foreign language studying by students of the VSPU and DonNU in conditions of microlearning technology;
▪ to determine the level of foreign language lexical competence formation among students of domestic higher educational institutions;
▪ to determine the effectiveness of the suggested technology of improving foreign language studying by students of HEIs.

3 Materials and research methods

The foreign and domestic experts on the problem under study, periodical literature, educational programs, teaching packages, electronic educational tools, libraries of electronic aids, materials of scientific and practical conferences, interviews and questioning of students, teaching observations of the learning process of students, data of the experimental pedagogical research were the fundamental basis of the research.
In the process of studying and processing information sources, economic-statistical, abstract-logical, and economic–

mathematical methods of research were used, as well as methods of factor and correlation analysis.

4 Results

Microlearning is a new stage in the development of mobile learning. If 5–10 years ago, the main emphasis in the integration of Web 2.0 services was on their accessibility through mobile devices (Wakil, Muhamad, Sardar & Jalal, 2017), nowadays the focus is on optimizing content not for technology, but according to the characteristics of clip thinking (ability to work with a lot of information; fast transition from one problem aspect to another; preference for non-textual (visual) information, high information processing speed and orientation in heterogeneous information flow; fast fatigability; reduced concentration of attention, operating with meanings of a fixed length; reduced ability for analytical activity).

Thus, in our view, the emergence and use of microlearning in the study of a foreign language is largely due to the emergence of a new type of thinking and features of the modern educational environment, requires the search for new approaches and learning tools to improve the effectiveness of the educational process. We are talking about splitting tasks into micro–parts (no more than 15 minutes), which are regularly published as posts on social networks and learning chats (Baumgartner 2013). The choice of these platforms as learning tools provides informal interactions, both between students and between students and teachers.

The psycho–pedagogical basis for microlearning as a technology of foreign language teaching consists of personality–centered and system–activity approaches. The implementation of the learning process in the familiar for the digital generation context of social services stimulates the involvement and active role of the student. Moreover, the initiative of such interaction comes precisely from the students, who invite the teacher to a group chat from the discipline. Thus, students become active participants in the learning process and content generators at the level with the teacher, who acts as a moderator, accepting the request for collaborative research activities, professional dialogue, and productive learning interactions (Khong & Kabilan, 2020).

In terms of the education form, microlearning as a technology can be implemented in blended and distance learning. However, here there is a departure from the usual modular form of presentation of learning material. On the one hand, students themselves can offer individual fragments of material according to the predetermined criteria. At the same time, the perception of the content offered by the teacher changes, namely, each content post can be saved to the selected by individual participants according to their inclinations and interests (Jomah, Masoud, Kishore & Aurelia 2016).

The goal of microlearning is to build sustainable skills in a familiar authentic environment for students. Actualized content, acting as learning content, allows to engage students in the learning process and provides a so–called "student's plan," where the user performs tasks not to achieve educational goals but to communicate. The teacher, in turn, follows the "teacher 's plan", which implements on social platforms the traditional curriculum of the discipline, transforming the tasks according to the audience's request (Panaqué & Soria–Valencia, 2021).

The principles of microlearning correlate harmoniously with the principles of lexical skills development through the use of the didactic potential of social networks and messengers. Thus, the unity of language and speech is achieved in the process of applying linguistic material in the primary context of exchanging comments and posts in the digital culture. Verification of mental components in solving problem situations is provided by diagnostic measurement of the level of background knowledge and formation of interdisciplinary skills, followed by compensation of gaps when integrating the material varies in complexity. Finally, the introduction of elements of the method of collaborative learning (peer learning) supports creativity, which includes originality, independence, and novelty of thought and statement.

In our study, given the above features of learning a foreign language, we used microlearning to explain the material, the introduction of certain special terms and concepts, as well as activation of students when performing paired and group tasks of an oral nature. Thus, the purpose of the study is to explore the possibilities of microlearning technology in the study of a foreign language in higher education and to assess the potential of its use as a teacher's tool. The objectives of the study are to determine the main features of this technology, the selection of necessary tools for the implementation of microlearning in the study of a foreign language, and further conduct a pedagogical experiment on the implementation of an individualized technology of microlearning in the educational process.

Speaking about the use of microlearning in higher education, the function of the teacher is defined in the selection of the necessary material, its processing, and presentation in a concise, concentrated form. The presentation of the material should be as accessible, capacious, and concise as possible. According to the concept of microlearning, the selection of material should be guided by what is needed "to date" to solve specific current problems, that is, a certain necessary and sufficient minimum (Salinas & Marín, 2015).

It seems that if the teacher gives the student information that is necessary and relevant now, directly related to its subsequent practical application, the probability that he will remember it will increase. Thus, microlearning makes it possible to work and teach in new realities, given the deficit of concentration (Redondo, Rodríguez & Escobar, 2021).

The key features of microlearning are: short duration of content units; focus on a specific learning outcome and practice–oriented; maximum mobility.

There are many tools (various applications and programs) with which it is possible to implement microlearning in HEIs, but each has its characteristics and deserves attention. In general, we can distinguish two main groups of such tools: some allow you to create video and audio content, while others help you create static visualizations.

As an example, for videos, applications such as "Powtoon" and "Canva" are well suited for easy-to-use, for infographics, posters (Piktochart" and "Infogram" etc.). Such programs do not require special hardware (a computer/laptop and an Internet connection are enough) and can be used both by a teacher directly in the classroom to explain the material (or to create additional materials for students to study independently) and by students, for example, when doing project work.

However, at the moment, there are not enough materials to analyze the impact of microlearning on foreign language studying in HEIs in Vinnytsia.

In this connection, we conducted an empirical study, which consists of verifying the effectiveness of the proposed technology to improve foreign language studying in conditions of microlearning, the approbation of the complex of tasks in foreign language classes to increase the level of foreign language lexical competence on the example of Vinnytsia State Pedagogical University named after Mikhailo Kotsyubinsky (VSPU) and Donetsk National University named after Vasyl Stus (DonNU).

360 respondents of I–V years of study with the level of foreign communicative competence from A_2 to B_2 according to all-European scale CEFR took part in the survey. The empirical research of the improvement effectiveness of foreign language studying by the students of VSPU and DonNU, based on the application of microlearning technology, was conducted in three stages:

1. Surveying HEIs students to determine the current state of their foreign language studying in e-learning: to find out the main difficulties of its organization on the part of both students and teachers, their attitude towards the use of microlearning in foreign language classes.

2. Pedagogical design of individualization of foreign language studying by HEIs students in the conditions of microlearning to increase their foreign language lexical competence.
3. Determination of the effectiveness of the proposed technology for improving foreign language studying in HEIs (checking the assimilation of new vocabulary) as well as the level of satisfaction with it.

Stage I. A total of 360 respondents of I–V years of study took part in the survey. Analyzing the results of the questionnaire, it can be noted that the majority of students consider learning a foreign language in e–learning conditions as a means which has significant potential. But at the same time, they note certain difficulties, which makes it necessary to develop and improve this approach.

Thus, 67.8% (244 people) believe that the difficulties in the educational process cause large portions of educational material presented in the electronic environment: 58.2% (209 people) noted difficulties in navigating in electronic learning courses and resources, 51.1% (184 people) noted insufficient consideration of individual characteristics and personal characteristics, 49.7% (179 people) noted lack of adaptation of educational material and test materials, 37.5% (135 people) noted lack of individualized interface settings, 36.4% (131 people) believed believe that in the implementation of e-learning there is a problem of the holistic organization of the educational process.

The following was found during the survey of I–II years students (162 people): 62.9% (101 people) note low student motivation as a source of e-learning problems; 60.2% (97 people) believe that e–learning causes difficulties in student self–organization; only 35.5% (57 people) believe that e–learning causes difficulties in communication with the discipline teacher; while 31.4% (50 people) note that difficulties may arise in the absence of teacher support in the educational process.

Questionnaires of students in the III–V courses (198 people) demonstrate that the situation is somewhat different: 45.7% (90 people) believe that in e–learning there are difficulties in the self–organization of students; 37.4% (74 people) note low motivation of students as a source of problems in organizing e–learning; at the same time 22.4% (44 people) note that difficulties may arise in the absence of teacher support in the educational process; only 17.4% (34 people) believe that there are difficulties in e–learning communication with the discipline teacher.

The analysis of the respondents' questionnaires allowed us to draw the following conclusions:

▪ a significant number of students note the lack of mechanisms for adapting learning material, difficulties in navigating in e-learning courses, insufficient consideration of individual characteristics (Figure 1);
▪ at the same time, part of the students notes low motivation and difficulties of self–organization when learning in the electronic environment, significantly higher than in senior courses (Figure 2);
▪ students also consider the participation of the teacher in the educational process when organizing it in the electronic environment as important, as they note as difficulties with communication problems with the teachers and the need for support.
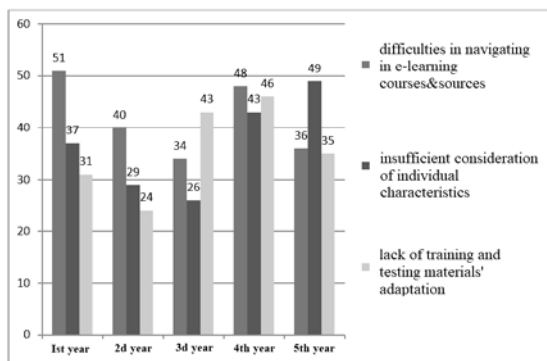
Figure 1 – Characteristics that cause difficulties in e–learning for students of VSPU and DonNU, persons
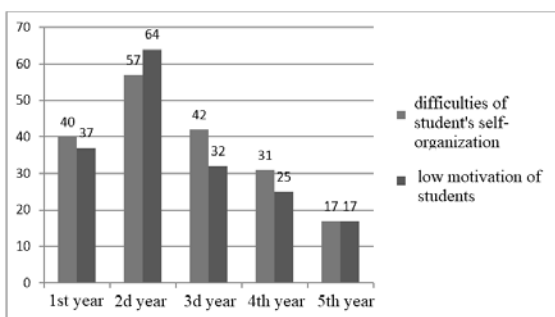*(Author's source)*

Figure 2 – Difficulties of e-learning: self-organization of students and low motivation for courses, persons
(Author's source)

As for the use of electronic educational technologies in the learning process and improving foreign language studying, it was determined that the respondents have a great interest (61.3%) and willingness to learn a foreign language is in conditions of microlearning, noting its possible effectiveness and productivity (58%).

When answering the question, "Do you think that learning a foreign language in a microlearning environment contributes to better learning of information?" 88.1% (317 students) agreed; 7.7% (27 students) could not answer this question; 4.2% (15 students) disagreed with this statement (Figure 3).
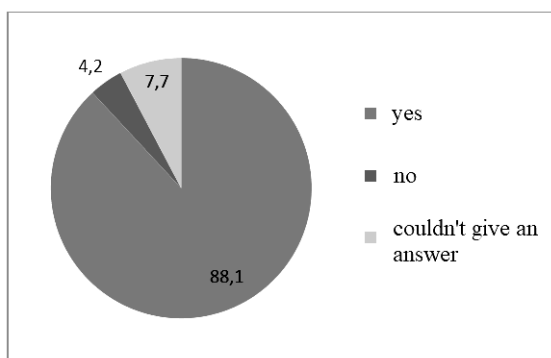

Figure 3 – Evaluation of the microlearning impact on foreign language acquisition by students of VSPU and DonNU, %
(Author's source)

When assessing the impact of microlearning on motivation according to the responses of students: 83,6% (301 respondents) noted the increase of motivation to study a foreign language, 14,5% (52 people) abstained from the answer, and only 1,9% (7 people) offered the technology seemed rather uninteresting, for the total absence of interest in the application of adaptation of educational content in learning a foreign language nobody spoke out (Figure 4).
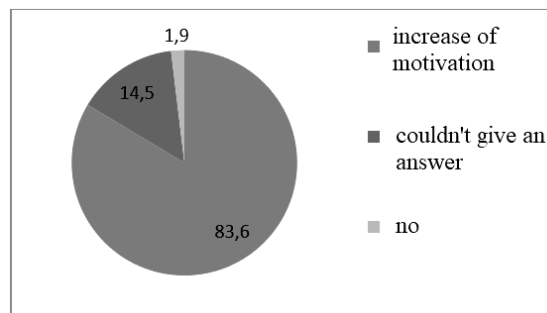

Figure 4 – Evaluation of the microlearning impact on motivation to learn a foreign language by students of VSPU and DonNU, %

When assessing the difficulties arising in the process of microlearning, 23.3% (84 people) noted a high rate of learning, 16.2% (58 people) noted high complexity of the learning material, 7.3% (26 people) noted a lack of sufficient interest in the discipline, 5.6% (20 people) noted technical problems, and 47.6% (172 people) showed no difficulties (Figure 5). It is important that no one noted that the difficulties in learning a foreign language are related to the lack of attention from the teacher, despite the increase in the proportion of independent work and the increasing advisory role of the teacher.
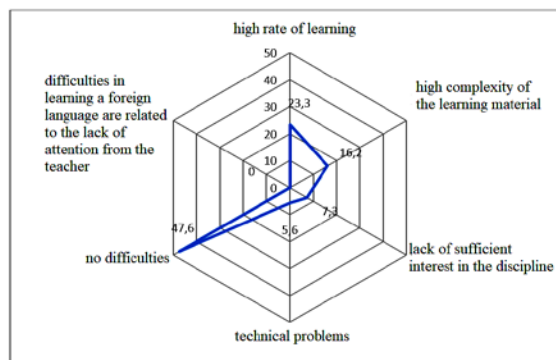

Figure 5 – Difficulties arising in the process of microlearning in the study of a foreign language by students of VSPU and DonNU
(Author's source)

At the same time, among teachers, there was partial organizational work on the systematic implementation of microlearning in the classroom. We found that only 25% of teachers use the technology of microlearning systematically, 3% don't use it at all.

Stage II. Let's proceed to the presentation of the results of the pedagogical experiment, aimed at the pedagogical design of individualization of foreign language studying by the students of VSPU and DonNU in conditions of microlearning to increase the level of their foreign language lexical competence. For experimental verification of the effectiveness of the results of pedagogical research, experimental work was carried out. The total number of 360 students consisted of 109 people: 1 control group (CG) – 50 respondents, studied according to the traditional program and 1 experimental group (EG) – 59 respondents (subgroup 1 – 30 respondents, subgroup 2 – 29 respondents) – with the involvement of an interactive microlearning tool (application "Pictochart"). As part of the pedagogical experiment, such microlearning tools as infographics and posters, independently created using Pictochart software, were used during a semester in the English language classes of VSPU and DonNU masters (discipline "Business foreign language").

The introduction of these tools in the educational process consisted of the preparation of the teacher and the further use of posters and infographics in each lesson studied. Since this course foresees active development of oral speech skills (including

spontaneous monologic speech), infographics and posters were used to introduce the topic and, later on, as a stimulus for speech exercises (such as "brainstorming," "lexical map", "dialogue from the studied topic," "discussion" etc.) as well as for repeating the studied material.

Thus, microlearning technology can be effective at all stages of the formation of foreign language lexical competence in the tasks of the following formats:

- "meme–presentation" (introduction of language material);
- "interactive semantization" (consolidation of language material);
- "micro discussion" (development of lexical skills in oral speech);
- "interactive writing" (development of lexical skills in written speech).

All these tasks were performed in the framework of independent extracurricular work with the interaction of students with each other. Current control should be student-oriented (learner–oriented formative assessment). The feedback is provided by all participants of the educational process. The task process is illustrated below.

Our technology for microlearning vocabulary includes four additional tasks of the formats proposed above for each thematic block of the basic educational and methodological complex (EMC) (A. Doff, C. Thame, G. Puchta, J. Stranks, P. Lewis-Jones. EMPOWER. Advanced Student's Book. Cambridge University Press, 2016) in the discipline of Business Foreign Language (English, C1) for students in the fifth year of study in Linguistics.

Experimental work is carried out in a group chat messenger Telegram, which can be traditionally used for the organization of the educational process and exchange of materials. The experiment consists of 32 tasks (4 tasks for each of 8 thematic blocks, where 1 block takes 1 week, or 6 academic hours). The results of input and interim testing, as well as 16 tasks on the production of oral and written speech, checks as part of the current control (8 grades), are used for analysis.

The process of formation of foreign language lexical competence passes the above 4 stages.

1. "Mem–presentation". At the first stage of speech material input, the teacher distributes a list of vocabulary among the students according to the individual results of the entrance test and invites them to find or create memes with these expressions to present them to their classmates in a chat room.
2. "Interactive Semantization." To reinforce the language material in the second task on the topic, each student should comment on one of their classmates' memes with an example of the use of an expression from a dictionary or linguistic corpus.
3. "Micro–discussion." Each student should record an audio message with a statement on a problematic issue for 1–2 minutes using 1–2 "their" expressions and 1–2 expressions of comrades.
4. "Interactive Writing." Each student should write a written message with statements on the problematic issue for 1–2 minutes using 1–2 "their" expressions and 1–2 expressions of friends.

The format of the notification statements corresponds to the tasks of the basic EMC: for oral speech, it is a debate, a story from life, etc. For writing, it is an essay, an article, a report, etc. Separately, it is necessary to note the fact that more than 98% of the works are handed in by the stipulated deadline.

According to the results of the analysis of quantitative data of the experiment, we can conclude about the increase in the arithmetic mean (M, Mean or Average) of the current control results with a decrease in the standard deviation (SD), which illustrates the feasibility of microlearning technology implementation to form foreign language lexical competence (Table 1).

Table 1 – Results of the current control tasks

The arithmetic mean	1	2	3	4	5	6	7	8
M, %	73	82	81	84	89	91	96	95
SD	14,2	8,3	8,5	5,4	6,2	3,7	3,3	2,9

Author's calculations

In our opinion, it is also important to compare the progress in the experimental (Group 1) and control groups (Group 2) according to the results of the entry (Placement Test) and intermediate (Final Test) tests. Moreover, the control group did not have additional vocabulary individualization tasks. In Group 2, lexical skills were developed on the EMC basis, which was placed on the MOODLE platform. As a result, a higher value of the arithmetic means result (M) for the experimental group (#1) with a lower standard deviation (SD) indicates the effectiveness of the described method for individualization of the learning process (Table 2).

Table 2 – Results of entry and intermediate testing in the experimental and control groups

Groups	1	2	3	4
Group 1 experimental – microlearning, involving an interactive tool (individualization of learning)	62	12,3	96	2,7
Group 2 control, traditional program (does not support flexible active adaptation of educational content to students' characteristics)	61	14,4	78	8,7

Verification of the developed tasks was carried out in three stages. The first stage was the diagnostic cut-off stage. At the second stage, our experiential learning was organized. The third stage is the final stage, where the final and delayed cut–offs were carried out.

Thus, the level of students' acquisition of foreign language lexical competence was determined based on the success coefficient (C_s). The success rate was determined by the formula: $C_s = a \div n$, where a – the number of correct answers, and n – the total number of expected answers.

The results obtained at the diagnostic, final, and delayed cut–off stages were summarized and summarized in Tables 3–8.

Table 3 – C_s of the operations performed while reading special texts (diagnostic segment)

Subgroup number	Number of students	C_s definition on the topic of a previously read text	Cs of selecting lexical units within the text	Cs of recognizing the meanings of lexical units
1	30	0,42	0,38	0,38
2	29	0,44	0,40	0,42

Author's calculations

Table 4 – C_s of performing oral and written tasks (diagnostic cross–section)

Subgroup number	Number of students	C_s of answers richness using English–language vocabulary	C_s of the logical structure of the answers	C_s of the adequate choice of lexical units
1	30	0,30	0,38	0,28
2	29	0,32	0,42	0,32

Author's calculations

Table 5 – C_s of operations performed when reading special texts (final cut)

Subgroup number	Number of students	C_s definition on the topic of a previously read text	C_s of selecting lexical units within the text	C_s of recognizing the meanings of lexical units
1	30	0,90	0,92	0,94
2	29	0,88	0,90	0,92

Author's calculations

Table 6 – C_s of performing oral and written tasks (final cut)

Subgroup number	Number of students	C_s of answers' richness using English–language vocabulary	C_s of the logical structure of the answers	C_s of the adequate choice of lexical units
1	30	0,88	0,84	0,82
2	29	0,88	0,82	0,82

Author's calculations

Table 7 – C_s of operations performed when reading special texts (delayed cross–section)

Subgroup number	Number of students	C_s definition on the topic of a previously read text	C_s of selecting lexical units within the text	C_s of recognizing the meanings of lexical units
1	30	0,82	0,88	0,88
2	29	0,80	0,84	0,84

Author's calculations

Table 8 – C_s of performing oral and written tasks (delayed cross–section)

Subgroup number	Number of students	C_s of answers' richness using English–language vocabulary	C_s of the logical structure of the answers	C_s of the adequate choice of lexical units
1	30	0,84	0,80	0,80
2	29	0,82	0,78	0,80

Author's calculations

The results of the delayed cut–off show that the achievement coefficients in the experimental groups remain almost stable, despite small deviations, which are the norm in terms of memory work features. The achievement coefficients in the two groups of experimental training remained above the score of 0.8, indicating the formation of foreign language lexical competence in the students. The quality of the lexical skill functioning of operating with English–language vocabulary is at a sufficiently high level.

To assess foreign language lexical competence at any stage of microlearning, it is possible to conclude the level of its formation among students: liminal (reproduction); basic (interdisciplinary integration); advanced (professional integration).

Let us note that the formation of foreign language lexical competence often takes place in several disciplines. Therefore, at the initial stage of curriculum development, it is necessary to determine the list of disciplines forming the foreign language lexical competence and to place a coefficient for each discipline reflecting the contribution of the given discipline to the competence formation. We found that foreign language lexical competence (FLLC) is formed in 5 (L) disciplines distributed in the curriculum, then its assessment was determined by the formula (Davenport, Barry, Kelliher, Nemirovsky, 2004):

$$COMP^{EMC} = \sum_{k=1}^{L} q_k^{EMC} * COMP_k \quad (1)$$

where q_k^{EMC} – is the coefficient of the k–th discipline's contribution to the foreign language lexical competence formation.

Thus, the dynamics of the foreign language lexical competence formation level in the control and experimental group at the beginning and at the end of the experiment is shown in Figure 6.
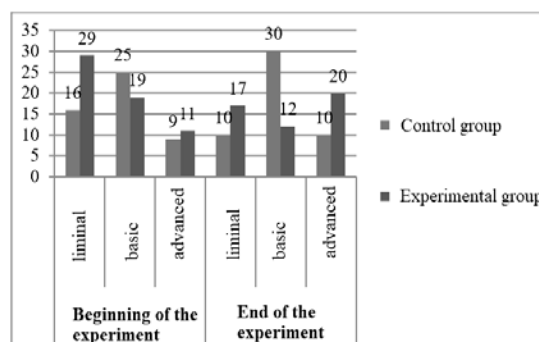

Figure 6 – Dynamics of the formation of foreign language lexical competence among the students of VSPU and DonNU, persons

Author's design

As can be seen from Figure 6, there is a positive increase both in the EG and in the CG. In the experimental group, we note a more intensive increase in the "productive" level of competence and a more intensive decrease in the "non–productive" level. At the same time, we refer to the basic and advanced levels to the productive level and the threshold level – to the non–productive one. This result indicates the effectiveness of the foreign language studying process of pedagogical design of individualized learning in the context of microlearning.

Consequently, the positive results of the conducted cross–sections (final and delayed) in the groups of experimental learning and the calculations made in the experimental and control groups testify to the validity of the previously put forward working hypothesis of the research. The students' acquisition of foreign language lexical competence by HEIs is more effective in the case of microlearning technology implementation, which allows them to operate successfully with English–speaking vocabulary based on a specially developed set of tasks.

Stage III. It is connected with determining the effectiveness of the improvement of foreign language studying of HEIs students based on the application of educational technology – microlearning. The analysis of the results obtained in the course of the study was carried out through mathematical and statistical data processing, as a result of which, was found positive dynamics in all the indicators of effectiveness assessment.
We assessed the authenticity of the results of experimental work with the help of methods of statistical analysis of data. As an example, let's check the authenticity of the results of the entrance and final control of the students of the experimental and control groups.

Statistical processing of the results of the pedagogical experiment was carried out by us in the R programming language environment. To verify the application of parametric one–factor analysis of variance, we tested the data for normality and homogeneity.

We checked whether the obtained samples (results of the experimental and control groups) belonged to the normal distribution based on visual analysis and formal tests. We made a visual assessment by examining the empirical distribution of the experimental group before the experiment.

To formally verify the subordination of data to the normal law of distribution, we conducted statistical tests: Anderson–Darling, Cramer–fon Mises, Kolmogorov–Smirnov, and Shapiro–Francia. We used these tests to test the hypothesis H_0: "The data is subject to a normal distribution" vs. the alternative H_1: "H_0 is

incorrect". The results of the data normality tests in the experimental group at the beginning of the experiment are presented in Table 9.

Table 9 – Test of data normality in the EG before the beginning of the experiment

Test	Test statistics	p–value	Significance level a	Conclusion
Anderson–Darling's test	A = 0.66085	0.08259	0.05	we accept the hypothesis H0 that the distribution is normal
Kramer–von Mises test	W = 0.09589	0.1266	0.05	we accept the hypothesis H0 that the distribution is normal
Kolmogorov–mirnov's test	D = 0.06812	0.162	0.05	we accept the hypothesis H_0 that the distribution is normal
Shapiro–Francia's test	W = 0.98075	0.0656	0.05	we accept the hypothesis H0 that the distribution is normal

Author's calculations

Analyzing the results of the tests, we can note that the obtained p–value for each test is greater than the fixed level of significance, therefore at the significance level of 0.05, there is no reason to reject the hypothesis H_0 about the normality of the data distribution in the experimental group before the experiment.

We did the same work for the control group data at the beginning of the experiment (Table 10).

Table 10 – Test of data normality in the CG before the beginning of the experiment

Test	Test statistics	p–value	Significance level a	Conclusion
Anderson–Darling's test	A = 0.69777	0.06686	0.05	we accept the hypothesis H0 that the distribution is normal
Kramer–von Mises test	W = 0.10571	0.09267	0.05	we accept the hypothesis H0 that the distribution is normal
Kolmogorov–Smirnov test	D = 0.075773	0.07499	0.05	we accept the hypothesis H0 that the distribution is normal
Shapiro–Francia test	W = 0.9823	0.09236	0.05	we accept the hypothesis H0 that the distribution is normal

Author's calculations

The visual analysis and the results of formal tests of the control group data by the beginning of the experiment also confirm the correspondence of the data in the control group (by the beginning of the experiment) to the normal distribution.

We then tested the condition of applying classical analysis of variance on the homogeneity of the sample data. To test homogeneity, we used statistical tests, the results of which are presented in Table 11. These tests verify the hypothesis H_0:

$\sigma_1^2 = \sigma_2^2$, i.e., samples are homogeneous, under the alternative hypothesis H_1: $\sigma_1^2 \neq \sigma_2^2$.

Table 11 – Verification of the data homogeneity at the beginning of the experiment

Test	Test statistics	p–value	Significance level a	Conclusion
Bartlett's test	0.1224	0.7264	0.05	we accept the hypothesis H0
Leven's test	0.0874	0.7677	0.05	we accept the hypothesis H0
Fligner–Killin test	0.1635	0.686	0.05	we accept the hypothesis H0
Fisher's test	0.93909	0.7266	0.05	we accept the hypothesis H0

Author's calculations

In all tests p–value significantly exceeds the fixed level of significance, so we can conclude that the data of CG and EG before the experiment are distributed homogeneously.

Since by the results of classical analysis of variance we obtained the fulfillment of normality and homogeneity conditions, therefore, we can use parametric analysis of variance criteria, such as Student's t–criterion (The probable), to compare independent samples of experimental and control groups before the experiment to assess the effectiveness of pedagogical research. The null hypothesis H_0, which was tested using Student's t–test, involved the fact that there were no statistically significant differences in the mean values of the results of the students of the experimental and control groups. According to the alternative H_1, "there are statistically significant differences in the mean values of the results of the students of the control and the experimental group". The results of the Student's t–test are shown in Table 12.

Table 12 – Results of the Student's t-test application

Student's t-test	The beginning of the experiment	The end of the experiment
Student's t–criterion statistics	t = 0.82634	t = –5.7036
p–value	0.5214	3.315e–08
Significance level a	0.05	
Conclusion	H_0 accepted	H_0 accepted
Interpretation	There are no statistically significant differences between groups (p–value > a)	The compared groups are both statistically and significantly different (p–value < a)

Author's calculations

The analysis showed the absence of statistically significant differences before the experiment between CG and EG students. Since the t–test statistic is less than the critical value and is in the zone of insignificance, we accept the null hypothesis and reject the alternative hypothesis of the existence of the statistically significant differences between CG and EG before the experiment.

Checking hypotheses H_0 and H_1 for EG and CG at the end of the pedagogical experiment, we found that the t–test statistic exceeds the critical value and is in the zone of significance, which allows us to reject the null hypothesis and accept the alternative hypothesis of the existence of statistically significant differences between the CG and EG at the end of the experiment.

Thus, testing the results of the study showed the presence of reliable differences in the educational results of CG and EG, which allows us to state the effectiveness of the introduction of microlearning technology. The conducted pedagogical experiment confirmed that the pedagogical design of

individualized learning allows the teacher to organize individualization of foreign language studying of HEIs students in the conditions of microlearning to increase the level of mastering foreign language lexical competence and to build an individual educational trajectory for each competitor.

In general, following the results of the technology implementation in the educational process, the number of the students in the experimental group (N = 59) with the threshold level of formation of foreign language lexical competence has decreased from 49.2% (29 people) to 28.8% (17 people); the number of the students in the experimental group with the advanced level of formation of foreign language lexical competence has increased from 18.6% (11 people) to 33.9% (20 people). Thus, the microlearning technology proposed in the process of experimental work contributes to the increase in the level of foreign language lexical competence of HEIs students, i.e., the quality of subject knowledge improves.

According to the results of the processing of the level 4 survey, the satisfaction with the psychological side of microlearning has a high rate of 82%, and the content side is 73%, which is an average indicator. The lowest satisfaction of students is the organizational side of microlearning – 61% (Figure 7), it was explained by students themselves in answers to open–ended questions of the questionnaire, where the conditions (Figure 1–2, 5), which hurt learning.
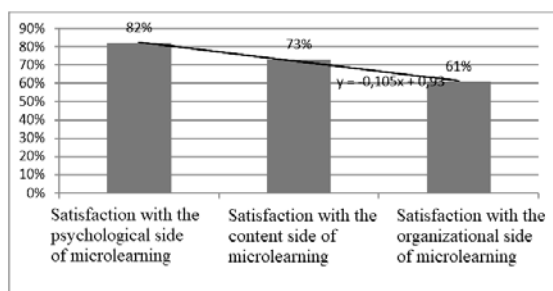

Figure 7 **–** The results of student satisfaction with microlearning

In general, the satisfaction with microlearning is demonstrated by the linear equation $=-0.105x+0.93$ and the group index, which is 68.75% and represents the average level. This index, on the one hand, is a positive result and indicates the effectiveness of microlearning technology to improve foreign language studying, and on the other hand, points to the need for management actions aimed at improving the level of organization and conduct of the educational process.

5 Discussion

Foreign scientists note that the introduction of microlearning firstly increases the level of interaction with the educational process, as it focuses solely on conveying relevant information through short visual and interactive elements. As a consequence, the likelihood of falling behind is reduced, and the student is less likely to drop out or disconnect during learning. Secondly, it improves memorization because microlearning activities are brief, concise, and coordinated with short–term memory, which is estimated to be able to manage no more than 4 items at a time. Microlearning technology works well with learning methods following a forgetting curve based on three basic principles:

1. interval repetition with adequate frequency to facilitate the cognitive process;
2. variety of formats and contexts for the same concept or element;
3. alternating between different concepts or elements to be learned to facilitate the transfer and acquisition of new knowledge.

Finally, it improves the process environment as content is adapted to students' schedules, educational backgrounds, and prior knowledge. The learning environment becomes more flexible and efficient (Alqurashi, 2017; Cole, 2017; Freeman, 2016; Renard, 2017).

However, this learning paradigm cannot be seen as a solution to all foreign language studying problems. Despite its obvious advantages, this paradigm also has an important disadvantage. Microlearning does not work as well when teaching complex abstract concepts that require a combination of interdisciplinary knowledge. In these cases, students need to spend a significant amount of time to ensure that they understand new concepts, make sure they are properly related to previously acquired ones, and apply them in practice to reinforce cognitive processes and guarantee their permanence. In other words, microlearning is an option for simple mechanistic learning that can be combined with more complex learning or directed toward basic skills.

We found that microlearning is an educational technology, which involves the acquisition of knowledge in the form of small independent blocks. Each of them presents the currently necessary information in the most structured, concise, and accessible form. Also, during our research, we found that university lectures are in a favorable position to adopt the new approach for the following reasons: increasing student motivation and engagement; increasing the level of content.

Quantitative and qualitative data of the conducted experimental work on approbation of the pedagogical design of individualized learning in the conditions of microlearning in a foreign language confirm its effectiveness, which indicates the achievement of the research goal, fulfillment of the set tasks, and confirmation of the research hypothesis. Undoubtedly, for the active implementation of microlearning technology in the educational process, it is necessary to conduct a large number of pedagogical experiments and further analysis of the obtained data and learning outcomes. However, it cannot be denied that in the modern educational environment, we are faced with high information density, high speed of information transfer and receipt, and individualization of information receipt and processing, in addition, modern students are carriers of a new type of thinking. Therefore, it is necessary to look for new ways and ways of students' adapting to these features of their successful socialization and professional activity. Therefore, a separate issue for further study may be to determine the place of microlearning as a technology in the network form of education.

6 Conclusions

Thus, the scientific novelty of the research is as follows: microlearning tools (infographics and posters) have been introduced into the educational process to increase the level of formation of foreign language lexical competence among the students of VSPU and DonNU.

Our research has shown that the theoretical significance of this study is that, in fact, it highlights the most important aspects of forming foreign language lexical competence. It also offers an individual e–learning trajectory – microlearning in foreign language studying as a technology for solving the highlighted difficulties. Practical use of the research consists in the fact that the theoretical provisions, results, and conclusions contained in it create real prerequisites for improving foreign language studying by students of domestic institutions of higher education. The hypothesis of the effectiveness of the pedagogical design of individualized subject microlearning in foreign language studying of HEIs students in the context of increasing the level of foreign language lexical competence is experimentally confirmed. The obtained results and scientific methodological experience can be replicated in the system of higher education. The main directions for further research should be considered, on the one hand, the development of entrance testing taking into account the foreign language; on the other hand, the study and optimization of the proposed technology for other learning contexts, namely, for a cycle of disciplines in the higher education system (for example, language for special purposes), for additional education (for example, for individual lessons), etc.

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