UDC 005.963:004.77

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IMPLEMENTATION OF MICROLEARNING TECHNOLOGY FOR ECONOMICS STUDENTS THROUGH ONLINE COURSES

Abstract. After the outbreak of the pandemic in 2019 and the outbreak of war in the country in 2022, educational institutions at different levels of Ukraine switched to a mixed format of the educational process and were forced to look for modern approaches and technologies for organizing the education of students. This study examines the implementation of microlearning technology using online courses developed on the Moodle platform. Microlearning is a modern learning technology that involves short, intensive training modules focused on the development of specific theoretical knowledge and practical skills. Available online courses, which provide the ability to create and deliver different types of educational content, focus mainly on the formation of necessary knowledge and skills of students, but do not take into account their individual needs and interests in the learning process, and pay little attention to their satisfaction with education in modern conditions. This article investigates the impact of microlearning technology using online courses on students' satisfaction with learning. To determine the level of student satisfaction, an online survey was conducted among 61 students enrolled in the specialty 051 "Economics" programs, which include Business Economics, International Economics, Economic Cybernetics, and Digital Economy, at the National

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University of Life and Environmental Sciences of Ukraine. All these students were studying using microlearning technology with the use of online courses. As a result, that the level of student satisfaction with learning using this technology is most influenced by such factors as the availability of learning resources, consideration of individual abilities and needs in the online course, opportunities for interaction and communication with the teacher, as well as the format of learning materials and acquired knowledge. Accordingly, these factors should be taken into account when developing online courses and implementing microlearning technologies in the educational process.

Keywords: microlearning; online course; procedure for creating a micro-course; satisfaction.

1. INTRODUCTION

Problem statement. The integration of education and science at the institutional, regional, and global levels is a generator of scientific knowledge and a basis for innovation development [1]. In today's educational space, the growing popularity of various online courses and the use of microlearning technology creates unique opportunities to improve the quality of the educational process, ensure accessibility of education, and increase the motivation and satisfaction of students of various institutions. However, the implementation of microlearning technology using online courses faces a number of challenges and problems. One of the main problems is the need to develop a procedure for creating micro-courses that would ensure the optimal use of short but intensive online course modules. Microlearning provides a new teaching paradigm that allows knowledge and information to be divided into small chunks and delivered to learners. Microlearning can make the learning subjects easy to understand and memorable for a longer period [2].

Analysis of the latest research and publications. For e-learning, it is important to present educational material using different types of resources and integrate them with each other [3], [4], [5], trying to make them interactive in order to improve students' learning, increase their satisfaction, engage them in active learning and interaction.

The concept of microlearning is based on Hermann Ebbinghaus' forgetting curve, which states that when people take in large amounts of information, retention of the learned information tends to degrade over time [6]. Microlearning is faster and more effective than traditional learning, which tends to distract pupils and cause them to forget crucial knowledge [7]. Essentially, microlearning encompasses learning activities that are performed on a small scale or within a limited time frame and implies delivering concise, bite-sized pieces of information to learners [8], [9], [10], [11].

There are many modes and delivery formats of microlearning content, such as: (1) image-based microlearning content, including infographics, process-diagrams, memes, and animated GIFs; (2) audio-based microlearning content, including short narratives and podcasts; and (3) video-based microlearning content, including video flashcards, screencasts, microlearning vlogs, demonstration videos, and time-lapse videos. Therefore, in microlearning, the learning content is designed and delivered in short, manageable chunks for the learners, allowing them to access it whenever, wherever, and in whatever media format they like to learn [12]. While microlearning offers various benefits, it can also lead to superficial learning of educational material, a concern highlighted by M. Litvinova in the context of modern students' clip thinking [13]. In our study, we address this issue by specifically examining one of the content delivery formats in microlearning: the use of video to present educational material.

Microlearning is flexible to accommodate different learning styles and can be customized to students' needs. With short material, students can choose which material is needed, desired, and relevant. Microlearning helps increase students' retention rates and comprehension levels. If the material is broken down into smaller parts, it is easier for students to remember lessons, and easier for teachers to update content and to know learning outcomes [14]. With

microlearning, students are given the opportunity to absorb more easily, and store information obtained from the learning process.

In addition, microlearning makes learning activities easier to manage, and lesson topics are more easily comprehensible [15]. Presenting lengthy content or subject topics to students all at once minimizes interaction between the learners and the information, exceeding their working memory capacity which ultimately leads to instability in the learning process [16]. The concept of microlearning is not a new thing but has often been used in the learning process such as in the development of blended learning. In blended learning, learning is carried out from a combination of instructions in face-to-face classes and then followed by microlearning as a reinforcement of learning [14].

The use of microlearning technology in the distance and blended learning format of the educational process can be effectively implemented on the basis of Moodle and can also increase the level of student satisfaction. Therefore, the **purpose of the study** is to theoretically substantiate the model of creating a micro-course based on the Moodle platform for the implementation of microlearning technology and to identify advantages/disadvantages compared to other e-learning technologies in the context of student satisfaction.

2. RESEARCH METHODOLOGY

To achieve this goal, we analyzed theoretical sources and studied successful practices of using microlearning technology in distance and blended learning formats. The pedagogical experiment was conducted as a part of the research carried out under the DAAD Project "Support of the digitalization of Ukrainian agricultural universities, Line 2" (Project-ID: 57649162) in cooperation with the National University of Life and Environmental Sciences of Ukraine (Ukraine) and the University of Applied Sciences Weihenstephan-Trisdorf (Germany). The pedagogical experiment on the implementation of microlearning technology using online courses lasted from 2022 to 2023 at the National University of Life and Environmental Sciences of Ukraine (NULES). The experiment involved first-year students of the field of knowledge 05 Social and Behavioral Sciences, specialty 051 Economics, study programmers Business Economics, International Economics, Economic Cybernetics, and Digital Economics (61 students in total). The study was conducted as part of the disciplines Information Systems and Technologies in Economics, Digital Economy, and in the course of studying the topic Types and Sources of Economic Data.

A survey method was used to determine the impact of using microlearning technology in online courses on student satisfaction (in October-November 2023). The study hypothesized that the use of microlearning technology in online courses contributes to an increase in student satisfaction. To assess the level of satisfaction, six factors were identified that can influence student satisfaction. The impact of each factor was assessed using a Likert scale from 0 to 4 [17].

The research results presented in the article are presented in the aggregate of the joint contribution of individual authors: the idea and preparation of the draft article (O. Hlazunova and R. Schlauderer); analysis of publications to substantiate the relevance of the research problem, international experience in the use of microlearning technology in distance and blended formats (T. Voloshyna), development and substantiation of a model for implementing microlearning based on the Moodle platform (V. Korolchuk), development of a questionnaire to determine the level of satisfaction of students and organization of the experiment (O. Hlazunova, T. Voloshyna, T. Sayapina), development of a scheme with learning objects, their correlation with video content and tasks, an example of implementation (I. Kostenko, T. Sayapina, R. Zolotukha), statistical analysis of empirical data (V. Korolchuk).

3. RESEARCH RESULTS

Micro-courses are characterized by their short duration, the use of multiple teaching methods, and ease of dissemination. They are a beneficial supplement to and improvement upon traditional teaching methods. Compared with the traditional textbook learning approach, the micro-course can shorten cognitive time, improve cognitive accuracy, and increase cognitive efficiency in the acquisition, search, and analysis stages [18].

The result of studying each topic in a course or micro-course is the formation of a number of learning outcomes that further determine the professional competence of the student. Accordingly, for each topic or micro-course, it is necessary to identify the learning elements that will allow the formation of such competences. The combination of all learning elements takes place in a single micro-course, the procedure for creating which is shown in Fig. 1. Before you start creating a micro-course, you need to define the topic on which the content will be created. A micro-course is created in two stages: preparatory and design. At the preparatory stage, the teacher needs to define the learning objectives within the discipline, plan the structure of such a course, and prepare its scenario, according to which the teacher will select the necessary learning materials and practical tasks, choose the type of content, as well as the service for its creation and the platform for creating a micro-course.

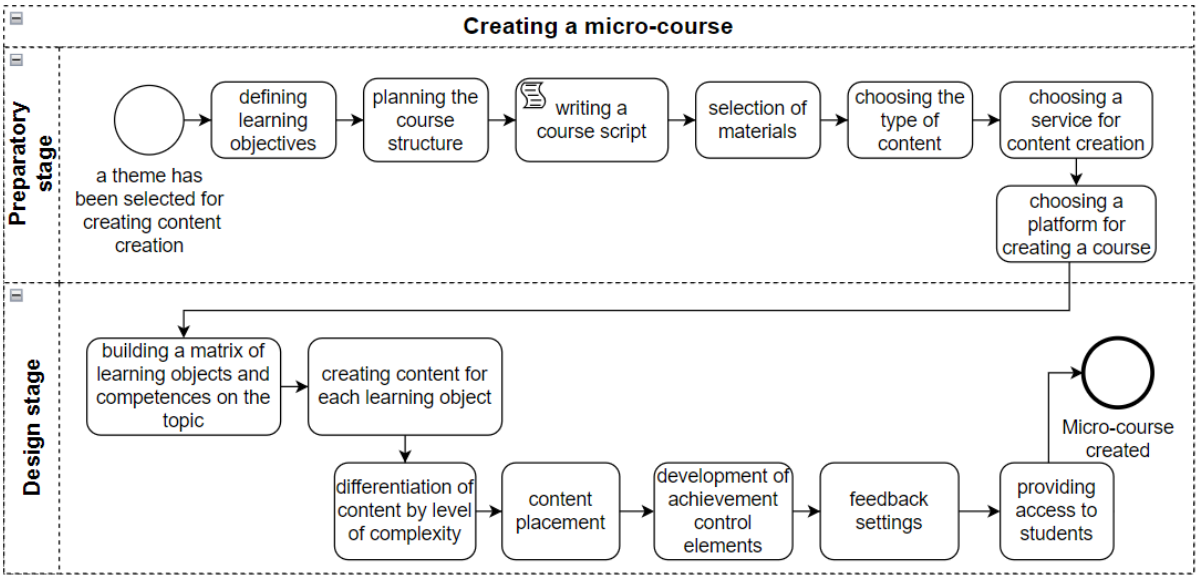

Figure 1. The procedure for creating a micro-course

The design stage involves the construction of a matrix of learning objects and competences on a particular topic (Fig. 3). The matrix includes learning objects, which are the topics of this micro-course, video resources that present learning materials within the defined topics, as well as assessment elements that allow for monitoring student learning. The set of learning objects allows students to prepare for the final test and develop certain competences. Based on the built matrix, the teacher creates content for each learning object and differentiates it by the level of difficulty. This content is then posted on a pre-selected platform. To assess the level of student learning, the teacher needs to develop learning control elements and set up feedback. Upon completion of all the steps of the preparatory and design stages, the teacher needs to provide access to the created micro-course to students.

To present the materials of one learning object, short videos of varying lengths of 1-3 minutes were developed, which provided comprehensive answers to specific questions related to the learning object. Micro-tasks were developed for each learning object to help learn practical skills. All learning objects are interconnected and presented in a logical sequence.

Some of the practical tasks are integrative in nature, linking the experience of studying the learning objects to each other. An important detail is that the duration of a micro-course should correspond to a completed module or topic in a particular subject area. This can be, for example, a part of an academic discipline. Such a micro-course should be aimed at quick perception of the learning material and achieving quick results in learning. Micro-courses can also be effectively used to form an individual learning trajectory for a student. In addition, small micro-courses can be used to create a personalized learning environment more quickly and efficiently, according to the needs and motivation of the students. Having a resource base for micro-courses makes it easier to focus on the competences that students need to develop as part of their studies.

As part of this study, a micro-course was developed "Types and Sources of Economic Data" as a part of the disciplines "Information Systems and Technologies in Economics" and "Digital Economy". Examples of screenshot are shown in Fig. 2.

Micro-course based on the Moodle platform was developed to study the module "Types and Sources of Economic Data", in which students had to work through materials on the proposed topics, namely

- statistical reporting of the enterprise (T1);
- open statistical data on the agro-industrial complex (T2);
- information from research institutions when collecting data for the MA (T3);
- information from agricultural producers in terms of collecting data for MA (T4);
- software for management accounting (T5);
- normative indicators in technological maps based on the agro-industrial complex (T6).

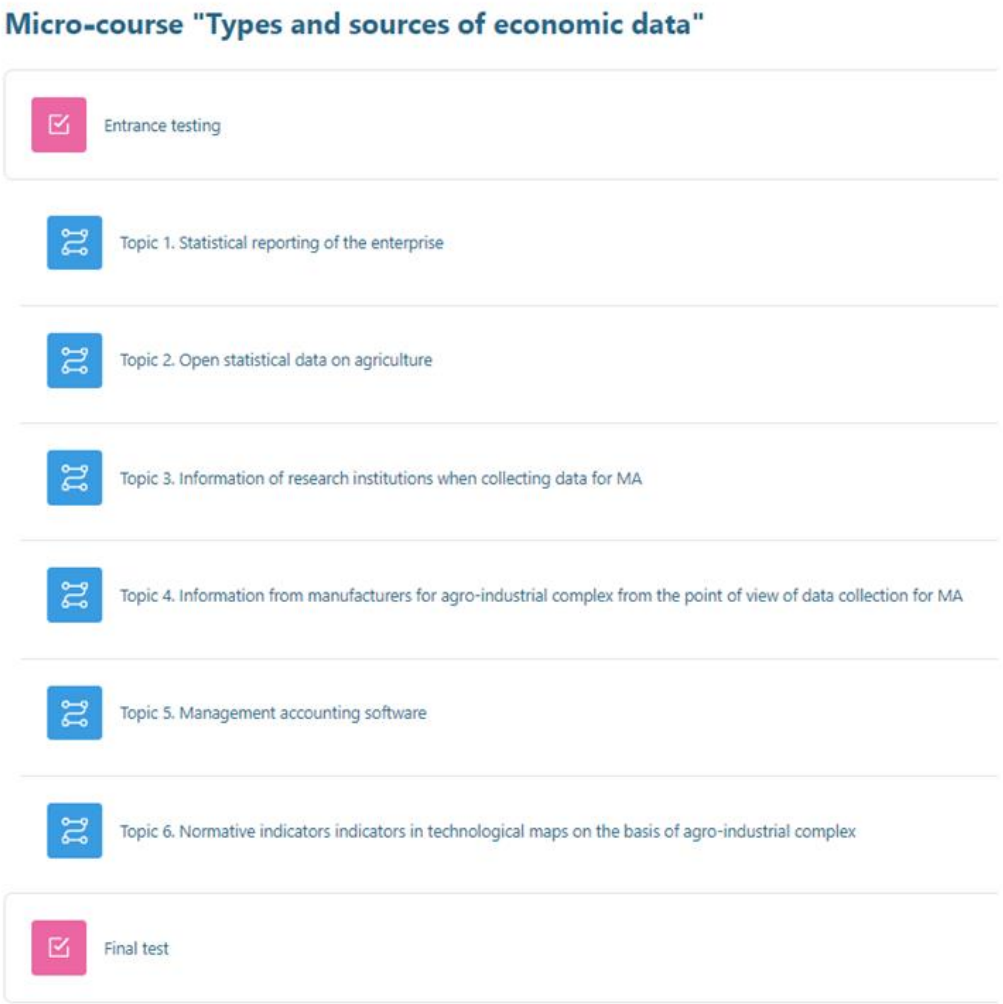

Figure 2. Structure of a micro-course Types and sources of economic data

This course included a set of learning objects (micro-course topics (T1-T6) and videos for each of them (V1-V9), which were combined into a single structure to form the necessary competencies of this module. An example of a scheme with learning objects, their correlation with video content and elements of learning achievement control (E1-E6 - elements of intermediate control, FT - final test) of students is shown in Fig. 3.

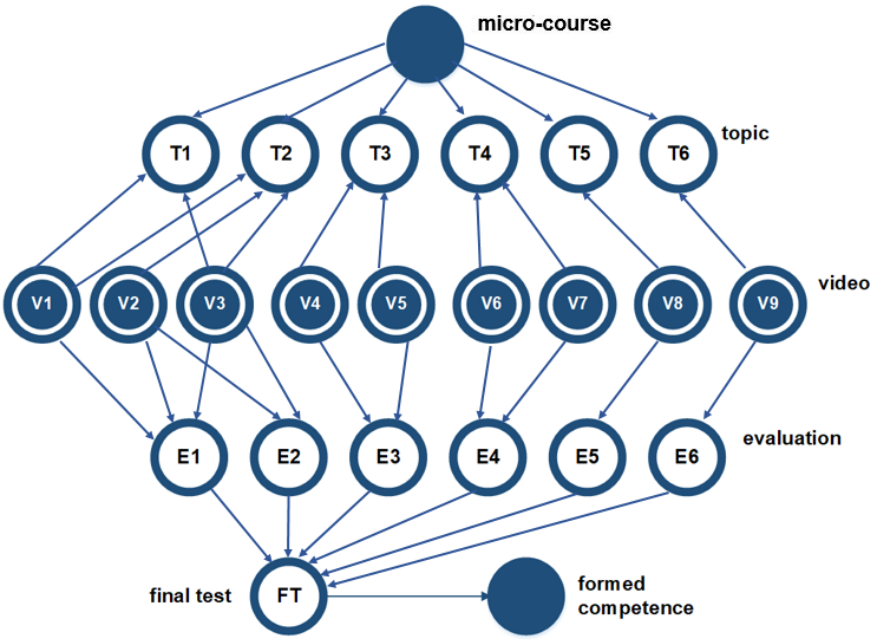

Figure 3. An example of a scheme of micro-course learning objects

The students' work with the online course based on microlearning technology began with an entrance test to assess their level of knowledge. Based on the results of the answers provided, students receive recommendations for further study of the educational content on specific topics (Fig. 4).

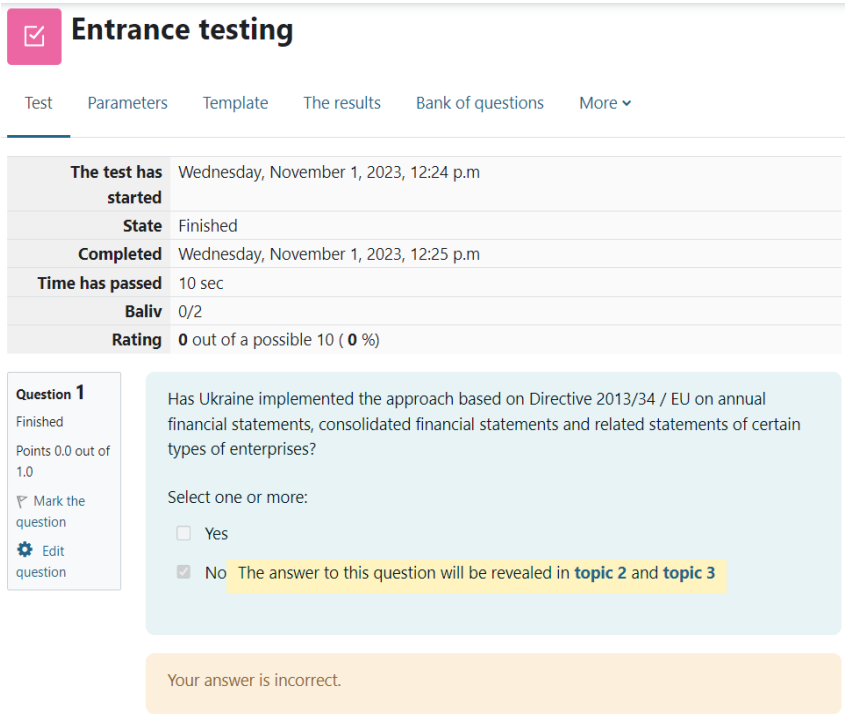

Figure 4. An example of input testing

Individual topics of the micro-course were presented in the form of a Lesson resource, for each of which several short videos were developed. The content was integrated into these resources, which allowed students to get answers to key questions in the Lesson and consolidate their knowledge on the topic. After watching these videos, students were given the opportunity to return to the topic or move on to the midterm. An example of one of the micro-course lessons is shown in Fig. 5, which includes 2 training videos (V6, V7) and one assessment element (E4).

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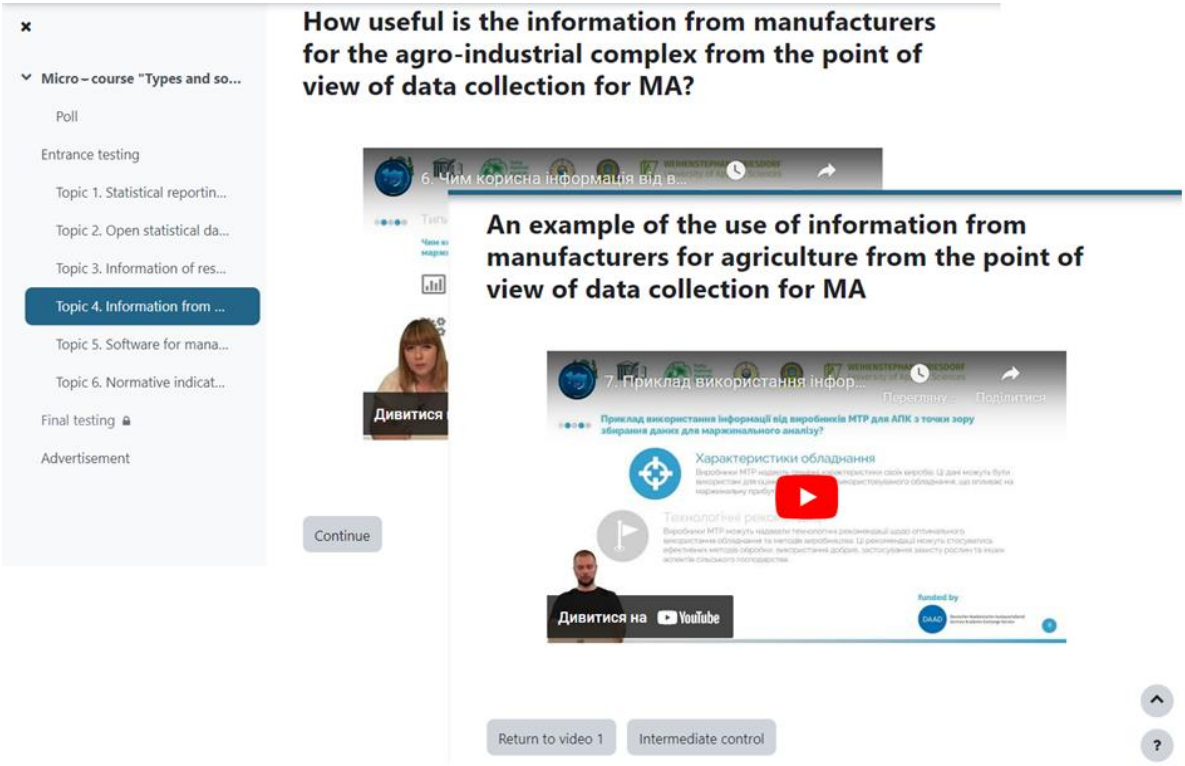

Figure 5. An example of embedding video content in a online course lesson

Intermediate assessments in the lessons of the online course were implemented in the form of built-in tests of various types, based on the results of which students were given recommendations for further processing of the educational content and accordingly built an individual learning trajectory (Fig. 6).

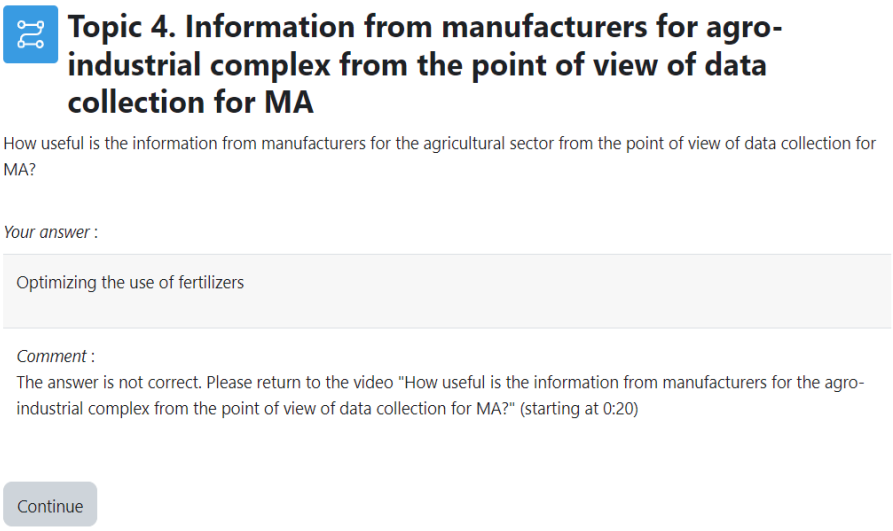

Figure 6. An example of a mid-term assessment in an online course lesson

To determine the level of student satisfaction, students of the field of study 05 Social and Behavioral Sciences, specialty 051 Economics, NULES of Ukraine were asked to complete a survey (61 respondents).

Based on scientific works [19], [20], [21] and own experience, a questionnaire was developed from the point of view of satisfaction on a 5-point scale (0 - inconvenient to use; 1 - more inconvenient than convenient; 2 - more convenient than inconvenient; 3 - convenient to use).

This questionnaire asked students to assess their satisfaction with the microlearning technology in an online course (S), as well as the factors that can effectively influence satisfaction with learning using this technology:

- F1: consideration of individual abilities and needs in the online course
- F2: the volume and duration of the online course
- F3: organization of interaction and communication between students within the online course
- F4: format of learning materials
- F5: availability of learning resources
- F6: the possibility of interaction and communication with the teacher

The average results of the experts' assessment of satisfaction with the microlearning technology based on an online course are presented in Fig. 7.

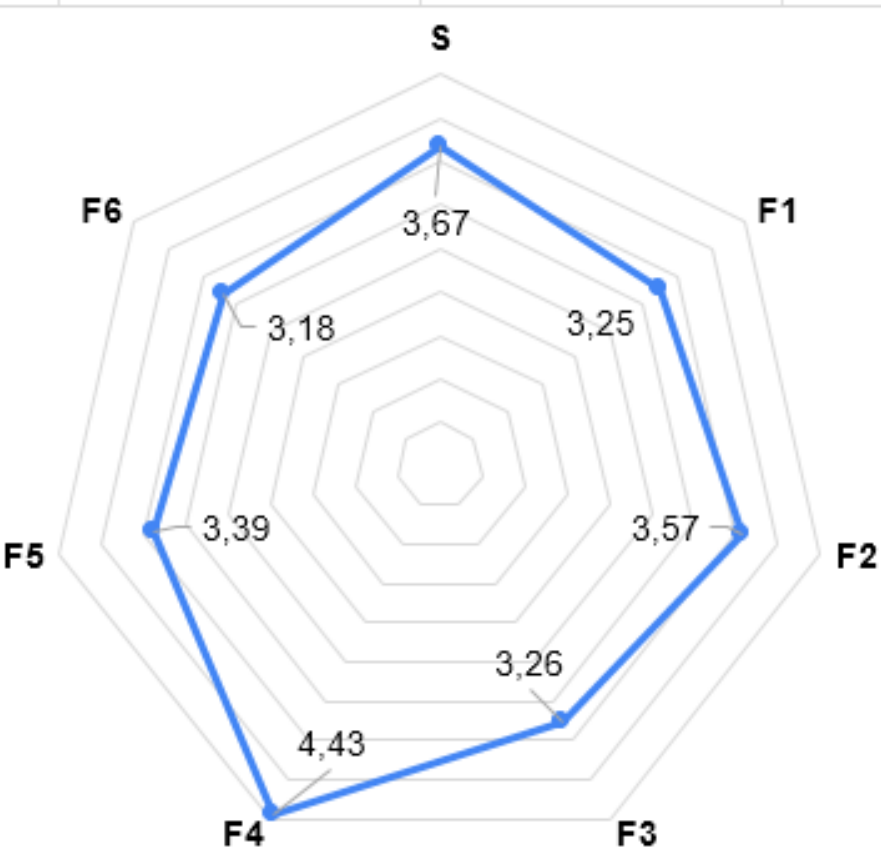

Figure 7. Evaluation of micro-course satisfaction by experts

To assess the reliability of the results obtained (Fig. 8) and measure the internal consistency of the test, an analysis of variance (ANOVA) was conducted and the Tau-equivalent reliability (Cronbach's alpha) was calculated.

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	131,0984	60	2,184973	5,398272	2,97E-23	1,363445
Columns	66,9071	5	13,38142	33,06062	7,71E-27	2,244087
Error	121,4262	300	0,404754			
Total	319,4317	365				

Cronbah`s Alpha **0,815**

Figure 8. Assessment of the reliability of the results obtained

The obtained overall Cronbach's α value for the questionnaire was 0.815, which indicates a high degree of reliability of the results.

Additionally, the data were tested for suitability according to Bartlett's sphericity and Kaiser-Meyer-Olkin (KMO) sampling adequacy criteria. Two hypotheses were put forward for this test:

- no correlation between the factors of microlearning technology evaluation and student satisfaction;
- partial correlation coefficients between the factors and the level of satisfaction are equal to zero.

To test the first hypothesis, the Bartlett's sphericity test was conducted, and the second hypothesis was tested using the Kaiser-Meyer-Olkin (KMO) criterion of sample adequacy (Fig. 9).

Value		**0,748**
Bartlett spherical test	*Approximate chi-square*	155,89
	df	21
	p	0

Figure 9. Test results of validity

Since the probability of the Bartlett's sphericity test value is below the threshold (0.05), the null hypothesis was rejected, which indicates the expediency of factor analysis. In our case, the null hypothesis is rejected because the significance is 0.000.

If the value of the KMO statistic does not exceed 0.5, the use of factor analysis is inappropriate. As can be seen from the results presented in Fig. 9, the questionnaire developed in the study to assess the level of satisfaction with microlearning technology has a high level of validity (KMO value was 0.748), which confirms the feasibility of performing factor analysis (Fig. 10).

	S	***F1***	***F2***	***F3***	***F4***	***F5***	***F6***
S	1,000						
F1	0,455	1,000					
F2	0,236	0,442	1,000				
F3	0,251	0,371	0,255	1,000			
F4	0,335	0,493	0,337	0,247	1,000		
F5	0,472	0,540	0,447	0,370	0,564	1,000	
F6	0,380	0,508	0,129	0,713	0,452	0,496	1,000

Figure 10. Correlation coefficient

The obtained results show that satisfaction with microlearning technology based on an online course had a direct correlation with all factors, but the highest correlation coefficients were recorded for the factor of availability of learning resources (F5, correlation coefficient 0, 472), consideration of individual abilities and needs in the online course (F1, correlation coefficient 0.455), the possibility of interaction and communication with the teacher (F6, correlation coefficient 0.380), the format of learning materials and the knowledge gained (F4, correlation coefficient 0.335).

4. CONCLUSIONS AND PROSPECTS FOR FURTHER RESEARCH

As a result of the study, a microlearning procedure was developed according to which an online course consists of a logical sequence of resources developed for a number of subject area learning objects. The study of the impact of factors of satisfaction with learning based on an online course using microlearning technology has shown that the greatest impact on satisfaction is made by the factors of accessibility of educational material, format of educational resources, consideration of individual needs and interaction between students and the teacher. This study allows us to conclude that the advantages of microlearning are the effectiveness of learning content, as short periods of study allow for better perception and assimilation of information, and students can use time efficiently, as the micro-course has the ability to take into account individual needs of students. However, at the same time, certain shortcomings have been identified, namely: insufficient opportunities for developing practical skills, in-depth study of complex topics, insufficient motivation for independent learning of students, and a much higher time spent by the teacher on preparing educational content. To overcome these shortcomings, learning resources should be supplemented with appropriate tasks for practicing practical skills, and the tasks themselves should have a comprehensive integrative content.

Further development of the study is planned to focus on comparing and selecting a convenient platform for microlearning, as well as building an individual student's educational trajectory, taking into account learning styles.

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Text of the article was accepted by Editorial Team 07.01.2024

ВПРОВАДЖЕННЯ ТЕХНОЛОГІЇ МІКРОНАВЧАННЯ СТУДЕНТІВ-ЕКОНОМІСТІВ ЗА ДОПОМОГОЮ ОНЛАЙН-КУРСІВ

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Анотація. Після спалаху пандемії у 2019 році та початку війни на території країни у 2022 році заклади освіти різних рівнів України перейшли на змішаний формат організації освітнього процесу та були змушені шукати сучасні підходи та технології організації навчання здобувачів освіти. У даному дослідженні розглядається реалізація технології мікронавчання з використанням онлайн-курсів, розроблених на платформі Moodle. Мікронавчання є сучасною технологією навчання, яка передбачає короткі інтенсивні навчальні модулі, орієнтовані на формування конкретних теоретичних знань та практичних навичок. Доступні онлайн-курси, що забезпезпечують можливість створення та доставки різнотипного навчального контенту, зосереджуються в основному на формуванні необхідних знань та навичок здобувачів освіти, але не враховують їх індивідуальні потреби та інтереси в навчанні, а також приділяють мало уваги їх задоволеності від здобуття освіти в сучасних умовах. У цій статті досліджено рівень задоволеності студентів навчанням на онлайн-курсах з використанням технології мікронавчання. Для визначення рівня задоволеності студентів було проведено онлайн-анкетування 61 студента спеціальності 051 «Економіка» освітніх програм Економіка підприємства, Міжнародна економіка, Економічна кібернетика та Цифрова економіка НУБіП України, які навчались за технологією мікронавчання з використанням онлайн-курсів. У результаті був зроблений висновок про те, що на рівень задоволеності студентів навчанням за даною технологією найбільше впливають такі фактори, як-от: доступність навчальних ресурсів, врахування в онлайн-курсі індивідуальних здібностей та потреб, можливості взаємодія та комунікація з викладачем, а також формат навчальних матеріалів та отримані знання. Відповідно саме ці фактори варто враховувати при розробці онлайн-курсів та впровадженні технології мікронавчання в освітній процес.

Ключові слова: мікронавчання; онлайн-курс; процедура створення мікрокурсу; задоволення.

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