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USE OF MENTAL MAPS FOR THE DEVELOPMENT OF VISUALIZATION IN TRAINING OF FUTURE TEACHERS OF VOCATIONAL EDUCATION

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The article is devoted to the problem of using mental maps in higher education through the use of the MindMeister web service as an innovative educational resource of information organization. An analysis of Ukrainian and foreign educators' researches who actively studied and discussed the specifics of using mental maps in education is presented.

The training of future specialists in vocational education encourages university teachers and professors to improve their pedagogical skills by developing and using electronic learning resources and online services in the educational environment, for effective, successful visualization of educational information and with the aim of qualitatively supplementing theoretical material in the process of training future teachers of professional education. One of the promising ways of visualizing educational data is the use of mind maps taking advantage the MindMeister web service.

The purpose of the study was to reveal the specifics of using mental maps for the development of visualization in the process of training future teachers of vocational training. To achieve the goal, a complex of theoretical and empirical methods was used: theoretical analysis of periodicals, methodological and scientific-pedagogical literature, with the aim of determining the essence of the main concepts, identifying the current state of the researched problem and possible solutions; analysis of the use of mental maps in the educational process on the example of the MindMeister web service.

The importance of the development of visualization in the process of training future teachers of vocational training is determined. The goals of using mental maps in the educational process are presented and the advantages of using mental maps as an innovative educational resource for the organization of information in the training of vocational education teachers in relation to traditional ones are highlighted: interactivity, support, productivity, accessibility, flexibility. It was established that

the use of mental maps allows to optimize the educational process, affects the development of visualization of undergraduates', the quality of memorization and perception of information.

Key words: innovative educational resource, mental map, educational process, active learning methods, web service.

Стаття присвячена проблемі використання ментальних карт в освітньому процесі вищої школи через застосування веб-сервісу MindMeister, як інноваційного освітнього ресурсу організації інформації. Представлено аналіз наукових праць українських та іноземних педагогів, які активно досліджували та обговорювали особливості використання ментальних карт в освітньому просторі.

Підготовка майбутніх фахівців професійної освіти спонукає науково-педагогічних працівників розвивати свою педагогічну майстерність шляхом опрацьовування та використання в освітньому середовищі електронних освітніх ресурсів та онлайн сервісів, задля ефективної, вдалої візуалізації навчальної інформації та з метою якісного доповнення теоретичного матеріалу у процесі підготовки майбутніх педагогів професійного навчання. Одним із перспективних шляхів візуалізації навчальних даних є використання ментальних карт із застосуванням веб-сервісу MindMeister.

Метою дослідження було розкрити особливості використання ментальних карт для розвитку візуалізації у процесі підготовки майбутніх педагогів професійного навчання. Для досягнення мети використано комплекс теоретичних та емпіричних методів: теоретичний аналіз періодичних видань, методичної та науково-педагогічної літератури, з метою визначення сутності основних понять, виявлення сучасного стану досліджуваної проблеми та можливостей у її вирішенні; аналіз використання ментальних карт в освітньому процесі через застосування веб-сервісу MindMeister.

Визначено важливість розвитку візуалізації у процесі підготовки майбутніх педагогів професійного навчання. Виділено цілі використання ментальних карт в освітньому процесі та виокремлено переваги використання ментальних карт, як інноваційного освітнього ресурсу організації інформації при підготовці педагогів професійного навчання по відношенню до традиційних: інтерактивність, підтримка, продуктивність, доступність, гнучкість. Встановлено, що використання ментальних карт дозволяє оптимізувати освітній процес, впливає на розвиток візуалізації у здобувачів вищої освіти, якість запам'ятовування та сприйняття інформації.

Ключові слова: інноваційний освітній ресурс, ментальна карта, освітній процес, активні методи навчання, веб-сервіс.

Introduction. The new realities and challenges of today require a review of the content of education and the reorganization of the educational process, especially in the period of distance learning. The system of training future specialists in vocational education in institutions of higher education is focused on quality, comfort, inclusion

and innovation. The digital transformation of education, a competency-based approach, person-oriented and activity-based learning models, the introduction of additional opportunities (dual form of learning, academic mobility, individual educational trajectory, etc.) fundamentally meets the expectations of university students, university professors, employers and the state.

The implementation of educational reforms in Ukraine, the development of innovations, and the increase in requirements to the quality assurance of training of university students require university professors to use not only traditional approaches, but also innovative ones. This leads to the search for ways to provide educational services for the development of visualization in the process of training of university students, which are necessary to support future specialists so that they can accurately navigate the information flows and be engaged in self-improvement and self-realization.

Therefore, the digital transformation of education is one of the alternative ways to restore access to formation, which guarantees a continuous learning process, high-quality vocational training of university students, and the development of society. As a result, it requires careful research and scientific and practical justification of the application of digital pedagogy, digital content, online services, etc.

The purpose of the study is to reveal the specifics of the use of mental maps for the development of visualization among the university students in the process of their professional training through the use of the MindMeister web service as an innovative educational resource.

Research task: to reveal the essence of the concept of "mental maps"; to theoretically substantiate the importance of the development of visualization in the professional training of future vocational education specialists; present the purposes of using mental maps in the educational process; highlight the possibilities and advantages of using mental maps in the educating teachers of vocational training for their quality studying.

Literature review. Ukrainian and foreign teachers are actively researching and discussing the features of using electronic learning resources and online services in the educational process: S. Nuzhna, O. Stupak, Yu. Bystrova, O. Romanovskyi, V. Hrynova, P. Farrand, H. Fearzana, E. Hennessy, N. Götz & J. Holmén and others.

Reforming the system of higher education in Ukraine motivates university teachers to introduce productive and ergonomic methods and means of training of university students into the educational process (Romanovskyi *et al.*, 2018). The use of online platforms and services in distance education provides wide opportunities for both teachers and of university students and is becoming more and more relevant. Digital content provides simultaneous access to complete and dynamic information for all participants of the educational process, which makes the learning process high-quality and productive.

Online tools are widely used in education (face-to-face, remote, blended (combined)). The use of online services allows more complete access to educational and information resources, which raises the level of teaching and learning for university teachers and undergraduates (Shakhina & Lazniuk, 2017).

Provided that innovations are introduced into the educational process, one of

the promising directions of education transformation is the use of various online services in the educational space. These services contribute to the development of visualization, interest, activity, informational and communicative competences of university students. They are also a suitable tool for creating electronic support for a class, distance course, conference or communication where it is convenient to use different types of files, tasks, create layouts, both individually and in a team in real time.

University teachers develop pedagogical skills by using electronic educational resources and online services in the educational process. Effective visualization qualitatively complements the theoretical material in the process of training future of university students. One of the promising ways of visualizing educational data is to present them in the form of mental maps.

According to Stupak (2022, 81), "different platforms and resources used during distance learning should complement each other and perform certain functions in the educational process. At the same time, working with mental maps remains a universal and generalizing technology, and the expansion of opportunities to use online resources for their creation is considered a relevant and relevant issue."

Scientists studied the use of mental maps by teachers. In the course of the analysis, they found that visualization helped to remember and generate new ideas. (Oksentiuk, 2015).

The possibility of using knowledge maps or mind maps in the educational process is described in the works of Hlushak (2013), Havrylenko *et al.* (2023), Hrytsenko (2023), Koval & Besklinska (2020), Stupak (2022).

In particular, the features of the use of mental maps in the process of training preschool education specialists are determined (Barna, 2016, Stupak, 2022); are highlighted the benefits of using mental maps in medical biology classes (Abuvatfa *et al.* (2019), Havrylenko *et al.* (2023)); are revealed scientific and pedagogical approaches to the use of information and communication technologies in the educational process of a higher education institution (Hlushak (2013), Koval & Besklinska (2020), Saiapina *et al.* (2021), Shakhina & Lazniuk (2017)); are analyzed the role of mental maps in works on geography (Götz & Holmén (2018)).

Methodology and results. The research was conducted using a complex of theoretical methods: theoretical analysis of periodicals, methodical and scientific-pedagogical literature, with the aim of determining the essence of the main concepts, identifying the current state of the researched problem; analysis of the use of mental maps in the educational process through the use of the MindMeister web service.

New opportunities are opening up for the participants of the educational process in the conditions of internationalization of professional education. High-quality training of future vocational education specialists requires rational use of foreign experience and practice. In the new realities of education transformation, an important and relevant direction is the educational student-centered space, which contributes to the intellectual, cultural, social and professional development of human capital and ensures the sustainable development of Ukrainian society and social institutions.

Our state needs effective and high-quality training of university students in

order to ensure the development of Ukraine and its recovery after the war. As a result of the introduction of martial law, the training of future vocational education specialists in higher education institutions is focused on a blended form of education. Distance learning technologies are an alternative option for ensuring the continuity of the educational process. Talented and capable youth strive for innovation and need high-quality, interesting educational information and updating the content of education. University students with the help of traditional education and the use of distance learning technologies must obtain a qualification level and full-fledged knowledge, capability, skills and talents to successfully implement them in future activities in the field. This directs educators to the development of digital literacy of students and the use of distance learning techniques, innovative technologies, online services, cloud-based services (services for saving multimedia files, blogs, wiki technologies, presentations and publications, tests, questionnaires, services for creating didactic materials in a game form, knowledge maps, information graphics) etc.

In modern research, there is no single generally accepted meaning of the concept of "mental maps". Koval & Besklinska (2020) associate them with the translation of the phrase "Mind map" from the English language, which has the following equivalents in the Ukrainian language: "intellectual maps", "mental maps", "schemes of thinking", "diagrams of connections", "mind maps", "image maps", "knowledge maps", "memory maps", "associative maps".

Guelton (2023, 1) notes that "the English term "mental map" does not usually cover the same scope as the French term "carte mentale" and is mostly limited to the meanings of a conceptual map or "carte heuristique"".

An intelligence map is a scheme that visualizes certain data when they are processed by a person, it is a way of depicting the process of general system thinking with the help of structurally logical schemes of radial organization (Buzzen & Buszen, 2006).

A mental map (mind map, intelligence map, memory map, mind map, consciousness map) is 1) a set of diagrams and schemes, which in a visual form (in the form of "trees", diagrams of relationships, lists and schemes) demonstrates thoughts, theses, connected with each other and united by a common idea; 2) a method of depicting the process of general thinking system using diagrams; 3) a convenient tool for structuring information in a visual form (Silkova & Lobach, 2018, Sydoruk, 2020).

B. Guelton (2023) emphasizes that a drawing is created from elements present in the subject's internal memory, but this memory is reconstructed with the help of this graphic image. Working memory and its role in creating the composition of a picture in connection with long-term memory is a very relevant issue, as well as episodic memory (experienced events and experiences) and memorization of cognitive maps. In both cases, two types of maps identify individualized entities and the relationships between them. Furthermore, in both cases there is memorization and design, in other words, the elements to be preserved are selected and the "operations" between the entities are established. The first is subject to the body's memory of the route in space and requires spatial cognition, while the second directly depends on an abstract spatial representation, a more or less conventional "blank page" on which entities and

relationships between them can be represented.

Before creating "mental maps" in the online service, they are usually drawn by hand on paper, in this way of university students activate their creative thinking. And then, with the help of an online service, in team they create mental maps, design and represent them through public access.

It is convenient to create mental maps with the help of various online services, as an example, the proposed digital content can be used in educational activities by teachers, university professors, of university students, as a tool for creating schemes, knowledge maps, mind maps, mental maps: MindMeister (https://www.mindmeister.com) – an online service, a convenient tool for thinking process and building schemes; Canva (https://www.canva.com/uk_ua/) is a tool for creating and editing design materials for social media pages, websites, presentations, reports and printed materials (Graphics, photos, Electronic worksheets, Mind maps, Presentations, Schemes and diagrams, Artificial intelligence); Bubbl (https://bubbl.us/) – service for creating schemes; Coggle (https://coggle.it/) – a service for building intelligence cards (Mental maps, Schemes and diagrams); XMind (https://xmind.app/) – a tool for creating intellectual maps and other visualized structures (Mind Maps, Schemes and diagrams); FreeMind (https://freemind.sourceforge.io/wiki/index.php/Main_Page) is a program for creating mind maps. (Mental maps); Cacoo (https://cacoo.com/) – a service for creating diagrams, schemes, posters; Mind42 (http://mind42.com/) is a service for creating graphic schemes, known as "mind maps" – mind maps or knowledge maps; Spiderscribe (https://www.spiderscribe.net/) is a service for creating mind maps and diagrams and many others.

"MindMeister" can be singled out among the online platforms that are advisable to use during the training of future specialists in vocational education. It is a convenient tool for thinking process and building schemes, mental maps. Working with the "MindMeister" application in creating mind maps is a relevant, universal learning technology. This technology contributes to the development and self-improvement of university students, expands opportunities for studying students in remote and blended forms, which facilitates visualization, structuring and classification of ideas and allows to visually represent complex concepts and large volumes of information. "MindMeister" is more beneficial for the future vocational teachers than the other tools for creating mind maps. Firstly, this online platform is more advanced. Secondly, it is accessible for group work. Thirdly, it is free of charge for creating three mind maps. Finally, it includes a wide range of mind map examples.

Online services are a practical tool for creating electronic support for successful communication in any lesson. Digital content (interactive learning tools, electronic textbooks, information visualization, digital educational and scientific platforms) used by educators in the implementation of the digital transformation of education provides an opportunity to carry out learning activities and high-quality presentation of theoretical material, as well as to organize the educational and research activities of university students. Digital educational and scientific platforms, interactive materials, applications and resources used by educators during distance learning complement each other and implement the educational process in today's conditions.

Mind maps created in MindMeister are an opportunity to create a joint mental model of any problem by the students' group. The university students place the right emphasis on those components that they want to highlight in their work. By creating mind maps in the MindMeister environment, students structure information and place it in a systematic order. When studying the topic "Psychological issues of occupational safety" from the academic discipline "Occupational safety and its psychology", university students work together in a team in the MindMeister environment to develop ways of the employee's safety.

Working together, university students can add new map elements or change them. There must be a team leader who provides access to one or another mind map. For convenient teamwork, this MindMeister online service has a chat and comment system.

Mind maps are a kind of memory cards. Mental representations, which are the object of internal understanding, are transcribed externally on the medium. Mental maps help university students to focus on the main aspects that are presented by the teacher for consideration and processing by students. For example, when studying the topic "Audit forms for industrial safety and occupational health" from the subject "Organization of supervisory activities in the field of occupational safety", the teacher sets the students the task of distinguishing the elements of internal and external audits and their distinction between audits. Thus, university students, under the guidance of a teacher, solve the problem presented to them through analysis and search for solutions, finding out the interconnections between the forms of industrial safety and occupational health audit.

Mind maps also develop visualization, creativity and stimulate thinking. Based on the topic "Risk assessment when using potentially dangerous processes and technological equipment. Risk management" of the educational discipline "Potentially dangerous production technologies and their identification" through the use of mental maps, students demonstrate the factors that cause the occurrence of dangerous situations and their causes, and also focus on undesirable consequences.

In educational practice in the period of distance learning participants of the educational process through the use of optimal platforms and online services for creating mental maps expand the possibilities of visualization development through the use of distance learning technologies. The development of visualization through a virtual educational environment facilitates the learning process for university students, makes educational material more accessible, simplifies memorization, stimulates and develops logical thinking, affects the development of analytical abilities, promotes collective thinking, etc. (Fig. 1.).

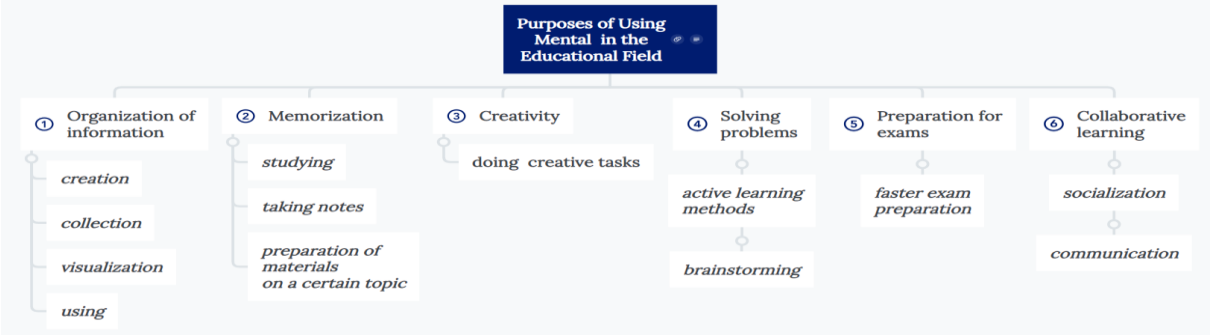

Fig. 1. Mind map 1.

Source: developed by the authors on the basis on their own research in MindMeister online service

Working with the MindMeister software tool in the process of training future teachers of vocational education makes it possible to accompany classes, visualize information, and successfully organize search and research activities of university students (Fig. 2.).

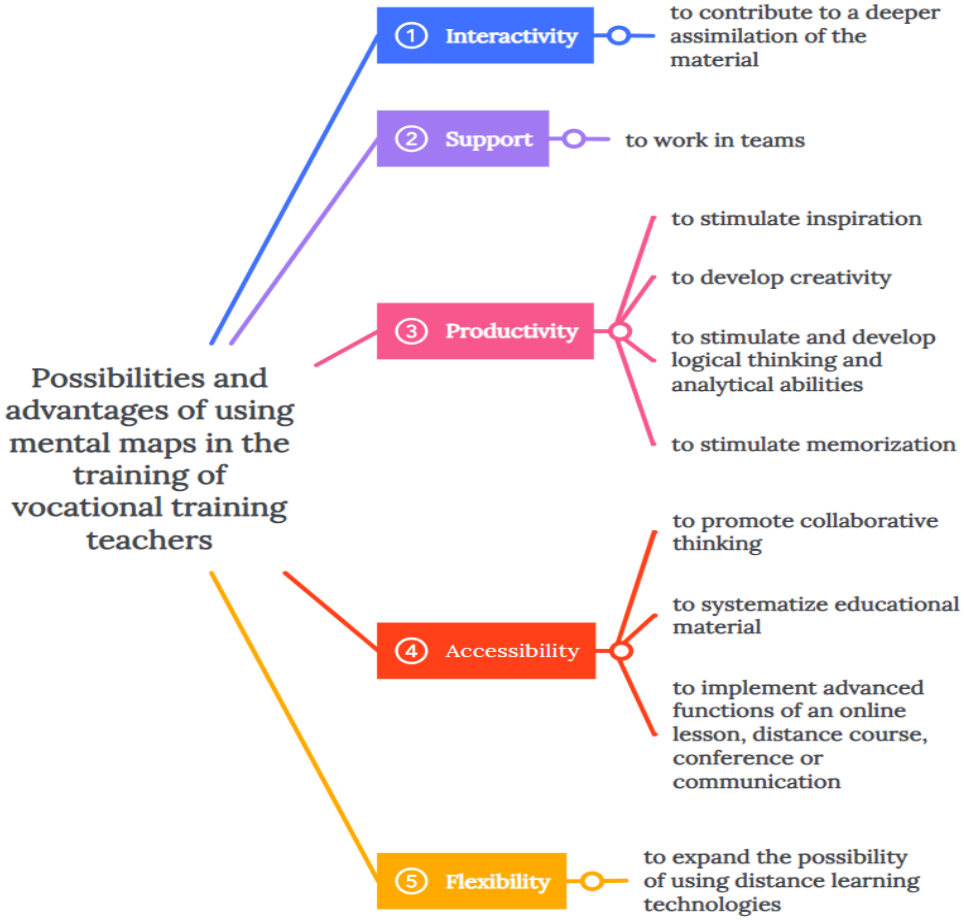

Fig. 2. Mind map 2.

Source: developed by the authors on the basis on their own research in MindMeister online service

The use of mental maps in the training of vocational training students is a convincing illustrative, practical material that helps to raise the level of professional training of future vocational education specialists, in particular for pedagogical activity in new conditions, through compliance with defined pedagogical requirements of application of innovation means.

Discussion. The peculiarities of the use of mental maps for the development of student visualization in the process of their vocational training through the taking advantage of the MindMeister web service are revealed. Under the guidance of the university teacher, students solve the problems through analysis and finding the right solutions.

The use of mental maps in classes is rational. University students develop the ability to visualize and systematize. Their successful use during the training of future teachers of vocational education in practical, lecture classes, when explaining new material, consolidating material, checking knowledge, group work with students contributes to better understanding and memorization of the material and facilitates analysis and accepting information. .

It has been established that mental maps are an effective technique in systematizing educational material and getting ready f for the credit-examination session.

The authors highlight the goals of using mental maps in the educational process, present the advantages of using mental maps through the use of the MindMeister web service to achieve learning outcomes and professional competencies.

Conclusions and recommendations. Therefore, the use of mental maps has an impact on educational activities in the system of higher education for the development of visualization, improvement of the professional career of future specialists in vocational education and guaranteeing the quality of professional training of future specialists in higher education.

The use of the MindMeister web service as an innovative learning resource in the educational process has a positive effect on academic outcomes, and provides future specialists with the prospect of being competitive on the labor market.

It would also be appropriate to compare the approaches and methods of using mental maps for the development of visualizations in the process of professional training in different regions of Ukraine and abroad.

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