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**RESEARCH ARTICLE**

# Information Services for the Use of Mind Maps in Teaching: the Experience of University Experimental Work

# Servicios de información para el uso de mapas mentales en la docencia: la experiencia del trabajo experimental universitario

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## Summary

The purpose of the article is to identify the information services for creating mind maps in the process of linguistic training of future philologists at the seminars. A comparative analysis of the most used software products for creating mind maps was carried out based on an expert survey. The results of this analysis made it possible to choose a software product using mind maps. The results of the pedagogical experiment confirmed the assumption that mind maps are an effective means of mastering the knowledge of future philologists at the seminars. The use of mind maps in the processes of understanding information in the classroom affects the activity of students' listening, makes it possible to systematize information through personal understanding and structuring, and promotes effective memorization. The next areas of scientific research on the presented problem are the analysis of the effectiveness of mind maps in the independent work of students.

**Keywords:** Mind Map, Seminar, Level Of Knowledge Assimilation, Software Product.

## Resumen

El propósito del artículo es identificar los servicios de información para la creación de mapas mentales en el proceso de formación lingüística de los futuros filólogos en los seminarios. Se realizó un análisis comparativo de los productos de software más utilizados para la creación de mapas mentales a partir de una encuesta a expertos. Los resultados de este análisis permitieron elegir un producto de software utilizando mapas mentales. Los resultados del experimento pedagógico confirmaron la suposición de que los mapas mentales son un medio eficaz para dominar el conocimiento de los futuros filólogos en los seminarios. El uso de mapas mentales en los procesos de comprensión de la información en el aula afecta la actividad de escucha de los estudiantes, permite sistematizar la información a través de la comprensión y estructuración personal y promueve la memorización efectiva. Las siguientes áreas de investigación científica sobre el problema presentado son el análisis de la efectividad de los mapas mentales en el trabajo independiente de los estudiantes.

**Palabras clave:** mapa mental, seminario, nivel de asimilación de conocimientos, producto de software.

## Introduction

One of the disadvantages of the traditional teaching system is the linear style of production of educational material (Zelenkov et al., 2020; Konovalova, Demenev, 2020) (for example, taking notes under the teacher's dictation), which, as J.W. Budd (2004) suggests, is insufficiently productive and rational in presenting the required amount of knowledge and memorizing it and also demonstrates the improper use of visualization in the educational process to enhance understanding of the content.

Therefore, the relevance and promise of the issue of the innovative learning technologies application that contribute to the memorization of information through the visual structuring of data and the generation of new ideas (Gogiberidze et al.: 2020; Gorbunov et al., 2019) is associated with the analysis of the problem and concepts based on the awareness of their structural units (Brinkmann, 2003). This is the mind mapping technology – visualization of educational material in the educational process. It contributes to a uniform load of all channels (visual, auditory, kinetic) and takes into account the dependence of the assimilation of

educational material on the method of its presentation (Arulselvi, 2017). The main tool for the implementation of this technology is a mind map.

According to researchers, a mind map is 1) a set of diagrams and schemes, which in a visual form ("trees", diagrams, lists) demonstrate thoughts and theses related to each other and united by a common idea (Goodnough, Long, 2002); 2) a way of depicting the process of general systems thinking using diagrams (Buran, Filyukov, 2015); 3) a convenient tool for structuring information in a visual form (Al Naqbi, 2011).

In scientific discourse, the idea of creating mind maps belongs to Tony Buzan. According to his definition, a mind map is a manifestation of radian thinking, which, in turn, is a function of the human brain (Buzan, Buzan, 2003). The concept of mind maps is based on the concept of the principles of the human brain (Golubeva et al., 2020; Dyganova, Yavgildina, 2020; Obedkova, 2020). Buzan (2003) investigated the physiological and psychological characteristics of the work of the left and right brain hemispheres and concluded that the simultaneous activity of the left (logical) and right (figurative) hemispheres is possible if a person is directed to make notes in the form of associative diagrams.

According to researchers (Evrekli et al., 2010), a feature of mind maps is the activation of memory, visualization of thinking, implementation of its associativity and hierarchy (from general to specific), and assistance in the holistic perception of the concept or the problem under study. Mind maps make it possible to establish relationships (semantic, associative, cause-and-effect) between the components of the research object, visualize its structure and logic, and also implement the individualization and differentiation of learning by students choosing an individual trajectory (Davies, 2011).

The use of mind maps makes it possible to connect to information processing of the left hemisphere, which is responsible for logic, analysis, and language, and the right hemisphere, which dominates in the field of imagination, color, and three-dimensional perception. Involvement of both brain hemispheres equally makes intellectual work more fruitful, while traditionally predominantly left-brain mental abilities are used in the educational process (Dhindsa, Anderson, 2011). Thus, mind maps contribute to the development of the right hemisphere of the human brain, which, as a rule, is less developed.

The efficiency of mind maps for the memorization process is postulated by most scholars (Goldberg: 2004; Boley: 2008). K.F. Wang (2007) argues that, despite the specified function, mind maps encourage students to a deeper level of learning, as they allow individualizing the perception of information.

S.O. Adodo (2013) focuses on the effectiveness of the mind maps method implementation, as evidenced by the activation of students' skills to apply emotions in the process of awareness – through figurative associations and the acquisition of research skills by them – through the excitement of the processes of synthesis, generalization, and comparison and free access to communication.

According to N.D. Parikh (2016), mind maps help students to comprehend and generalize the information they receive due to its structuring. Firstly, it is a concentration on important (nodal) moments, since each new node of the mind map, especially if it is highlighted with color and pictograms, is a new center of the association. Accordingly, the so-called emphasis (concentration on the center of the composition) occurs that helps to better memorize information. Secondly, visually clear associations make it possible to correlate different concepts and terms "in space"; a system of concepts associated with deductive and inductive methods is formed, which is of particular importance in the formation of the professional competence of future specialists.

Analysis of the work of scholars (Willis, Miertschi, 2006; Harkirat et al., 2011) allows concluding that the use of mind maps in the teaching and educational process of a higher education institution contributes to:

- increasing the effectiveness of training (for example, through the categorization of knowledge, the development of thesauri, visualization of the process of comprehending and assimilating the content of training) by enhancing the cognitive interest of students and stimulating their logical thinking;

- comparison of theoretical material with concrete practical;

- development of professional, subject competences (for example, equipping students with knowledge of the subject area, knowledge of "how to act" and "how to be", etc.);

- increasing the motivation of students, the quality of education, and, as a result, their competitiveness in the labor market;

- enhancing the activity of students, organizing interaction between them in group work, and developing communication, emotional intelligence, and introspection;

- reflection (for example, it makes it possible to determine the problems of understanding the content of information, correct the logic of the process of its perception in time, identify problems of student's professional development with their subsequent correction either in consultation with the teacher or independently);

- creating an atmosphere of easy communication and productive dialogue.

Achieving the goal of the article involves the consistent implementation of the following tasks:

- to define and reveal the main provisions of the use of mind maps in the learning process;

- to carry out a comparative analysis of software products, including those that can be used online, to create mind maps;

- to carry out an experimental study of the effectiveness of using mind maps as a means of effective assimilation of knowledge by future philologists at seminars.

Research hypothesis: mind maps are an effective means of assimilating the knowledge of future philologists in the process of seminars and contribute to the systematization and generalization of theoretical material.

Based on the results of the study, it can be concluded that the goal set in the study was achieved.

## Methods

General scientific methods were used to solve the tasks set in the work:

a) theoretical: analysis of peer-reviewed scientific sources on the research problem to determine the conceptual and categorical apparatus, clarify the main provisions of the use of mind maps in the learning process, and substantiate the advisability of using mind maps as a means of forming the linguistic competence of future philologists;

b) empirical: expert survey and pedagogical experiment;

c) methods of mathematical statistics to obtain results on the effectiveness of the use of mind maps in seminars in higher education institutions.

At the first stage of the study, an expert survey was conducted for a comparative analysis of the most used software products for creating mind maps. For comparison, the experts were offered a list of 14 most famous software products, based on the analysis of scientific literature. The experts were asked to evaluate software products according to the following criteria: free tariff, interface simplicity (on a 5-point scale), availability of a Russian version, synchronization with the cloud, the ability to create presentations, interface design (on a 5-point scale), sufficiency of a set of functions (on a 5-point scale).

The experts (25 people), teachers of higher education institutions, who use mind maps in their teaching activities, took part in the survey.

All participants were warned about the purpose of the survey and that the organizers of the study planned to publish the results of the study in a generalized form in the future.

At the second stage of the study, the effectiveness of the use of mind maps in seminars on the discipline "Theory of Literature" was tested using a pedagogical experiment. The pedagogical experiment was carried out in a real educational process.

The experiment was attended by second-year students of the "Philology" specialty (total of 112 people). Organizationally, all conditions and content of training were the same in the control and experimental groups, except for the use of mind maps at seminars.

The means of determining the results of experimental learning were diagnostic tests, after checking which we received information about the actual knowledge of students. Ascertaining and control measurements of the effectiveness of teaching students were carried out in the experiment, which was determined by the level of success in teaching. The levels of learning success were determined depending on the assimilation rate (AR), which is the ratio of the number of correctly reproduced elements of knowledge (correct answers) to the total number of questions of the input (output) test: low level – $AR \leq 0.3$; sufficient level – $0.3 \leq AR \leq 0.6$; average level – $0.6 \leq AR \leq 0.9$; high level – $AR \geq 0.9$.

The results were processed using methods of statistical analysis: the characteristics of the samples were compared, the reliability was determined, the significance of differences was estimated, and a correlation analysis was carried out.

## Results

The results of the comparative analysis of software products that are most often mentioned in various sources and used to create mind maps are presented in Table 1.

**Table (1):** The results of a comparative analysis of the most used software products for creating mind maps

| Software | Characteristics | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | type of product | operating system | free tariff | interface simplicity | Russified version | sync with the cloud | presentation | interface design | feature set |
| MindMeister | online | iOS, Android | + | 5 | + | + | + | 4 | 4 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| MindMup | online | any | + | 5 | - | + | + | 5 | 5 |
| Mind42 | online | any | + | 4 | - | - | - | 4 | 3 |
| FreeMind | PC, online | Windows, Vista | + | 5 | + | + | - | 4 | 5 |
| XMind | PC | Linux, iOS, Windows, Mac | + | 5 | + | + | + | 5 | 5 |
| MindJet Mindmanager | PC | iOS, Android, Windows, Mac | + | 5 | + | + | + | 4 | 5 |
| PersonalBrain | PC | Windows, Mac | - | 3 | - | - | - | 3 | 3 |
| iMind Map | PC | Windows, Mac | - | 5 | - | - | + | 5 | 5 |
| Bubbl.us | online | any | - | 5 | - | - | + | 4 | 4 |
| Comapping | PC, online | Windows, Mac | + | 4 | - | - | + | 3 | 3 |
| MindGenius | PC | Windows, iOS | + | 5 | - | - | + | 4 | 4 |
| Wisemapping | online | any | + | 4 | - | - | + | 4 | 3 |
| Mapul | online | any | + | 4 | + | - | + | 5 | 4 |
| Mindomo | PC, online | Linux, Windows, Mac | + | 5 | + | + | + | 5 | 4 |

Note: compiled based on the expert survey

Based on the results of comparative analysis, we decided to use the software product XMind, which is freely available on the Internet for the development of seminars on the discipline "Theory of Literature" using mind maps.

After a cycle of seminars using mind maps in the experimental groups, the ratio of the number of students shifted towards those with sufficient and high levels of knowledge assimilation. Accordingly, there was a decrease in the number of weak students (low level of knowledge assimilation).

The ratio between the number of students with different levels of knowledge assimilation remained almost unchanged in the control groups. The difference between the results of the control and ascertaining sections for all levels was less than 1.5% up or down. This allows concluding that the use of mind maps in seminars contributes to a significant improvement in learning outcomes.

Table 2 shows the coefficients of assimilation of knowledge in the discipline "Theory of Literature" of students of the experimental and control groups.

**Table (2):** Results of the pedagogical experiment

| Number of students | The ascertaining cut | | The control cut | | Student's t-test for the control cut | Effect |
|---|---|---|---|---|---|---|
| | Number of correct answers | AR | Number of correct answers | AR | | |
| EG (n = 58) | 898 | 0.774± 0.012 | 992 | 0.855± 0.015 | 2.0567 (p <0.001) | +0.081 |
| CG (n = 64) | 994 | 0.776± 0.012 | 1009 | 0.788± 0.012 | 0.1627 (p <0.001) | +0.014 |

The obtained result of the control section indicates a high level of assimilation of knowledge by students of the experimental groups whose training took place using mind maps at seminars. Table 2 shows that the pedagogical effect was +0.081 in the experimental groups versus +0.012 in the control groups. The increase in knowledge, calculated as the difference in AR by the students of the experimental and control groups, was positive and amounted to 0.081, which proves the pedagogical effectiveness of using mind maps in seminars when studying the discipline "Theory of Literature".

The existence of a normal distribution within both data sets makes it possible to compare the mean results of the control section for both groups using Student's t-test to compare the results of the ascertaining and control sections. The results (Table 2) indicate the presence of a statistically significant difference between AR in the experimental groups compared to the control groups.

## Discussion

The results of the study showed that today, there is a significant selection of software products for building mind maps, including those that can be used online. Most often, researchers pay attention to five of them, which, in their opinion (Liu et al., 2014), are the most effective and relatively simple for beginners (iMindMap, FreeMind, XMind, Bubble, and Mind42).

The iMindMap service was created by T. Buzan, the author of mind mapping technology. The program fully complies with the technology, but has one significant drawback – it is possible to use it for free for only 30 days (Buzan, 2010).

One of the most famous and popular free mind mapping software is also FreeMind. Its disadvantages include average quality graphic elements; its advantages are intuitive control, availability of all the tools necessary for building a map, the ability to store finished maps in any convenient format (PNG, JPEG, XML, HTML, XHTML, etc.), support for various styles of structures and schemes, and the ability to link to external sources (Balim, 2013).

The Bubble is also a convenient online resource with which one can quickly and easily create bright mind maps. The Bubble is shareware: it is possible to create up to three mind maps for free. However, this is enough to familiarize students with the principle of working with mind maps. The advantages of this resource are easy navigation, access for several participants at once, and the ability to import the finished map into a website or blog. The language of the resource is English, but the interface is very simple and implemented using graphic images (Kedaj et al., 2014).

Mind42 is a free online program for novice PC users to create a simple yet understandable mind map. The advantages of this program include a user-friendly interface, the possibility of group work, the presence of an integrated image search via Google, the ability to take notes, and compatibility with similar programs (Ellozy, Mostafa, 2010).

The advantages of the XMind product chosen by us for the experimental study are a free tariff, the ability to create different types of schemes, beautiful and bright design, a wide variety of tools and functions (setting font parameters, editing and spell checking, external links, etc.), the ability to work on one mind map for several users at once, and compatibility with the Microsoft Office programs. A significant advantage is that the program interface is accessible and does not require high user qualifications. It is possible to create easy-to-use Fishbone Mind Maps and Diagrams and brainstorm with the help of XMind.

The appearance of the seminar in the form of a mind map developed using the XMind software product on the screens of a personal computer, multimedia projector, etc. presents interrelated elements (concepts) highlighted in color and supplemented by corresponding pictograms and figures. The content of the training material is revealed by adding attachments in the form of text documents with illustrations and videos.

When building a mind map, it is necessary to adhere to a certain algorithm (Seyihoglu, Kartal: 2010):

- definition of the object of study (central concept) – the sphere of responsibility of the teacher representing the topic of the lesson;

- selection of basic structural units associated with the main object (main branches from the basic concept) – the sphere of responsibility of the teacher, who orients students concerning the lesson plan;

- the location of structural units relative to the main concept (branches with words around the main node) – the area of responsibility of students who understand the logic of the presentation of the teacher's text;

- supplementing the mind map with additional information (branches extending from structural units) – the area of responsibility of students, each of which provides a personal meaning of information by adding symbols, files, drawings, or coloring;

- editing the mind map (noting that structural nodes are not sufficiently or exaggeratedly reproduced) is a collective responsibility of the teacher and students within the framework of joint activities to correct the map (either by the way of collective completion of information or by the way of changing the map located in the cloud service).

It is worth noting that the teacher, preparing for the lesson, can also write information in the form of a mind map – then they focus on logical connections between concepts. However, this method can be used only if there is a free orientation in the text and prepared cards citing the necessary definitions. Mind mapping learning material is flexible and easy to adapt to changing conditions. During the rapid development of knowledge, the teacher can easily and without a significant investment of time make adjustments to their materials.

At the same time, if we consider not the individual results of the teacher's or student's activities, but the result of educational and research activities on a specific topic, then the mind map should be created not by one subject of activity (teacher or student), but by all participants in the educational process involved in the work. The teacher can provide a mind map base for students to supplement it. Then the mind map represents the result of the awareness of a specific topic by the subjects of educational activity and its creation occurs through a step-by-step gradual familiarization and addition or correction of information by the teacher and students. It should be noted that the links between individual elements of information, highlighted by students, can be a find for the teacher.

## Conclusion

Analysis of programs for creating mind maps allows determining their advantages and disadvantages. First of all, when creating mind maps, one should be interested in how convenient the program will be for use in a particular type of occupation; another prerequisite for the program should be the possibility of free access to the resource. Summarizing the results of the expert analysis of information services for the creation of mind maps, the most suitable software product for use in the given conditions was determined.

The results of the study confirmed the hypothesis that mind maps are an effective means of assimilating the knowledge of future philologists in the process of seminars and contribute to the systematization and generalization of theoretical material.

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