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Mind maps to boost the learning of English as L2 at higher education institutions in Ukraine

Ментальне картографування у стимулюванні вивчення англійської мови як іноземної в закладах вищої освіти України

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
Abstract


Mind mapping is a powerful tool for teaching English as a foreign language, particularly in the context of learning and mastering English as a second language (L2). Visualizing the content contributes to a more effective memorization and error-free reproduction, even after some time. In the Ukrainian pedagogy, the didactic potential of “cognitive graphics” and specific means of its implementation calls for deeper studies and systemic representation as the concept itself is a multi-disciplinary phenomenon on the intersection of neuro-/psycholinguistics, psychology, theory of language communication, cognitivism, and web-design. That is why the aim of this work is to ascertain the essence of mind mapping as powerful means of teaching and learning English, to show its relations with ICT in designing an effective set of academic tasks and stimulating the student’s digital competence. The innovative character benefits


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
Ментальне картографування є потужним інструментом у навчанні англійської мови як іноземної. Проведене дослідження засвідчило, що його застосування як інноваційного методу в ЗВО України на основі інформаційно-комунікаційних технологій підвищує ефективність освітнього процесу. Використання ментального картографування оптимізує зусилля українських студентів у роботі з інформаційними масивами для вивчення англійської мови. Візуалізація контенту сприяє чіткішому його запам’ятовуванню й безпомилковому відтворенню з плином часу. В українській педагогіці дидактичний потенціал “когнітивної графіки” та конкретних засобів її репрезентації вимагає прискіпливого вивчення й системного представлення, а саме поняття є суміжним явищем, перебуваючи на перетині нейро/психолінгвістики, психології, теорії

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the perception, and thus, the interiorization of the course content, increases the academic performance of students and their confidence in their abilities providing internal motivation for further work. As a result, the student's self-assessment receives additional clarity, communication in L2 gets extra motivation, critical analysis skills and soft skills develop better creating a sturdy foundation set of skills for a highly professional graduate from a Ukrainian university.

Keywords: associative scheme, interactive tool, cognitive graphics, mind mapping, Ukrainian higher education institutions (HEI).

Introduction

The post 2000-s higher education sphere in Ukraine has been significantly determined by the impact of digital technologies due to immense volume of the course content as well as increasing requirements to the Ukrainian university graduate (Rakhno & Shramko, 2021) and a future specialist (Kulichenko & Polyezhayev, 2020). In the age of intense information flow, when the amount of data obtained grows exponentially and the core problem is to master it effectively, not everyone is able to manage the proper work with insights and grapple with a problem of the content overload. The issue is particularly acute for students of the Ukrainian higher education institutions, whereas they are the contingent that need as much new information as possible for self-development and self-assessment on the way of becoming a highly qualified specialist, sharpening their skills of critical analysis, deepening the ability to navigate the continually variable world of science correctly and quickly.

The purpose of the given research is to make deep analysis of mind mapping as an innovative method of teaching and learning English as L₂ in Ukrainian tertiary education institutions. It aims to outline its connection to human's ability to

мовної комунікації, когнітивістики та вебдизайну, у межах кожної з цих галузей реалізує спектр відповідних функцій. Саме тому мета роботи – розкрити сутність ментального картографування як потужного засобу викладання / навчання англійської мови, показати його зв'язок з ІКТ для підготовки ефективного комплексу навчальних завдань та стимулювання цифрової компетентності студента. Інноваційність упровадження ментального картографування в навчанні англійської мови в ЗВО України покращує сприймання, а отже, засвоєння контенту курсу, підвищує академічні досягнення студентів, посилює їхню впевненість у власних силах, що слугує внутрішнім тригером подальшої роботи: чіткішим стає самооцінювання здобувача освіти, мотивованішою – комунікація із застосуванням іноземної мови, швидшим – рівень та ступінь формування навичок критичного аналізу, а також м'яких навичок як рис висококваліфікованого випускника ЗВО України.

Ключові слова: асоціативна схема, заклади вищої освіти України, інтерактивний інструмент, когнітивна графіка, ментальне картографування.

visualise the information due to ensure better memorisation.

The described aim involves implementing the following tasks:

- to describe the specific features of mind mapping as a special way of structuring information by the human brain;
- to specify the concept of “cognitive graphics” and types of its implementation for learning tasks;
- to outline how visualization affects perception of learning material;
- to describe the impact of implementing the method of mind mapping in teaching English as a foreign language at the Ukrainian higher education institutions.

Theoretical Framework

Learning English as L₂ within the cognitive theory must be a consciousness-based and reasoned thinking process. Students acquire a whole set of data via L₂, i.e., encode details to be processed and relate it to knowledge in memory, store new data and retrieve it when needed (Schunk, 2012). University students as

information handlers in L_2 face challenges on the problem how to make interlinks between intellectual and emotional concepts in native and foreign languages. Nowadays the innovative methods use several new tools helping to simplify processing the information in the brain. Mind mapping is among the most powerful ones, functioning as a graphical information transfer tool used in the process of thinking presented in a convenient perception form of association schemes. It also might come as a multi-coloured and image-centred radial diagram (Eppler, 2006) that hierarchically represents semantic or other connections between parcels of learned material.

The essence of mind map approach primarily was introduced in the "Use your head" research by T. Buzan (Buzan, 1984) which once made him one of the brilliant students at the University of British Columbia. Those students with whom this scientist optionally studied also gained remarkable results, whereas those who were lagging, noteworthy fostered their academic performance after implementing the cognitive cards approach.

In the digital era mind map is profoundly embedded into the investigation of intelligent agents based on cognitive architectures, serving a pre-requisite to a cognitive systems' toolkit. Such cognitive architectures contribute to understanding the interaction mechanism of cognitive processes, constituting "a special niche in the development of AI systems, endowed with mental capabilities, such as perception, attention, memory, reasoning, learning" (Marques et al., 2022). Therefore, mind map appears to be an effective tool of cognitive graphics underlying, f. i., scientific visualization that "merge information and graphics to produce appealing images of data that boost a person's ability to quickly consume and understand content" (Smiciklas, 2012). Nowadays cognitive graphics presents a new branch of human acquisition, integrating "cognitive science, computer graphics, psychology, graphic design, education, science and many others depending on a sphere of application" (InfoScipedia, 2023). Cognitive visualization within the theory of multimedia learning performs a complex process that includes some mental activities, whereas the process of learning (Mayer, 2002) in turn consists of three subsequent stages. First and foremost, visual images are perceived by the eyes. Secondly, students deal with some aspects of the visual image in working memory. Following the construction of series of mental images, they arrange the set of images into a coherent mental representation called a pictorial

model. The latter involves selection, organization and integration of figures and is commonly referred to as visual-spatial thinking. The mentioned above theory of multimedia learning is related to a constructivist epistemology of learning, under which students diligently develop their own understanding of the world, rather than get such understanding delivered to them. Such an outlook requires students to be active participants in the learning process rather than to merely absorb information entirely presented to them (Mnguni, 2014).

Cognitive visualization as an utterly multi-dimensional function of human consciousness plays a vital role in formation and activation of personal potential in learning subjects. Within a visualization which makes the meaning visible a student has to mobilize resources of figurative and logical complex thinking as well as the aesthetic-cultural artistic feature and other important personality traits and qualities.

Up-to-date visualization objects have become scientific formulas, logic-symbolic models, technical functional and structural schemes as well as a range of didactic tools, allowing to manipulate the properties of objects in the internal and external extents. To create visualization products, the evidence of external prototypes might not be necessary due to the autonomy of internal images related to the object. Reflection of visualization process has its base in abstract imagination which formalize the original image. The cognitive visualization results in an image formed by the conscious thought that defines an unknown object / phenomenon and represents in the external plan of the educational activity. Therefore, the key tasks of cognitive visualization become development of ways and means of purposefully creating thought images within the educational process.

Cognitive visualization has certain properties that significantly affect the degree of activation, increase dynamism of mental systems and educational activities on processing and assimilation of knowledge. The first property of cognitive visualization lies in a quality of knowledge concentration. Being the core of intensification of the educational process, it suggests an increase in the density and saturation of information presented to students. In a diachronic plane, visualization, especially cognitive, has been "an integral part of man's investigation of the world" which significantly contributed "to invention and discovery", while modelling functions as a "flexible, recursive process which is dependent on the individual

practitioner, the practitioner's skill level, and the modelling task" (Crapo et al., 2000). Therefore, they are of the utmost value in the educational process in the tertiary education institutions. We can attribute to enlargement of didactic units of such an educational activity as an integration of specific approaches to learning which is implemented in reliance on an associative mechanism.

The quality of cognitive visualization to knowledge concentration is embodied in compression learning, a technological method of educational activity, a solution to the issue of educational content accelerating increase. It allows lecturers to blend "the most critical learning concepts in each individual course and boost their relevancy and comprehension for the student without losing any of their relevant qualities" (Allard, 2013) by means of teamwork, brainstorming, as well as integration of new courses (f.i., ethnography, anthropology, psychology, sociology) into the educational process.

The essence of compression learning can be exemplified by a brief excerpt that presents a visualization constructed by replacing text data with reference signals, ranging the details via the method of associative information coding. It is highly valuable in mastering L_2 , though tends to be a challenge among students who experienced "confusion, frustration and stress" (Allard, 2013), solved by careful lecturer-student interactions.

The second property of cognitive visualization is generalization of knowledge, performed as reduction of the essential semantic core, revealed in details, which helps to optimize huge amounts of data in a short period of time. Operating basic methods of analysis and synthesis, student can perform content reduction, highlighting the core concepts of the given material, and reveal inner interlinks between the latter as a theoretical image via mental operations. As a result, it deepens students' ability to quickly evaluate the content on the course, promoting rapid task understanding, but, simultaneously, lowering the limits of quantity of exercises performed, therefore "multitasking limits are the price we pay for behavioural flexibility" (Garner & Dux, 2023).

The defragmentation of the given data also derives from analysis and synthesis as an ability of human brain to parcel structures on the logical-semantic as well as on syntactic levels of speech organization, resetting the item in reverse.

Working out the excerpt consequently leads to the possibility to unfold the information, reflected in specific images. It also opens the perspective to a student to interpret content and establish associative links. A special function of human abstract thinking is construction of a semantic research space providing the possibility of experimenting with arbitrary formation of conceptually figurative constructs of the model of an investigated object. At the same time formalization of the results of thinking is displayed in exact concepts and statements, thanks to which information has been provided on the core of the object and its structure / properties. The task of forming a logical idea of the studied concept in the form of a semantically connected system, effectively perceived, and fixed by brain, finds its realization due to a certain design, the table of the structurally logical scheme, radially concentrated graphics.

According to C. Carter and H. Hamilton (Carter & Hamilton, 1995), knowledge generalization refers to "the replacement of specific attribute values found in the data with more general concepts" from concepts hierarchy, defined by the user.

Thus, optical visualization of data marks an ultimately powerful cognitive means, which broadens human abilities. Computer-based representations gained popularity because they provide peculiar computer-human interconnection (Steichen & Fu, 2020). Simulation, a particularly efficient interactive tool, reveals potential of didactic transformation under the study terms, forming changeable settings like reality. It can be defined as "the representation of an object, a natural or social phenomenon by software" (Bellou, 2009), that outlines feedback and therefore motivates students to self-assessment and self-development.

Desire to soften the statistic character of most didactic visualization tools necessitated the study of achievements of neurophysiology. According to the data analysis in the field of world perception by visual organs, the eye, particularly its retina, picks up an object when it is in a moving state or when it is changing. The dynamic phenomena are tracked easily and do not require special explanations. To maintain the statistics and dynamics of the object in consciousness, the nature created a particularly active organic mechanism that made the organ of vision mobile, or rather the specific structure that makes it up.

Due to the associative mechanism, the human psyche works better if the system of visual means of representing external information is supported by the entire range of expressiveness and pictoriality means. In this case information has been enriched and visual channel can translate this increment to the brain adequately and quickly in comparison to the verbal channels. Building a system of visually conceptual aesthetic and emotionally coloured coding will contribute to improving interaction between internal and external plans, as well as supporting and enhancing students' learning activities.

Thus, a mind map is a "powerful graphic technique which provides a universal key to unlocking the potential of the brain" (Buzan & Buzan, 1996). Based on a hierarchy and classification of information, mind map represents the way of thinking. According to the researchers, there are four essential characteristics to be mentioned as follows:

- the subject of attention is visualized in the central image;
- the main themes of the subject radiate from the central image as branches;
- branches comprise a key image or key word printed on an associated line. Less important topics are also represented as branches attached to higher level branches;
- the branches form a connected nodal structure (Buzan & Buzan, 1996).

To understand how mind map works the features of human brain functioning should be analysed. Thinking is associative by its nature. When new information is presented to us, associative neural connections arise. Our brain relates existing knowledge to what we have just received and connects it; brick by brick builds a unique path from the already known to the new knowledge (Buzan, 1986). When a person thinks, they engage the entire branched neural network. We work with information nonlinearly, associatively because of our brain structure. Cognitive maps resemble the brain itself in its structure. Information consists of various chains, associative links.

Some researchers (Genesee, 2000; Jensen, 2008) argue that foreign language learning involves two hemispheres of the brain. The right hemisphere is responsible for imagination, colour, mindset, and holistic perception. The left hemisphere operates with numbers, being engaged in logical tasks, analysis, speech generation. Consequently, when any cognitive maps are created, the information is depicted so

that both hemispheres work, which makes thinking process more efficient. Numbers, verbal information has closely been intertwined with pictures, various colours. Any idea of radiant human thinking can develop almost indefinitely. The process of mind mapping begins with a central idea – a key problem, which, as a rule, has its location in the centre or at the top of the sheet. After brainstorming you become aware which of the discussed categories are key and most directly related to the underlying problem. If the categories seem too abstract, you are recommended to attach an image to them, which will help to make the categories more specific. At the second level, development of the basic idea takes place. There are ramifications and numerous connections. The problem unfolds, presenting its essence. The third, generally the final, level gets its creation precisely after the whole completion of the second one. Here is the widest scope for creativity. For a sufficient specification of ideas, they recommend using additional means of mind mapping: notes, callouts, inter-element pointers (Buzan, 1984).

In fact, the mind mapping changes boring information, intended to be memorized, into a colourful and clearly organized picture, helping to raise "bridge" between new and already known data. Generating a mind map, a set of instructions is to be followed in succession:

- a sheet of paper is put horizontally;
- the basic idea lies in the main question to consider;
- the branches of the diagram become thinner as you move away from the central problem;
- each branch should be signed with a keyword that would help to memorise a whole scheme after a certain period;
- any mind map is focused on the result: solving the core problem (Buzan, 2005).

To create a diagram, one should arm themselves with paper and markers. However, if a classroom is sufficiently computerized, it is more appropriate to use diverse applications (such as MindApp, MindMeister, XMind, Pro3, MindView, SpiderScribe etc.) when structuring thoughts. They allow to share charts with other students in a group, to add new items and move them with the help of a single mouse click on the computer. If written correctly, mind map becomes one of the most powerful tools a lecturer uses to achieve creative success. Some of modern infographic designers propose a new advanced idea of computer mind mapping – organic mind mapping and give some valuable pieces of advice as for making the mind map on

the computer screen. The operation of mind mapping generation involves seven steps.

Step 1. Start your mind map with an eye-catching core idea image. Using specific image will stimulate different associations and make it more memorable.

Step 2. The branches of your mind map are to be curvilinear and organic. They will draw the students' attention faster compared to traditional branches because organic lines reflect our natural process of thinking.

Step 3. Modify your colour scheme to suit your ideas and tasks. Try to combine colour, style and mode of your mind map in a successful integration so that you can find any branch without difficulties. Don't forget that your creativity should not interfere with clarity of content, but rather should enhance understanding of the subject.

Step 4. Your mind map will gain more brightness and clarity if you add felicitous images to it. Images aid your cortical skills, automatically boosting your memory and creative thinking power whilst helping you represent key themes and spark ideas.

Step 5. Scientists insist on using only one pivotal idea per branch and avoiding long phrases or sentences for it will work as a "little supernova" of ideas. Such an approach stimulates the appearance of new thoughts so that the stream of creative thinking will be almost unlimited.

Step 6. The technical facet of the issue. A developer of the mind map can vote for the most valuable and successful ideas by hitting the thumbs on the icon. If you share your key ideas with others, they can easily assist you in highlighting the brightest of them and eluding those ones which are too much of a good thing.

Step 7. The most progressive step in a set. An idea remains an idea until actioned. So, you should provide an appropriate task or some assignments within each branch. Students will be able to show the level of their understanding in practice.

Appropriate usage of the specialized applications in the educational process, f.i., at higher education institutions, "takes your mind map to the next level by turning your idea directly into actionable tasks that you can track and manage from start to finish, from collaborating with your team on ideas to grouping related ideas into categories. It boosts memory, improves

productivity and expands creativity" (AYOA, 2023a).

Another valuable point of this educational method implementation is forming a deeply profound "bank of ideas" via a specialised digital tool, particularly, one can use Organic Mind Map. It accumulates the creator's "stray thoughts" and doubtful ideas and allows sharing them with other participants / colleagues as well as transferring any of them into an active mind map to the branch which seems highly applicable to the moment. Scientists suggest systematizing mind map by creating categories around each branch via singling out the key spheres of the map, defining the analogies and interconnections between crucial themes and thoughts.

"Inspired by the hand-drawn Mind Map, Organic Mind Maps <...> use curvilinear branches to support your natural thinking processes. A natural way of organising information, Organic Mind Mapping allows you to capture and expand on your ideas – for infinite and unrestricted creative thinking" (AYOA, 2023b), thus stimulating one of the essential skills of up-to-date university graduates.

It is also a strong recommendation to add some files, comprising interesting documents on the discussed topic and audio links. The step will brighten the mind map, make it deeper and memorable for every student. Supplementing different notes and detailed comments to each branch serves a useful technique whereas it helps to understand the key questions and their discussion clearly. It results in feedback from the lecturer and sharing the ideas between him and students. Using autohide is not less important and convenient. The function helps students to concentrate their mind on points by hiding away other parts of the mind map which are of minor importance at the moment. Its significant value appears in case if it concerns large complicated mind maps, thus providing an opportunity to focus on the branches needed.

Mind map developer can also apply mind map links to show ideas to other students and lecturers. It is also possible to connect branches from various mind maps which makes the creating easier and much faster. The mentioned above platform of organic mind mapping has the "show creators' function" which demonstrates whose ideas are shown or the branch of the mind map by displaying their avatar. Such a function tends to be helpful if you are eager to expand ideas. You can also export your mind map as a whole product or some separate group of specific

branches to a PDF image. Students are supposed to print it and send to co-workers, lecturers or just friends: “You can share your mind maps with anyone and everyone. Simply invite an email address to your mind map and they will receive an email invitation. Depending on the permissions you’ve granted them, they’ll be able to view, edit, comment, and add branches to your mind map. You can also export your mind map as an image to share with others” (AYOA, 2023b).

Purpose of the Study

The current research was conducted to identify the effect and frequency of mind mapping in university students who learn English as L₂. Assessing the students’ views on the factors of creativity and the process of thinking, clear answers have been provided to the following questions: 1) How did the use of mind maps affect the attitude of the students towards English classes? 2) Does mind mapping stimulate creative thinking and activity of the students?

The following hypotheses were tested:

- the usage of mind maps has positive influence on the students’ interest in English as a subject;
- students believe that they become really active and motivated due to mind mapping;
- using mind maps makes students’ minds creative and bright.

Table 1.
Characteristics of participants

Groups	Control group	Experimental group
Total	20	20
Females / Males	10/10	9/11
Average age	17	17
Experience of learning English as L ₂	11 years 5 month	11 years 5 month

Source: (Own authorship, 2023).

Research Instruments and Procedures

The research took place between September 2022 – January 2023 involving experimental and control groups, based on two groups of two separate departments at the same University. Both groups learnt the same material and did the same assignments. The lecturer asked

Methodology

Research Design

Determining the effect of mind mapping for learning English as L₂ by University students was conducted in the framework of the experimental research design. In the acquisition one group of students was chosen as an experimental group and in the process of learning English as L₂ they were proposed to use mind maps. The other group of students was chosen as a control group to compare the results with the experimental group.

Participants

The participants of the study consisted of the first-year students of two departments of Sumy State Pedagogical University named after A. S. Makarenko: Foreign Languages Department and Biology Department. The study was performed during the autumn semester of the 2022–2023 academic year. A total of 40 students participated in research. Random sampling was applied to identify the experiment and control groups. The control group consisted of 20 students (10 females and 10 males). There were 20 students in the experimental group as well (9 females and 11 males). The average age of the students was 17 in both groups (experimental and control ones). All students had English seminars twice a week.

Table 1 shows that students in the control and experimental groups had been studying the English language for the same period (11 years at institutions of comprehensive secondary education and 5 months at the University).

students of both groups to fulfil anonymous questionnaires before and after the research. The anonymous questionnaires integrated all the aspects of the study. The preliminary test had its focus on collecting general information about each student (age, gender, years of learning English, studying favourite subjects). The research was carried out with a five-level Likert

scale questionnaire with 30 statements; answers were used to control the students' interest towards mind mapping and the predictable results of using it during English classes.

Further investigation took place in January 2023 and revealed students' grades of the first semester and their own considerations concerning degree of their creativity and motivation level. The January research was carried out with the help of a six-level Likert questionnaire.

Data Analysis

For analysing the effects of mind mapping on the students' motivation and creativity, three sets of variables from the questionnaire were considered. Data analysis was done with the help of IBM SPSS v 20 software.

Sets of variables used in the research were those:

- analysing “positive influence” data, based on the categorization methodology of Szeto (Szeto & Hung, 2009);
- activity and motivation question unit;
- creativity question unit.

Data reduction methodology was used on variables of activity and motivation question unit as well as the creativity question unit. The maximum likelihood algorithm was employed to separate 3 factors with 10 variables altogether, which made possible to keep 59.17 % of their original information. The factors were assessed according to a 5-level scale where 5 was an absolute agreement with the following statement.

1. I've become more interested in English after using mind mapping.
 - I feel the need to study English deeper after using mind mapping;
 - English is one of the most interesting subjects for me due to mind mapping;

- Mind mapping stimulates communicative activity at English seminars;
 - Mind mapping adds to my creativity at the English language seminars.
2. The facilitating effect of mind mapping (those students who think that mind mapping facilitates learning English as L₂ will score high for this factor, close to 5). This very factor consists of the following attitude statements:
 - When I study English, I often use mind mapping to revise the material;
 - Using mind maps helps me to make the process of a new topic learning easier.
 3. The debilitating effect of mind mapping (students who consider mind mapping to be a waste of time will score high for this factor, close to 5). The following factor consists of such attitude statements:
 - I would like to use mind maps as little as possible;
 - Mind mapping is a very time-consuming process for me because I need to spend too much time creating mind maps.

Results

Examining answers on the first question (“How did the use of mind maps affect the attitude of the group towards the English language?”) the difference between students' responses provided for the preliminary test (the end of September 2022) and the post-test (the beginning of January 2023) questionnaires in both groups was analysed, after using data reduction method with the help of questions devoted to students' attitudes towards the English language.

The results of the conducted survey showed that in both groups almost more than one tenth of the students chose the English language as favourite subject (13 % – 11 %) (Figure 1).

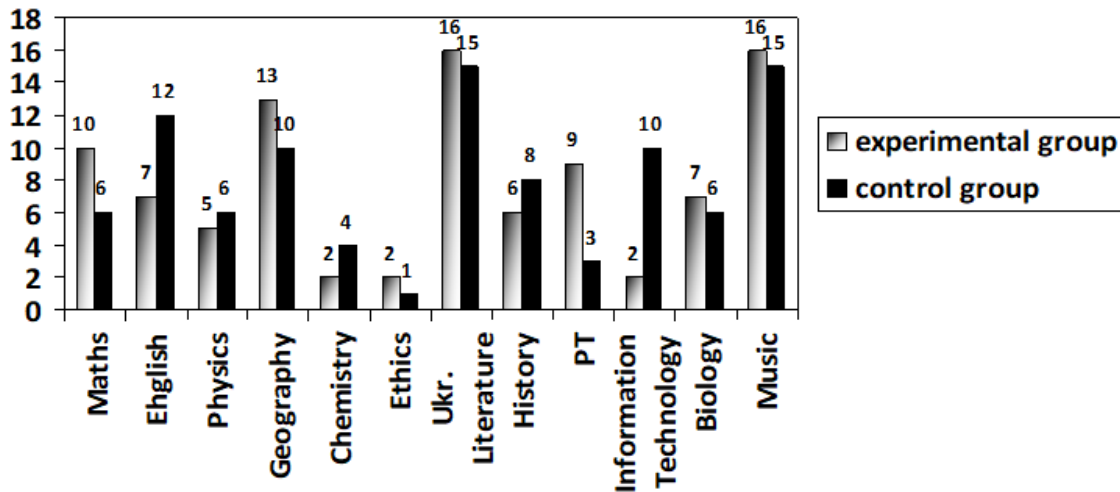


Figure 1. The most favourite subjects for the students (two groups: experimental and control ones)
Source: (Own authorship, 2023).

Thus, the difference between the September and December data is much more significant in the experimental group. Nevertheless, after using

mind mapping, students' attitude towards the necessity of the English language as a subject became much more positive (Figure 2).

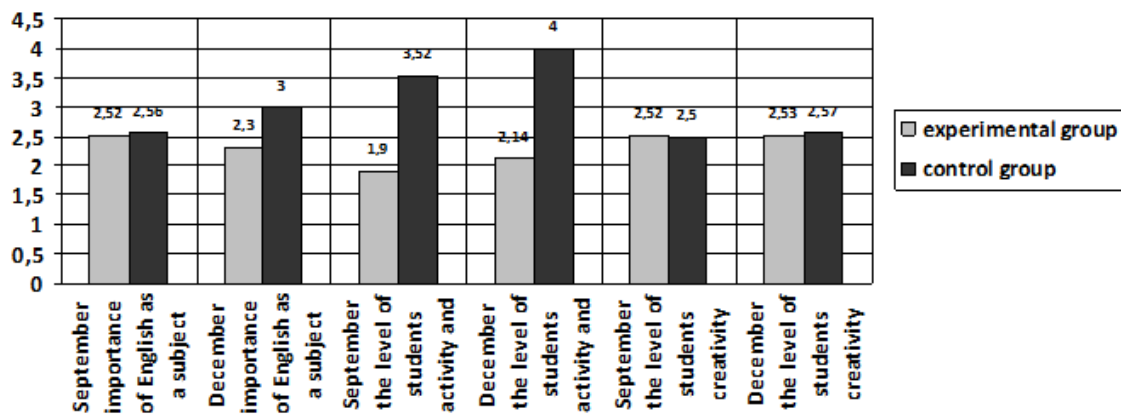


Figure 2. Average factor values in September and December in two groups (experimental and control)
Source: (Own authorship, 2023).

The second factor was focused on students' activity and motivation. If to follow changes in the averages of the experimental and control groups, it could be seen that there is a positive shift in the first and the second groups.

The third factor summarizes the level of students' creativity. There is a minimum decrease in the experimental group. It means that a small number of students considered during post-test than during pre-test on the point that mind mapping has no effect on their creativity. But in the control group the increase compared to the first value could be traced.

M. Gómez and G. King consider that "students have different learning styles and different

proficiency levels. Thus, students need a logical sequence of learning in the classroom. In other words, the instruction needs to follow steps to have a sense of coherence and flow" (Gómez & King, 2014). The authors continue the discussion pointing out that the diversity of learning styles is not solely determined by students' intelligence; rather, it hinges on the extent to which the educational environment accommodates and nurtures those specific learning styles, ultimately fostering a comprehensive understanding of the material (Gómez & King, 2014).

We have analyzed students' learning styles (visual, kinaesthetic, auditory, and mixed) in relation to three factors – facilitating factors for

mind mapping, debilitating factors for mind mapping, and the significance of the English language. This comparison aims to unveil the

correlations among these items, as illustrated in Table 2.

Table 2.

The connection between factors according to the students' learning styles

Students' style of learning	Number of students	Mind Map facilitating factor	Mind Map debilitating factor	Importance of the English language
Visual	20	3.80	1.72	2.85
Kinaesthetic	2	2.57	1.94	2.70
Auditory	4	2.55	2.77	2.45
Mixed	14	2.50	1.83	2.55
Total	40	2.58	2.07	2.57

Source: (Own authorship, 2023).

Discussion

The key purpose of our research was to reveal and to make a comparison of the mind mapping effects on the students' motivation and creativity between two groups of students with the same curriculum. After four months' period of mind mapping application in the process of learning English as L₂ in the experimental group, the post-data analysis exposed that a significant number of students consider the English language more interesting and useful subject than they used to think before the experiment.

The first hypothesis was proved by the data. It affirms that the use of mind maps has a positive influence on the students' interest in the English language. According to the given research we can also observe that the level of students' activity and motivation increased in both experimental and control groups if to compare September and December results of the experiment (3.52 in the control group / 1.90–2.14 in the experimental group).

Concerning the third hypothesis we can't but admit that at the end of the experimental period the experimental group showed a lower debilitating effect compared to the control one (2.55–2.54 for the experimental group / 2.50–2.57 for the control one). The debilitating effect was not very significant, nevertheless. We see much more evident positive shift in the control group. This can prove the third hypothesis connected with the creativity factor.

Considering the joint analysis of three factors suggested in the research we can confirm that using mind maps positively deals with the following aspects:

- *the attitude of the students towards English seminars.* Interactivity and visualization

with mind maps make the educational process more engaging and help students dive more actively into the material. An increase in interest leads to a more positive attitude towards the mentioned seminars;

- *creative thinking.* Mind maps help to stimulate students' creative thinking. The process of creating mind maps requires them to have an analytical and creative approach to solving problems. This develops their creative abilities and helps them turn abstract language concepts into certain interesting illustrations;
- *activity of the student.* Mind maps activate the participation of students in the educational process. As an active learning tool, mind mapping allows students to participate in creating their own learning experiences. This promotes greater personal responsibility for learning and makes classes more interactive.

Furthermore, it is important to delve into the implications of the findings for educational practices, specifically exploring how the integration of mind maps can contribute to the improvement of English learning in a classroom. Several essential points should be mentioned:

- *vocabulary.* Creating mind maps for different categories of words and adding related words and synonyms to each branch helps organize and expand vocabulary;
- *grammar rules and structures.* Mind maps can have several branches with different grammar concepts as well as with sub-branches containing examples and explanations;
- *writing.* Mind maps can show how to structure thoughts before starting to write a text;

- *communication*. Mind maps can represent different aspects of the speech, which will help students systematize and express their ideas clearly;
- *cooperation*. Students can work together to create mind maps. It promotes teamwork and sharing of ideas;
- *exam preparation*. Mind maps can serve as an effective tool for preparing and revising important material.

Conclusions

Thus, our research proved mind mapping progressive enough to motivate students in learning the English language, to make them more active and interested at seminars and to promote their creativity in general. Four months of mind mapping contributed to the importance of the English language learning factor and the factors of students' creativity.

Taking into account the data analysis and the discussion the conclusions can be as follows:

- a) mind mapping should be used more frequently at seminars to meet the demands of the students in more creative and interesting lessons;
- b) mind mapping usage stimulates students' activity while learning English as L₂;
- c) mind mapping makes the process of learning easier and clearer, thus promoting the positive academic results of all the students.

The general outcome of the activity under the thorough examination is the growth of students' accurate self-assessment of their skills and abilities. As a result, they show progress in self-development. Further investigation in this area is welcomed to provide larger and more deep research of statistical significance.

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