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Digital mind maps (DMM) in developing students' critical thinking within the course of Business Communication

In the era of information technology development, various interactive computer programmes and electronic resources in educational settings are of particular relevance for effective teacher-student interaction. This paper discusses didactic potential of using Digital Mind Mapping (DMM) technology in the context of developing Masters students' critical thinking within business communication classes. In this context, mind mapping is an innovative strategy to facilitate recognition and memorization of important information by students, as well as to ensure the depth of their understanding by making connections between pieces of information and to develop critical thinking of students. The study gives an overview of services for creating DMM, a comparative analysis of their functional characteristics, and also offers a model for using DMM consisting of several stages, using the "Business communication" course in a foreign language for Masters students as an example. The authors concludes that the use of DMM in the educational process stimulates the development of creative abilities and critical thinking of students; develops general cultural competencies of students in group work; promotes the development of argumentation skills; justification of their point of view and possession of clear oral and written speech; forms the ability to work in a team, and promotes the development of cooperation skills; makes it possible to master the training material in an accelerated form; promotes the development of various types of memory.

Keywords: mind maps, digital mind mapping, critical thinking, business communication, distance learning, business culture, visual aids, problem-based learning.

Introduction

Today, in the age of fast technology innovation, didactic principles of using various interactive computer programmes and electronic resources in the educational context are of particular relevance for effective interaction between students and teachers. Electronic educational resources, modern educational methods and technologies have recently been actively used in teaching various disciplines in higher education, contributing to the development of soft skills, as well as the formation of students' critical and creative thinking.

This article discusses the didactic possibilities of using Digital Mind Mapping (DMM) technology in developing critical thinking among students on the example of Business communication course which is an elective professional discipline conducted in a foreign language for Masters students. Within the framework of this discipline, Master students must quickly and effectively assimilate and integrate voluminous professional information in English, developing the critical thinking skills necessary to perform competent professional, analytical, and research work as part of their master's projects. In this context, the mind map acts as an innovative strategy used to facilitate the recognition and memorization of important information by students, as well as to ensure the depth of their understanding by establishing links between pieces of information and developing critical thinking among students [1].

In order to provide a better understanding of using mind maps in developing critical thinking among students, the study first reviews the definition of critical thinking itself in different research perspectives. Second, it explains the didactic potential of using various active teaching methods in developing critical thinking in educational settings in combination with digital mind maps, followed an explanation of the research methodology of this study and a presentation of the findings and some relevant discussion. The article concludes with a critical examination of the limitations of the study and some pointers for future research.

Background

As noted by experts, the main skills that a modern professional in the 21st century should master are critical thinking, communication skills, cooperation skills, creative, life and career skills [2]. Higher education institutions strive to prepare graduates to become full-fledged members of society, with excellent academic

and professional abilities through the development of critical thinking skills and problem-solving abilities. Students at all levels of training develop critical thinking while absorbing learning material, analyzing data and solving problems [3]. At the same time, as research in recent years has shown, the issues of developing students' critical thinking in the digital environment and modern university settings require additional study and solution [4].

Researchers define critical thinking as an ability to identify and evaluate arguments by applying logical principles [5]. Critical thinking also involves the process of looking at subjects, content and problems by analyzing, evaluating and reconstructing ideas to make logical connections [6].

According to scholars and practitioners, the development of critical thinking should be central to the educational process because it contributes to knowledge formation and overall academic performance [7], enables learners to adapt more easily to an ever-changing era [8], and generally succeed in their studies, careers and society [9].

Numerous studies have also looked at the very definition of critical thinking. Some scholars approach the term from a more philosophical perspective [10], while others try to explain the term in psychological terms [5, 11]. The philosophical definition of critical thinking emphasizes the ability to challenge assumptions, evaluate arguments and information and reach valid conclusions [12]. On the other hand, from a psychological perspective, critical thinking refers to a wide range of thinking, including problem solving, decision making, hypothesis testing, etc. [13], including contextual tasks and problems [14]. In this regard, critical thinking is classified as higher-order thinking, consisting of six main indicators, i.e., interpretation, analysis, evaluation, inference, clarity and self-regulation [5]. Critical thinking is the process of providing a simple explanation, determining the basis for a decision, drawing a conclusion, clarifying an answer, creating an assumption and integration, and organizing strategies and tactics [15].

Given the central role of critical thinking in learning and the need to find new solutions to improve critical thinking in students, scholars have identified one of the most appropriate teaching methods, namely the introduction of active learning strategies in the classroom [16]. Active learning strategies are a series of activities that involve students in searching and collecting evidence, and involve the application of knowledge to strengthen the argument [17], which includes problem-based learning.

Several studies have shown the effectiveness of problem-based learning in combination with mind maps, which significantly improve student performance [18]. As mind maps provide a simple overview of complex information, learners can understand the relationship between concepts [19]. Mind maps can help learners to learn better, but they can also develop higher-order thinking in learners [3].

Mind maps can also be created digitally [20]. This type of mind map is widely known as Digital Mind Maps (DMM). DMM is a technological application that allows the learner to explore, critically evaluate and visually represent ideas [21]. It also offers more than just training in a particular discipline. Instead, this technology provides learners with effective and dynamic learning to develop and organize their ideas using higher-order thinking skills. This technological information tool provides unrestricted access to any knowledge so that students of all backgrounds can apply their ideas and new knowledge [22].

According to the founder of the mind map method, psychologist Tony Buzan, who studied the human brain, both hemispheres of the brain must be involved for effective learning because they are responsible for different functions. On this basis, T. Buzan developed the mind map technology, which activates both hemispheres at the same time, resulting in a synergistic effect and enhancing the thinking process and cognitive functions of the brain by structuring and analyzing information in the form of visualization and the use of different images [21].

Experimental

This study gives an overview of digital mind mapping services and a comparative analysis of their characteristics. There are currently various computer software products-services for creating electronic mind maps, working online or offline (desktop), as well as mobile mode.

In general, DMM software has the following functionalities needed to create optimally structured mind maps with learning material:

- 1) displaying links with lines of different thickness and appearance;
- 2) using hyperlinks to other sources with keywords and associations;
- 3) adding graphical objects; adding notes, comments, lists;
- 4) prioritizing tasks, adding comments to blocks and other functions [23].

These functionalities increase the efficiency of DMM visualization and student motivation.

Below there is an overview of DMM services and a comparative analysis of their characteristics presented in Table:

Table .

Comparative analysis of online and desktop DMM services

No	Name	Mode	OS	Website	Presentation
1	MindMeister	Online Desktop	any	https://www.mindmeister.com	yes
2	MindMup	Online	any	https://www.mindmup.com	yes
3	Mind42	online	any	https://mind42.com	no
4	XMind	Online Desktop	Linux, iOS, Windows, Mac	https://www.xmind.net	yes
5	MindJet Mindmanager	Desktop	iOS, Android, Windows, Mac	https://www.mindmanager.com/en/	yes
6	Bubbl.us	online	any	https://bubbl.us	yes
7	Comapping	Online Desktop	Windows, Mac, Linux	https://www.comapping.com	yes
8	MindGenius	Desktop	Windows, iOS	https://www.mindgenius.com	yes
9	Wisemapping	Online	any	https://www.wisemapping.com	yes
10	Mapul	Online	any	https://www.mapul.com	yes
11	Mindomo	Online Desktop	Linux, Windows, Mac	https://www.mindomo.com/ru/	yes
12	Coggle	Online	any	https://coggle.it/?lang=ru	yes
13	SimpleMind	Desktop	Windows, Mac, iOS, Android	https://simplemind.eu	no

The analysis of the presented computer services shows that there is a sufficiently large choice of software for creating electronic mind maps. The online services MindMeister and XMind were used for this analysis. The following criteria justified the choice of these software products: 1) availability of a free tariff; 2) work online; 3) possibility to work with cloud storages; 4) availability of a mobile application; 5) possibility to export mind-maps in various formats, including pdf format. In addition, MindMeister has the possibility of collaborative work with colleagues with the right to edit.

The work with mind maps can be carried out in several stages and goes on throughout the learning cycle of a given topic or subtopic. As noted by experts, certain conditions need to be followed in order to create a mind map. First of all, the mind map should start with the main concept and mark it in the centre of the sheet. Next, it is recommended to identify the most important general ideas related to the main topic and arrange them around the main concept. In doing so, each subsequent idea is further developed. Visual tools such as arrows and/or dotted lines are used to link concepts to each other [23]. The resulting diagrams can then be used by the students as a discussion support during discussions, roundtables etc.

Results and Discussion

Let us consider the use of Mind mapping technology by 1st year master students of the Economics in the course of Business Communication conducted in a foreign language while preparing an oral report in the form of a presentation on the topic "Communicating in a World of Diversity". As a credit assignment, Master students must make a presentation on the characteristics of one of the business cultures and on business etiquette in different countries of their choice. As practice shows, it is sometimes difficult for students to structure their statements correctly, to highlight the most important aspects of the message.

Traditionally, an ordinary sheet of paper and coloured pencils or markers can be used to create mind maps. However, Master students easily build such mind maps in the XMind computer programme (Fig. 1).



Figure 1: Example of an intelligence map in XMind (<https://xmind.works>)

Work with mind maps can be structured in several stages (Fig. 2). The first stage, as a rule, is the orientation and motivation stage where general introduction to the learning material and immersion into the problem take place, the goal and objectives are formulated, background knowledge is activated and personal experience is actualized [24]. The following instructions can serve as an example of a group task:

Imagine that you work for one of the branches of an international company that has several branches around the world (of your choice). And you were asked to prepare an advertising presentation about the peculiarities of doing business in your country and make it to business partners. What topics and issues would you cover in this presentation? What would a plan for preparing such a presentation look like? Let's try to use the X Mind program for compiling mind maps to prepare such a presentation. To do this, you need to study the proposed text materials, update your personal experience, and obtain the necessary information from your partners and colleagues.

In the second stage, the work on the mind map starts, where Master students highlight the main problem and define the central concept of the mind map. As a rule, students mark the following key concepts: business culture; business etiquette, cultural norms; cultural competency; cultural context; cultural pluralism; stereotyping. In our case it is the concept Business culture, which is the central block of the mind map, from which all subsequent branches at other levels are derived on the basis of the Master students' own background knowledge, experience and associations. In the third stage, there is a need to refer to additional information resources.

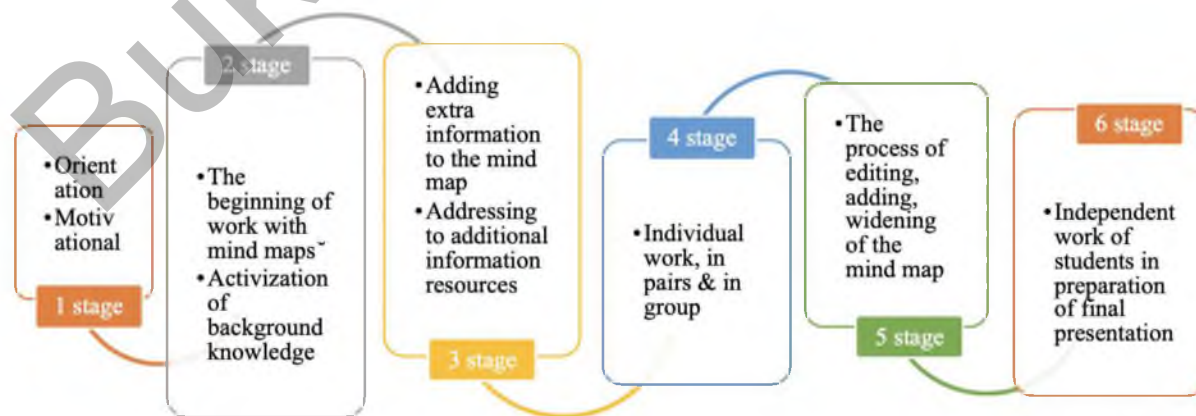


Figure 2: Steps in working with DMM

The group can then work with one of the texts to obtain more information on the topic of the lesson, according to the sample instructions below:

Read the text below. What are the main semantic blocks in this text? Find and write down information on each semantic block in the form of keywords and expressions. Each semantic block that you select becomes a branch on the mind map.

In the following stages, individual and paired-group work with the text material takes place. Masters students are provided with various work topics and search, identify and record new information on the highlighted blocks. The task for this stage can be formulated as follows:

Read the 4th paragraph of the text. Present the information in the form of keywords and phrases on the semantic block "Business culture". Use these lexical tools to make simple sentences and further discussion. Prepare a short report on this block, answer the questions of group mates.

At the fifth stage, master students edit, supplement and, if necessary, extend the mind maps, detailing some blocks and concepts [25]. It is worth noting that in preparation for the presentation at this stage, students can also attach additional files and resources, such as audio and video files, icons and images, texts, a list of keywords with the help of a computer programme for the construction of mind maps.

The sixth and final stage is an independent students' work to prepare a presentation on the business culture and business etiquette of the chosen country. A detailed mind-map serves as an informational basis for the presentation, replacing the traditional Power Point slides, from which some Master students sometimes only read the text without prior analysis and reflection.

Conclusions

Due to the large volume of information and the difficulties faced by undergraduate and graduate students when trying to navigate and properly structure the learning material, it is necessary to create appropriate conditions for the formation of critical thinking skills and abilities that would allow students to penetrate the content, find certain information, critically reflect and discuss it with a partner. Such an effective information base could be electronic mind-maps that learners develop together with the teacher using modern information technologies and special computer programmes for a number of reasons, since DMM:

- contribute to the formation of creative abilities and critical thinking of students, which is beneficial for the development of communicative and cognitive interest.
- contribute to the development of such general cultural competences in group work, which are the ability to argue, justify one's point of view and to speak clearly orally and in writing.
- develop the ability to work in teams and groups and contribute to the development of collaborative skills.
- allow learning to be accelerated.
- promote the development of different types of memory.
- enable the use of digital forms in distance learning.

Thus, the use of Digital Mind Mapping in the educational process has a positive impact on material learning, as students develop the ability to competently analyze, select, structure and remember important information material in a foreign language to prepare an oral report and presentation. It has been noted that mind maps promote critical thinking, memory and attention, and make learning more interactive, engaging and fruitful. Particularly, the use of mind maps in report writing, presentations, essay writing, project work and other creative processes is effective. The developed mind map can be used as a presentation plan that has been developed on the basis of brainstorming, group discussion, planning and problem solving.

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References

- 1 Edwards S. Mind mapping as a teaching resource / S. Edwards, N. Cooper // *The clinical teacher*. — 2010. — Vol. 7, No 4. — P. 236-239.
- 2 Fong C.J. A meta-analysis on critical thinking and community college student achievement / C.J. Fong, Y. Kim, C.W. Davis, T. Hoang, & Y.W. Kim // *Thinking Skills and Creativity*. — 2017. — Vol. 26. — P. 71-83.

- 3 Zubaidah S. Revealing the Relationship between Reading Interest and Critical Thinking Skills through Remap GI and Remap Jigsaw / S. Zubaidah, A.D. Corebima, & S. Mahanal // *International Journal of Instruction*. — 2018. — Vol. 11, No 2. — P. 41-56.
- 4 Quitadamo I. Community-based inquiry improves critical thinking in general education biology / I. Quitadamo, C.L. Faiola, J.E. Johnson, & M.J. Kurtz, I.J. Quitadamo // *CBE—Life Sciences Education*. — 2008. — Vol. 7, No 3. — P. 327-337.
- 5 Browne M.N. Asking the right questions: A guide to critical thinking. / M.N. Browne, S.M. Keeley // Pearson Education, 2007.
- 6 Arsal Z. The impact of inquiry-based learning on the critical thinking dispositions of pre-service science teachers / Z. Arsal // *International Journal of Science Education*. — 2017. — Vol. 39, No 10. — P. 1326-1338.
- 7 Aksu G. Determination the Effects of Vocational High School Students' Logical and Critical Thinking Skills on Mathematics Success / G. Aksu, N. Koruklu // *Eurasian Journal of Educational Research*. — 2015. — Vol. 59. — P. 181-206.
- 8 Dwyer C.P. To teach or not to teach critical thinking: A reply to Huber and Kuncel. / C.P. Dwyer, J.D. Eigenauer // *Thinking Skills and Creativity*. — 2017. — Vol. 26. — P. 92-95.
- 9 Gojkov G. Critical thinking of students—indicator of quality in higher education / G. Gojkov, A. Stojanović, A.G. Rajić // *Procedia-Social and Behavioral Sciences*. — 2015. — Vol. 191. — P. 591-596.
- 10 Bailin S. et al. Conceptualizing critical thinking / S. Bailin // *Journal of curriculum studies*. — 1999. — Vol. 31, No 3. — P. 285-302.
- 11 Ennis R.H. The nature of critical thinking: An outline of critical thinking dispositions and abilities / R.H. Ennis // *University of Illinois*. — 2011. — Vol. 2, No 4. — P. 1-8.
- 12 Kim K. et al. Effects of active learning on enhancing student critical thinking in an undergraduate general science course / K. Kim // *Innovative Higher Education*. — 2013. — Vol. 38, No 3. — P. 223-235.
- 13 Vong S.A. Instructional model development to enhance critical thinking and critical thinking teaching ability of trainee students at regional teaching training center in Takeo province, Cambodia / S.A. Vong, W. Kaewurai // *Kasetsart Journal of Social Sciences*. — 2017. — Vol. 38, No 1. — P. 88-95.
- 14 Carriger M.S. Problem-based learning and management development—Empirical and theoretical considerations / M.S. Carriger // *The International Journal of Management Education*. — 2015. — Vol. 13, No 3. — P. 249-259.
- 15 El-Shaer A. Impact of Problem-Based Learning on Students Critical Thinking Dispositions / A. El-Shaer, H. Gaber // *Knowledge Acquisition and Retention. Journal of education and practice*. — 2014. — Vol. 5, No 14. — P. 74-85.
- 16 Hariyadi S. Contribution of mind mapping, summarizing, and questioning in the RQA learning model to genetic learning outcomes / S. Hariyadi, A.D. Corebima, S. Zubaidah // *Journal of Turkish Science Education*. — 2018. — Vol. 15, No 1. — P. 80-88.
- 17 Cuthell J. Multimodal Concept Mapping in teaching and learning: a MirandaNet Fellowship project / J. Cuthell, C. Preston // *Society for Information Technology & Teacher Education International Conference*. — Association for the Advancement of Computing in Education (AACE), 2008. — P. 1999-2007.
- 18 Laampere M. Integrating a concept mapping tool into a virtual learning environment: Pedagogical and technological challenges / M. Laampere, E. Matsak, J. Kippar // *Concept maps: Theory, methodology, technology: Proceedings of the Second International Conference on Concept Mapping*. — 2006. — Vol. 1. — P. 280-287.
- 19 Faste H. The untapped promise of digital mind maps / H. Faste, H. Lin // *Proceedings of the SIGCHI conference on human factors in computing systems*. — 2012. — P. 1017-1026.
- 20 Qi A. A study of the effect of implementing intellectual property education with digital teaching on learning motivation and achievements / A. Qi // *Eurasia Journal of Mathematics, Science and Technology Education*. — 2018. — Vol. 14, No 6. — P. 2445-2452.
- 21 Buzan T. *Mind map mastery: The complete guide to learning and using the most powerful thinking tool in the universe* / T. Buzan. — Watkins Media Limited, 2018.
- 22 Hidayati N. The PBL vs. Digital Mind Maps Integrated PBL: Choosing Between the two with a view to Enhance Learners' Critical Thinking / N. Hidayati, S. Zubaidah, S. Annah // *Participatory Educational Research*. — 2021. — Vol. 9, No 3. — P. 330-343.
- 23 Митрюхина И.Н. Технология *Mind-Mapping* как информационная основа при обучении монологическому иноязычному говорению в условиях цифровой среды / И.Н. Митрюхина // *Вестн. Перм. нац. исслед. политехн. ун-та. Проблемы языкознания и педагогики*. — 2021. — Т. 2. — С. 150–162.
- 24 Mohaidat M.M.T. The Impact of Electronic Mind Maps on Students' Reading Comprehension / M.M.T. Mohaidat // *English Language Teaching*. — 2018. — Vol. 11, No 4. — P. 32-42.
- 25 Астахова Л.Г. Интеллект-карты как средство формирования профессиональных знаний студентов / Л.Г. Астахова // *Науч. журн. Калуж. гос. ун-та им. К.Э. Циолковского*. — 2021. — № 4 (53) — С. 68–73.

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Digital Mind Maps іскерлік коммуникация курсында студенттердің сыни тұрғыдан ойлауын дамыту

Ақпараттық технологиялардың даму дәуірінде оқытушы мен студенттердің тиімді өзара әрекеттесуі үшін білім беру процесінде әртүрлі интерактивті компьютерлік бағдарламалар мен электрондық ресурстар мәселелері ерекше өзекті болып отыр. Мақалада жоғары оқу орындарының цифрлық ортасы жағдайында іскерлік коммуникация сабақтарында білім алушылардың сыни ойлауын қалыптастыру контекстінде *Digital Mind Mapping* технологиясын пайдаланудың дидактикалық мүмкіндіктері қарастырылған. Бұл тұрғыда интеллект-карта студенттердің маңызды ақпаратты тану және есте сақтауын жеңілдету, сонымен қатар ақпарат бөліктері арасында байланыс орнату және оқушылардың сыни ойлауын дамыту арқылы олардың түсіну тереңдігін қамтамасыз ету үшін қолданылатын инновациялық стратегия ретінде әрекет етеді. Авторлар электрондық интеллект-карталарды жасау бойынша сервистерге шолу, олардың функционалдық сипаттамаларына салыстырмалы талдау жасаған, сондай-ақ магистратураның білім алушылары үшін шет тіліндегі «Business communication» пәнінің мысалында бірнеше кезеңнен тұратын электрондық интеллект-карталарды пайдалану моделін ұсынған. Сонымен қатар, білім беру процесінде электрондық интеллект-карталарды пайдалану білім алушылардың шығармашылық қабілеттері мен сыни ойлауының дамуын ынталандырады, топта жұмыс істеу процесінде студенттердің жалпы мәдени құзыреттіліктерін дамытады; дәлелдеу дағдыларын дамытуға, өз көзқарасын негіздеуге және нақты ауызша және жазбаша сөйлеуді меңгеруге ықпал етеді; командада жұмыс істеу қабілетін қалыптастырады, ынтымақтастық дағдыларды дамытуға көмектеседі деген қорытындыға келді; оқу материалын жеделдетілген түрде игеруге мүмкіндік береді, есте сақтаудың әртүрлі түрлерінің дамуын қолдайды.

Кілт сөздер: интеллект-картасы, электронды интеллект-картасы, сыни тұрғыдан ойлау, іскерлік коммуникация, қашықтықтан оқыту, іскерлік мәдениет, көрнекі құралдар, проблемалық оқыту.

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Digital Mind Maps в развитии критического мышления студентов в рамках курса деловой коммуникации

В эпоху развития информационных технологий для эффективного взаимодействия преподавателя и студентов особую актуальность приобретают вопросы различных интерактивных компьютерных программ и электронных ресурсов в образовательном процессе. В настоящей статье рассмотрены дидактические возможности использования технологии *Digital Mind Mapping* в контексте формирования критического мышления у обучающихся на занятиях по деловой коммуникации в условиях цифровой среды высшей школы. В этом контексте интеллект-карта выступает как инновационная стратегия, используемая для облегчения распознавания и запоминания важной информации обучающимися, а также для обеспечения глубины их понимания путем установления связей между фрагментами информации и развития критического мышления у обучающихся. Авторами приведен обзор сервисов по созданию электронных интеллект-карт, сравнительный анализ их функциональных характеристик, а также предложена модель использования электронных интеллект-карт, состоящая из нескольких этапов, на примере дисциплины «Business communication» на иностранном языке для обучающихся магистратуры. Кроме того, сделан вывод, что использование электронных интеллект-карт в образовательном процессе стимулирует развитие творческих способностей и критического мышления обучающихся; развивает общекультурные компетенции студентов в процессе работы в группе, способствует развитию навыков аргументации, обоснования своей точки зрения и владения четкой устной и письменной речью, формирует умение работы в команде, помогает развитию навыка сотрудничества, дает возможность усвоения учебного материала в ускоренной форме, поддерживает развитие различных видов памяти.

Ключевые слова: интеллект-карты, электронные интеллект-карты, критическое мышление, деловое общение, дистанционное обучение, деловая культура, наглядные пособия, проблемное обучение.

References

- 1 Edwards, S., & Cooper, N. (2010). Mind mapping as a teaching resource. *The clinical teacher, Vol. 7, 4*, 236-239.
- 2 Fong, C.J., Kim, Y., Davis, C.W., Hoang, T., & Kim, Y.W. (2017). A meta-analysis on critical thinking and community college student achievement. *Thinking Skills and Creativity, Vol. 26*, 71-83.

- 3 Zubaidah, S., Corebima, A.D., & Mahanal, S. (2018). Revealing the Relationship between Reading Interest and Critical Thinking Skills through Remap GI and Remap Jigsaw. *International Journal of Instruction*, Vol. 11, 2, 41-56.
- 4 Quitadamo, I., Faiola, C.L., Johnson, J.E., & Kurtz, M.J. (2008). Community-based inquiry improves critical thinking in general education biology. *CBE—Life Sciences Education*, Vol. 7, 3, 327-337.
- 5 Browne, M.N., & Keeley, S.M. (2007). Asking the right questions: A guide to critical thinking. *Pearson Education*.
- 6 Arsal, Z. (2017). The impact of inquiry-based learning on the critical thinking dispositions of pre-service science teachers. *International Journal of Science Education*, Vol. 39, 10, 1326-1338.
- 7 Aksu, G., & Koruklu, N. (2015). Determination the Effects of Vocational High School Students' Logical and Critical Thinking Skills on Mathematics Success. *Eurasian Journal of Educational Research*, Vol. 59, 181-206.
- 8 Dwyer, C.P., & Eigenauer, J.D. (2017). To teach or not to teach critical thinking: A reply to Huber and Kuncel. *Thinking Skills and Creativity*, Vol. 26, 92-95.
- 9 Gojkov, G., Stojanović, A., & Rajić, A.G. (2015). Critical thinking of students—indicator of quality in higher education. *Procedia-Social and Behavioral Sciences*, Vol. 191, 591-596.
- 10 Bailin, S., Case, R., Coombs, J.R., & Daniels, L.B. (1999). Conceptualizing critical thinking. *Journal of curriculum studies*, Vol. 31, 3, 285-302.
- 11 Ennis, R.H. (2011). The nature of critical thinking: An outline of critical thinking dispositions and abilities. *University of Illinois*, Vol. 2, 4, 1-8.
- 12 Kim, K., Sharma, P., Land, S.M., & Furlong, K.P. (2013). Effects of active learning on enhancing student critical thinking in an undergraduate general science course. *Innovative Higher Education*, Vol. 38, 3, 223-235.
- 13 Vong, S.A., & Kaewurai, W. (2017). Instructional model development to enhance critical thinking and critical thinking teaching ability of trainee students at regional teaching training center in Takeo province, Cambodia. *Kasetsart Journal of Social Sciences*, Vol. 38, 1, 88-95.
- 14 Carriger M.S. (2015). Problem-based learning and management development—Empirical and theoretical considerations. *The International Journal of Management Education*, Vol. 13, 3, 249-259.
- 15 El-Shaer, A., & Gaber, H. (2014). Impact of Problem-Based Learning on Students Critical Thinking Dispositions. *Knowledge Acquisition and Retention. Journal of education and practice*, Vol. 5, 14, 74-85.
- 16 Hariyadi, S., Corebima, A.D., & Zubaidah, S. (2018). Contribution of mind mapping, summarizing, and questioning in the RQA learning model to genetic learning outcomes. *Journal of Turkish Science Education*, Vol. 15(1), 80-88.
- 17 Cuthell, J., & Preston, C. (2008). Multimodal Concept Mapping in teaching and learning: a MirandaNet Fellowship project. *Society for Information Technology & Teacher Education International Conference*, 1999-2007. Association for the Advancement of Computing in Education (AACE).
- 18 Laampere, M., Matsak, E., & Kippar, J. (2006). Integrating a concept mapping tool into a virtual learning environment: Pedagogical and technological challenges. *Concept maps: Theory, methodology, technology: Proceedings of the Second International Conference on Concept Mapping*, Vol. 1, 280-287.
- 19 Faste, H., & Lin, H. (2012). The untapped promise of digital mind maps. *Proceedings of the SIGCHI conference on human factors in computing systems*, 1017-1026.
- 20 Qi, A. (2018). A study of the effect of implementing intellectual property education with digital teaching on learning motivation and achievements. *Eurasia Journal of Mathematics, Science and Technology Education*, Vol. 14, 6, 2445-2452.
- 21 Buzan, T. (2018). Mind map mastery: The complete guide to learning and using the most powerful thinking tool in the universe. Watkins Media Limited.
- 22 Hidayati, N., Zubaidah, S., & Amnah, S. (2021). The PBL vs. Digital Mind Maps Integrated PBL: Choosing Between the two with a view to Enhance Learners' Critical Thinking. *Participatory Educational Research*, Vol. 9, 3, 330-343.
- 23 Mitryukhina, I.N. (2021). Tekhnologiiia *Mind-Mapping* kak informatsionnaia osnova pri obuchenii monologicheskomu inoazychnomu govoreniu v usloviakh tsifrovoy sredy [Mind-Mapping technology as an information basis for teaching monologue foreign language speaking in a digital environment]. *Vestnik Permskogo natsionalnogo issledovatel'skogo politekhnicheskogo universiteta. Problemy yazykoznanii i pedagogiki — Bulletin of the Perm National Research Polytechnic University. Problems of linguistics and pedagogy*, Vol. 2, 150–162 [in Russian].
- 24 Mohaidat, M. (2018). The Impact of Electronic Mind Maps on Students' Reading Comprehension. *English Language Teaching*, Vol. 11, 4, 1-32.
- 25 Astakhova, L.G. (2021). Intellekt-karty kak sredstvo formirovaniia professionalnykh znaniy studentov [Mind maps as a means for forming professional knowledge of students]. *Nauchnyi zhurnal Kaluzhskogo gosudarstvennogo universiteta imeni K.E. Tsiolkovskogo — Scientific journal Founded in March 2006 K.E. Tsiolkovsky Kaluga State University*, 4(53), 68–73 [in Russian].