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THE USE OF WEB-BASED MIND MAPPING TOOLS IN THE STUDIES OF ESL AND ESP IN HIGHER EDUCATION: A REVIEW OF RESEARCH

Mind mapping is a teaching and learning technique which helps to visualize interrelated ideas that branch out from a central concept. With education becoming increasingly technologically focused, educators and learners rely more often on the affordances of Web-based mind maps. This review of research aims at presenting the current landscape of using Web-based mind mapping technologies and techniques for teaching and learning ESL and ESP in higher education and provides useful insights for both practitioners and researchers within the field.

1. Introduction

Mind mapping is a powerful organizational and analytical technique which helps to visualize connected ideas that branch out from a central concept. For decades it has been employed as an effective tool for brainstorming, note taking, analysing, problem solving, visualising and memorizing in all levels of education, including the sphere of learning and teaching English as a Second Language for General Purposes (henceforth ESL) and English for Specific Purposes (henceforth ESP) in higher education. Learning and teaching ESL and ESP at the tertiary level can be both appealing and challenging for all the participants

of the educational process. Students need to acquire, store and retain significant amounts of information in the target language. As it may come in the form of complicated linear texts (such as documents, articles or reviews), hardly supplemented with audio-visual inputs, learners may find it problematic to "digest" it, whereas teachers have to find effective ways to alleviate the process. Mind mapping is considered a powerful tool for language learners to enhance their cognitive abilities, acquire new information, and understand complex concepts. By observing student-generated mind maps, teachers, in turn, "can quickly determine and detect students' understanding of teaching content and learning content, and adjust efficient and feasible teaching strategies" (Cui 2016: 161). Previous research suggests that the use of *paper-and-pencil-based* mind mapping techniques can be effective for developing ESL and ESP students' reading comprehension skills (Sujana 2012; Ardakani and Laskarian 2015; Hasan 2017), assisting with vocabulary acquisition and retention (Munsakorn 2012; Gómez Betancur and King 2014), enhancing their writing skills (Ningrum, Latief and Sulistyo 2016; Wette 2017) or developing their speaking skills (Mustajib 2017).

With education becoming increasingly technologically oriented, this research, however, aims at presenting the current landscape of using *Web-based* mind mapping technologies for teaching and learning ESL and ESP in higher education.

2. Theoretical background

The term *mind mapping* was coined and popularized by English author and educational consultant Tony Buzan back in 1970s. It is a graphical tool, the structure of which imitates the way human mind works and engages the brain; therefore, it is often referred to as the Swiss army knife of the brain. Advocates of the technique claim that it provides a universal key to unlocking the potential of our brain and thus "can be applied to every aspect of life where improved learning or clearer thinking will enhance human performance" (Buzan and Buzan 1994: 59). Mind mapping is closely associated with the concept of *Radiant Thinking* (Buzan and Buzan 1994). The essence of it is that each bit of information entering our brain can be visualized as a central sphere radiating an infinite number

of hooks. Each hook in turn represents an association, while each association has an endless number of links and connections of its own. The mind map, as suggested by Buzan, is an external expression of our radiant thinking: its subject of attention is crystallized in a central image; subject-related topics (branches) also containing some key image, radiate from the central image; topics of lesser significance are represented as branches attached to higher level branches, all forming an interrelated nodal structure. To add individuality and to wake-up certain untapped intelligences, this structure can be enhanced with colour, images or symbols.

The mind mapping technique is often related to the *Theory of Multiple Intelligences* (Gardner 2000), which claims that people have different ways of processing data and thus different types of intelligence: logical-mathematical, verbal-linguistic, musical, bodily-kinaesthetic, spatial, interpersonal, intrapersonal, natural and spiritual. When mind mapping, according to Muqodas et al. (2020), learners have the opportunity to enhance their logical thinking skills, level up their mathematical intelligence and hone the ability to build logical patterns. Through the use of colour, images and dimension they can develop their visual intelligence, space perception and image understanding. Mind mapping technique can also be supported by cognitivist approach, especially by Ausubel's (1969) *Assimilation Theory*. It states that meaningful learning occurs as a result of the interaction between a specific structure of knowledge (cognitive structure) that the learner already possesses and newly acquired and symbolically expressed information or ideas.

Mind maps can be drawn by hand; however, with education becoming more technologically focused, educators and learners more often rely on the affordances of computer-based mind maps. Researchers within the field (Bhattacharya and Mohalik 2020; Bystrova and Larionova 2015) enumerate around 40 examples of free and commercially packed mind mapping tools and applications available, including *Xmind*, *MindManager*, *Mindomo*, *MindMup*, *Coggle*, *TheBrain*, *Venngage*, *DrakonHub*, *MindMeister*, *Padlet*, *Bubbl.us*, *Ayoa*, *SmartDraw*, *Visio*, *Miro*, *Lucidchart*, *Cacoo*, *FreeMind*, *Edraw*, *Docear*, *Freeplane*, *WiseMapping*, *Mind42*, *MindGenius*, *MindMapper*, *Novamind*, *GitMind*, *Creately*, *Mindly*, *Comapping*, *Dabbleboard*, *MAPMyself*, *ConceptDraw*, *SpiderScribe*, *Popplet*, *Slatebox*, and *DebateGraph.* The seminal typology of Free Web-based Learn-

ing Technologies arranged by Bower and Torrington (2020) incorporates 8 free Web-based mind mapping tools suitable for educational purposes. These include *Bubbl.us*, *Mindomo*, *WiseMapping*, *MindMup*, *Popplet*, *Mind42*, *MindMeister*, *Slatebox*, *Coggle* and *DebateGraph*. This literature review aims at presenting the current landscape of using both free and commercially packed *Web-based* mind mapping technologies and techniques for teaching and learning ESL and ESP in higher education.

3. Method

A review of the research literature, as suggested by Whitehead and Maude (2016), is a systematic and critical review of published academic and scholarly papers on a particular topic of interest in a specific subject area. It presents the existing trends about the topic and provides new knowledge that can assist in the development, testing or refinement of theories. The rationale behind this approach, as noticed by Aydin (2021), is that it explores specific research questions stemming from realistic settings; therefore, it helps to identify areas which call for more profound investigation. Whitehead and Maude (2016) recommend 6 steps for the search of literature and the process of reviewing, which are being followed for this current review: 1) developing a review question, 2) performing a thorough literature search, 3) evaluating relevant studies to be included in the review, 4) critically assessing the selected studies, 5) summarizing the findings, and 6) reporting on the results and proposing recommendations for future research.

Five research questions were formulated for this current literature review:

1. Which types of Web-based mind mapping tools have been used in the field of teaching and learning ESL and ESP in formal higher education institutions? What are the specifications of the identified tools?

2. Which of the traditional ESL and ESP language skills and other knowledge areas have been focused through the use of Web-based mind mapping tools?

3. Which ESP areas have been targeted through the use of Web-based mind mapping tools?

4. Which research designs were preferred by the authors to investigate the use of Web-based mind mapping tools?
5. Which theoretical frameworks ground the previous research targeting the use of Web-based mind mapping tools?

It should be noted that the first research question was formulated to collect *primary evidence* on which types of previously enumerated free and commercially packed Web-based mind mapping tools were preferred by the researchers and practitioners within the sphere. The subsequent four questions were in turn developed to get *evaluative evidence* about the effective application of these tools in ESL and ESP studies in higher education.

Considering the rule of thumb suggested by Whitehead and Maude (2016), that research literature that is less than five years old (especially for providing evidence for practice) is preferable for literature reviews, this current review only incorporated articles published from 2017 to 2022. This relatively short timeframe was also selected because mind mapping technologies, just like any types of technologies, are rapidly improving, with new products being created and new generations being developed. For example, when software pioneer *Corel* obtained the *Mindjet* business and *MindManager* product line in 2016, *Mindjet* was removed from their product name. This is how the mind mapping tool *Mindjet* became *MindManager.* Another example is the transition of desktop-based mind mapping tool *iMindMap* into the cloud-based software tool *Ayoa* with neuro-inclusive design, incorporating mind mapping, task management and instant messaging.

To identify sources that addressed the aforementioned research questions, several inclusion and exclusion criteria were determined. Publications that *were* considered for inclusion had to be research articles, providing knowledge strictly derived from empirical evidence and thus had to employ experimental, correlational, qualitative or mixed-method research designs. Systematic literature reviews or meta-analyses were considered not feasible for the investigation and were excluded. Moreover, as this current review targeted only empirical studies focusing on the application of mind mapping software in the studies of ESL and ESP in higher education, publications, which addressed informal education or primary/ secondary levels of formal education, were eliminated, too. The publications relevant for the review were identified by searching several multidisci-

plinary and subject-related online data bases, including *Web of Science*, *Science Direct*, *ERIC (via EBSCOhost*) and *Taylor and Francis Online*, using the key words *mind mapping technologies*, *mind mapping software*, *web-based mind mapping*, *digital mind mapping*, *online mind mapping*, *ESL* and *ESP*. The rationale behind the preference of the mentioned data bases is that they offer a large collection of journals and books within the sphere of humanities, highlighting historical context, current developments, theories, applications and trends.

In the first round of searching, 32 publications, the titles or abstracts of which seemed to match the pre-established criteria of selection, were retrieved. They were then saved, assessed and screened out by applying the exclusion criteria. The use of this search strategy helped to finally retrieve 11 relevant research papers providing primary and evaluative evidence about the effective application of Web-based mind mapping software in ESL and ESP studies in higher education.

4. Findings of the systematic literature review

The first research question of this literature review was set out to answer which Web-based mind mapping tools have been used in the field of teaching and learning ESL and ESP in formal higher education institutions within the period of 2017–2022. The analysis of the findings demonstrates that for some reason several studies incorporated into this literature review did not indicate the exact title of Web-based mind mapping technologies used, and simply referred to them as *e-mind mapping software* (Masoud and Ibrahim 2017), *electronic mind maps* or *mind mapping websites* (Wannas, Hassan and Mohsen 2022). Some authors (Orlova 2017) included illustrative samples of learner designed mind maps, clearly created with the support of one or another type of mind mapping software. Other studies reported on the use of 6 mind mapping technologies, including *MindMeister*, *FreeMind*, *MindMup*, *Bubbl.us*, *XMind* and *LoiLooNote*. It should be noted that all of the tools (with the exception of *LoiLooNote*) appear in previously introduced lists of digital mind mapping tools arranged by Bhattacharya and Mohalik (2020) and Bystrova and Larionova (2015). Three of them (*MindMeister*, *MindMup* and *Bubbl.us*) are incorporated in the aforemen-

tioned typology of Free Web-based Learning Technologies designed by Bower and Torrington (2020). Although all 6 enumerated technologies share certain fundamental characteristics, i.e., they support the development of images to represent interrelated concepts in the form of a visual knowledge network that can be shared via URL, each of them possesses at least one or two unique specificities. *MindMeister*, for instance, has a handful of additional applications beyond mind mapping, including creating to-do lists, project planning, designing timelines, and brainstorming. It offers expertly-designed themes and extensive customization options, as well as the possibility to add images and icons to user created maps. As indicated by *GetApp*,[1] a recommendation engine delivering tailored, data-driven guidance and insights needed to make informed software selection decisions, *MindMeister* integrates with several third-party applications, e.g., *Google Drive*, *Google Docs* or *Microsoft Teams*. *MindMup* is another web-based mind mapping tool connected to *Google Drive*. It is designed to instantly and creatively capture users' ideas, which can be stored in the cloud for a limited time, saved to the *Google Drive* account or exported for long-term storage. *FreeMind*, as described by Bhattacharya and Mohalik (2020), provides quick operation and navigation with just one-click. It contains such features as scads of icons and colour for formatting options; it supports hyperlinks and thus allows users to bind web pages and documents to a map, which may be then exported in various formats. *Bubbl.us*, as its title suggests, derived its name from the word *bubbles*, or to be more precise, from *thought bubbles*. Mind maps created with this tool may be printed in documents or saved as a file in different formats. It also enables its users to share their work through a link generated by the application. However, as this link appears to be read-only, it is not possible for other users to edit the map. *XMind* contains a very powerful presentation feature, which enables users to view and present their ideas from topic to topic. Finally, the *LoiLooNote* app, which has not been included in previously discussed lists of Web-based mind mapping tools arranged by Bower and Torrington (2020), Bhattacharya and Mohalik (2020), Bystrova and Larionova (2015), originated in Japan and defines itself as an interactive lesson platform for student-centered learning. It works as "a virtual workspace where users can save information as multimedia cards which can be arranged and grouped like a mind map, helping

[1] https://www.getapp.com/

students organize their thoughts and providing a birds-eye view of what has been learned" (Robillos 2022: 504).

Notwithstanding the fact that all the enumerated Web-based mind mapping technologies offer countless possibilities for their users, it should be noted that none of them were primarily designed for language teaching and learning purposes. The key to successful use of any technology in language teaching, as emphasized by Abunowara (2014: 2) lies not in the software itself, but more importantly, in the language instructors' capacity to plan, to design and to implement effective educational activities supported by that software in order to meet their students' learning goals and objectives within a specified content area.

The second research question of this review thus aimed at exploring which of the traditional ESL and ESP language skills and other knowledge areas had been focused through the use of Web-based mind mapping tools. It was established that Web-based mind mapping tools have effectively been employed in a variety of ESP and ESL contexts for developing students' skills in both receptive and productive language use. The majority of ESP studies, however, reported on the effectiveness of Web-based mind mapping tools for the development of ESP *receptive vocabulary*. The study conducted by Marunevich (2021) is a perfect illustrative example witnessing how digital mind mapping techniques can be effectively employed for developing ESP students' *vocabulary* acquisition skills within the sphere of transport. Detailed mind maps, generated by research participants with the support of *MindMeister*, proved to be effective in improving and expanding their transport vocabulary while covering historical facts of transportation, discussing the impact of transport on the society and environment, as well as analysing its advantages and shortcomings. The author indicates that the technique was also beneficial in teaching and learning ESP vocabulary related to different modes of transport, their parts and the materials they are made of, electronic equipment, as well as machines designed to convert energy into mechanical one. The effect of mind Web-based mind mapping technology on ESP learners' *vocabulary* gain was addressed by Alba's (2021) pre-test/post-test experimental research. Participants enrolled in the experimental group received specific vocabulary instructions supported by *MindMup*, while students in the control group were taught by employing traditional methods. At the end of the treatment, all participants were post-tested. It was discovered that the

learners who used the mind mapping software, performed significantly better than the control group, suggesting that the use of *MindMup* can be very beneficial and effective for ESP students' vocabulary acquisition. Likewise, significant impact of Web-based mind mapping techniques on students' performances in *vocabulary acquisition* is witnessed by another experimental study conducted by Masoud and Ibrahim (2017). The findings of this study obtained from the vocabulary tests, revealed that teaching vocabulary through mind mapping to the treatment group was very effective.

Alongside with the development of specific vocabulary, two studies incorporated into this literature review (Orlova 2017; Robillos 2022) address the development, advancing and mastering ESL and ESP students' *communicative competence* and *oral presentation* skills. To illustrate, the findings of experimental research conducted by Orlova (2017) reported on the effectiveness of mind mapping technique for developing, ESP students' professional *communicative competence* within the sphere of psychology. All research participants were working on the topics related to major schools of thought in psychology, and at the end of the course, they had to perform an *oral monologue talk*. However, students enrolled in the control group were taught through standard linear texts, while their counterparts in the experimental group produced individual mind maps. Their mind maps on the topic and the talk involved the use of thematic *vocabulary* (terms, terminological phrases, key words and word-combinations) related to schools of thought in psychology: historical and current approaches, iconic figures and personalities as well as thinking processes. The author noticed that while working on their mind maps, research participants in experimental groups enhanced their abilities of portraying structural characteristics of analysed concepts, retaining facts, thematic vocabulary, analysing events and their consequences as well as generating new ideas. In another study, Robillos (2022) investigated the impact of *LoiLooNot*e digital graphic organizer on ESL students' *oral presentation* skills across four components: clarity, content, fluency and coherence. The results of this research show that through the use of *LoiLooNote*, the participants improved their oral presentation skills in terms of all aforementioned four components and enhanced their critical thinking dispositions.

Two studies (Alqasham and Al-Ahdal 2021; Karim 2018) addressed the development of ESL students' *writing* skills. To illustrate, the research of Alqasham and

Al-Ahdal (2021) aimed to enhance ESL students' *writing* efficiency and mindset by utilizing mind mapping tool *XMind* as an interactive brainstorming tool. Karim (2018) investigated the efficiency of mapping techniques supported by *Bubbl.us* in ESL *writing* classrooms at the University of Technology in Malaysia. It was established that the majority of the participants had very positive attitudes towards this Web-based mind mapping tool used for learning writing in their English classroom. They believed that creating online mind maps improved their novice writing skills and assisted in developing their creativity skills.

The study conducted by Al-Jarf (2021) reported on the effective use of the Web-based mind mapping software *FreeMind* for developing ESP students' *reading* skills. According to the author, this user-friendly software helped the students to identify the relationships between a central idea, concept, category or topic of the text and allowed them to understand the organizational structure of a text (classification, chronology, enumeration, compare contrast).

Tverezovska et al. (2020) reported on the successful practical implementation of *MindMeister* based mind mapping techniques into the ESP training course to intensify the learning process and to enhance both language skills and motivation of ESP students with different levels of language proficiency (classification, chronology, enumeration, compare contrast).

The third research question of this literature review addressed *ESP spheres and areas* the research on the use of Web-based mind mapping tools was focused on. According to McDonough (2010) there exist at least 20 profession related spheres in which the use of English may be essential for effective communication, e.g., medicine, engineering, nursing, commerce, finance, information technology, law, tourism, etc. The analysis of this current research data shows that Web-based mind mapping techniques were successfully being implemented within different spheres of ESP, including engineering and mechanical engineering (Wannas, Hassan and Mohsen 2022; Tverezovska et al. 2020), transport (Marunevich 2021), translation (Al-Jarf 2021; Alba 2021), education (Masoud and Ibrahim 2017), psychology (Orlova 2017).

The sphere of *engineering* was addressed by Tverezovska et al. (2020) who targeted ESP students (including those enrolled in engineering study programme) pursuing their studies at the faculty of Computer Sciences and Cybernetics at a

university in Ukraine. Similarly, Wannas, Hassan and Mohsen (2022) reported on the effective use of Web-based mind mapping software to develop ESP students' skills within the sphere of engineering. Kucharíková, Lipkova and Lokajová (2019) successfully employed mind mapping techniques during their ESP classes of *mechanical engineering* at the Slovak University of Technology. The study conducted by Marunevich (2021) involved ESP students from an Electromechanical Department at a University, Russia and targeted the development of *transport* vocabulary. The participants of research conducted by Al-Jarf (2021) were students majoring in *translation* at college in Saudi Arabia. According to the author, they were taking part in a variety of translation courses in different disciplines, including medicine, Islamic studies, military field, law, computer science, media and oil industry, taken in different semesters of the translation program. Likewise, the participants of research conducted by Alba (2021) were students enrolled in the study programme of *English Language Translation* at a university in Iran. The study conducted by Masoud and Ibrahim (2017) investigated the effectiveness of using mind mapping software on students enrolled in ESP studies within the sphere of *education*. Finally, research conducted by Orlova (2017) aimed at analysing the influence of mind mapping technique on the development of oral monologue speaking skills of ESP students within the sphere of *psychology*.

The fourth research question aimed to identify which research designs were preferred by the authors to investigate the use of Web-based mind mapping tools. The majority of studies incorporated into this review (Wannas, Hassan and Mohsen 2022; Alba 2021; Marunevich, Shefieva and Bessarabova 2021; Alqasham and Al-Ahdal 2021; Tverezovska et al. 2020; Kucharíková, Lipkova and Lokajová 2019; Masoud and Ibrahim 2017; Orlova 2017) investigated the *effectiveness* of one or another Web-based mind mapping technology in ESL and ESP studies at the university by using the quantitative approach and *experimental* pre-test/post-test, experimental/control group designs to determine causal relationships between the use of the software and ESL or ESP students' language acquisition. This is in line with the reasonings of Agodini et al. (2003) who believe that discussing the effectiveness of any educational technology is actually investigating if it improves students' learning outcomes. They, therefore, assert that namely experimental research designs involving experimental and control groups as well as certain treatment procedures, are fairly consistent with research evaluat-

ing the impact of educational technology on learning achievements. Two authors (Robillos 2022; Al-Jarf 2021) chose the *mixed methods design* for their studies, allowing to integrate strategically and combine both quantitative and qualitative research methods for collecting and analysing the data. Apart from investigating the *effectiveness* of mind mapping software, these studies additionally measured ESL and ESP students' *attitudes* related the software employed. The data for their research were obtained from participants' pre-test and post-test scores, interviews and questionnaire answers. One study included in this literature review, conducted by Karim (2018), employed the *survey research* design. Data for this research were collected through the use of an attitudinal questionnaire investigating research participants' opinions on Web-based mind mapping technique in their ESL writing classroom. Survey research can provide an in-depth understanding of how students feel about digital mind mapping software, what their needs and intentions are and to measure technology acceptance.

The fifth research question of this review aimed at determining which theoretical frameworks ground the previous research targeting the use of Web-based mind mapping tools in ESL and ESP studies in higher education. When incorporating any kind of media into courses' curricula, as suggested by Blaschke (2014), "educators should consider the construct of the course, the technologies used and the pedagogical approaches followed to design and deliver the desired learning activities" (Blaschke 2014: 1). It was identified, however, that more than a half of the reviewed empirical studies were not driven by any clearly identifiable theoretical framework. The remaining part of the studies were mainly centred around concepts, theories or approaches traditionally associated with mind mapping techniques and discussed in the theoretical part of this current review: Buzan and Buzan's *Radiant Thinking* (Tverezovska et al. 2020; Masoud and Ibrahim 2017), *Meaningful Learning Theory* (Robillos 2022) and *Cognitive Theory* (Kucharíková, Lipkova and Lokajová 2019). It should be noted that Kucharíková, Lipkova and Lokajová (2019) additionally incorporated *Content and Language Integrated Learning (CLIL)* approach. According to the authors, it promotes language proficiency simultaneously with subject-based lexical competence acquisition, implements language learning into academic subjects, and favours the development of cognitive skills through activity-based learning. Finally, a study conducted by Alqasham and Al-Ahdal (2021) appeared to be framed along *Communicative Language Teaching (CLT),* which is an approach

to language teaching that emphasizes interaction as both the means and the ultimate goal of study.

5. Conclusions and implications

This literature review analyzed empirical research, published as articles in international scientific journals in the realm of ESL and ESP in higher education within the period of 2017–2022. Its findings show that researchers in the field provide evaluative evidence on the use of 6 mind mapping tools, including *MindMeister*, *FreeMind*, *MindMup*, *Bubbl.us*, *XMind* and *LoiLooNote*. They suggest that Web-supported mind mapping techniques can be effectively employed within different spheres of ESP, including engineering, transport, translation, education and psychology, and is considered by a majority of researchers as very beneficial for improving ESL and ESP students' vocabulary acquisition and retention. The use of Web-based mind mapping software is also effective for developing students' communicative competence, enhancing their speaking, writing and reading skills as well as for improving their motivation. Most of the studies embraced by this review investigated the effectiveness of one or another Web-based mind mapping technology in ESL and ESP studies by using quantitative approach and experimental research design. Researchers also employed mixed-method design and survey research to investigate ESL and ESP students' attitudes and opinions on the use of Web-based mind mapping technologies in their classrooms. The use of mind mapping techniques is usually guided by assumptions underpinning cognitive philosophical approaches; however, for some reason the majority of research incorporated into this review lacked a clear theoretical background. This study provides useful insights for both practitioners and researchers interested in the use of Web-based mind mapping tools for teaching and learning ESL and ESP in higher education.

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Primjena mrežno utemeljenih umnih mapa u istraživanjima engleskoga kao drugog jezika (ESL) i engleskoga za posebne namjene (ESP) u visokom obrazovanju: pregled istraživanja

Sažetak

Umna mapa snažna je organizacijska i analitička tehnika koja pomaže vizualizirati povezane ideje koje se granaju iz središnjega pojma. Desetljećima se *umne mape utemeljene na papiru i olovci* primjenjuju kao učinkovit alat za *razmišljanje, analizu*,

vizualizaciju, *pamćenje* itd. na svim razinama obrazovanja, uključujući sferu poučavanja i učenja engleskoga kao drugoga jezika (ESL) i engleskoga za posebne namjene (ESP) u visokom obrazovanju. Cilj je ovoga sustavnog pregleda literature predstaviti trenutačnu primjenu mrežno utemeljene tehnologije mapiranja uma za poučavanje i učenje ESL-a i ESP-a u visokom obrazovanju u razdoblju od 2017. do 2022. godine. Rezultati pokazuju da istraživači na terenu pružaju dokaze o upotrebi šest tehnologija mapiranja uma, uključujući *MindMeister*, *FreeMind*, *MindMup*, *Bubbl.us*, *XMind* i *LoiLooNote*. Tehnike mapiranja uma podržane tim tehnologijama autori smatraju korisnima za razvoj stjecanja vokabulara učenika ESL-a i ESP-a, za komunikacijske kompetencije, vještine govora, pisanja i čitanja, kao i za poboljšanje njihove motivacije. Štoviše, mogu se učinkovito upotrebljavati unutar različitih sfera ESP-a, npr. u inženjerstvu, transportu, psihologiji, prevođenju, obrazovanju i dr. Većina istraživanja obuhvaćenih ovim pregledom odnosila su se na učinkovitost jedne ili druge tehnologije mrežno utemeljenoga mapiranja uma primjenom kvantitativnoga pristupa i dizajna eksperimentalnoga istraživanja. Istraživači su također koristili različite metode i ankete kako bi istražili stavove i mišljenja učenika ESL-a i ESP-a o korištenju tehnologija mrežno utemeljenoga mapiranja uma u njihovim učionicama. Korištenje tehnika mapiranja uma u obrazovanju obično je vođeno pretpostavkama koje podupiru kognitivne filozofske pristupe, no većini studija uključenih u ovaj pregled nedostajala je jasna teorijska pozadina. Kako bi se poboljšala njihova primjenjivost i valjanost, buduća istraživanja trebala bi pružiti dublji uvid u primjenu teorije.

Keywords: Web-based technologies, mind mapping technologies**,** language teaching, higher education

Ključne riječi: mrežno utemeljene tehnologije, tehnologije mapiranja uma, nastava jezika, više obrazovanje