Review Article

Digital Mind Mapping Software: A New Horizon in the Modern Teaching-Learning Strategy

Dipak Bhattacharya[1*], Ramakanta Mohalik[2]

[1]Ph.D. Scholar, Department of Education, Regional Institute of Education, NCERT, Bhubaneswar, India
[2]Professor, Department of Education, Regional Institute of Education, NCERT, Bhubaneswar, India

Abstract

Digital mind mapping is a unique method which improves productivity by helping to build and analyze ideas, and facilitates information structuring and retrieval. Educators and learners can use different types of software to create digital mind map for teaching learning. The objectives of the paper are: to describe about different types of software used in creating digital mind maps; to highlight the process of digital mind map development through software and to provide an overview of benefits and usefulness of digital mind mapping software. It's a review-based study. Articles published in various leading journals, conference proceedings, online materials have been referred in the present article. The first part of the paper describes concept of digital mind mapping software. Second part of the paper provides a brief description about different software used in creating digital mind maps. The third part of the article explains about the process of digital mind map creation through software. The last part of the paper elaborates benefits and usefulness of digital mind mapping software. It reveals that digital mind mapping software can be used by institutions/teachers/students for teaching and learning as it simplifies the information easily for better understanding. The article points out that digital mind mapping software gives learners the ability to engage directly in the learning process by developing digital mind maps. The paper also indicates that digital mind mapping software can be used as brainstorming tool to construct visual diagrams of ideas. The paper would be great use for educators as well as students for teaching, learning and assessment at different levels of education.
Keywords: Digital Mind Mapping Software, Teaching-Learning Strategy, Process, Benefits, Usefulness.

INTRODUCTION

Digital Mind mapping is a method of teaching and learning, used to organize knowledge and concepts in a simple way to grasp and contextualize the ideas. Digital mind maps display the links between ideas, words and information through the combination of text and graphics. It can be utilized at all levels of education and has proved to be appropriate learning resources for talented and disadvantaged students. Adult learners can able to make a connection between learned facts and newly obtained information through digital mind mapping [1]. Basically mind maps are developed through paper and pen. Recently computerized versions of mind maps became popular which also increased learners' level of interest in creating mind maps [2, 3]. So, it can be said that there are two types of mind maps. First one is traditional mind map which is developed on paper or board by hand. Another one is digital mind map which is developed on computer, mobile or other electronic devices through appropriate software. In digital mind maps branches of ideas automatically originate from centre part of the screen [4]. Digital mind mapping software is used to construct diagrams of connections between thoughts, ideas or other knowledge. In contrast to traditional note-making, the software of mind maps can enhance learning and study performance. As a learning tool, digital mind mapping software helps learners to express their ideas visually. It can also transform boring concepts and ideas into colourful, exciting and impressive flowcharts [5].

This paper describes different types of software used in digital mind mapping strategy, highlight the process of digital mind map development through software and provide an overview of benefits and usefulness of digital mind mapping software.

Concept of Digital Mind Mapping Software

Digital mind mapping is an effective imaginative practice to formulate thoughts and connections. Usually, digital mind maps are created in a blank electronic page. Digital mind map has lots of advantages: it is easier, portable and not limited to the scale of the document, simple to save and share with friends [6]. Digital mind mapping software compiles our thoughts and ideas directly to something organized and tangible manner which is quite common in today's world. Digital mind mapping software is now used by everyone. Doctors, professors, graduates, attorneys, nurses, businessmen and others are using software related to digital mind map, because digital mind maps can be developed quickly through software [7, 8].

Different Software Used in Digital Mind Mapping Strategy

Digital mind mapping software is designed to reflect the connections between thoughts and ideas graphically. Digital mind mapping software is a system of visual learning that allows us to evaluate, synthesize, remember and successfully create fresh ideas. The brief descriptions of some best software used in digital mind mapping strategy are given below [9-14]:

(i) XMind: This digital mind mapping software was developed by XMind limited in China. It is available in both free and professional version. It was first released on 2007 for commercial purpose. It was considered as most famous digital mind mapping software on Lifehacker in 2013. It is a combined brainstorming and digital mind mapping platform. It has the purpose of creating ideas. Tree maps, fishbone map, cards, etc. are provided through this system. Xmind allows us to view the graphics everywhere.

(ii) Mindjet: Mindjet is a popular commercial digital mind mapping software first developed by Mike and Bettina Jetter in 1998. It's headquarter is in the San Francisco, USA. This software helps us to plan, operate and handle our ideas. Mindjet gives us the ability to build and operationalize an ambitious system by way of mind modeling, big-data research, and play dynamics. It helps us to gather knowledge and insight easily. It allows us the ability to incorporate knowledge into a single dashboard.

(iii) Mindomo: It's a freemium digital mind mapping software developed by Expert Software Applications. Initially it was released in 2007. Mindomo utilizes different features to improve information analysis, description and comprehension. It uses high-density graphics, visual and audio aids, multi-level numeration, comments and votes on subjects, spell search, touch importation and map exportation. The connectivity method can also be applied here.

It reflects on the easy and efficient use of the tools in general.

(iv) Mindmup: Mindmup is a kind of free and open source software written in JavaScript and can run in HTML5 browsers. The idea maps and statement maps can also be developed by Mindmup. It helps us to build and store unlimited maps in online. The software adds descriptive details and pictures automatically.

(v) Coggle: Coggle is a real-time collaborative and free digital mind mapping tool invented by three graduates (James Crosby, James Ogborne, and John Pritchard) of Cambridge University in 2013. It's a web based mind mapper which produces hierarchically organised documents. This compares with many other collaboration apps, such as Google Docs, that can have a spreadsheet or text file. It helps us to produce beautiful notes rapidly and efficiently.

(vi) TheBrain: It's a digital mind mapping tool developed by TheBrain Technologies. It was launched in 2018. There is a hierarchical interface used to chart the relationships in the network. It helps us to gather essential information.

(vii) Venngage: Venngage is an open source digital mind mapping software that helps to visualize any subject with various stages, nodes or sub-sections. Here we can choose a font which is both readable and aesthetically pleasing. It provides professionally constructed templates for mind maps that are simple to make.

(viii) Drakonhub: DrakonHub is an online tool for the development of simple flowcharts, checklists and mind maps. It is designed to create virtual business processes for company owners, administrators and app developers. Tablet and real-time editing is provided by DrakonHub. It complies with ergonomic criteria that remove visible noise diagrams. Dissect the representation in the illustration of an entity, object or human into separate conceptual components. It allows us to make precise and standard mind maps.

(ix) Mindmeister: MindMeister is a platform for the imagining, communication and interpretation of ideas. This interactive programme provides users with amazing graphic tools for brainstorming, recording, making project schedules, and executing other activities online. MindMeister helps us to communicate and interact in real time with as many people as we want. It has an integrated viewing mode to render mind maps interactive slideshows in less time. It combines both a community project management framework and an intuitive online mission. People can

work together in different ways and in real time solving problems.

(x) Padlet: Padlet is a digital mind mapping software which exchange ideas and allow people to collaborate. It is an easy to read method to create stunning screens, fabrics and web pages. It allows users to add content, feedback and make real-time improvements. We can add images, letters, web links, videos and music in this software. We may choose a designed template or choose a blank template. We can also share our padlet with friends, colleagues and relatives.

(xi) Bubbl.us: Bubbl.us is a framework for collaborative brainstorming. This browser-based platform can be used for the preparation and coordination of projects. It is a completely web-based application. It saves our digital map as an image. A colourful and beautiful mind map can be developed by using this software which helps us to better understand the content.

(xii) Ayoa: Ayoa is a platform to build the concept with others. It is a digital mind mapping tool which enables individuals and teams to easily construct unique mind maps. It helps us to change the branches and connectors' appearance. Here we can connect files and pictures to the divisions directly. It allows us to convert our ideas into activities. We can connect divisions with emoji reactions. It provides a way to arrange the chart by arranging division groups.

(xiii) Smartdraw: SmartDraw is a digital mind mapping tool for the development and arrangement of flowcharts, maps and charts. The platform is used to record operations, coordinate strategy plans and programmes by organizations and businesses. SmartDraw is simpler to use than the G Suite and Microsoft Office's standard drawing tools. It can be worked on any device or phone. We can create graphic and scheme diagrams with this programme. More than 4,000 templates are included in the package.

(xiv) Visio: Microsoft Visio is kind of software helps to create simple and complicated diagrams as per our needs. Visio also helps us to construct comprehensive maps, mind maps, levels, pivot tables, etc. Visio delivers the opportunity to conveniently build a variety of corporate technical tools for databases. The platform helps us to access our knowledge in a perfect way. Visio online interface allows us to work with schemes from any web browser. It promotes the development of various diagrammatic structures.

(xv) Miro: Miro is a digital mind mapping software that enables teams to centralize cross-functional coordination. Miro is a fast and easy way for a team to collect, tracks, and arrange user stories, schedule scripts and reflect. It offers creative drawing in real time. The platform is packed with a limitless immersive whiteboard for all visual activities such as agile planning, project management and the architecture. More than 20 applications are embedded, including InVision, Confluence, Slack, Google Drive, Jira and more.

(xvi) LucidChart: Lucidchart is a HTML-5 based mind mapping tool which provides real time collaboration. We can construct a simple diagram with complicated technical diagrams. It operates on an HTML5 browser. No third-party applications need to be modified. It runs on every computer on different platforms. We can attach live information to our diagrams or import data in order to create organisational charts automatically. It is easily combined with MS office, G suite, Atlassian office, etc.

(xvii) Cacoo: Cacoo is a web-based digital mind mapping tool helps to build flowcharts, tables, mind maps, and mockups. It helps users to add their ideas to pictures, details, comments, or diagrams. Here some readymade templates are available to draw diagrams.

(xviii) FreeMind: FreeMind is a free mind mapping software that allows people the opportunity to arrange thoughts on a webpage. FreeMind's features like scads of icons, and colour for formatting options, support hyperlinks allow users to bind web pages, and documents to a map, and users can export in various formats including HTML, PDF, and JPEG. This software provides quicker operation and navigation with its one-click.

(xix) Edraw Mind Map: Edraw Mind Map is a kind of software that can be used for free mind mapping. Here user can construct mind maps or graphs with the ability to use their examples and models. It also helps to generate thoughts, communicate and link complicated details and exchange knowledge with the user. It is fastest diagram development software. It offers numerous items and tools for making mind maps or diagrams of all sorts, storming thoughts, linking and associating abstract knowledge and exchanging information.

(xx) Docear: Docear is an open source digital mind mapping tool used for the production of notes, charts, maps and the preservation of records and papers all in one place. It enables literature to be organised using comments and notes instead of documents themselves. It enables us to write papers, assignments and recommends free web-based documentation. It allows us to create notices and mind maps, store and create documents and journals, and to download free books.

(xxi) Freeplane: Freeplane is the free and open source software that generates and analyses mind maps. Freeplane is running on every Java version of any operating system. Freeplane can be accessed locally in our computer, as an open source mind mapper programme, or we can execute it through a USB device if we don't want to download it. The key focus is the root node, sub-subjects are referred to as child nodes, and wider subjects are known as free nodes. It structures information nodes like text, symbol, algorithm, calculation, etc.

(xxii) WiseMapping: It is also a free and open source mind mapping tool which can be used to render embedded mind maps by people, experts, organizations and educators. It can now be installed and licensed on our local servers. The software is Java based and offers both a public and a private workspace. Users will have different mind maps and shared maps with teams. It supports Windows, Linux, Mac and is also available in online (in the cloud version). It can also be downloaded in online. The chart history can be restored to display all past updates. The layout, formats and background style can be changed. It can dramatically introduce and extend branches in different formats.

(xxiii) Mind42: Mind42 is the online project management software designed to build mind maps that can freely notify the computer about the layout of a diagram. It is free, but advertising is allowed. We can share our mind maps with many people worldwide. It's private by nature. With the validated mind mapping process it allows us to imagine our thoughts.

(xxiv) MindGenius: MindGenius is a realistic project management platform designed for individuals who want to boost the productivity of their life, team and company. MindGenius helps us to compile, imagine and translate concepts quickly into actionable projects and activities, which allow us to prepare and prepare and handle all tasks relating to projects. Here we can creatively appealingly arrange our thoughts with a variety of colours and pictures from the image library. The software has a set of visual models so that we can brainstorm and execute our ideas faster than from a blank canvas.

(xxv) iMindMap: iMindMap is a comprehensive mind mapping software that has an organic mind map view, a specific free-form imagination view, a quick-capture view with a new time map view and a new branch drawing feature. The choices for iMindMap10 are infinite. The graphic task management application drop task can be combined with iMindMap. This iMindMap is a workspace that helps us to catch ideas, to organise, to create, to gather knowledge in a single hub, to play with our opinions, to implement them, to make ideas a reality.

(xxvi) MindMapper: Mind mapper is a kind of flexible project management software with interactive dashboard and planner. The key functions of this software are concepts, knowledge mapping and organization, and schedules. It can help us to be more efficient, innovative and effective with our plans by combining the three usability components. This software can help us to create information, analyze and interpret knowledge or concepts from a range of viewpoints.

(xxvii) Novamind: It's a mapping software enabling users to imagine and coordinate their plans through innovative production and brainstorming in order to coordinate, recall, exchange and carry out plans. Novamind is a platform that helps users to arrange their ideas and thoughts easily by placing them in an immersive visual map. It helps them to brainstorm and coordinate the specifics of their proposals and give them a detailed summary.

(xxviii) GitMind: GitMind is an online tool for free mind maps. It enables us to imagine complex issues, to develop new theories, to list goals for assignments and to deliver an introduction. It helps us to assign a work objectively. It contains an integrated toolbar. It helps us to create a mind map with keyboard shortcuts.

(xxix) Creately: It's an online browser based mind mapping software. It has a library of thousands templates with the most comprehensive mind mapping architecture. It was developed to help teams not only to catch and coordinate ideas, but also to improve them. It also provides mouse tracking and export diagrams, including PNG, JPEG, PDF and SVG, in real-time. Slack and Confluence can be integrated in this digital mind mapping software.

(xxx) Mindly: It is one of the best representations of digital mind maps. It is a special mind mapping tool that organizes the thoughts into an easy to use hierarchical structure. It captures our ideas and easily reviews them, schedule our projects and use our planning organisations. The Mindly software designers have designed a method deliberately without needing much typing, coding or specification modification. It draws our inventions. This software for mind mapping is available on iOS, Linux and Mac and has a free package with many basic features.

(xxxi) Microsoft Word: Microsoft Word is popularly used free and open source software

for the development of digital mind maps. This is more versatile than pen and paper. It can be quickly changed by inserting or rearranging the subjects. We can copy it to the other Office programmes and print it out if necessary. PowerPoint or e-mail sharing options are also included.

There are also some other digital mind mapping softwares like Semantik, Compendium, MindView, iMindQ, Openmind, ConceptDraw MindMap and others used to prepare digital mind maps.

How to Create a Digital Mind Map through Software:

Digital mind mapping is a teaching-learning strategy for recording the free flow of ideas and is commonly used to explore the topics. It may also be used for the arrangement and aggregation of information on a topic. Because digital mind mapping is an imaginative activity, a digital mind mapping strategy can vary according to the personal interests, resources and projects. There is no "one way" to construct the digital mind map, so if we use technology to build a diagram, we have to follow a systematic process.

Step-1: Start with a blank screen.

Step-2: Fill the central idea or theme with the central node. Write the brainstorming theme in the middle.

Step-3: Brainstorm sub-ideas or linked ideas, adding them to the screen. Write brainstormed ideas / reflections on branches originating from the middle.

Step-4: Draw lines for the association between ideas and sub-ideas. Drag and drop the elements in the diagram to reorganize our thoughts. Apply more facts to each sub-idea. We can continue to add more information in our digital mind map until we are adequate.

Step-5: Use formatting tools to visually coordinate and represent the ideas like modify colours, shape, size, and add icons and pictures, etc.
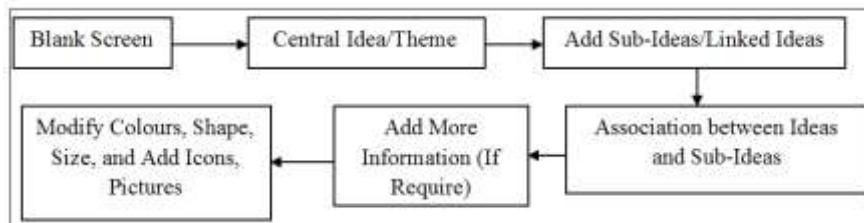

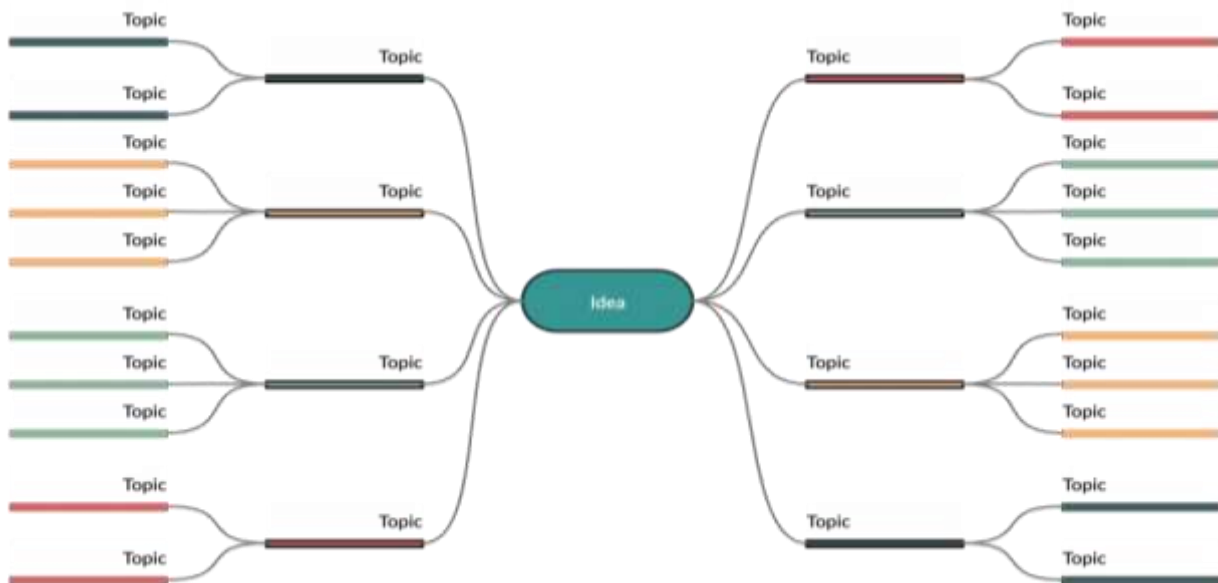**Fig-1: Steps to Create a Digital Mind Map through Software**

Fig-2: Digital Mind Map
Source: Creately (Digital Mind Mapping Software) https://app.creately.com/diagram/axPiPKzaipZ/edit

Benefits of Digital Mind Mapping Software:

Digital mind maps are excellent instruments for interpreting and transmitting thoughts, because human beings can easily interpret visual knowledge. Although we can construct mind maps on papers, but using digital mind mapping software has several benefits, such as [15, 16]:

- Software for digital mental mapping can be used in institutions for studying and writing across the curriculum. It helps to simplify the information easily.

- It encourages knowledge to be visualized or viewed easier to understand by splitting larger or more challenging concepts or theories into smaller and simpler items.
- It gives learners the ability to engage directly in the learning process by developing digital mind maps.
- It contributes to the development of cognitive skills such as brainstorming, analytical and imaginative thinking, categorization and concentration on content, reflection etc.
- It helps to retrieve past knowledge and easily link it to new learning.
- It encourages self-learning. Students can educate themselves with a lesson even more effectively by the use of interactive digital mind maps for note taking, interpretation, learning, etc.
- It is flexible. By clicking and dragging, we can quickly reorganize thoughts.
- Software allows us to construct mind map digitally. Here, several people together can work on the same mind map.
- We can use the design tools to create quality diagrams that we can easily share and represent.

Usefulness of Digital Mind Mapping Software:

Digital mind mapping software is a brainstorming tool that helps us to construct visual diagrams of our ideas. With the help of digital mind map we can construct an idea map, a design map that demonstrates the structure and relationships between ideas. Digital mind mapping strategy requires basic brainstorming software and complicated display and diagramming tools. The usefulness of digital mind mapping software is given below [17]:

- Brainstorming: Build mind maps – arrange thoughts visually and show them.
- Diagramming: Build engineering graphs, conceptual diagrams, construction plans, org graphs, network diagrams, and other technical diagrams.
- Software development and web design: Build site map diagrams and wireframes.
- Business Intelligence: Import and show interactive information in tables, graphs etc. from market applications.

CONCLUSION

Digital mind mapping strategy is a modern and powerful approach to recall information rather than the normal way to read texts. From the above discussion it can be said that digital mind mapping software can help learners to improve their technical imaginative skills in terms of the logical development of thoughts. Digital mind mapping software can serve as an influential tool, not only to improve students' self-confidence and visualization skill, but also to provide quicker and comprehensive ideas for their better conceptual understanding.

REFERENCES

1. Mani, A. (2011). Effectiveness of digital mind mapping over paper-based mind mapping on students' academic achievement in environmental science. In T. Bastiaens & M. Ebner (Eds.), *Proceedings of ED-MEDIA 2011--World Conference on Educational Multimedia, Hypermedia & Telecommunications* (pp. 1116-1121). Lisbon, Portugal: Association for the Advancement of Computing in Education (AACE). Retrieved July 20, 2020 from https://www.learntechlib.org/primary/p/38011/
2. Sabbah, S. (2015). The effect of college students' self-generated computerized mind mapping on their reading achievement. *International Journal of Education and Development using Information and Communication Technology, 11*(3), 4-36. Retrieved May 20, 2020 from https://files.eric.ed.gov/fulltext/EJ1086649.pdf.
3. Elzaaby, R. (2013). Studying English language and its relation to students and teachers of the English language and their attitudes towards learning English. *The Jordanian Journal of Educational Sciences, 9*(2), 221-241.
4. Abbaspour, B. N., Rastgoo, V., Fathi, N., & Yek, Z. M. (2019). The use of mindomo software to improve the logical development of EFL learners' writing. *International Journal of Innovation, Creativity and Change, 8*(12), 238-252. https://pdfs.semanticscholar.org/a759/11d0fdcf7c3 d51ab4da005b1649a9da63845.pdf?_ga=2.255740 232.1742113125.1588614738-1563454339.1587 043695
5. Aljaser, A. M. (2017). The effectiveness of electronic mind maps in developing academic achievement and the attitude towards learning English among primary school students. *International Education Studies*, *10*(12), 80-95. Retrieved August 11, 2020 from https://files.eric.ed.gov/fulltext/EJ1164128.pdf
6. Myre, M. (2020). *The best mind mapping software in 2020*. Retrieved July 07, 2020 from https://zapier.com/blog/best-mind-mapping-software/
7. Mammen, J. R., & Mammen, C. R. (2018). Beyond concept analysis: Uses of mind mapping software for visual representation, management, and analysis of diverse digital data. *Res Nurs Health, 41*(6), 583-592. https://doi.org/10.1002/nur.21920
8. Masoud, H., & Ibrahim, O. L. (2017). The effectiveness of using an e-mind mapping software based program in developing faculty of education 2nd year english majors' vocabulary acquisition and use. *Journal of Research in Curriculum, Instruction and Educational Technology*, *3*(4), 177-224. Retrieved July 22,

2020 from https://scholar.googleusercontent.com/scholar?q=cache:84hKszzTS9sJ:scholar.google.com/&hl=en&as_sdt=0,5

9. Darke, N., & Turner, B. (2020). *Best mind map software of 2020: Chart and diagram ideas and processes.* Retrieved June 05, 2020 from https://www.techradar.com/in/best/best-mind-map-software

10. Pickard-Whitehead, G. (2020). *Find a mind map tool – 20 of the best of 2020*. Retrieved February 03, 2020 from https://smallbiztrends.com/2020/07/mind-map-tool.html

11. Mordy, J. (2020). *The best 7 free and open source mind mapping software.* Retrieved May 24, 2020 from https://www.goodfirms.co/blog/best-free-and-open-source-mind-mapping-software

12. Chi, C. (2020). *12 of the best mind mapping software to brainstorm better ideas.* Retrieved July 19, 2020 from https://blog.hubspot.com/marketing/best-mind-mapping-software

13. Mohapatra, S. (2020). *Creating mind maps using venngage.* Retrieved September 07, 2020 from https://www.youtube.com/watch?v=5XBt9HgLlZs

14. Kola, R. K. (2020). *Coogle: A mind mapping tool.* Retrieved September 06, 2020 from https://www.youtube.com/watch?v=aIZzPANLlAc

15. Bahadori, A., & Gorjian, B. (2016). The role of mind mapping software in developing EFL learner's vocabulary at the pre-intermediate level. *Journal of Applied Linguistics and Language Learning 2* (1), 8-16. Retrieved February 17, 2020 from http://doi.org/10.5923/j.jalll.20160201.02

16. Frey, C. (2008). *10 advantages of mind mapping software vs. hand-drawn maps.* Retrieved May 13, 2020 from https://mindmappingsoftwareblog.com/software-vs-hand-drawn-maps/

17. Aston, B. (2020). *Compare the 10 best mind mapping software of 2020.* Retrieved August 18, 2020 from https://thedigitalprojectmanager.com/mind-mapping-software/#:~:text=Mind%20mapping%20software%20(also%20called,and%20connections%20between%20different%20ideas.