Creativity Software and Idea Mapping Technology

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Abstract This contribution focusses on technologies connected with the graphical representation of knowledge and text content through the generation, creation and organization of important concepts, thoughts or ideas into visual diagrams. Although they already existed in the pre-digital era, with digitalization, mind maps and concept maps have been scrutinized methodologically and the scope of their use has been expanded with respect to function and applicability. For writing, mapping technologies serve both a creative function to develop a pool of interconnected ideas from where to begin writing and a selective and structuring function to organize content during writing. Both kinds of mapping have been developed primarily as learning and thinking tools but can also be used as valuable means of connecting thinking and learning with writing. The contribution shows important developments as well as methodological differentiations and suggests the integration of idea mapping technologies into writing courses at the early undergraduate level, particularly in connection with the teaching of reading, summarizing and synthesizing sources.

Keywords Creativity software · Mind mapping · Concept mapping · Idea mapping

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1 Introduction and Background

Creativity techniques in writing had been fairly well established at the time when digitalization set in. Basic concepts for such techniques came from stage models of writing which always suggested brainstorming and idea-collecting activities as a pre-writing phase (Anson, 2014; Murray, 1985; Rohman, 1965). Differing from the demanding formulation activities, where ideas have to be linearized into a coherent succession of words, the preparatory activities were assumed to undercut the grammatical and linguistic constraints of formulation activities and focus on thought and concepts instead.

Creative thinking was thought of as an uncensored, associative, and "left-hemispheric" activity producing more ideas than necessary for a text so that writers could select the most relevant ones. The most prominent philosophy of idea development as a preparation for writing came from Elbow (1981, 2000) who established free writing and automatic writing as modes of idea generation. To him, there were four main benefits of free writing (summarized and quoted from Elbow, 2000, pp. 86–88):

- It gets writers going and makes it much easier to begin
- It does not only lead to words on paper but also initiates thinking
- It "puts life into our writing: voice, energy, presence"
- it makes writers experience themselves as writers when enjoying the surprising results of spontaneous text production.

Cognitive process models of writing, such as that of Hayes and Flower (1980), de-emphasized the role of brainstorming activities in favour of a rather rational activity of planning, thus accounting for idea selection more as a problem-solving activity than as a creative one.

A decidedly creativity-enhancing approach was offered by Rico (1983) who connected idea development with a graphical arrangement of thoughts which were placed in circles around a core word. Here too, idea development was enhanced by abstaining from formulation activity and consisted in jotting down just single words or expressions and encircle them. Similarly, as in Elbow's free writing, writers were instructed to reduce rational control of word production and let the unconscious guide the pen. Every word can lead to new, associated ideas which are then also encircled and connected to the first one with a line. When enough associations have come up, a tentative network of ideas is available to start writing. Rico's main idea of creativity involved making use of graphical arrangements to arrive at a bi-hemispherical engagement of the brain and avoid early rational filtering of the ideas. Only when the associative process has dried out, a conscious selection and connection of the ideas should take place. To our knowledge, there is no digital version of clustering directly based on Rico's approach, but some versions of the mind map technology come close to it (for instance, Scapple, see below).

A group of techniques appealing more to the rational side of the mind compared to Rico's clustering are mind maps and concept maps (Novak, 2010), here summarized as idea mapping technologies. Other terms for them are "knowledge maps"

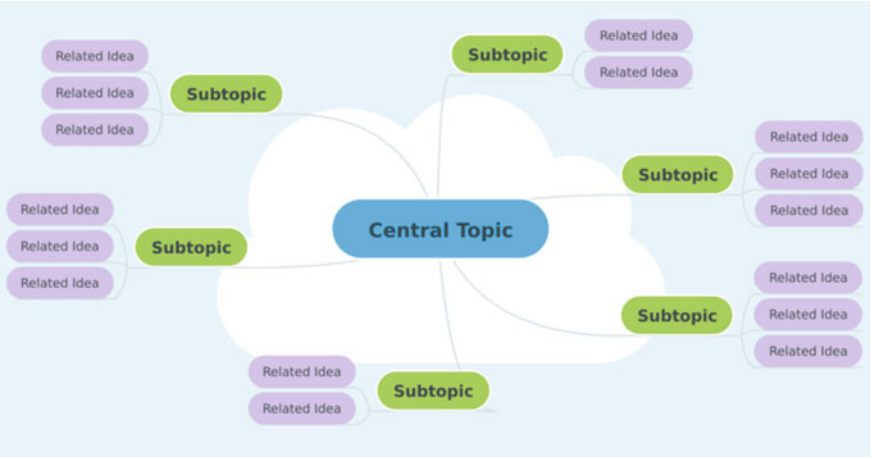

Fig. 1 Mind map schema. From: https://www.mindmeister.com/blog/wp-content/uploads/2019/09/Mind-Map-Example-796x417.png

(O'Donnell et al., 2002) or "graphic organizers" (Alvermann, 1981; Ives & Hoy, 2003), knowledge maps or node-link diagrams (Nesbit & Adesope, 2006), or mind tools (Jonassen & Marra, 1994). Both forms make use of graphical arrangements to create and organize thought. They also aim to make accessible for inspection what a thinker has in mind. They see their techniques as multi-purpose tools that can be used for various activities, such as idea-generation, note taking, summarizing, memorizing content, organizing ideas, understanding complex matters, or preparing to write a paper. This last function, as it pertains specifically to academic writing, is what we focus on in this chapter. Other graphical organizers such as flow charts, Venn diagrams, Vee diagrams or conceptual diagrams are not considered here as they are preferably used as a visual communication media, not as part of writing activities (Fig. 1).

Buzan (2006) designed the mind map technique primarily as a thinking device. The technique consists of writing a topic or core issue in the middle of the paper and then add branches to other concepts (nodes), each of which represents a relevant aspect of the topic. The branches receive names and smaller branches are attached on them, each of them representing a separate, subordinate aspect. Mind maps feature what are referred to as spoke, radial or hierarchical tree-like structures. Michalko (2006, p. 67) described the five common features of all mind maps. They

- organize topics
- work out core aspects of topics
- illustrate relations between the aspects on the map
- form thematic clusters
- focus thoughts around the topic (involvement).

Concept maps follow an idea similar to mind maps but are justified more as a way of representing knowledge than as a tool for thinking (see Fig. 2), even though thinking and knowledge seem to belong to two sides of a single coin. Developed by Novak (2010) in the 1960s, concept maps were initially considered a pedagogical means of representing the knowledge students have acquired but soon the concept was expanded to a tool for a wider range of tasks and users. Novak and Cañas (2006) describe the basic structure of concept maps: Concept maps are graphical tools for organizing and representing knowledge. They include concepts, usually enclosed in circles or boxes of some type, and relationships between concepts indicated by a connecting line linking two concepts. Words on the line, referred to as linking words or linking phrases, specify the relationship between the two concepts. We define *concept* as *a perceived regularity in events or objects, or records of events or objects, designated by a label.* The label for most concepts is a word, although sometimes we use symbols such as + or %, and sometimes more than one word is used. (See Fig. 2 as an example)

Hay and Kinchin (2006) identified three predominant concept map structures though there may be some deviation or crossover with a single concept map. In predominantly *chain* structures, concepts are linked sequentially. In *radial* structures, a central concept branches out into subordinate concepts, resulting in a root or tree-like structure. *Network* structures can have multiple links to and from concepts and do not adhere to a top-down hierarchy. For Hay and Kinchin, concept maps are a representation of conceptual knowledge to be used to assess learning, where the richness of the conceptual understanding is characterized by the number of concepts and crosslinks between them.

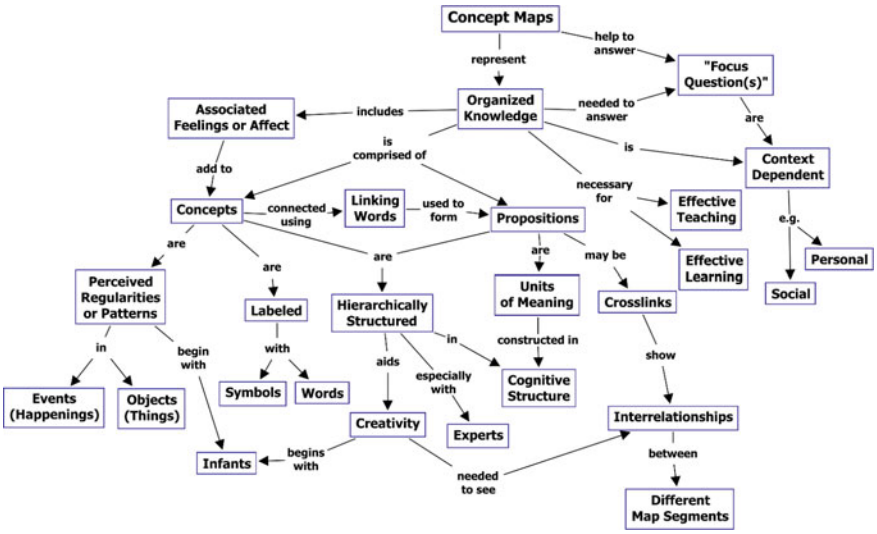

Fig. 2 Example of a concept map that represents concept mapping (Novak & Cañas, 2006)

A meta-analysis of Nesbit and Adesope (2006) from 55 studies on the effects of concept and knowledge maps in secondary and higher education showed constant learning gains in various tasks and in comparisons with other forms of knowledge representations from readings such as lists or notes. Unfortunately, information on the support used for mapping (digital or paper) and when digital, on the type of tool used, was not provided. The study was also primarily interested in learning and retention effects after reading, rather than in the effects on writing practice.

Eppler (2006) notes that concept mapping techniques are difficult to apply, particularly for non-academic users:

- they have relatively strict formal rules that have to be followed
- the emphasis on identifying concepts and relations is time consuming
- the general top-down structure of concept maps (from concepts to examples) may not always be adequate to represent sequential content (processes, timelines)
- the boxes-and-arrow format makes it difficult to efficiently represent a great number of items.

These difficulties seem greater for concept maps than for the less-demanding mind maps.

Both techniques, mind maps and concept maps, were theoretically framed as tools for self-directed learning and intellectual empowerment. As writing in education, similarly, fulfils both functions, they do connect well. What makes concept maps differ from mind maps is that the connecting lines between the elements may be named, thus allowing writers to specify the kind of relationships between the concepts. Labels may be pre-given (like "is" and "has") or may be created by the user, thus connecting two elements by labels such as "results in", "contains", "means", "is necessary for", "is part of", and so on. The connecting lines usually are arrows to indicate that the relations specified are unidirectional. Mind maps in contrast, only specify higher-order and same-order aspects: mainly indicating different levels of abstraction organised in sets and subsets. While mind maps simply name elements (or thoughts) and order them, concept maps create more complex structures by connecting two ideas with a connecting element such as "Creativity - > needed to see - > Interrelationships." Each of these triplets forms a concept of its own. As each element may be connected to several other elements, a network of ideas arises.

2 Core Idea of the Technology

The opportunities which a transfer of idea mapping technology into digital environments would offer were obvious. Instead of drawing circles and squares around the text on a separate sheet of paper, it could be done in the same environment and be connected to the emerging text in various ways. As multimedia opportunities were one of the most remarkable features of early digital writing software, the graphical approaches of mind mapping and concept mapping inspired many developers to

create digital supports for these activities. Both are part of a larger class of visualization software, which also includes such graphic elements as Gantt diagrams and flow chart diagrams which are not discussed here as they are not used to enhance writing. Software such as MindManager, Cacoo, Diagram.net and Lucidchart include various types of premade "nodes" for specific types of diagrams, such as Gantt and flow charts, as well as node palettes and chart templates for modelling domain specific activities (business, engineering, software development, etc.).

Although faithful to their paper-based ancestors both, digital mind maps and concept maps changed in many ways and were enriched with additional functions and an extended list of applications in different fields. Digitalization primarily added an easy-to-handle graphical design with flexibly arrangeable boxes, branches and connecting lines along with optimized modes of inserting content. In the last decade, these have moved from locally installed software to online application services. This has added the possibility to collaborate on single maps and co-construct knowledge representations offering artefacts for socio-constructivist learning scenarios and collaborative writing (Kurniawan et al., 2020; Mammen, 2016).

Using idea mapping technologies is part of several activity fields which overlap but may form a particular focus:

- Reading: active reading, note taking, and summarising
- Writing: idea development and conceptual elaboration
- Content development and analysis: Exploring complex systems of ideas or phenomena
- Communication: Information visualization
- Project work: Idea management and workflow

In summary: Idea mapping technology may be seen as an alternative form of knowledge generation, organization, visualisation, and representation avoiding time consuming verbalizations of content in linear script. Both technologies have moved away from a stage approach to writing to accompany the whole writing process by mapping and documenting the core elements of the emerging text in a separate document. Idea mapping helps the writer both to prepare the core ideas of the text but also to keep control over what has already been said and what has to be said next. With digitalization, the maps can easily be modified and ideas can be rearranged to represent emerging text structures and revised in parallel to writing. Idea mapping technology thus supports or prepares decisions on linearity of content. Aside from writing, they can serve as a way to document the results of reading and note taking, record the results of discussions, explore knowledge structures, make conjectures, while supporting project planning, project supervision and metacognition.

3 Main Products

Although mind and concept maps share some basic ideas and can be produced within the same application, they have remained two separate approaches, both conceptually and technologically. A fairly complete list of technological solutions, including free ware is provided by Wikipedia under https://en.wikipedia.org/wiki/List_of_concept-_and_mind-mapping_software. Software development, however, has gone separate ways for each approach.

The first digital version of the mind map appeared on the market in 1994, initially under the term MindMan, then Mindjet, and beginning in 2006, MindManager. Techradar.com (https://www.techradar.com/best/best-mind-map-software) claims to have listed the best mind map software, some of them, however, in fact, are concept mapping software—indicating the often conflating of mind mapping and concept mapping as the technologies evolved. Of the software listed at Techradar.com, only Scapple, a mixture between mind mapping and concept mapping software, is specially designed for writers. Scapple is a comparably low-cost application, easy to handle and in a certain way it follows Rico's (1983) clustering idea: Click on any space of the screen to place a note there and repeat this until all ideas are deposed. Writers/users may then move the ideas around and start connecting them to look for concepts and structures from which the writing project can emerge. Another software that connects both kinds of mapping and is particularly designed for writers is Inspiration, see https://www.inspiration-at.com.

Fewer applications are available for concept mapping. Next to the dominant CMap Tools, there are Lucidchart, Cacoo, Coggle, yEd (both concept and mind mapping), and Visual Understanding Environment (VUE) that support concept mapping amongst other services and proposed process templates. The Wikipedia entry for Concept and Mind-Mapping software https://en.wikipedia.org/wiki/List_of_concept-_and_mind-mapping_software lists many tools and platforms and presents examples of their graphical appearance.

4 Functional Specifications

The number of idea mapping software and applications that include mapping offered today is hard to estimate. The PAT website (Predictive Analytics Today) on https://www.predictiveanalyticstoday.com/top-free-premium-mind-mapping-software/ lists 29 mind mapping tools in 2021. Wikipedia lists mind maps and concept maps in comparison, including a list of freeware under https://en.wikipedia.org/wiki/List_of_concept-_and_mind-mapping_software. What most idea mapping technologies include is:

Visualizing large numbers of ideas and concepts in one space: A key point of all mapping software is to make all elements visible on one page (i.e., at one glance) before they are linearized and hidden in the long language strings of written text.

Colours: Mind maps encourage the use of different colours for different branches, thus codifying relationships and enhancing the visibility of structures.

Shapes: Concept maps encourage the use of shapes to create visual relationships between nodes that are not linked, or to define additional attributes of concepts that their placement cannot denote.

Moving ideas and concepts around: A flexible, effortless arrangement of elements is a basic requirement and makes comfortable handling of large numbers of ideas possible. Usually drag and drop technology is offered.

Use of symbols other than words: Many tools allow users to choose or create non-linguistic symbols for more expressive maps. In some cases, this makes mapping more playful and more attractive for users.

Creative design ideas and choices for the users: Offering palettes of box shapes, colours, lines, background containers, and overall configurations is standard. Most tools try to appeal to the creative forces in users by offering them many opportunities for designing their maps. How much this adds to idea mapping is not clear.

Transfer of content from maps into script: Maps can be transferred by exporting functions diagrams. Some tools also allow maps to be exported as outlines, lists, SVG formats or Excel documents, which then can become part of the text.

Collaboration: Most browser-based tools by now have a function for real-time collaboration offering tool boxes for idea development, often enriched by white boards, story boards, containers for ideas, chat functions or blogs.

Content management: Almost all current software offers linking documents and URLs to nodes.

Animated maps: Both mind and concept mapping software can offer animations by making elements move and form developmental sequences. Usually, a presenting software such as PowerPoint, Prezi, Google Slides or similar (overview: https://www.techradar.com/best/free-presentation-software) is used in addition.

5 Research

Idea mapping technology has been studied in various settings and for different educational purposes. Research in the context of writing in higher education, however, is amazingly scarce. It seems most research has been done in second language learning and mostly for secondary education (Fu et al., 2019). The preferred context of studies is the field of reading and learning. Meta-analyses reveal a constant gain in learning outcome for the use of mind maps and concept maps when learning tasks are studied as Liu et al. (2014) showed for mind maps, and Nesbit and Adesope (2006) for both, mind and concept maps. When looking to assess the strength of the relationship between concept mapping and learning through effect sizes, they found that both, creating concept maps (0.82) and studying concept maps (0.37) were associated with statistically significant advantages over other modes of instruction such as lectures or whole-class discussions. Effect sizes are statistical indicators for the extent to which a certain treatment influences a target variable. They may be calculated differently. Positive values of 0.3 would indicate a small of 0.8 a medium size effect. If the same treatment is tested in multiple studies, then a meta-analysis may calculate aggregated effect sizes which are seen as the best indicators for evidence-based practice.

A new meta-analysis by Schroeder et al. (2018) in which they connected their data with the previous one of Nesbit and Adesope (2006) led to altogether 142 independent effect sizes from more than a hundred studies. They found an overall effect size of 0.58 for the use of concept maps as compared to other ways of instruction. Effect sizes were higher when maps were created by the learners themselves and not only offered as summaries for knowledge fields. Effect sizes were greatest when concept mapping was compared to other teaching forms such as lectures/discussions.

Batdi (2015) collected 15 studies published between 2005 and 2013 comparing the use of mind maps in higher education. In his meta-analysis, he received effect sizes of 1.05, 0.62 and 0.43 for the criteria of academic achievement, attitude towards the task, and pure retention measures respectively. Even if this study was not related to writing, its effectiveness for learning and academic achievement suggests that it might also improve writers' attitudes and engagement in writing projects, particularly with respect to a better understanding of the knowledge base of the intended text.

6 Implications of This Technology for Writing Theory and Practice

6.1 Writing Spaces, Digital and Real

Transferring the conceptual and terminological content from text to a graphical representation leads to a uniquely new digital space for thinking aside from the word processor. It might be characterized as non-linearized content representation enabling the writer to see large numbers of ideas in one view, a comfort which linear texts do not easily provide in such detail (the outline does a similar job but with less comfort and detail). While linear text can be read in one direction only, mappings can be read in various directions. What is said later does not depend on what has been said earlier. Mapping follows the logical or conceptual relations between ideas and not the sequential one in textual content-building. This is often considered the particular freedom which mapped collections of ideas provide.

6.2 Organizing Writing Processes

Mind and concept maps may precede or accompany writing processes and serve a high number of functions for text development such as planning, conceptual enrichment, thinking things through, step-by-step progress. They also prevent an early closure of idea development which may happen when writers verbalize their ideas right away, before structuring them.

6.3 Conceptual Thinking and Cognitive Processes

Both kinds of mapping technologies belong to the class of mindtools (Jonassen & Marra, 1994). They build valuable bridges from linguistic representations to more abstract, cognitive representations. Both of them show, however, that conceptual thinking always relies on terms and names for concepts without which any higher-order thinking cannot happen. There is a lot of little-explored cognitive activity involved, such as grouping thoughts, connecting them to concepts, specifying their relations, creating hierarchies of thoughts, connecting abstract and concrete issues, coordinating definitions, and isolating cause-effect relationships. Introducing a second technology next to the word processor helps understanding the conceptual side of writing and provides a deeper access to *writing-to-learn* as well as to *writing-to-think* aspects of writing. Idea mapping guides idea development and provides a semi-lexicalized structure of the possible content. Its activity comes close to that of an outline generator but it allows for a more focussed approach to interrelating content elements.

6.4 Formulation Support

Mind maps and concept maps do prepare formulation effectively, even if they do so particularly by abstaining from linearized text. They can, however, prepare a conceptual and terminological bone structure of the text-to-be-developed and relieve formulation from (some part of) conceptual thinking which has been done beforehand. It should be kept in mind, however, that there is probably a transfer in both ways, from conceptual thinking to formulation and from formulation back to the conceptualizing. Therefore, it should be recommended to develop maps not only in advance of formulation but in correspondence and close connection with the text development.

6.5 Writing Opportunities, Assignments, and Genres

Mapping approaches should not be considered separate assignments and should be taught in connection with regular writing prompts. Mind maps and concept maps are neutral with respect to genre. They can be used for stories as well as for essays or research articles, provided that terminologies and registers are adequately matched. A good opportunity might be to connect mapping approaches with the teaching of process-based writing to show what the change from conceptual to language-based idea development is.

6.6 Collaborative Writing and Collective Papers

Almost all mapping technologies allow for group work, be it synchronous or asynchronous. Mind mapping can be a good way of planning a project or paper together, while concept mapping additionally seems to be a way of jointly exploring a knowledge field. Both mapping approaches are fairly unique in instigating collaborative thinking and abstract thought.

6.7 Does the Digital Technology Improve Writing Quality?

There are indicators that the text quality of second-language writers is improved, particularly in summarising tasks (Yang, 2015). Liu (2011) found that using concept mapping as a pre-writing activity, whether done individually or collaboratively, resulted in better texts than the no-mapping condition. The quality of the concept maps also correlated to text quality, particularly for higher-level writers producing maps individually. The main effect should be that mapping technology support structuring and memorizing efforts in writing and learning. This, however, has not been studied in connection to improving writing quality as little as it has been in learning tasks.

6.8 Author Identities, Roles, and Audience

The use of mapping technology probably does add a new and favourable facet to the writer's identity by offering them a better access to the conceptual side of writing in connection with the mastery of a (complex) digital environment. This may prove as an important asset on the way of intellectual independence and critical thinking. In collaborative digital writing spaces, concept maps can be used to organize and structure collective knowledge in pre-writing stages.

6.9 Technological Knowledge

What competences are needed for future writers? For student writers, an introduction into mapping software seems necessary and useful. Both groups of tools help bridge academic writing with intellectual development and thus deepen the impact of the writing-to-think connection that writing usually has. It can lure writers away from believing that it is mainly rhetoric and style that makes a good text in favour of a more material- or content-based view. Also, it makes content better accessible to tutors and supervisors visualising the gist of the piece to be written.

6.10 Learning to Write: Can Machines Teach Concept Mapping?

Mapping tools, we believe, cannot teach themselves but need some instruction. While software has become increasingly accessible to mainstream users, understanding the linking and labelling approach that is more conducive to elaborating and reflecting on ideas on a deeper level than the simpler categorization of parent–child node structures requires some guided practice. This is may be particularly important to early-stage or lower-level writers.

6.11 Limitations and Dangers

Users following different writing strategies may react differently to such a tool. Fostering abstract thinking better than strategies built on formulation, concept mapping software favour not only conceptual thinking but also the collection of concepts and ideas, providing a valuable basis for formulating text. However, the shift from collecting and connecting ideas to formulation into text seems a critical one. Mindmap's hierarchical tree structures are easier to translate into linear text than networked concept maps, which may comprise more and richer connections between concepts. While a text can be enriched by a good concept map, it may be hindered by a poor or unclear map that represents ideas still under development.

7 Conclusions and Recommendations

7.1 Writing Practice

Connection of knowledge organization and writing can be well supported by mind or concept mapping technology. It is unclear, however, how different types of writers and writing strategies interact with the preference for such technology. Modes of using maps as pre-writing tool or as a tool accompanying text production seem both possible but are unexplored.

7.2 Teaching

Idea mapping needs some training to get started with. Training should contain both usage of the technology and introduction to a certain tool. Idea mapping tools are a good candidate for the writing course or the composition class as it can illustrate

the relationship of content organization in a visualized, static way and content organization in a linearized, dynamic way as in script. It can also connect with learning theories and learning development, provide a valuable connection between language and knowledge, and allow writers to prepare the interconnection of thoughts in a text (particularly concept maps which specify relations between concepts).

7.3 Research

Studies on the uses of mapping technology in connection with L1 writing are missing in research. Also, differences between both mapping technologies are not widely explored with respect to their usefulness for writing.

7.4 Tool Development

There are currently many software applications that resemble each other and appropriating one to particular academic writing needs and processes is difficult. Software development needs to investigate devices for facilitating the transition from conceptualization in networked maps to linearization into written text. These devices could allow for indicating pathways or tagging nodes like in VUE (Visual Understanding Environment) and exporting text according to a defined structure. Too few applications allow users to import a body of text or data and easily transform it into nodes. This can be particularly useful for academic writing where outside sources of information need to be integrated into the conceptualization or pre-writing phases.

8 List of Tools

There are a vast number and variety of available concept mapping software as either software to be installed locally as desktop applications or as browser-based web services. While some are limited to text nodes and interlinking, many also offer customized icon or shape nodes for targeted diagramming uses (process modelling, flowcharts, wireframes, UML). Most online services allow some form of sharing and real-time collaboration (Table 1).

Table 1 List of a selection of concept and mind mapping software

Software	Mapping type	Access	Specificities	Licencing
MindManager (formerly MindMan) https://www.mindmanager.com	Concept map,Mind map	Local installation and web versions	Microsoft Teams integration	Proprietary
Inspiration https://www.inspiration-at.com	Concept map	Local installation	Computer and mobile devices, aimed at educators and researchers	Proprietary
Freeplane https://www.freeplane.org	Mind map with limited cross-linking	Local installation	Portable to USB drive	Open-source
XMind https://www.xmind.net/	Mind map	Local installation and web versions	Desktop, mobile and web versions	Freemium
CMap https://cmap.ihmc.us	Concept map	Local installation and web versions	Aimed at educators, research-based design, collaborative	Proprietary freeware
Scapple https://www.literatureandlatte.com/scapple	Concept map	Local installation	Freeform note connecting, aimed at writers	Proprietary
Mindomo https://www.mindomo.com	Mind map	Local installation and web versions	Outlining	Freemium
Bubbl.us https://bubbl.us	Mind map with limited cross-linking	Web version only	Limited use without sign-in, Collaborative with sign-in	Freemium
Coggle https://coggle.it	Concept map	Web version only	Adapted for touchscreen manipulation	Freemium
Cacoo https://www.cacoo.com	Concept map, Mind map	Web version only	Multi-palette nodes for dedicated uses	Freemium
Wisemapping https://www.wisemapping.com	Mind map	Web version only	Portable to other servers	Open-source, freeware online for individuals
IdeaFlip https://ideaflip.com	Sticky notes, linked or grouped	Web version only	Process templates for groupwork	Freemium

(continued)

Table 1 (continued)

Software	Mapping type	Access	Specificities	Licencing
Lucidchart https://www.lucidchart.com	Concept map, Mind map	Web version only	Process templates for groupwork, Specialized nodes for dedicated uses	Freemium
yEd graph editor (part of yWorks suite) https://www.yworks.com/products/yed	Concept map, Mind map	Local installation and web versions	Specialized nodes for dedicated uses, aimed at developers	Proprietary freeware
Visual Understanding Environment (VUE)—from Tufts University https://vue.tufts.edu	Concept map, Mindmap	Local installation	Aimed at educators and researchers. Data and ontology imports, metadata scheming, visual pathways for presentation	Proprietary freeware
Vym (View your mind) https://sourceforge.net/projects/vym	Mind map	Local installation	Some added content and task management features	Open-source

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