

Using Mindomo to engage students in higher-order thinking

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Abstract

Mindomo (www.mindomo.com) is a web-based tool designed to aid in the creation of digital concept maps. This article provides an overview of concept mapping and Mindomo, followed by reflections on implementing Mindomo in a digital technology course for pre-service teachers. A SWOT analysis of Mindomo is presented in concept-map format, the goals being to provide information helpful to anyone considering using Mindomo and to encourage instructors to consider how concept mapping might facilitate higher-order thinking in their classes.

Keywords: Bloom's Taxonomy, concept map, online collaboration, pedagogical design

Introduction

A concept map is a multimodal document created to represent the relationships between connected ideas. Traditionally created using analog materials, several digital applications have been designed for – or could be repurposed to allow – concept maps to be created digitally. This article introduces *Mindomo* (www.mindomo.com), a web-based application designed to create digital concept maps and other graphical representations of ideas. Mindomo is a web-based program designed to assist in the creation of digital concept maps and mind maps, which have been identified as effective strategies for learners to demonstrate an understanding of concepts and information while also making connections (Novak, 2010).

Mindomo was developed in 2007 and re-built in 2016 (Expert Software Applications, 2019); since then, I have found that its functionality has greatly improved. Users begin with a map template or can create from scratch one of many styles of maps. Maps are created using a series of editing tools which can customize font, colour, size, shape, and background. Additional features include the ability to embed in a map images, audio, video and hyperlinks. Sharing is possible across the platform and maps may be saved and downloaded in PDF format. Mindomo operates on a freemium model: full tool functionality is free for students, teachers and the general public to construct three maps. Various paid subscription tiers for educators range from \$3 to \$9 USD per month – I use the middle 'teacher' tier (\$5/month) – and offer increases to the number of maps, publishing formats and Learning Tools Interoperability (LTI) integration into various learning management systems (LMS). Recently, an offline editing version of the program has been released.

Concept mapping as a pedagogical tool

Concept mapping is a technique whereby interconnected ideas related to a topic, idea or belief are represented in a visual way. Unlike traditional content-driven activities designed for memorization of content and recall, concept mapping asks learners to represent their knowledge visually by showing connections between seemingly disparate pieces of content. That reading and creating concept maps can be difficult at first may cause confusion about their function; explicit instruction on the format of a concept map is usually necessary.

As a pedagogical tool, concept mapping encourages deep learning, promotes creativity and promotes the connection between content, theory and practice. Concept mapping is documented as an effective pedagogical strategy regardless of age, level of study or discipline (Novak, 2010; Schwendimann, 2015). Additionally, concept maps can be employed for a variety of assessment and evaluation needs (Turns, Atman and Adams, 2000), including demonstrating understanding of a given text and as a means of collaborative presentation of ideas. For example, a psychology student could construct a concept map addressing Freudian theories and show the theoretical connections between psychoanalytic theory and psychosexual stages and break down psyche into the id, ego and superego, in addition to connecting examples from mass media that correspond to those theoretical concepts. There is no one 'correct' concept map for a given topic.

Concept mapping has been identified as an activity that engages students in higher-order thinking skills (Novak, 2010). What distinguishes a concept map from other graphic organizers (e.g., mind map, t-chart, Venn diagram, etc.) is the logical nature of a concept map. Unlike mind mapping, which suggests summarization or a series of consistent relationships, concept mapping supposes a depth to the levels and types of relationships depicted. In this way, concept mapping moves students beyond lower-order thinking skills (i.e., summarizing, defining, classifying and memorizing) and engages them in higher-order thinking actions (i.e., justifying, analyzing, defending and hypothesizing). Student creation of a concept map usually involves negotiating and clarifying ideas in ways that traditional assessment practices do not. These choices made by a student characterize what Ausubel (2000) called *meaningful learning*, whereby new information is fit into a learner's existing knowledge structure.

A *Novakian* concept map (Kinchin, 2015) can be read in a logical way, owing to the following technical elements included in its construction:

1. ideas or concepts outlined in some sort of shape;
2. non-crossing lines that connect all concepts to at least one other;
3. directional arrowheads on the connecting lines to denote the direction the relationship between two or more concepts;
4. words written on each line to describe the relationship.

The design of Mindomo allows students to use this rigid structure or to use a more organic structure, depending on the task.

How I have used Mindomo

Over the past three years, I have taught a pre-service teacher education course called *Digital Technology and Social Media Applications* a total of nine times. In each iteration of the course, I have included variations of concept-mapping assessment activities. During the 2018-19

academic year, the students (training to be K-12 teachers) worked in randomized groups to create multiple different concept maps, some of which were completed manually (i.e., using chart paper, post-it notes, pens, markers etc.) and others created digitally, using Mindomo. These activities were designed to engage my students in deeper thinking about theories (e.g., technological pedagogical content knowledge [TPACK; Mishra and Koelher, 2006], substitution-augmentation-modification-redefinition [SAMR; Puentedura, 2013], etc.) and issues (e.g., access, student collaboration, critical digital pedagogy, learning management etc.) related to teaching using technology. Their concept maps were graded using a rubric which included the technical elements listed earlier as well as categories related to connection to course activities and the level of integration of digital media into the concept map.

Reflection on practice

Brookfield (1995) suggests that effective teaching and learning involves the practice of critical reflection. What follows is a snapshot of the unpacking of the use of Mindomo from my perspective as the instructor and from the perspectives of some of my students.

Instructor's reflection

My first engagement with concept maps was as a doctoral student. A former professor of mine had been using them as a form of assessment for a number of years and encouraged me to think about the ways in which concept maps might promote more meaningful learning. Now, as an educator, I strive to make connections between theory and practice in a way that will equip my students to think critically once they leave my class. The work my students have done has challenged me to think critically about my own perceptions of the course content as well as my pedagogical decisions. Figure 1 shows a comment I made on a particularly striking concept map where students suggested that creativity in the classroom could (a) be promoted through self-directed activities and (b) foster a sense of community.

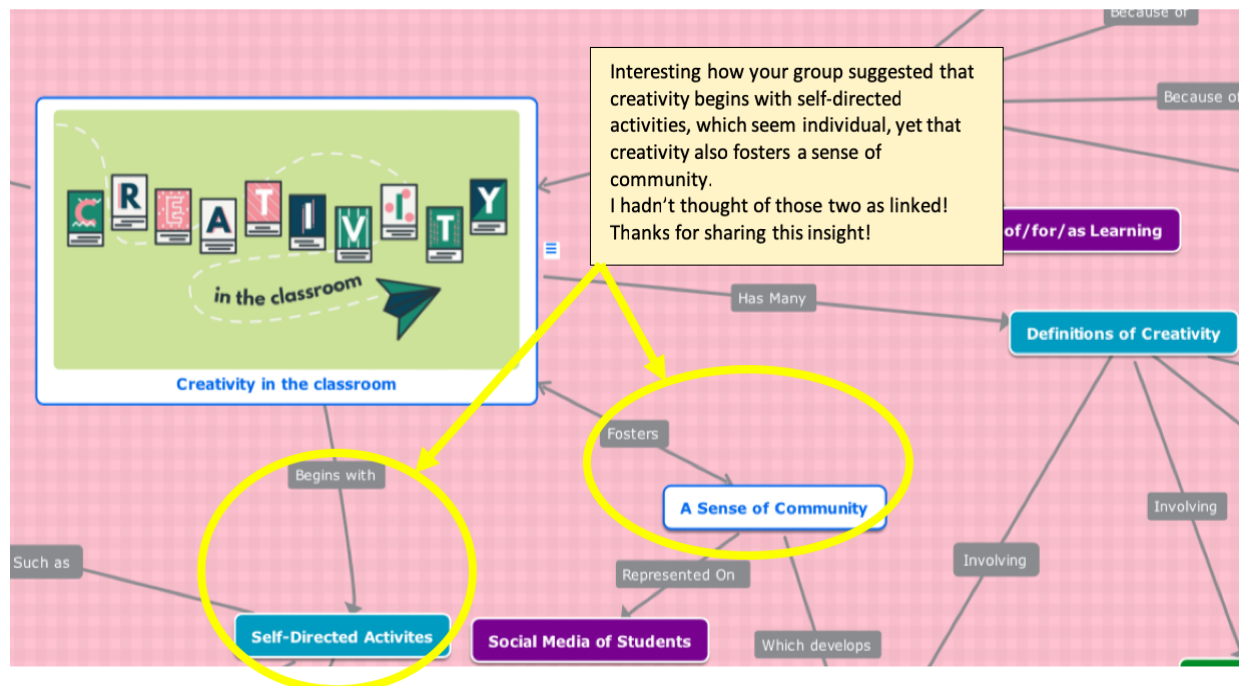


Figure 1: Snippet of a student-created concept map which suggested connections I had not considered were related

Student Feedback on Mindomo

Throughout my years using Mindomo in digital technology courses for pre-service teachers, I have received feedback on Mindomo as a tool to create digital concept maps. A more detailed research project (Sabourin, 2019) explored the perceptions of pre-service teachers in relation to digital concept mapping. The majority of pre-service teachers who have provided feedback to me describe positive experiences while using the software. Many of them have suggested that concept mapping allowed them to engage with course content in a more meaningful way:

“For the Mindomo concept mapping activity, I learned a lot more in depth into the article “The Kind of Schools We Need” because I worked with a group that took some different things from the article than when I read it. This allowed me to remember the article a lot better. I feel like I’ve retained the ideas in the article a lot better even a week later today than I would have if I had just taken notes and not done a digital concept map with a group of my peers.” (An intermediate-senior-level pre-service teacher)

Others appreciated how the complex ideas and connections of their group can connect with media beyond what can be represented in physical space and time:

“One advantage to using Mindomo to create our concept map is that we were less restricted than when we made the paper concept map. We didn’t need to conform to the size of the page, and it was easier to keep lines from overlapping because you can move them unrestrictedly anytime you have a new idea. It’s also a lot easier to add more detail, such as different coloured lines, pictures, and videos.” (A primary-junior level pre-service teacher)

Alternatively, some were critical of how Mindomo might sacrifice authentic discussion in favour of productivity:

“A problem with making the concept map using Mindomo is that although you’re still communicating with the people you’re working with, you don’t get the same amount of feedback as you do when you’re working with a group in person. In person, you’re able to bounce your ideas off one another. One person comes up with a concept, for example, and then the rest of the group adds in their opinion on if they think it’s a main concept and how to word it...Online, a lot of the conversation was very much to the point.” (A primary-junior level pre-service education student)

This last point highlights the need for educators to consider the trade-off between the advantages educational technology can provide and the degradation of other forms of communication that remain important. This is especially true in the concept-mapping process, as the *process* itself is a significant learning experience. A poor process, from my observation, often results in a poorly designed concept map.

SWOT Analysis

Mindomo is one of many tools designed to create digital concept maps. I have used a number of other desktop-based (e.g., CmapTools, Microsoft Visio) and online tools (e.g., Coggle, MindMeister etc.), but I find Mindomo offers the best user experience for teachers and students. The included concept map (figure 2) illustrates a breakdown of Mindomo by way of a SWOT analysis (i.e., strengths, weaknesses, opportunities and threats). I have identified internal strengths and weaknesses of the platform and the external opportunities and threats as they relate to my specific use, as well as more generally, regardless of the discipline. Note how the concept map format allows for connections across the four categories of SWOT and how the concept map inherently requires active interaction by the reader.

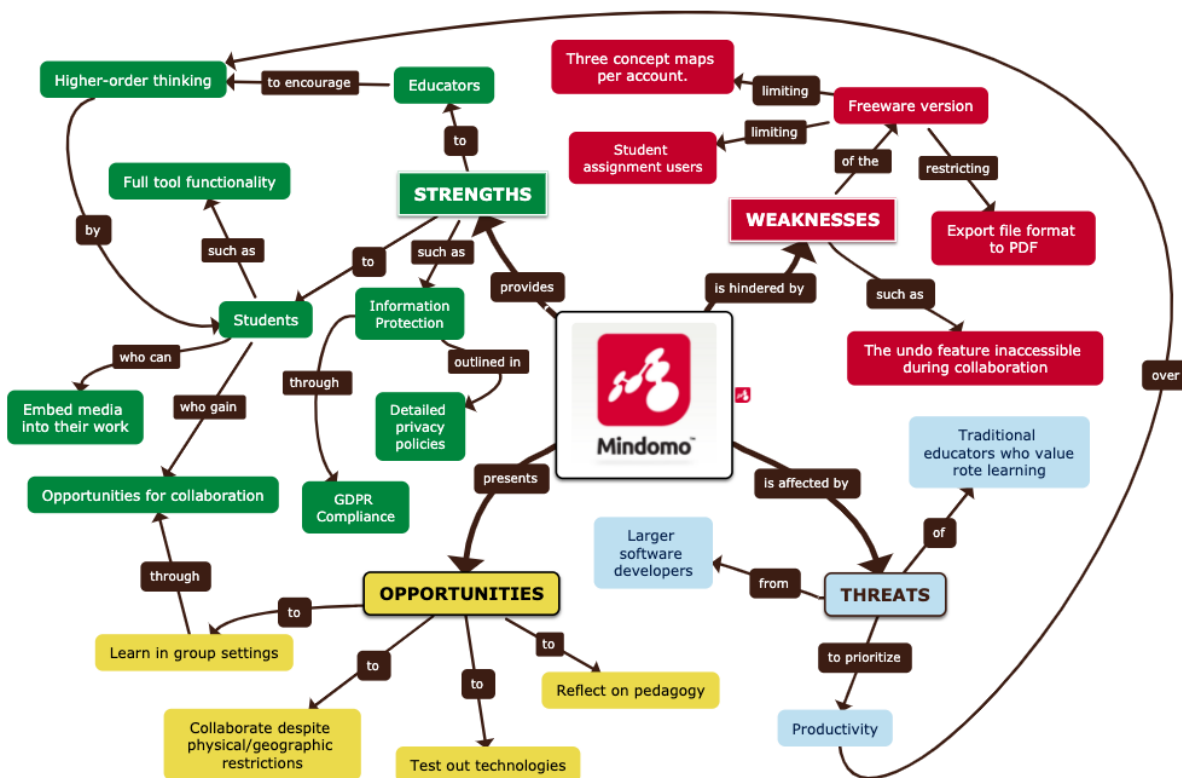


Figure 2. Concept map illustrating a SWOT analysis of Mindomo. The concept map should be read from the middle outwards, and along each branch as indicated by the arrowheads.

In general, Mindomo’s strengths and opportunities rest in its treatment of users as learners who can use the tool to engage in meaningful learning experiences. Although not a novel approach by any means, Mindomo’s decision to allow full tool functionality in the free version allows users to complete tasks without annoying pop-ups asking the user to upgrade. Additionally, considerable flexibility is built into the platform to allow users to share only limited personal information before first use.

Conclusion

Throughout many implementations of Mindomo, I have found it to be a useful tool for my students to use to show how they uniquely conceptualize ideas and examples discussed in the courses I teach. Student feedback generally supports the pedagogical use of Mindomo, but raises concerns about whether using technology usurps the development of other important learning processes. As with all new digital tools, I recommend those interested in using Mindomo should decide if concept mapping indeed aligns with the goals and outcomes of the learning experience they are looking to provide. In short, the adaptability of concept mapping as a pedagogy makes it suitable in a variety of disciplinary contexts and Mindomo is an effective digital tool to aid in creation.

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