
Isiyaku Dauda Dansarki
School of Secondary Education (Business), Federal College of Education (Technical) Bichi, Kano - Nigeria

Abstract
The objective of this study was to propose specific mind mapping tools that can support the transformation of teachers’ instructional practice in tertiary institutions of Sub-Saharan African nations. The sample of the study was made up of 212 business education teachers randomly selected from 13 tertiary colleges of Northwestern Nigeria. Based on literature, ten (10) mind mapping tool items were generated and a structured questionnaire titled Mind Mapping Scale (MMS) was developed as the instrument of the study. Participants of the study were asked to identify from the ten (10) mind mapping tools itemized in the instrument, those ones that they use in their instructional practice. Findings have shown that out of the 10 mind mapping tool items proposed, the most familiar to the teachers that participated in the study was mindmap with a meagre 8.5% users, while the most unfamiliar tool item to them was bubbbl.us with only 1.4% users. Overall, the study has revealed that the mean ratings of the responses of the participants of the study on the types of mind mapping tools they use in their instructional practice was as low as 4%. The study recommends that teachers in tertiary institutions of the Sub-Saharan African nations should endeavour to familiarize themselves with mind mapping technologies and use them for the transformation of their instructional practice.

Keywords: instructional practice, mind-mapping, Nigeria, Sub-Saharan African nations, teachers, transformation, tertiary institutions,
Introduction
Usage of new technologies for education-related purposes has continued to increase across the globe, with numerous educational tools transforming the classroom and giving room for easy and quicker access and dissemination of information (ITU, 2014; Valtonen, Kukkonen, Kontkanen, Sormunen, Dillon & Sointu, 2015). Typical examples of these new technologies include mind mapping tools which are used to help impart critical and analytical skills to students, to enable students see relationships between concepts, and to serve in effective assessment of the students. Mind mapping tools are basically characterized with a common feature of presentation of diagrammatic relationships of various kinds which are mostly preferred than written or verbal descriptions because, pictures and structured diagrams are basically thought to be more comprehensible than just words, and they are also considered to be clearer means of explaining and illustrating complex topics (Davies, 2011).
Mind mapping is a technique of teaching, learning and research that has been in use for over 25 years in education and it plays significant role in supporting teachers’ instructional practice transformation (Cismaru, & Novac 2015; Kathrina Mendez 2019). But while the use of mind mapping technologies has become key in developed countries across the globe, the diffusion of such technologies has remained extremely low in most nations of the Sub-Saharan Africa, including Nigeria (Anandarajan, Igbaria, & Anakwe, 2002; Isiyaku, Ayub & Kadir, 2018). UNESCO (2010), observed that while educational institutions in regions such as Europe, America, Australia and most of Asia have advanced in the use of new technologies in their classrooms, in nations of the Sub-Saharan Africa, strong obstacles have continued to constrain the utilization of these technologies in most institutions of learning (Mbaba & Shema, 2012; Ubulom, Enyekit, & Onuekwa, 2011; Umoru, 2012). For instance, in Nigerian tertiary institutions, up to the present time business education teachers are still using obsolete tools like the manual typewriters and ink duplicators in the classroom (Isiyaku, 2019). Invariably, it suffices to say that despite the prevalent educational benefits of new technologies such as mind mapping tools, teachers in the Sub-Saharan Africa have not been able to implement these technologies.

In this regard, the basic objective of this study was to investigate the types of mind mapping tools that teachers in tertiary institutions of Sub-Saharan African nations use in their instructional practice. This objective will be achieved through answering one fundamental research question: “What are the mean ratings of the responses of business education teachers in tertiary institutions of Nigeria on the types of mind mapping tools they use in their instructional practice”

**Literature Review**

Mind mapping is a process by which classified diagrams are used for the purpose of organizing and understanding information, ideas, and discussion topics (Jaylyn, 2020). Supported by the use of a non-linear graphical layout that allows the user to build an intuitive framework around a central concept, mind mapping is a technique that aids visual thinking, learning, planning and creativity; and it can turn a long list of monotonous information into a colorful, memorable, and highly organized map that works with the brain's natural way of doing things (Jaylyn, 2020). Accordingly, mind maps help us remember information, as they hold it in a format that the mind finds easy to review and recall (Tureniyazova, 2019). Therefore, through mind mapping, teachers can guide students not only to master a great variety of concepts, but to develop essential learning and thinking skills; generating new ideas, synthesizing and structuring information, problem-solving, decision-making, using evidence to support claims, and it serves as a technique for accurate planning (Kathrina, 2019).

Jaylyn (2020) stated that mind mapping was invented as an aid for visual thinking and learning, by Tony Buzan in the 1970s and it has since then been steadily modified and modernized as a tool that increases memory and promotes understanding of concepts, ideas, key terms, and complex information. Tureniyazova (2019) described mind mapping as a flexible process because it does not require a structured outline or a specific way to be created. It is simply created by creativity and the flow of cognitive information translated into a visual diagram. It also helps organize notes and makes the learning process more active.
Jaylyn (2020) observed that mind mapping comprises many benefits, especially with regard to teaching and learning. Consistently, in Davies (2011) Brinkmann (2003) revealed that mind maps have helped students understand class content in a more simplified pattern. He describes mind maps as being identical to a tree if sliced in half and viewed from above. The main idea being the tree trunk and its branches being the supporting topics. He reasons that mind maps help organize information, memory, prompts consolidation (connection between old knowledge and new knowledge), and summarization.

In Jaylyn (2020) studies led by Goodnough and Long (2002) and Luke, Lloyd, Boyd, and Exter (2014) found reliable results regarding effectiveness in group settings and enjoyableness of the use of mind maps in education. Goodnough and Long instructed their students to practice creating mind maps in groups where they had to create associations with words and images. They found that the students enjoyed the experience making learning fun and learning easier. Additionally, Luke and his colleagues found similar results. In their group study, they found that mind mapping increased the group members participation, communication, and socialization. Mind maps encouraged them to work together and also provided clarity to the subject reinforcing understanding. In addition to mind maps making learning easier, it also makes learning more enjoyable increasing the likelihood of retaining the information and making that knowledge useful. Accordingly, the use of mind mapping method in learning was found to improve the memory of 10-11 years old students (Ihsan, 2019). Mind Mapping was also found to improve tertiary students’ presentation skills (Solusia, 2020). Altogether, these studies demonstrate that mind mapping is beneficial in education and should be applied when studying, learning, or presentation.

**Uses of mind maps**

Jaylyn (2020 opined that mind maps can be used in the following areas:

- Brainstorming – individually, and as a group.
- Summarizing information.
- Taking notes.
- Consolidating information from different sources.
- Thinking through complex problems.
- Presenting information clearly.
• Studying and memorizing information.

**Components of mind maps**
Jaylyn (2020) presented the following as the basic components of an ideal mind map:
• Main idea/topic/concept
• Subtopic/concept
• Concept/definition/terms

**How to create mind maps**
Jaylyn (2020) presented the following as the basic steps for creating mind maps
• The center of the map should be the main idea.
• This can be the whole chapter
• A section in the chapter that isn’t clear
• A main topic.
• A problem, a procedure, a decision.
• A discussion.
• Brainstorming
• Next, break the main topic into subtopics. This can be sections in the chapter, themes, terms, or concepts.
• Themes.
• Slightly more detail about the main subject.
• Subtopics could be organized in different ways such as terms, concepts, or sections.
• Continue to add branches and connections to the topics until the map contains all the information that is needed to be understood better.
• Add information about the subtopic but not too much information.
• Keep it simple.
• Add images/pictures and drawings that will support understanding of concept or term.
• Include images that are relevant to the topics.
• Include images that can be associated with the topics.
• Drawing could also be incorporated but remember to not overwhelm the map with too much detail.
• Add color or color code subtopics so that associations could be created which aids the learning process.
• Adding color helps with association which makes learning easier and interesting.
• Color helps to visualize parts of the map in your mind.

When teachers or students want to create mind maps, they can use browser-based mind map tools, desktop-based tools or paper-based mind map (Douma and Ligierko, 2009). Browser based mind map can be created by using available online tools such as the following:

*Table 1 Mind mapping tools proposed for teachers use in their instructional practice*

<table>
<thead>
<tr>
<th>S/N</th>
<th>Tool</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mindomo</td>
<td><a href="https://www.mindomo.com">https://www.mindomo.com</a></td>
</tr>
<tr>
<td>2</td>
<td>Mindmeister</td>
<td><a href="https://www.edrawsoft.com/mindmaster/">https://www.edrawsoft.com/mindmaster/</a></td>
</tr>
<tr>
<td>4</td>
<td>Bubbl.us</td>
<td><a href="https://bubbl.us/">https://bubbl.us/</a></td>
</tr>
<tr>
<td>5</td>
<td>Mapul</td>
<td><a href="https://www.mapul.com/">https://www.mapul.com/</a></td>
</tr>
<tr>
<td>6</td>
<td>Mindmup</td>
<td><a href="https://www.mindmup.com">https://www.mindmup.com</a></td>
</tr>
<tr>
<td>7</td>
<td>Miromindmap</td>
<td><a href="https://miro.com/mind-map-software/">https://miro.com/mind-map-software/</a></td>
</tr>
<tr>
<td>8</td>
<td>Mind42</td>
<td><a href="https://mind42.com/">https://mind42.com/</a></td>
</tr>
<tr>
<td>9</td>
<td>Ayoa</td>
<td><a href="https://www.ayoa.com/">https://www.ayoa.com/</a></td>
</tr>
<tr>
<td>10</td>
<td>Other tools</td>
<td>App Store and Play Store for use on iOS and Android devices</td>
</tr>
</tbody>
</table>

Figure 1 is an example of a browser-based mind map created by the researcher for the purpose of his lectures in Principles of Management for a tertiary institution in Northwestern Nigeria, using *Mindomo* from https://www.mindomo.com. Browser based mind mapping also provides the user with an added advantage of fantastic presentation tools that show how individual pieces of information are connected, letting students comprehend and retain information more easily.
Figure 1 Mind Map Example I
Desktop-based based mind map can be produced on a computer screen but only for offline use. Figure 2 is an example.

Figure 2 Mind Map Example II
Paper-based based mind map can be manually sketched on a piece of white blank paper with a landscape orientation. Colorful pens with varying thickness of line can be used in creating the map (Murley (2007). Figure 2 is an example.

Figure 3 Mind map Example III

The purpose and justification for mapping tools
Davies, (2011) opined that the over-riding aim of all mapping techniques is similar. If students can represent or manipulate a complex set of relationships in a diagram, they are more likely to understand those relationships, remember them, and be able to analyse their component parts. This, in turn, promotes ‘‘deep’’ and not ‘‘surface’’ approaches to learning (Biggs 1987; Entwistle 1981; Ramsden 1992). Secondly, according to Davies, (2011) for most people, maps are also much easier to follow than verbal or written descriptions, although reservations need to be made in terms of the kinds of ‘‘maps’’ under consideration, for not all maps are equal (Larkin and Simon 1987; Mayer and Gallini 1990; Davies, 2011). Thirdly, the work involved in mapmaking requires more active engagement on the part of the learner, and this too leads to greater learning (Twardy 2004; Davies, 2011).
According to Davies, (2011) there is empirical support for the use of mapping in enhancing, retaining and improving knowledge. Evidence from the cognitive
sciences shows that visual displays do enhance learning (Vekiri 2002; Winn 1991). Maps allow the separate encoding of information in memory in visual and well as propositional form, a phenomenon called “conjoint retention” or “dual coding”. In simple terms, processing information verbally as well as pictorially helps learning by virtue of using more than one modality (Schwartz 1988; Davies, 2011).

**Methodology**
This study was conducted on a sample of 212 business education teachers randomly selected from 13 tertiary colleges in Northwestern Nigeria using a survey design. Based on literature, 10 items were generated for mind mapping tools and a structured questionnaire was developed as the instrument of the study, titled “Mind Mapping Scale” (MMS). The instrument was made up of five demographic items and ten (10) items for the mind mapping tools proposed in the study from which teachers were asked to identify the ones they use in their instructional practice. All items were validated by experts (One from Universiti Putra Malaysia, and the other from University of Ilorin, Nigeria). Pilot study was conducted on 30 teachers from three tertiary institutions in Northwestern Nigeria, and the reliability coefficient obtained for the instrument was 0.75, indicating that the instrument was valid at measuring what it was purported to measure.

**Results**
The opinions of the teachers that participated in this study on the types of mind mapping tools they use in their instructional practice are shown on Table 2.

*Table 2 Mind mapping tools used by teachers in their instructional practice*

<table>
<thead>
<tr>
<th>Mind-mapping tools proposed for the transformation of teachers’ instructional practice</th>
<th>Usage Options</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>S/N</td>
<td>Item</td>
<td>f</td>
<td>%</td>
</tr>
<tr>
<td>1</td>
<td>Mindomo</td>
<td>199</td>
<td>93.9</td>
</tr>
<tr>
<td>2</td>
<td>Mindmeister</td>
<td>198</td>
<td>93.4</td>
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<tr>
<td>3</td>
<td>Mindmanager</td>
<td>202</td>
<td>95.3</td>
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<tr>
<td>4</td>
<td>Bubbbl.us</td>
<td>209</td>
<td>98.6</td>
</tr>
<tr>
<td>5</td>
<td>Mapul</td>
<td>206</td>
<td>97.2</td>
</tr>
</tbody>
</table>
Table 2 shows that out of the 10 mind mapping tool items proposed in this study, the most familiar to the teachers that participated in the study was mindmup with 18 users (8.5%), while the most unfamiliar tool item to the teachers was bubbbl.us with only 3 users (1.4%). On the whole, the average percentage mean score of users of the mind mapping tools proposed in the study was a meagre 8 teachers (4%), while a huge majority of 204 teachers (96%) were non-users. The foregoing has answered the research question of the study; implying that the mean rating of the responses of business education teachers in tertiary institutions of Nigeria on the types of mind mapping tools they use in their instructional practice is as low as 4%.

**Conclusion**
In consistence with the claims of extant literature that teachers in Nigeria are yet to explore and benefit from the potentials of new technologies in the classroom, this study has shown that the mean rating of the responses of business education teachers in tertiary institutions of Nigeria on the types of mind mapping tools they use in their instructional practice is very low. Basically, teachers are expected to be able to enhance their teaching by accessing and using new technologies such as the mind mapping tools proposed in this study. With the insight provided in this study, it is expected that teachers in the Sub-Saharan African nations will be inspired to apply new technologies in their classrooms and be able to cope with the dynamics of technological innovations in teaching and research.

**Recommendations**
The study has revealed a very low usage of mind mapping tools among business education in tertiary institutions of Northwestern Nigeria and therefore recommend as follows:
i) Teachers in tertiary institutions of the Sub-Saharan African nations, should endeavour to familiarize themselves with mind mapping technologies and use them for the transformation of their instructional practice.

ii) Teachers in tertiary institutions of the Sub-Saharan African nations should also endeavour to teach their students the techniques of mind mapping in order boost their students’ memory, creativity, and productivity in the classroom.

References


