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Incorporating Mind-maps in Cell Biology Lectures –
A Reflection on the Advantages and Potential Drawback

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Abstract

Mind-maps have been advocated to be a useful learning tool for students. For Mind-maps to be effective, students have to learn how to use them and then construct their own maps. In this report, I describe my use of Mind-maps as a simple but useful tool for integration into teaching slides during Cell Biology lectures for providing students an overview of the topics that they are learning, orientating students during lectures with respect to the progression of the lesson and for showing links between topics. I highlight the strengths and potential weaknesses of such an approach.

Keywords: Mind-maps, Presentation, Overview, Orientation, Student learning

1. Introduction

The use of Mind-maps or Concept Maps has been proposed to be useful for promoting active-learning of Biology among students (eg. (Allen & Tanner, 2003; Morse & Jutras, 2008; Odom & Kelly, 2000)). For such an approach to work, students have to be taught how to use and construct the maps. It is also useful to provide timely feedback to students on their use of Concept Maps to fully exploit the advantages of the tool (Morse & Jutras, 2008).

I have been teaching a large-class Cell Biology module which was shared by two other lecturers. Due to time-constraints and the student numbers of about 250 - 280, I was not able to provide close supervision of Concept Mapping as we do not have teaching assistants in our module (Morse & Jutras, 2008). Moreover, because the

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time constrains, peer-evaluation was not tried. Given that Cell Biology is challenging both at the breadth of the subject matter and the amount of details that are accumulating from the fast-paced research in the field, I therefore chose to use Mind-maps as a presentation tool to provide not only the overview of the topics, but to highlight to students where the lectures are in relation to the main ideas I was teaching.

Essentially, the Mind-maps allowed me to zoom-in and –out of the topics as the lectures went on, providing me a tool to supplement my Powerpoint slides to present ideas and concepts to the students. I could demonstrate to the students how I use the Mind-map tools to organize my thoughts. This should provide students with a framework for understanding the topics I was teaching and how the topics connect to one another. Students can add details to the overview maps that they can use as quick revision tools. I also encourage students to try out the Mind-map programs for themselves to determine if they find it useful for making their own maps when they are doing their revisions.

1.1. Software Used

Given the large class with students from different background, the guidelines I used to choose suitable software for use are that it should be free and that it should not be restricted to any particular operating systems. FreeMind (freemind.sourceforge.net/) and Xmind (http://www.xmind.net/) are examples of such tools that fit these criteria. This was important because in addition to my using them as presentation tools, I also hoped that some students might find it useful as a learning tool.

Both the software are relatively similar and I used them interchangeably depending on the need such as whether I wanted a simple map (FreeMind is sufficient) or if I wanted the maps presented as a fishbone, logic chart or organizational chart (Xmind has more choices). Students were introduced to these two softwares briefly at the beginning of my series of lectures. It was explained to them that I was using the software as a presentation tool to provide overviews and summaries of the topics I was teaching.

I also highlighted that some students might find it useful as a learning tool, but that they have to construct their own maps for the maps to be effective. To help students use the Mind-map software, I also made a screen recording (recorded with QuickTime) (data shown in the virtual presentation) that I uploaded at the Integrated Virtual Learning Environment (IVLE) site showing how to use the software for students interested in using it as a learning tool for themselves either for the Cell Biology module or any other modules they were taking.

1.2. Examples of use

At the start of my series of lectures, I showed a figure with the module topic at the center of the Mind-map (Figure 1) and the key subjects that are essentially the four main areas that will be covered in the module (Figure 1). The red tick indicated the topic just covered by my co-lecturer.

Fig. 1. Main topics as shown in the Mindmap figure inserted into the Powerpoint slide
To zoom into the details of what has been taught as a way to help student recall the previous lectures, the Mind-map can be expanded to show more. For example, for each organelle, I highlighted their key functions (Figure 2, left panel). It was also easy to indicate on the same Mind-map the new subject matter for the lecture of the day (Figure 2, green arrow).

Fig. 2. Expanding a node in the Mind map.

At the end of the lecture, the Mind-map was shown again, but with expanded nodes to indicate what it was that had been covered in the 2-hour lecture (Figure 3, red tick). This will help put into context what we had just taught the students and how that related to the previous topics.

Fig. 3. Topics covered during the day.
1.3. Unsolicited Comments from Students on Mind-maps during End-of-Semester Feedback

Although no formal survey was carried out to obtain the students’ thoughts on the use of the Mind-maps, it was interesting to note that in the students’ feedback at the end of the semester that the students made mention of the Mind-maps in favorable light. Mostly the students either stated that the Mind-maps were useful or they alluded to “summary figures” as being beneficial for their learning of concepts as well as for following the lectures and use the Mind-maps as quick study guides. One particular student mentioned that he is normally averse to using Mind-maps as a learning tool personally but found the Mind-maps presented as effective as a summary tool.

It should be noted that with a class size of 250 – 280, these few comments should not be taken to be representative, but that the Mind-maps made an impression on the students who provided the comments voluntarily. These are comments that would only serve to provide some hints as to how the Mind-maps were useful to students.

Table 1. Examples of unsolicited students’ comments on Mind-maps

| 1. | “…the use of Mind-map is helping students to know which part of the lectures that are being taught” |
| 2. | “Her teaching of the Mind-map, although I am one who dislike using such techniques, is very effective in summarizing all the concepts taught during the lecture” |
| 3. | “Like how she makes use of the mind map to help everyone see where we are now so we don’t get lost” |
| 4. | “Mind-map is very useful to highlight the main points” |
| 5. | “good Mind-maps in the notes” |
| 6. | “…and she has a summary mind-map page. I think this is effective in giving and overview on what has been coverd so far” |
| 7. | “the Mind-map helped give me an overview of the content covered” |
| 8. | “Mind-maps and the breeze recordings were useful” |
| 9. | “mind mapping ways are really helpful in our learning” |
| 10. | “Her use of Mind-maps is extremely helpful in studying and revising” |
| 11. | “Provides Mind-maps that allow students to link subject to entire process” |
| 12. | “her Mind-maps or the way she teaches us link between ideas is very useful” |
| 13. | “Notes are good too, especially the Mind-maps” |
| 14. | “Provides useful Mind-maps which links content together” |
| 15. | “promotes good studying habits like making Mind-maps” |

1.4. Reflections on the use of the Mind-maps

At the personal level, I found that the Mind-maps were a good tool to represent the concepts I wanted to teach my students, as the programs such as Xmind allowed me easily to create concept-maps that could be expanded and collapsed to show overviews and details of Cell Biology. It was also easy to copy and paste the Mind-maps as figures into Powerpoint slides so that the maps are incorporated into my lectures. With such an ease of use, I
imagine it would also not be difficult for students who are generally more technologically savvy and who want to use the programs for their own learning, especially if they want to construct their own maps.

More importantly, the positive comments from the various students (Table 1) on their impression of the Mind-maps were encouraging to me as it showed that the Mind-map used as a presentation tool could help students in the way I had intended. This is especially so for the use of Mind-maps to provide a good framework for students to orientate themselves through the lectures that can sometimes be rather overwhelming in terms of the content.

A potential drawback of this usage of Mind-maps can be seen from the comments such as #10 or #11 or #14 (Table 1). These comment appear also to be positive in terms of how students think they benefited from being able to see links between topics so that they do not learn each topic in isolation. However, on reflection, I think that having me make the links between topics for students might potentially impede active-learning in students if they do not gradually learn to make their own associations between concepts in Cell Biology. Indeed, Mind-maps should be useful for encouraging conceptual and active-learning in students (Allen & Tanner, 2003; Knight & Wood, 2005; Michael, 2006; Morse & Jutras, 2008). If students become over-reliant on the teacher to make the Mind-maps for them, a possible problem could be that they use the Mind-maps I created merely as materials for studying. As such, even though the use of Mind-maps in my lectures seemed to be an approach that students welcomed, modifications on how they are used need to be made to fully capitalize on the strengths of such a tool not only for presenting ideas, but also for promoting active-learning in students (Wood, 2009).

1.5. Future improvements in applying Mind-maps

The figures of the Mind-maps shown during the lectures were in fact screen shots of the Mind-maps on my computer that I then copied pasted onto Powerpoint slides. This has the advantage that when I uploaded the slides at IVLE for the students, the Mind-maps are directly found in the slides. This was especially useful for students who did not use the Mind-map programs because they were unsure how to use them. However, this was a cumbersome way of presenting the map as compared to using the programs and showing the expansion and collapse of individual nodes to highlight connections between topics. Xmind has a portable version that would allow one to present the Mind-maps at the lecture theatre from a thumb-drive without having to pre-install the software at the computer that one is using in the lecture theatre. This is helpful as there might be administrator protected-rights on several of these computers that might forbid me from installing the Mind-map programs. By presenting from the Mind-maps directly, one can click on various nodes easily to draw students’ attention to specific points of interest. The Mind-maps can then easily be export as image files or Pdfs that can be uploaded at IVLE for students.

Another improvement would be to incorporate figures and diagrams of cellular components or processes into the Mind-maps. This will help me better represent ideas as compared to merely using words and phrases in the Mind-maps shown above (Fig 1 – 3). Xmind allows one to do that rather effectively. The figures will enable students to better visualize the structure and processes occurring in the Cell as they learn about the concepts.

It is also critical to address the issue of active-learning (Wood, 2009) that students should be encouraged to do in relation to the use of Mind-maps to make links between topics. While I use my Mind-maps for presentation, a partial Mind-map could be distributed to students who are interested to use it as a starting point to learn to create their own maps or start from afresh. This should not be a completed Mind-map, but rather, one in that provides a framework for students to construct their own Mind-maps. By omitting certain facts in the maps, students will have to think about the links that they find among the different topics. For example, a Mind-map with questions could be used as a starting point to motivate students to think about the topics taught in context of functional processes in Cell Biology (Figure 4). I could provide such maps at the beginning of each lecture for students to review what they had learnt in the previous lesson before I begin on a new lecture. They can also use such question-based maps their self-constructed Mind-maps to fill in details that they judge to be important in their self-constructed maps. These maps could then be peer-reviewed at least so that students can get feedback on their
conceptual understanding (Morse & Jutras, 2008). As such, a discerning use of Mind-maps should be the strategy to allow me both to present critical ideas in an effective way in class and at the same time, provide enough motivation for students to learn actively on their own by constructing their own maps. It would be useful to set-up surveys to gather feedback from more students as to their experience with Mind-maps. This will provide me with practical information as to the habits of the students such as whether they are contented to use my Mind-maps or if they are motivated to create their own. Any difficulties or resistance to using Mind-maps could also be revealed and such information will be beneficial to me for improving upon how to encourage students to test out the Mind-mapping programs.

More significantly, it might be valuable to set-up experimental tests to determine if the use of Mind-maps in my lecture slides actually helped with student learning. For instance, I could teach initial topics without using Mind-maps and conduct pre-tests to determine if students can make connections between topics. I could then incorporate the Mind-maps into subsequent other lectures and perform post-tests to see if the students’ ability to make links across topics is improved. One could also perform such tests after students progressed to the next level of their degree program and check if such skills in making connections between topics are retained. Such tests could be further combined to examine if students who use such Mind-mapping tools are able to learn better than students who do not. The data gleaned from such a study can be shown to subsequent students so that they can consider better whether they want to try out the Mind-mapping software for themselves.

Fig. 4. Question-based Mind-map to encourage Active-learning in Students.
1.6. Summary

In summary, the use of Mind-maps as a presentation tool that allowed me to provide topic overviews as well as to drill down into topic details, had indeed been a positive experience for myself and the students who provided comments on them. It would however, be worthwhile to further improve upon the usage of the Mind-maps during my lectures in my subsequent semesters, bearing in mind the potential drawback of using this without at the same time engaging the students in creating their own maps. Students will be encouraged to make use of such Mind-map programs to explore by their own experience, if making their own maps to link concepts give them a better grasp of the different topics taught to them. Ultimately, the aim is to achieve a good presentation of the subject to students but also to get more students who will provide comments such as in #15 (Table 1).

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References