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# Using concept maps to help students organise the content of your lectures

## **Abstract**

Teaching has been considered the act of transferring information from the teacher to the learner who was seen as an empty vessel to be filled with knowledge. This view of learning was due to the popularity of behaviourist learning theories that focused on how the presentation of the information affected learning outcomes (Weinstein and Mayer, 1986). Therefore, it is not surprising that the art of teaching became the art of presenting information. This approach has been applied in universities where lecturers are often required to make presentations to large and diverse student audiences.

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**Brian Ferry**

**Background**

Teaching has been considered the act of transferring information from the teacher to the learner who was seen as an empty vessel to be filled with knowledge. This view of learning was due to the popularity of behaviourist learning theories that focused on how the presentation of the information affected learning outcomes (Weinstein and Mayer, 1986). Therefore, it is not surprising that the art of teaching became the art of presenting information. This approach has been applied in universities where lecturers are often required to make presentations to large and diverse student audiences.

In recent decades cognitive scientists emphasised the study of how information is stored and processed in memory. They view learners as processors of information who use a variety of strategies to store and retrieve knowledge (Weinstein and McDonald, 1986). Thus the learner is a person who can engage in activities that will aid in the processing of information. Such mental activities help people to acquire, organise, and remember incoming knowledge more efficiently (Park, 1995).

Since the 1980s a constructivist approach to learning has become popular with many educators. This approach is based upon the supposition that as learners interact with the world, they construct their own experience and knowledge. Therefore, learning is viewed as 'the product of self-organization' and the learning process is supported by two broad principles: first, knowledge is not passively received but actively constructed by the learner, and second, learners generate understanding when they relate prior knowledge to present experiences (Wheatley, 1991). Often this occurs when the learner attempts to reconcile differences that exist between his/her explanation and the explanations of others about the same phenomena. Such a process often involves intensive and extensive interpersonal negotiation (von Glassersfeld, 1989).

Strategies devised to support a constructivist approach to learning rely upon connecting prior knowledge to new concepts and research indicates that concept mapping is an example of such a strategy (Novak and Gowin, 1984; White and Gunstone, 1992). Concept maps are two or three dimensional spatial or graphic displays that make use of labelled nodes to represent concepts and lines or arcs to represent relationships between pairs of concepts. Six uses of concept maps were identified by White and Gunstone (1992) and these were: to explore understanding of a limited aspect of the topic; to check whether learners understand the purpose of instruction; to see whether learners can make links between concepts; to identify changes that learners make in relationships between concepts;

to find out which concepts are regarded as key ones; and to promote learner discussion.

When students construct concept maps they identify and define important concepts or ideas and graphically represent interrelationships among concepts (White and Gunstone, 1992). The resulting two-dimensional or three-dimensional map represents a spatial organisation of their knowledge. As the links in this structure are labelled, and the concepts fully described, the map becomes of greater value to the learner. While this part of the process is crucial, it is not an easy task and White and Gunstone (1992) report that learners find this part to be a 'most irksome . . . and would skip it if they could' (p. 18).

### Instructing students to create concept maps

I recommend that students employ five steps when they create a concept map about a topic:

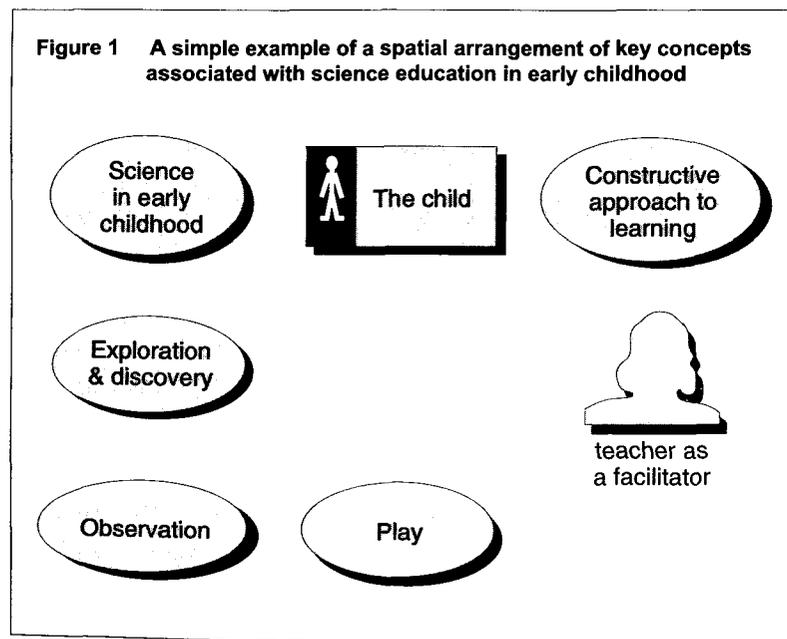
- 1 select key concepts. This is a recognition process that activates relevant knowledge, and assists in topic identification;
- 2 write the key concepts;

- 3 make a list of the characteristics of the key concepts;
- 4 relate key concepts in a spatial relationship;
- 5 rearrange these spatial relationships until they form a meaningful structure.

Figure one is a simple example of a result of these 5 steps. The concepts relate to science education in early childhood but there is little meaning unless the concepts are linked with lines or arcs that contain explanatory text and Figure 2 shows this map at the next stage.

The lecturer created concept map in Figure 2 was used as a framework to which additional material can be added. The main points to be discussed in the lecture are arranged around the periphery so that additional information can be easily added to the map.

It is important to model the process of concept map creation to students, and provide assistance that can be in the form of named links, structured hierarchies, chains, or clusters of concepts. I suggest that a period of direct instruction is necessary before learners can successfully employ this process. The instructional steps that I follow are recommended by White and Gunstone (1992).



- 1 Begin with a simple topic, familiar to students so that it is easier for them to concentrate on the learning process. Ensure that only a small number of terms are involved.
- 2 Model the construction of a concept map to the class. This can be done with an overhead projector, a whiteboard or computer with projection facilities.
- 3 Encourage students to think of all possible links and to write down the nature of each link.
- 4 It is unlikely that students will produce accomplished maps on their first attempt. Provide constructive criticism.
- 5 You may provide a suggested layout the first time, but it is important to remove this aid during subsequent mapping exercises.
- 6 Tell students that there is not a single correct answer to the task.

Computer technology can replace pen and paper as concepts and links can be easily manipulated on a computer screen. I found that most students take little time to learn computer-based programs and they can

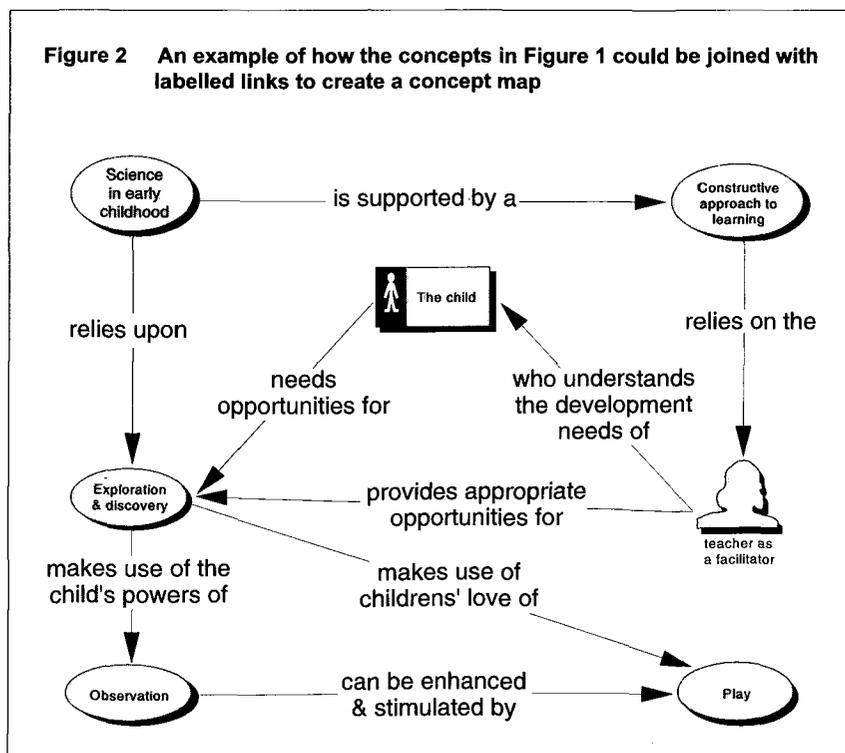
easily construct and revise concept maps. Even though the physical part of the process is easier than with pen and paper, students still have to apply their current knowledge when they construct their map. In general early attempts at creating concept maps are generally poor but as the students persist and revise their maps they report that the revision process (which is less irksome with a computer than with pen and paper) becomes easier and they gain a better understanding of how concepts link together.

Concept mapping tools quickly become transparent to students and this allows them to focus on the cognitive processes involved in the construction of their maps. However, careful instruction is needed as providing the hardware and the software is not enough.

### Using concept mapping in lectures

Students can create: a pre-lecture map that shows what they currently understand about the topic of the lecture; or a formative map that they create as the lecture progresses; or a post-lecture map done at the end of

**Figure 2** An example of how the concepts in Figure 1 could be joined with labelled links to create a concept map



the lecture to summarise their understanding of the lecture. You can ask students to compare their pre-lecture map with their post-lecture map.

Alternatively you can use lecturer-prepared concept maps for these purposes. I find that it is often useful to present a simple concept map as an advanced organiser as this tells the student what I am going to cover and displays visually how the information links together. Students can then use this map as a framework to which they can attach additional information, that is, they can turn my map into a lecturer-guided formative organiser. Another useful strategy is to stop part-way through a lecture and ask students to compare maps that they are creating. This strategy allows students to compare knowledge structures and to identify any misconceptions they have about the lecture material presented.

### **Using computer-based concept mapping tools**

There are several computer-based applications available and students and lecturers can put these to good use. The concept maps I produced for this article were created with an application called 'Inspiration' (Version 5.0) and is available in Mac and PC versions. This application allows the user to create large concept maps that can be in several layers. Each concept can have a special icon, selected from an icon library, and all concepts, links and background can have specified attributes such as colour, shape, text and size. Further, the concept map can be viewed in outline mode that can be imported into a word processor document. Also at each stage an explanatory note can be added to a concept or a link.

I often organise students in pairs to produce a cooperative map as it is good way to generate discussion and forces them to justify their map to a peer. The discussion (at times arguments!) about how concepts are related or linked helps students to gain a better understanding of their knowledge structure and

to identify misconceptions. Most students like using this program because it is easy to use and the product is visually appealing. While they enjoy working in pairs to construct their maps, there are times when I want them to construct their own maps. In particular I like them to construct a map of their current understanding at the start and at the end of a topic. By comparing their first and last maps students can see how much they have learnt. Also they can compare their final map to others in their group to verify the structure of their map.

### **Concluding remarks**

Concept mapping is a useful strategy for lecturers and students to employ, but like any other strategy, it can be overused. It helps students to explore their understanding of a limited aspect of the topic and to check whether their understanding is similar to their peers. Also it allows them to see whether they can make and describe links between concepts and to identify changes that they make to their maps as they learn more about a topic. There is no doubt that it promotes learner discussion and I commend it as a strategy that you may wish to add to your repertoire.

Further information about 'Inspiration' software can be obtained by contacting: Inspiration Software Inc, 7412 SW Beaverton Hillsdale Hwy; Suite 102, Portland OR, Fax: USA + 503.297.4676

Web site: [www.inspiration.com](http://www.inspiration.com). Other related web sites are included below:

CMap 2.0 for Macintosh, gopher://

[oldal.mannlib.cornell.edu:9570/40/misc/](http://oldal.mannlib.cornell.edu:9570/40/misc/)

CMap\_2.0.hqx

Banxia Software (maker of Graphics COPE), [http://](http://www.scotnet.co.uk:80/banxia/)

[www.scotnet.co.uk:80/banxia/](http://www.scotnet.co.uk:80/banxia/)

SemNet Research Group, [http://apple.sdsu.com/](http://apple.sdsu.com/logan/SemNet.html)

[logan/SemNet.html](http://apple.sdsu.com/logan/SemNet.html)

MindMan by Micheal Jetter, [http://mindman.com/](http://mindman.com/english/mindman.html)

[english/mindman.html](http://mindman.com/english/mindman.html)

CoCo Systems maker of VisiMap and InfoMap (Lite),

<http://www.coco.co.uk/>

Activity Map by Time/system Int, <http://www.timesystem.dk/software/index.html>  
 EGGLE Magic maker of  
 MindMapperMMInfo@emagic.marc.cri.nz <ftp://ftp.std.com/ftp/vendors/emagic/mindmap/mindmap.zip>

### Examples of software currently available

Software	Version	Platform
Inspiration	5.0	Mac/Windows
TkstNet/TextVision	1.40	Mac/Windows
CMap	2.01	Mac
LifeMap	2.8	Mac
KennisGraaf	2.0	Windows
Structure Activator	1.00	Windows
LearningTool	1.1	Mac
Graphics COPE	2.07	Windows
CourseWorks	0.7	Windows
SemNet	1.0	Mac
MindMapper	1.0	Windows
MindMan	2.0b	Windows
Mind Mapping Tool		Mac
VisiMap/InfoMap	1.4021	Windows
Flowchart tools e.g, MacFlow	3.7	Mac
General drawing tools		Mac and PC

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