Mind Maps
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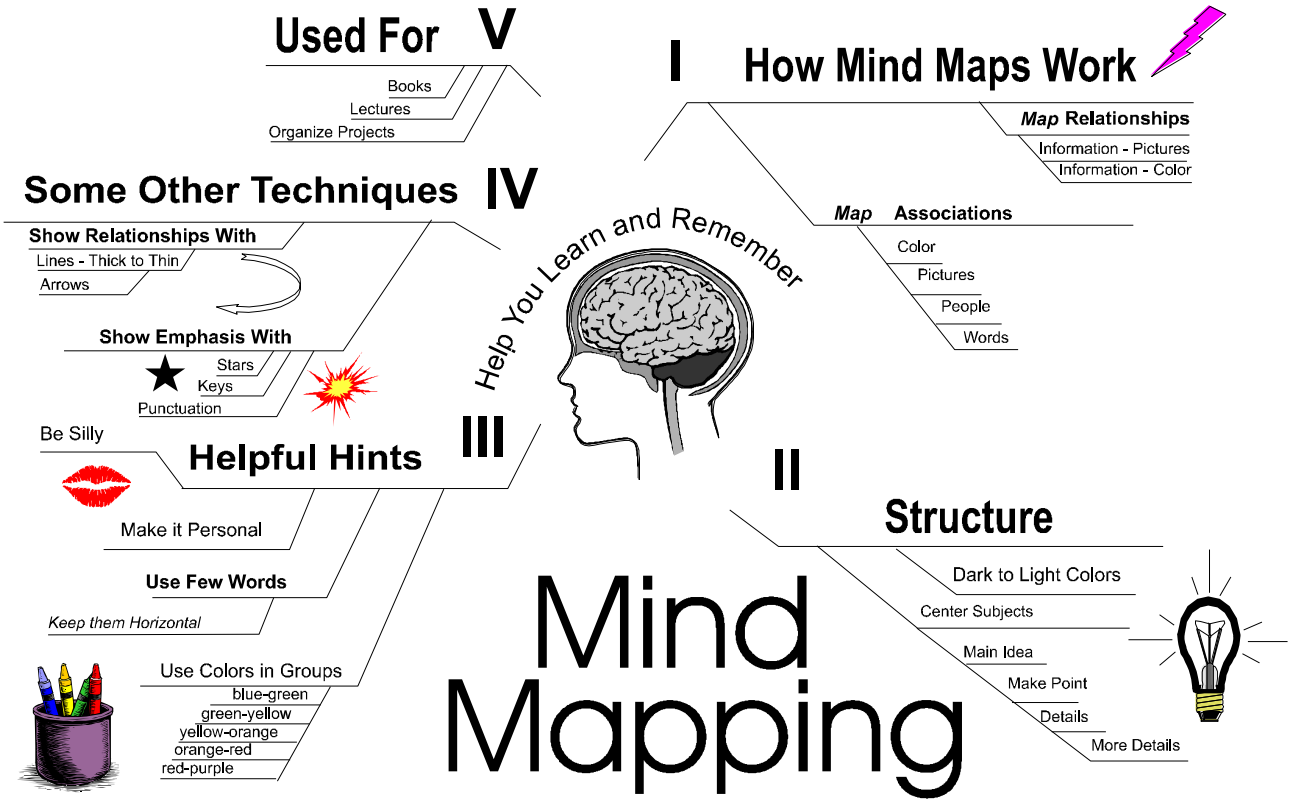

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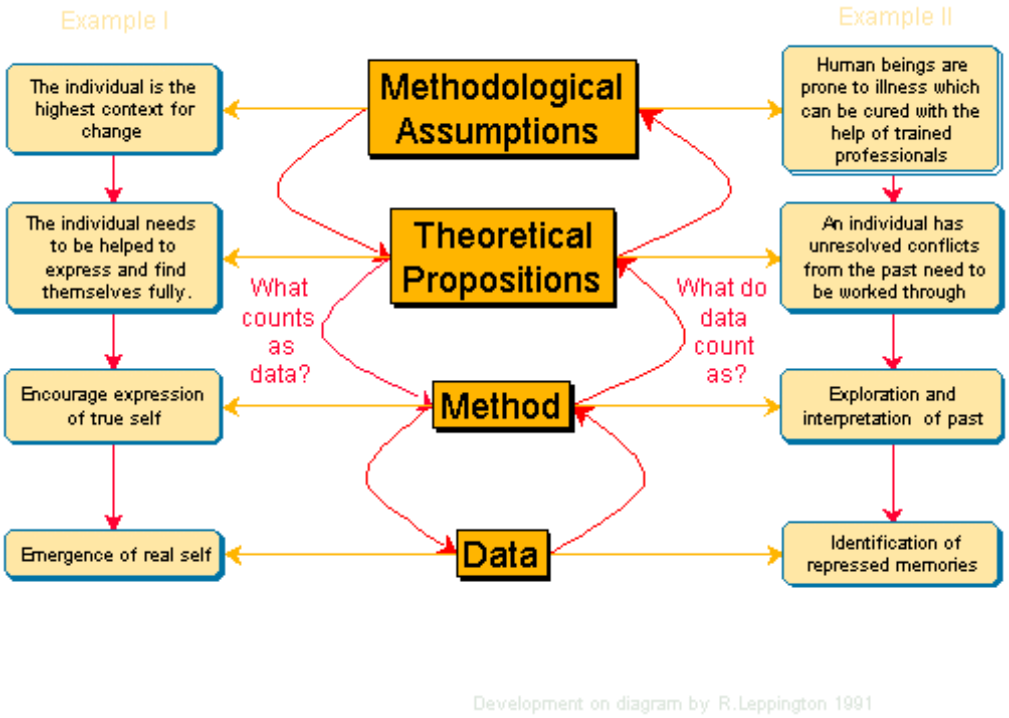

Mindmaps for Conceptual Understanding: A Preliminary Report

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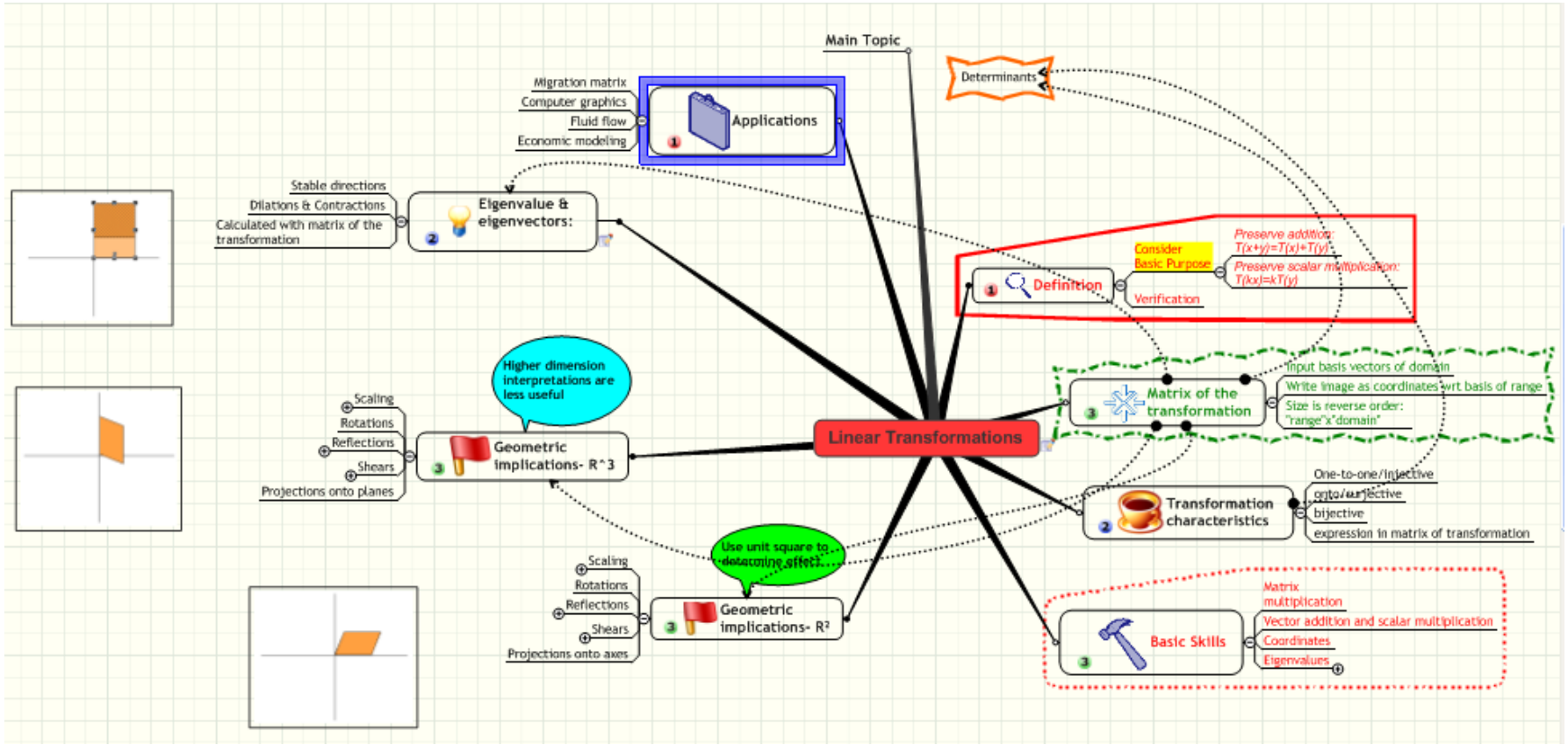
Mindmaps – and their counterpart conceptual maps – have been advocated for many years to improve understanding of material. The mind map, as distinct from concept maps, was developed by Tony Buzan in the late 1960's. Technology along with more recent work in brain research and learning theory have cast a new light on mindmaps for higher education and allow the development of new uses and techniques. The purposes of this article are to present the theoretical bases and technique for constructing mindmaps and follow with a suggestion for a few uses. This paper includes a sample mindmap for a mathematical topic, constructed with mindmap software.

Mindmaps have as their goal the identification of major concepts relating to a topic and then the physical presentation of these topics in a way that reveals the relationships between them and enhances long-term memory and understanding. A brief outline of the steps in constructing a mindmap includes:

1. Locate central topic in center of mindmap; radially place first level major concepts around central topic. Map should be constructed so that you start reading first level topics starting at the equivalent of "one o'clock" on the page.
2. Brainstorm a list of relevant topics/concepts/related ideas – possibly on a separate piece of paper.

Sample Mindmap – Linear Transformations



3. Place the related topics from step 2 on the mindmap, connecting them appropriately to first level topics and adding topics as needed.
4. Draw relationships between sections of the map.
5. While constructing the map, use colors and cartoon art/icons to help make memory markers. [North]

The construction of a mindmap requires you revisit each step in the process repeatedly. The following map illustrates the mindmap as applied to the mathematical topic of linear transformations, and was constructed using *MindManager Pro X5. (www.mindjet.com)*

Long-standing theories of learning support the use of mindmaps. There are three theories described here that particularly address the effectiveness of mindmaps as a learning tool. These theories express different beliefs regarding the learning process; one of the particular strengths of mindmaps is that they support learning through various mediums.

1. Ausubel (1963) proposed that no learning takes place without connections being made to previous learning. Mindmaps emphasize connections – both to previous learning and to topics of current study. This allows the placement of the new knowledge in context with old learning and also allows the use of previous learning to be distributed appropriately to all the new topics. That is, not only do the connections

between new and previous major topics occur; there is also the ability to connect homogeneously throughout the topic, making connections at secondary and tertiary levels.

2. Perry (in Finster, 1969) advocates the understanding of the learning and ethics development process as spiral in nature and going through as many as ten stages. The learner begins with a black-and-white perspective in an environment with no nuances, and progresses through stages which connect to previous learning, more subtle judgments, and increased awareness of the need for decisions and commitment to ideas. The construction of the mindmap with the linkages encourages the development of more advanced, sophisticated understanding of a topic. The revisions of the map, especially if it is constructed electronically with the usage of currently available software, encourage the learner to refine and develop spiral learning and the advancement of a more nuanced understanding of a topic.
3. The theory of constructivism (Coll, 2001) is based on the belief that learning is created in the mind of the learner. The learner must be actively engaged in the learning and the development of the knowledge to make it "his own or her own". The mindmap is an act of construction which allows the learner to discover individually the

connections and interactions between concepts. The construction of the map mimics the construction of understanding in the brain. This enhances both understanding and memory retention (p.26).

Distinct from the theories of learning are the theories resulting from recent brain research. These theories tend to emphasize the relationship between the evidence of the physical/neurochemical functioning of the brain and the connections to learning. Once again, here are three specific theories from the approach of brain research which positively support the construction of mindmaps as a tool for learning. From this perspective, the important feature of mindmaps is that each mindmap is unique and the value is in the construction

1. Gardner (1999) has proposed in his theory of multiple intelligences that there are different methods of processing learning and different "ways of knowing". The flexibility and variety of structure of the mindmap can allow the learner to draw on his/her learning strengths to construct connections and relationships which are most meaningful. The learner, especially once he/she knows her strengths and profile of multiple intelligences, can apply these strengths to the construction of the mindmap.

2. Sternberg's (1997) triarchic theory of intelligence promotes the proposition that one must go beyond a linear structure of knowledge to a synthesis of relationships and meanings before one can adequately use that knowledge. Mindmaps encourage the synthesis of topics and the independent development (by the learner) of a structure of relationships and connections.
3. Kitchen's (theory of right brain/ left brain (Eppele, 1989). This theory proposes that an individual's abilities are distributed differently between the sides of the brain with an "artistic, non-linear" side and a *logical, linear* side. The theory contends that people *play to their strength* and tend to favor using one side of the brain over the other. The best and most lasting learning occurs when one can tap into both sides of the brain during the learning process. With the ability to spatially present non-linearly along with the use of colors, icons, and other map markers, mindmaps address significant features of this area of brain research.

There are many more theories of learning and knowing; those presented here directly support the use of mindmaps.

One of the great advantages to mindmaps is that in the simplest format they require nothing more than colored pencils, paper, and time. This is probably the best format in which to learn the principles of mindmaps and also one of the best ways to enhance memory as a learner. The act of concentrating, and the time spent drawing and considering icons, relationships, etc., reinforce the time spent on thinking about the material being learned. An excellent resource for the beginner is *Get Ahead: MindMap your Way to Success* (North, 2001).

The technology explosion of the last decades has provided tools that will allow the use of mindmaps in a variety of places and for a variety of purposes not previously considered and not always feasible for pencil and paper. We will consider the new areas and purposes in a moment, but here we will identify a few sources of technological tools that aid in either the construction of mindmaps or aid in their presentation in electronic format.

If one is going to construct mindmaps electronically the most advanced tool, designed for the job, is MindManager Pro X5. Available from Mindjet www.mindjet.com, this software package is made to order for making maps electronically. The mindmap included in this paper was constructed using this program. During the construction of the map, some of the best features are the ability to add relationship connections, clipart, map

markers, notes, task memos, and prioritizations. The map can be viewed in outline mode or, during a presentation; the program will "feature" areas of the map in a clockwise direction and allow one to present information details while the map and its relationships are visible. One of the strongest features of the program, and one which allows greater flexibility in usage, is the ability of the program to export the map to Microsoft products such as Word and PowerPoint. The PowerPoint capability is particularly impressive as the program clips various portions of the map with headings and places them on individual slides, in order, in a PowerPoint presentation with no effort on the part of the user. These resources for electronic presentation allow for mindmaps to be used in settings where a hand drawn mindmap would not be suitable.

In addition to a base package for constructing the mindmap, there are several other software packages which would be helpful for making the most of mindmap construction electronically. This is especially true if one is from the sciences or mathematics since the construction of equations and graphics is not widely supported in most packages.

1. Snag-it – a tool for clipping photos or images from electronic documents, especially good for selecting small portions and annotation. Excellent for "snagging" a copy of the mindmap in its entirety and

pasting it into a document, such as the one at the beginning of this article. (www.techsmith.com)

2. Scientific Notebook – for writing mathematical equations and for constructing two and three dimensional graphs of functions. This program is good for writing any scientific equations involving superscripts and subscripts, matrices, diagrams, and other mathematical script as well as for graphs. (www.mackichan.com)
3. SmartDraw 6 – an excellent tool for making network diagrams and for importing a varied and sundry number of editable, colorable diagrams including U.S. maps, electrical diagrams, organizational structures, etc. Although most of these are constructible using drawing tools, the package is more than the sum of the total in this program since it has incorporated a great deal of interactivity between manipulatives/drawing actions and the diagrams being affected. (www.smartdraw.com)
4. ClipArt collection – you need a really good, varied collection of clipart for inclusion in your mindmaps. There are good collections, with up to 600,000 copyright-free icons, available in office supply stores and on the web.

5. Microsoft Office Suite – although it is good to use a variety of packages and support different companies, the most impact can be gained for electronically presenting your mindmaps if you have the ability to export them into a document, a presentation format, or a webpage. The MindManager package is pre-configured to do this efficiently with the Microsoft Office products. The use of these products can be avoided, but only with a serious expense of time and energy. In any case, the use of web editors and presentation programs allow your maps to go where paper drawings will not be effective.

Purposes for Mindmaps

The construction of a mindmap is a learning process – the constructor learns about the topic of the mindmap. As previously seen, the results of this process can evolve into a variety of formats for use and presentation. New technologies, especially internet and web technologies, have led to different sources of information and different avenues of information processing and presentation. The interaction between mindmaps and these new technologies offer new roles for mindmaps and their uses. For now,

we will concentrate on the role of the instructor. Comments regarding the learner will follow later.

Mindmaps and the Instructor

The instructor has a classic process to undertake in the teaching of a concept:

1. Learn the concept and practice it; identify subtleties and nuances, along with stumbling points in the learning process.
2. Identify connections with other material to be taught; determine context and importance of concept within the framework of the course.
3. Develop lesson plans and exercises for teaching the concept.
4. Present the concept, with discussion and/or practice.
5. Assess learning.
6. Document concept for future use, testing within comprehensive final exams or other forms of assessment.
7. Link to the next topic to be taught.

Mindmaps have the potential to impact and/or facilitate each step of this process; as we all know as instructors and professionals in our discipline; the teacher is at all times also a learner. Simplistically then, the teacher can learn, relearn, reorganize or adapt to a new book through the use

of a mindmap to clarify the thinking and scope of a concept. The results of this process can be magnified and leveraged into the other six aspects of the teaching process outlined above.

Specifically, once the map of the concept has been drawn, the teacher can enhance it with relationship ties to other parts of the course. The map becomes the front page, the index if you will, for the plans and papers for the rest of that section of material. Each lesson can begin with the portion of the mindmap that describes and outlines it, with the instructor being careful in each class to preserve connections to the rest of the map and to the relationships to the rest of the course and other concepts. The presentation mode for presenting a mindmap – focusing a class on each branch and developing the underlying ideas – is connected to the primary purpose of the class at this time.

At this point, a subtle transition takes place between the role of the instructor and the role of the learner. For the most part, the role of the learner is the active role in the rest of the learning process from this point forward. However, the original mindmap and mapping can still impact this process in several ways. As learners, the students can make mindmaps of their own for their own use and to explain to fellow students. There is a multitude of research presented on the use of mindmaps for evaluating

student learning, along with rubrics for assigning grades to mindmaps in a normalized fashion. There are advocates and opponents for using mindmaps for assessment; however, no one argues with the idea of using mindmaps for learning. Finally, for future reference and for use by students, the original mindmap from which the instructor developed his/her plans can be used to document future testing topics, important ideas, the relationship of the concept to the rest of the course, and provide a *map* to the material from the book and handouts which are related to the concept.

Mindmaps and the Web

A new structure since the origins of mindmaps is the Internet – along with web page and web site presentation of material. The term *web* was first associated with the Internet because people envisioned massive numbers of linkages and connections in the Internet. This came to fruition and in particular, the structure of the World Wide Web (WWW) – including web navigation maps and linkages – are more parallel to a mindmap structure than to a linear outline of topics. For this reason, mind maps are the perfect tool for use during the design process for web pages and web sites. As students use the web, they are learning this style of connection. As teachers, if we can make the students conscious users rather than passive users – oblivious readers – of the Internet structure, then students will already be

thinking in a manner parallel to mindmaps and this will soon become a natural, reinforcing way of presenting material.

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