CONCEPT MAPPING AND THE DEVELOPMENT OF THEORETICAL KNOWLEDGE

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This paper outlines the rationale, approaches to implementation and evaluation, and outcomes of concept mapping as a learning technique in the discipline of information science. While the case study is oriented to the teaching of information science for information practice in the context of university education, the methodology, insights and perspectives presented have wide applicability across many disciplines.

EDUCATIONAL FRAMEWORK

The literature on concept mapping as a learning technique appears largely in the context of primary and secondary education, with very little research undertaken in higher education. Educators at all levels of education, however, would not dispute that the learning of concepts is central to all curriculums. To understand the meaning of key concepts and the nature of their interrelationships in a field of study, and to be able to link these concepts to relevant theoretical knowledge already possessed are considered fundamental for students to progress through their courses of study. This notion of learning has its foundation in the learning theory of Ausubel. Ausubel maintains that a key factor for successful learning, and the contrast between meaningful and rote learning, is when people constructively link new knowledge to a framework of relevant concepts and propositions they already possess. Two important assumptions are being made here. Firstly, meaningful learning is an active, constructive and cumulative process of grasping new knowledge and adding it to an existing knowledge base. Secondly, concepts and propositions are central elements in our knowledge base and in the construction of meaning and understanding and thus play a central role in the learning process.

As a learning technique, concept mapping is an overt way of representing meaningful relationships between concepts in the form of propositions, that is, two or more concept labels linked by clarifying words. As such, they are a representation of concepts in the form of a picture or map, with interrelations between ideas clearly articulated. They tend to be hierarchical in structure, with the more general and inclusive concepts at the top of the map with progressively more specific, less inclusive concepts arranged below them. (Novak & Gowin, 1984; Stice & Alvarez, 1987)
BENEFITS OF CONCEPT MAPPING

The technique and benefits of concept mapping is well documented in the international research and reflective literature. Novak, Gowin & Johansen (1983), Lehman Carter & Kahle (1985), Okebokola & Jegede (1988) and Mayer (1989) posit meaningful learning as an important learning outcome for students using concept mapping. They identify enhanced meaning, precision of meaning, improved ability to form conceptual relationships, improved clarity of reasoning and focus on key ideas, and easier grasp of difficult or new concepts and tangible outcomes of working with concept maps. According to Downing & Morris (1984), concept mapping helps students manage difficult readings more effectively by providing a logical process of thinking through, reflecting on, reasoning and judging the content of readings, and enabling to extract, organise and interrelate the concepts. Novak, Gowin & Johansen (1983) suggest that concept mapping helps develop reflective thinking because it enables learners to separate trivial from significant information, encourages critical assessment of the literature, hierarchical organisation of knowledge, and thinking in multiple directions. Novak (1984) argues that because concept maps are explicit visual representations of the concepts a person holds, they can facilitate the exchange of viewpoints, help identify missing links, misconceptions and false relationships, and develop speaking and reasoning skills. Mayer (1989) suggests that concept maps help learners to creatively transfer information to solve problems; to organise information coherently, and provides a convenient and concise schematic summary of learning. According to Stice & Alvarez (1978), concept mapping gives students a sense of confidence in manipulating and rearranging information; increases concentration and focus on the task; and improves motivation for self-directed learning.

THE APPLICATION

Concept mapping as a learning technique was introduced to students in the Bachelor of Applied Science (Information) in the subject Information Science 3. This subject, the third of six subjects comprising an information science disciplinary sequence, focuses on the theories, principles and concepts relevant to information user behaviour. Key concepts such as information, information need, information seeking, information gathering, information use, information utilisation, information sources,
and user satisfaction are examined from a range of paradigmatic perspectives. The subject is based extensively on empirical research, and students are expected to analyse, synthesis and critically evaluate this research to build their understanding of information user behaviour. Students have consistently expressed difficulty in making sense of this literature, particularly with assimilating conceptual patterns into an integrated whole to build an understanding of information behaviour, making inferences about these concepts and their interrelationships, and applying them to related problem solving tasks. Given the benefits of concept mapping espoused in the literature, and recognising the paucity of applications to higher education, the decision was made to introduce the technique to help students address these concerns.

THE PROCESS

The following broad guidelines, based on Ault (1985) were used to help students master and work with concept mapping:

1. select: students were to read and reread the set paper, (usually a journal article reporting a research study), determine the central or focus concept, identify subordinate concepts, words, phrases, statements of relationships and jot these down;

2. rank: students listed concepts from the most abstract and inclusive to the most concrete and specific;

3. cluster: students made judgements about the closeness of association using two criteria - at a similar level of abstraction, and closeness of interrelationship - to generate groupings of related concepts;

4. arrange: students arranged concepts as a two dimensional array incorporating hierarchies previously determined;

5. link: working on one pair of concepts at a time, students linked related concepts with lines, directional arrows, with each line labelled in prepositional or propositional form with brief explanatory notes; encouraged to assess the extent their completed map represented an understanding of the relationships of the key set of concepts in the reading and does it efficiently communicate this understanding to others.

Subsequent workshops built on this foundation. Up to forty minutes were allocated each week for students to discuss their concept maps. This process of sharing enabled them to see the variety of maps generated from the same papers and helped affirm
that there were no right and wrong maps. Students were encouraged to explain the concepts and their interrelationships shown in their maps to others. This technique of translating a visual summary was a useful way of gaining confidence about the mapping technique and speaking about abstract ideas.

The following checklist was used to help students reflect on their own progress of learning through using this technique:

• Is my concept map complete? Does it contain all the essential ideas and relationships according to the task set?

• Is my concept map concise? Does it present a level of familiarity and detail appropriate for the learning task, but does not overwhelm the learner with detail?

• Is my concept map coherent? Does it make sense based on sound arguments?

• Is my concept map labelled? Does it show an understanding of how key ideas are linked together?

• Does my concept map differentiate important from trivial information?

• Does my concept map show the integration of all the ideas?

THE DIFFERENCE?

At the completion of the teaching programme (over one semester), students completed an evaluation of their perceptions of the helpfulness of concept maps as an aid to their learning. Students responded to 27 statements about their learning and their use of concept mapping in that learning. A selection of responses is included below:

5=strongly agree; 4=agree; 3=neutral; 2=disagree; 1=strongly disagree.

STATEMENT

1. Concept mapping enabled me to draw out the major concepts and ideas of the readings

PERCENTAGES

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2. Concept mapping enabled me to link concepts as meaningful relationships

3. Through concept mapping I am able to present, in diagrammatic form, the hierarchical relationships between concepts

4. The concept maps provided a useful summary of my learning in the unit

5. I felt confident in using concept mapping as an approach to learning

6. Concept mapping encouraged me to analyse carefully what I had read

7. The time spent learning the technique of concept mapping seems worthwhile when I consider how it has helped me in Information Science 3

8. Concept mapping has helped me to think critically

9. Concept mapping helped me focus on key ideas with greater clarity

10. Concept mapping has enabled me to more positively approach difficult reading

11. Concept mapping has helped me to separate trivial from significant information
12. Concept mapping has enabled me to work independently
7  45  31  14  3

13. Concept mapping aided my understanding of the concepts
16  69  14  1  0

14. Concept mapping has given me a sense of confidence in
manipulating and rearranging information
14  52  25  9  0

15. I have been better able to concentrate on tasks through
concept mapping activities
8  40  41  11  0

16. I have gained a good understanding of the field of
information user behaviour
32  58  8  2  0

The findings suggest a positive reaction to concept mapping by
the students. Within the limits of this preliminary evaluation,
the students have indicated that their time invested in learning
the technique has been worthwhile, given the benefits to them.
There is strong support for concept mapping in terms of helping
them to understand major concepts in the subject, and enabling
them to analyse the required reading and draw out the concepts
and their interrelationships. Students also saw value in the
technique in terms of thinking critically about their reading,
focusing on ideas with greater clarity, and helping them
concentrate on their learning tasks. Some benefits in terms of a
more positive attitude to difficult readings and confidence in
working with these are also expressed by students.

Conclusion

Obviously an analysis of an application of this kind is
preliminary in nature and findings will need to be interpreted
with caution. What is needed is more systematic research in
tertiary education on concept mapping as a learning strategy, its
impact on the development of meaningful learning, and the role of
interacting variables such as cognitive preference, learning
mode, and learning climate. From the experience with students of
information science, concept mapping appears to be a promising
heuristic in developing effective teaching techniques for
extending theoretical, concept-based knowledge. Learning
requires dedicated commitment to an understanding of the
structure and relationships of concepts in a body of knowledge,
and concept mapping techniques can lead students in this
direction. By enabling students to present a level of detail
appropriate to their stage of understanding, concept mapping has
the potential for identifying individual differences in the level and nature of learning. Concept mapping has the potential to facilitate the communication of knowledge, both verbally and in written form, and it may make a valuable contribution to broadening the scope of evaluation tools available to educators.

REFERENCES


