

UNIVERSITEIT TWENTE.

FINAL PROJECT THESIS

Developing a Tool for Learning Concept Maps

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Part I

Design

Introduction

General Idea

Conceptual Framework

Concept maps

Comparison to other visual mapping techniques

Concept maps are not the only type of visual mapping techniques, ? (?) distinguishes four different types of visual mapping techniques. These types are quite similar to each other, and therefore the differences between them will be elaborated further. Table 1 displays the different types and there specific characteristics.

Novakian concept map

Conditions

Research

Effectiveness

Attitudes

Paired-Associate Learning

Testing Effect

Flashcards

Research

Effectiveness

Student attitudes

Criticism

	Concept map	Mind map	Conceptual diagram
Definition	A top-down diagram showing the relationships between concepts, including cross connections among concepts, and their manifestations	A multicoloured and image-centred, radial diagram that represents semantic or other connections between portions of learned material hierarchically	A systematic depiction of an abstract concept in pre-defined category boxes with specified relationships, typically based on a theory or model
Main function or benefit	To show systematic relationships among sub-concepts relating to one main concept	To show sub-topics of a domain in a creative and seamless manner	To analyse a topic or situation through a proven analytic framework
Macro structure adaptability	Flexible, but always branching out	Somewhat flexible, but always radial	Fixed
Level of difficulty to construct	Medium to high	Low	Medium to high
Extensibility	Limited	Open	Limited
Memorability	Low	Medium to high	Low to medium
Understandability by others	High	Low	Medium

Table 1: A comparison between different concept mapping techniques, as described by ? (?)

Design Choices

Display

Visual mapping technique

As described in section ?? on page ??, ? (?) distinguishes between four kinds of visual mapping techniques (concept maps, mind maps, conceptual diagrams, and visual metaphors).

Paired-Associate Learning

Design Guidelines

Summary

Part II

Research Proposal

Summary

Here follows a summary of maximum 250 words.

Project Description

Problem Statement

A currently existing method to efficiently rote memorise information is the flashcard system, where declarative knowledge is studied in a paired-associate format. Within this format, learners are asked to associate terms with other terms outside meaning-focused tasks, for example by associating a definition with a presented concept (A, B). With flashcards, large numbers of words can be memorised in a very short time, and are more resistant to decay (A, B, C). A (A) adds to this by stating that increasing the amount of drill or practice is the most effective device that can be applied to learning. Finally, when evaluating flashcards in a psychology setting, it was found that students who use flashcards have a significantly higher final average than those who do not (A, B, C).

Per contra, not all research favours using flashcards for textual comprehension. A (A) states that flashcards are especially useful for learning declarative knowledge, while learning from a textbook is a form of learning for intellectual skills (A, B). This problem is also emphasised by A (A), who states that the use of flashcards is helpful for language learning but the main emphasis of flashcards is memorisation, not comprehension. A (A) points out the overemphasis placed upon the rote memorisation of disconnected facts, whereas whatever it is that students are to place into memory they should, more importantly, understand. Furthermore, A (A) describes flashcards as a relic of the old-fashioned behaviourist learning model, and states that we have to look for more modern constructivist models.

Solving the aforementioned problem could lead to better understanding of memory, and could lead to better utilisation by teachers and students with the intent to produce a store of knowledge that remains flexibly retrievable in a variety of contexts over a period of time, in contrast to only segregated paired associations which depend on specific cues in order to be retrieved. Furthermore, it could pave the way for the design of new educational activities based on consideration of retrieval processes. Furthermore, using computer-based flashcards have been used very widely (A, B), and more recently textbooks have started making flashcards available on their websites (A, B, C). A (A) stated that "Perhaps no memorisation technique is more widely used than flashcards" (p. 125). Improving currently existing flashcards therefore has the potential of reaching a wide audience of future users of flashcard systems. Finally, it might be a solution to the need expressed by A (A) for more meaningful rote memorisation.

An instructional tool more in line with constructivistic approaches is the concept map, which is defined by A (A) as a hierarchical diagram showing the relationship between concepts, including cross connections among concepts, and their manifestations (see figure ??). Multiple researchers have found by means of both qualitative and quantitative studies that concept maps can promote meaningful learning leading to positive effects on students (A, B, C, D). This has been demonstrated in comparison to activities such as reading text passages, attending lectures, and participating in class discussions (A, B, C). A (A) describes the process of concept mapping as the only effective

way of using the concept map, which refers to students constructing their own concept maps. This is why the concept map is generally viewed as a tool in alignment with the constructivist perspective. Because of this, the concept map might seem as a solution to the need asked by ? (?) and his peers. However, a recent article by ? (?) reveals that paired associate learning produced better performance than elaborative concept mapping for meaningful learning, even on the short-term.

Therefore, another solution might be the development of a new tool, namely the flashmap. The intention behind the flashmap is to combine the paired associate mechanism of the flashcard system with the visual representation of the concept map, and is a new tool designed and developed for this research project. This tool might have the potential to bridge the gap between the two systems and therefore make meaningful and effective rote memorisation possible, for it makes the relations between the concepts explicit to the student.

In conclusion, flashcards systems are an effective tool for meaningful learning, but could be enhanced by visualising it with concept maps. The objective of this research is therefore to evaluate whether learning with a flashmap is a more effective or efficient for meaningful learning than flashcards, and whether it might be more affective.

Theoretical Conceptual Framework

Flashcards systems

There are many different flashcard systems, varying in scheduling algorithms (?, ?), offline or online applications (?, ?), and tasks (?, ?). The simplest and earliest example is a deck of physical cards, with on one side a question and on the other side the answer to that question. Every day, the student has to go through the deck trying to answer the question on the card. After answering it, the student turns around the card to check whether was correct. If the answer was correct the card goes to the deck for the next day, and if incorrect the card goes to the bottom of the current day's deck.

Concept maps

Flashmaps

? (?) describes that fill-in-the-cmap or memorise the concept map conditions are not recommended, for meaningful learning does not work this way. However, they do not provide statistics or literature in order to support this claim, and furthermore the findings from ? (?) about paired associate learning being more effective for meaningful learning than concept mapping also puts this claim into doubt. Finally, the flashmap creates the opportunity for a more interactive concept map that starts with a parsimonious and theme-oriented structure which gradually expand the details along with the instruction, advised by ? (?) to mitigate map shock. This phenomenon occurs when students view the kind of larger concept maps that might more fully capture textbook knowledge structures, but is a type of cognitive overload that prevents students from effectively processing the concept map and thereby inhibiting their ability to learn from it (?, ?).

Research Question and Model

Scientific and Practical Relevance

Research Design and Methods

Research design

Respondents

Instrumentation

Procedure

Data Analysis

Planning

Timeline

Outputs