



## 45. Modular mind mapping

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### Abstract

Concept maps, or mind maps as learning tools mirror the knowledge constructed through observation of events or objects in relation to the concepts already known. Different types of computer based concept mapping tools allow various forms of expressions and the versatility of some special tools promote their use from providing course maps for users to adaptations of learners knowledge maps. Modular mind mapping allows a clearer view of more complex structures and details of endless hierarchies can be embedded. The paper illustrates the Coraler mapping tool together with the mind mapping tool developed in Imagine as a modular tool-base in constructing highly structured maps with flexible content and interpretation.

### Keywords

Mind map, concept map, learning tool, Imagine

### 1. Concept maps

Jonassen et al. (Jonassen, et al, 1993) defined concept maps as “*representations of concepts and their interrelationship that are intended to represent the knowledge structures that humans stored in their minds.*” While concept maps are formed by nodes (represented as lexical labels) and links (represented as lines) having individual labels between nodes, mind maps can be more freestyle, visual and do not necessarily have particular meanings imposed on relationships (Buzan, 1995). Bruillard et al. summarises the main characteristics based on review of the scientific literature devoted to issues related to computer based concept mapping as learning tool, taking into consideration that knowledge is constructed through observation of events or objects in relation to the concepts already known (Bruillard, et al, 2000):

Concept maps help to access representation as a given state in learning, which can be more easily produced by children since it involve more of drawing than of writing processes.

Concept maps are communicational tools to share content and ideas in their complexity.

Concept maps are useful for collaborative activities, where existing representations can be easily modified if created using computer tools.

Concept maps are proved to be useful teaching tools at lesson design identifying key concepts and their relationship, building the whole structure of the curriculum as a content analysis tool in itself, while during the progress of the learning phase it represents a change in the learner’s mind compared to previous states of knowledge, thus it represents the knowledge map of the learner (Kaszas, et al, 2003).



Creating concept maps is an effective constructive learning process since it requires explication, reflection and enhances critical thinking.

Using concept maps in context of hypertext is suitable as navigation tool within educational materials and in assisting reading comprehension within complex text.

Though there are several types of computer based concept mapping tools, observations reveal that concept mapping is rarely used spontaneously by pupils, because it is difficult and the process of map modification is messy and cumbersome.

Though scientific literature cannot as yet prove any significant improvement in the effectiveness of educational materials visualised as links between concepts, the construction process of concept maps does prove to lead to effective learning within constructivist approach (Bruillard, et al, 2000).

However Bookmap Ltd. ([http://www.bookmap.com/bookmap\\_uk.html](http://www.bookmap.com/bookmap_uk.html)) claims to have developed a universally applicable method to mimic more efficient organisation of knowledge which is subsequently combined with specific details experts consider essential for a good understanding of a complex scientific subject. This combination is used to make the **brain-oriented organized knowledge map** (*bookmap*). When using a *bookmap* the non-expert learner's brain automatically "learns" at the level of the "expert learner", which results in better and faster learning. The report of the SLO shows that in a field experiment performed on behalf of the Dutch Ministry of Education the school results improved 12% while 34% less time was needed to master the subject (SLO Report).

Thus it is very important to enhance the abilities of computer based concept mapping tools, but at the same time allow ease of use and flexibility of expression in order to take off the cognitive load from users presented by the tool itself and let forward self expression. Any concept mapping tool should allow the freedom of expressing concepts, mirroring knowledge and mood in a rather fluent way like with pencil and paper or the easiest of computer based painting tools. Thus, they can be used as valuable tools in monitoring the cognitive states of knowledge acquired by learners.

During the evaluation of the image-based, brainstorming-style, concept mapping task used at ImpactT2 on the theme "*Computers in my world*" done by children aged between 10-16, five quantitative measures emerged from heuristic analysis of the maps: counting the number of nodes and links, calculating the ratio between them to give a "connectivity score", categorising of maps through phenomenographic analysis into "*Spheres of Thinking*" and "*Zones of Use*". The correlations between the data obtained and other data gathered from students suggest that the concept mapping scores provide valid significant indicators of the pupil's experiences of ICT and the breadth and complexity of their "secondary artefacts" of networked technologies (Mavers, et al 2002). The evaluation further suggests inclusion of colour within these maps to allow a very sensitive representation of concepts that mirrors the mood and preference of presenter as well; however it was not included within this research.



## 2. Different examples of mind maps

During different experiments with on- and off-line activities with children aged 10-14 during a tele-house project (Turcsányi-Szábo, 2003), we have requested the construction of mind maps on several themes with very interesting results and forms of mind maps produced in the range of plain drawings of thoughts (e.g. visualisation of friendship) to structured text of different complexity and interpretation (e.g. family tree).



Figure 1. Friendship as actions (paper & pencil)



Figure 2. Friendship in colours (Paint)

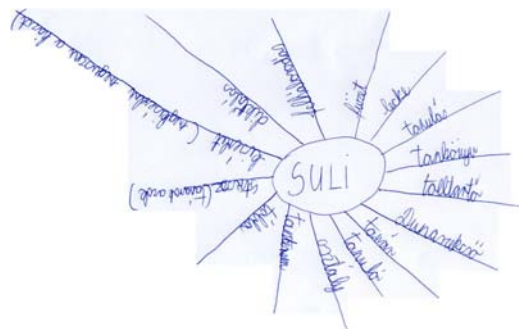


Figure 3. School with radiant mood (paper & pencil)

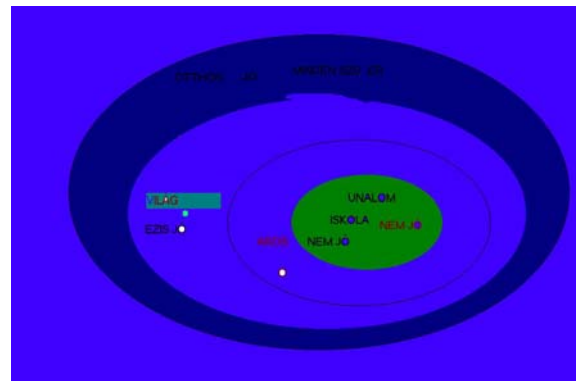


Figure 4. School is gloomy mood (Paint)

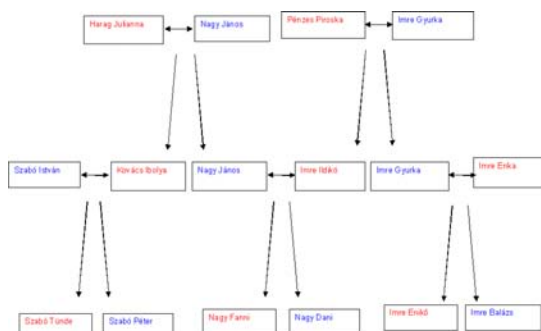


Figure 5. My family as relations (PowerPoint)

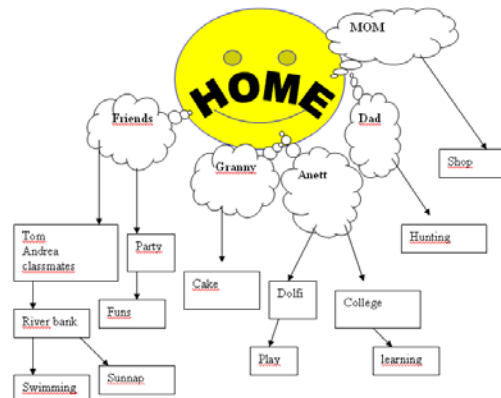


Figure 6. My home through experience (Word)

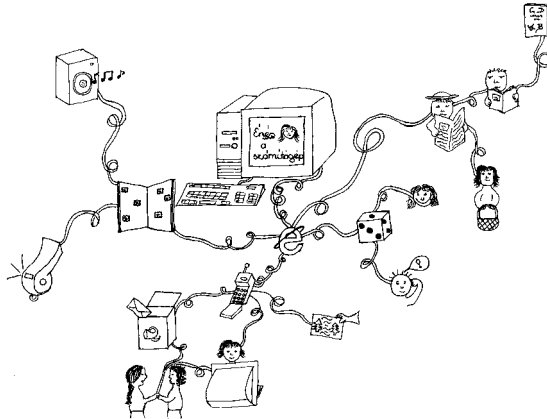


Figure 7. Computers in my world (paper & pencil)

As one can see the connection of concepts are very differently expressed depending on the theme, complexity, intention of thought, as well as the ease of possibilities offered by tools.

### 3. Modular concept mapping

The modular structure of building concept maps with respect of starting out of a global concept, building on it further associations and then refining the associated concepts are a natural requirement in concept mapping. The process of refining sub-concepts continues till the full understanding is represented which produces the whole concept and its understanding. Every group item leads to a lower level of associated concept maps, just as a link in a hypertext (or hyper media for that matter).

#### 3.1. Coraler as a modular concept mapping tool

The Coraler ([www.coralier.com](http://www.coralier.com)) mapping tool simplifies the process of finding, retrieving, organizing, understanding information and sharing knowledge online. Coraler has two main parts: mapEditor and mapViewer. Coraler mapEditor that allows users to create and publish information maps with simple drag & drop operations. MapViewer displays information maps with any Java (or Flash) enabled browser and eliminates the need of installing further software. Coraler mapEditor allows the organisation of thoughts as links of nodes within a concept map. Clicking on the group nodes we can travel one layer underneath till we reach the concrete nodes of web links or files. Thus the Coraler mapping tool can be thought of as a tool that is more intelligent than a general browser, allowing visual organisation of web links.



Figure 8. My clown (multimedia product in Imagine with sounds and animation associated to different parts of drawing)

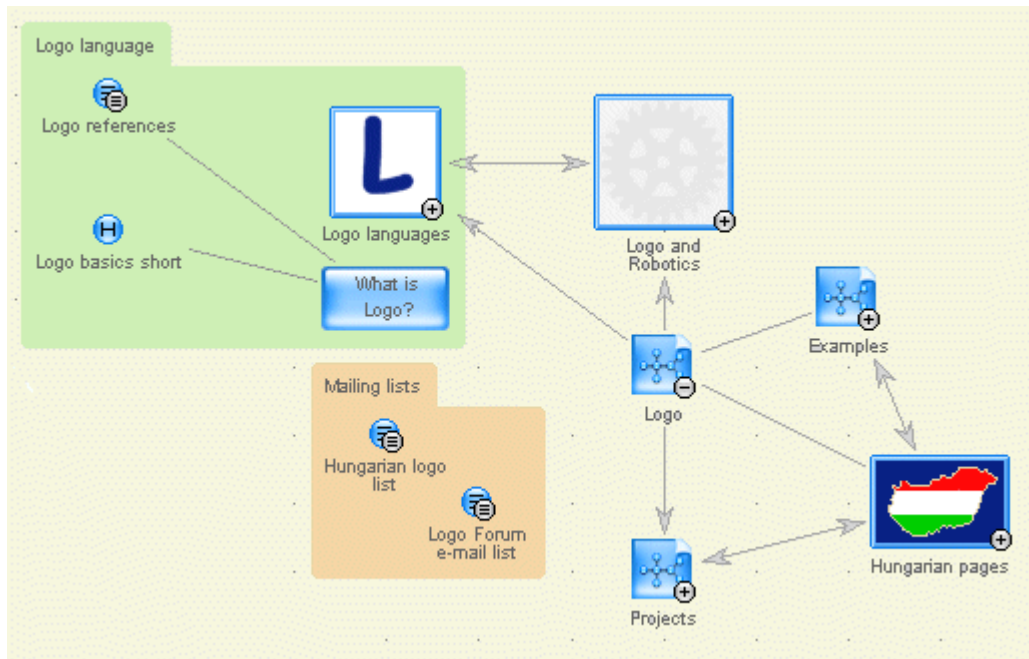


Figure 9. Coraler map of logo links on the Internet (Pluhár, 2001)

It must be mentioned here that there are other very interesting and similar software using highly visual aids in associating links:

Aquabrowser: <http://www.medialab.nl/engels/aquabrowser/index.html>,

see demo at demo map at <http://www.waddenzee.nl/default1/defaulteng.htm>

Visual Thesaurus: <http://www.visualthesaurus.com/index.jsp>

Internet mapper: <http://www.fractalus.com/steve/stuff/ipmap/>

Touchgraph browser: <http://www.touchgraph.com/TGGoogleBrowser.html>

On the other hand, since a node can also be a file itself, Coraler mapping tool can also be considered as a highly visual file organiser too.

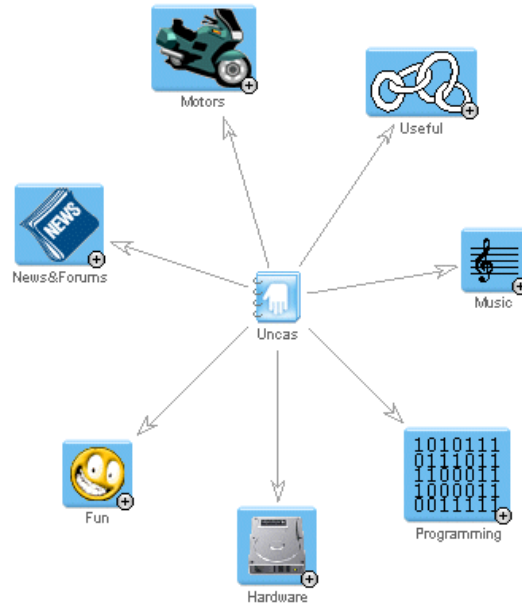


Figure 10. Coraler map of subdirectories of local machine

Taking into consideration the flexibility of the mapEditor, allowing the manual creation of any number of associations between any types of nodes (not necessarily associated with any concrete object, i.e. file or web link) within a map, it can also be considered as an ideal concept mapping tool. The complexity of the map can be detailed to any number of levels, where each level is considered as a group node and clicking on a group node can lead to the level below.

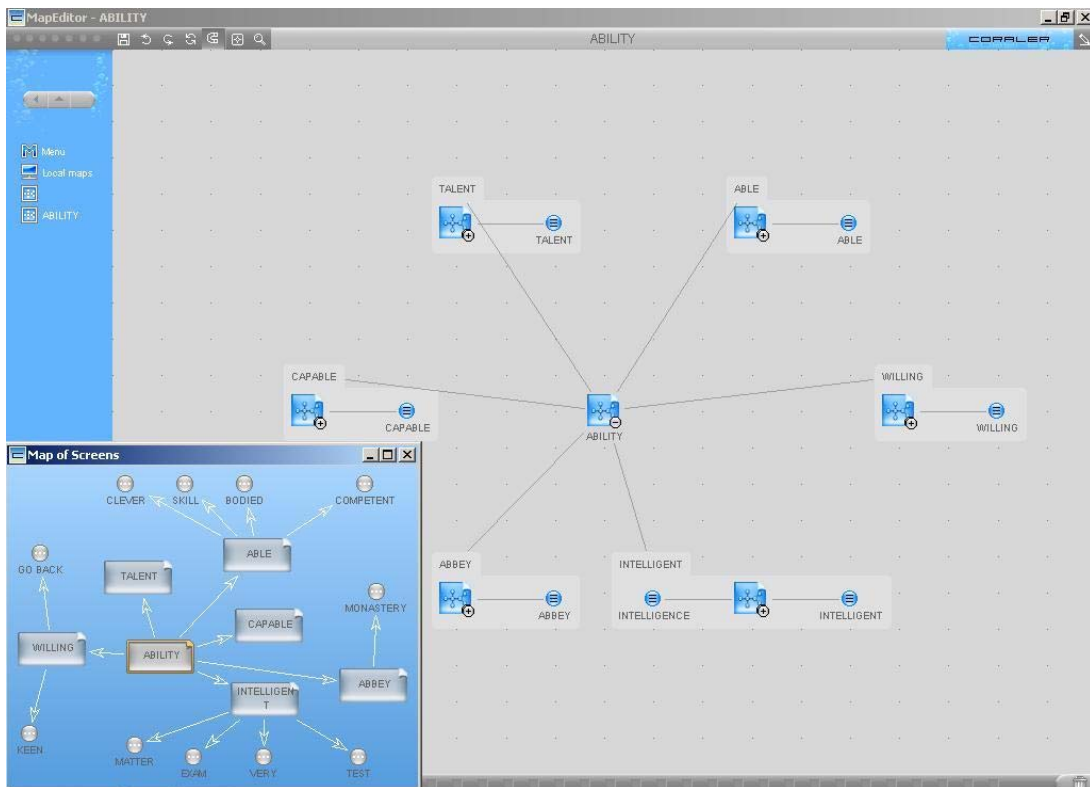


Figure 11. Coraler mind map on "ability" (example inserted by courtesy of prof. Andras Lorincz)



Functions within the Coraler mapping tool fulfil all requirements needed in producing a multidimensional concept map or mind map. Among others it allows:

Creation of multilevel, modular concept maps;

Easy editing, with drag-and-drop functions;

Representation of node with any given picture;

Commenting nodes with text strings;

Commenting connection lines with text strings to produce concept maps as defined;

Nodes can be evaluated by users, thus they can be weighed for value and personalised by users;

Nodes can be easily grouped into group nodes;

Nodes can be empty or contain web links, any type of files of any multimedia element or program.

In the English grammar learning system (Kaszas, et al, 2003) authored trails using Coraler mapEditor, visually represented the curriculum as structured mind maps of the course, while the actual route maps taken by individuals represented the individual's knowledge map of achievement.

#### 4. Colabs project

The "Colabs" MINERVA project aims to develop an online collaborative learning environment (<http://matchsz.inf.elte.hu/Colabs/>), which contains Imagine course materials, exercises, tests, asynchronous and synchronous co-laboratories, forums, mailing possibilities, and many more different tools for constructivist learning through collaboration. The main feature of the developments promised by the Hungarian group is to produce collaborative microworlds authored with Imagine for creative communication emphasising on self expression. One of such tools being developed is for creating highly visual topic specific mind maps. Tasks include on and off computer activities, which often result in recommending the creation of mind maps on the acquired understanding of a specific topic and/or expression of emotions and other communicative elements. Mind maps are thus used in tracing the knowledge gained through off computer activities, like reading text, observations in the real world, reflections and communication of ideas as a tracing tool for thoughts.

Mind maps can be composed using two tools: the Coraler **mapEditor** for macro constructions and the **Imagine map editor** for micro constructions. Since the nodes of a Coraler map can contain any type of file, it might we even be an Imagine project that contains a mind map itself.



#### 4.1. The Imagine map editor

The Coraler mapEditor is thought of as the “big brother” of the Imagine map editor. Thus we wish to create flexible functions for creating rather similar maps using the features of Imagine and concentrating on visual elements that are closer to children’s forms of expression. The following objectives were considered:

10-14 aged children should be able to use the tool fluently, like any other computer tool;

using as far as possible drawing functions that are present in any other software, yet providing the very special abilities of Imagine to surface in the most natural way as provided in the Imagine environment itself;

to enjoy the use of the tool and ease cognitive load, not to use difficult functions that might take away attention from the object of representation;

the ability to use multimedia elements: pictures drawn, wave files, different musical elements, animations, web addresses, or even little programs if needed.

##### 4.1.1. Creation of nodes

All nodes are instances that are descendants of Turtles, thus they possess all features of a general Turtle: acquiring modifiable shape as picture. For this we developed a small simplified paint tool within the microworld to allow visualisation of nodes.

Functions within the simplified drawing tool are identical to existing functions within Imagine as general and all the other co-laboratories we developed for the project. The microworld allows all possibilities existing within Imagine to be used i.e. assigning simple Turtle events to take place, e.g. clicking on node plays a tune or video. Nodes can also contain labels as descriptions that can appear if requested.



Figure 12. The paint window



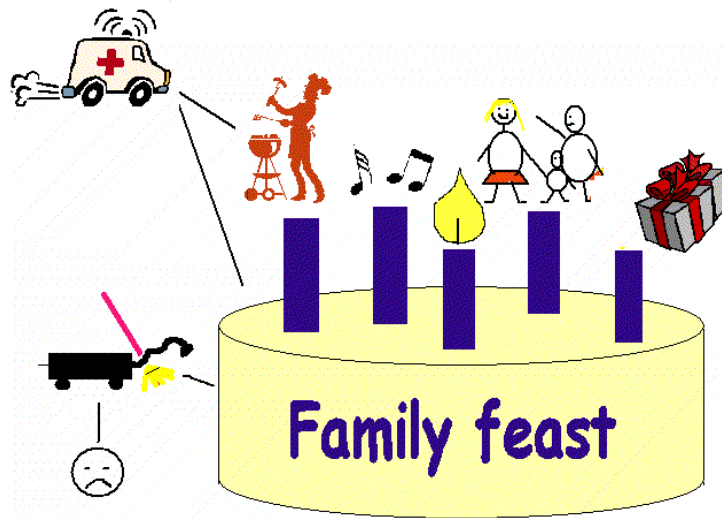


Figure 13. Imagine implementation of “Family feast”

#### 4.1.2. Connections between nodes

The connections between nodes are realised in the present microworld with lines of different thickness and colour. The directions of the lines are also stored as important data that is hidden from users. In creating complex connections however, the lines corresponding to connections can be very messy, thus prevent a proper visual view of mind map.

#### 4.1.3. Nodes on move

Any selected node can be moved to the centre on the mind map as originator concept on a new page, which invokes the appearance of its directly linked nodes to surface. Thus we can create a multidimensional mind map, which:

provides a better view for each level,

offers the possibility of having several corresponding concepts to appear as originator – that is, it is possible to embed several mind maps into each other.

Each level can be saved individually and printed if needed. Since the map is itself a graph, each group node can appear on several levels similar to our own thoughts which are not just sequential derivatives of a single thought.

## 5. Conclusions and further implications

Concept mapping and mind mapping is a very versatile tool in education which can be used in different ways to enhance the learning process. One of the most effective ways is to invoke construction of mind maps mirroring internal thought on different topics. Mind maps are ideal tool for self expression, communication and collaboration and thus are very efficient tools for collaborative learning. The presentation at Eurologo, shall illustrate the different types of mind maps that express special meaning, the Coraler tool used for modular creations, and the use of Imagine map editor during the Colabs project.



### 5.1.1. Acknowledgement

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