A proposed visualization tool for multilayer conceptual representation

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Abstract

Visualization is the graphical or semi-graphical representation of information that aids human comprehension of and reasoning about that information. Visualization tools are critically important for creating, querying, visualizing and validating Conceptual Data. Conceptual Representation is an efficient infrastructure that enhances visibility of knowledge on the Content, the lack of robust and efficient tools to visualize, analyze and represent this Type of representation within Content framework constraint remains a big challenge. In this study, Conceptual delivery and their visualization tools were reviewed. ADS (Conceptual ,Delivery, Student Tool), a tool to evaluate and represent formal description of concepts, relationships of data models within a given framework for publishing contents of the Materials more efficiently is developed and proposed. Performance of ADS was investigated on samples of Delivery sessions. The proposed tool showed remarkable improvement over the existing tools as it aids a better comprehension of the syntax and semantics of Conceptual delivery investigated in this study.

Keywords: *Conceptual Representation, Concept Mapping, Conceptual Delivery, Visualization tool, Authoring tool, Delivery tool, Concepts maps Technologies.*

I. INTRODUCTION

People assumed that Students are proficient learners, can understand and apply knowledge gained from texts. However they may face difficulties in extracting important information, relating ideas, and organizing concepts in useful structures. These difficulties become worse by a number of factors.

One factor is that the knowledge domain may be new to them. Also the texts itself may cause comprehension problems. The failure to use appropriate learning strategies makes the problem worse. Learning strategies are flexible plans applied to put ideas together in a meaningful structure and apply them to different contexts, helping students meet academic requirements. Instructing students by using appropriate learning strategies can overcome these difficulties.

Concept mapping, as a learning strategy, has received considerable attention over the past twenty years. It is similar to other approaches such as networking, multiple-relationship mapping, and knowledge mapping. Concept mapping is a cognitive strategy which is suited to clarify relationships between ideas or concepts. [10][11]

Historically, from the early 1970s, the concept map appeared in the work of Ausubel, Novak, and Hanesian. Concept mapping was introduced originally to explore meaningful learning acquired through audio-tutorial instruction in science. Meaningful learning occurs when learners can connect new knowledge with something they already know. Ideas and knowledge need to be linked to each other when many ideas are presented at once; they are integrated into a conceptual whole. [8]

Concept maps can be used to improve learning and teaching in four ways:

- It can be used as a learning strategy.
- It can be used as a teaching strategy.
- As a tool in the instructional design process
- Used to assess the student's understanding. [9]

Concept mapping is one of visual-spatial strategies that facilitate thinking and learning about the information by extracting, reorganizing, and representing it externally.

Concept maps differ from other learning strategies:

- Concept maps are graphic illustrations of written statements.
- It enables learners to represent not only the ideas itself but also its interrelationships.
- Concept maps help teachers design better lesson by increasing students' cognitive learning, enhancing their understanding and help them thinking, analysis, and apply their gained knowledge. [10]

In the process of mapping concepts, a student's concepts and ideas are declared and, thus, misunderstanding may be corrected. Implementations of the concept-mapping strategy can take various forms. In all of them learner is required to take the initiative for his own learning by participating in the process of abstracting

ideas, clarify their relationships, and put them in a meaningful structure. [8][10]

A presentation is a structured and organised form of data delivery, operating through a suitable delivery medium. The goal of a presentation is illustrate some appropriate cognitive processes that lead to acquisition of information or knowledge.

Many students find electronic concept mapping very useful, as it minimizes the exhausting and time-consuming activity of erasing, revising, and beginning anew. It allows them greater freedom to adjust their conceptual thinking and mapped representations. [10]

Concept maps are visual models structured as directed or undirected graphs. Concept maps and their variations, such as mind maps, proved to be useful as graphical knowledge representation tools for human users who are able to derive semantics from context. In particular, concept maps are extensively used in education to present knowledge to students, and to enable students to "construct" their own Knowledge in a structured way. [1]

Conceptual mapping can be defined as a cognitive externalisation of a conceptualisation represented in a graphical form and the standard form used in this type of mapping is a node-arc graph in which the nodes represent concepts and the arcs connecting them represent the relationships between the respective concepts.

The above description of conceptual mapping is more akin to a ‘formal ontology’ than to a ‘cognitive activity’. This is an important distinction since formal ontologies are meant to support computer processing of knowledge representation while cognitive activities are more suited to human use. There are systems that sit somewhere between formal ontology representation and cognitive mapping activities e.g. Topic Maps, which has an ANSI standard. For this framework, Content description framework scheme is proposed [7]. The main contribution of the scheme is to integrate classical content hierarchies with conceptual models, thus closing the gap between the two entry points of classical documentation: the content at the front end and the index at the back end. Thus, the Content description framework scheme is composed of three parts: a discipline based hierarchy at the top, followed by a topic description layer in the middle and ends up with conceptual clusters representing domain models at the bottom. The Joint Academic Coding Scheme (JACS) used for subject classification provides a good framework for the top part, the discipline based hierarchy. Figure 1 illustrates the nine layers that make up the Content description framework, including three layers representing the JACS description.

Repository management level	Subject group	Subject classification
	Principal subjects	
	Subject classification	
User interface level (document usability)	Topic Hierarchy	Topic description (semi-formal)
	Rhetorical model	
	Domain model	
Machine processing level (mapping on domain ontology)	Activity relations	Ontology representation (formal)
	Property relations	
	Class relations	

Figure 1: Multilayer content model

JACS: Joint Academic Coding Scheme, available online at website of the Higher Education Statistics Agency [2]

II. PROBLEM OF THE RESEARCH

Students and learners are facing many difficulties during their learning process. Mainly they could not connect their old knowledge with the new knowledge which they learn. There are some factors may cause problems as the knowledge domain may be new to them and the texts itself may cause cognitive problems.

The concept mapping helps learners to learn, as it enables students to extract the new concepts from their learning materials and connecting it with their old knowledge, clearing the relations between all this concepts.

Students find that using concept mapping is very useful which facilitate understanding and retain but when use paper-and-pencil to apply the concept mapping technique it be time consuming and exhaustive tasks. They spend a significant amount of time and effort revising and maintaining concept maps. With the advancement of information and communication technologies, these problems will disappear.

Electronic concept map minimizes the time and effort that the students spend in constructing their concept map and its activities as erasing, revising, and beginning a new map also it enable them to share their concept maps. Here we will implement a tool that will support concept mapping methodology using Content description framework shown in Figure 1 and conceptual representations by seeding and harvesting of content shown in figure 2. And develop a delivery strategy based on conceptual representation to be used by tutor

A. Objectives of the research

Our main objective is to improve concept mapping process through the following:

- Help students get rid of the dull existed in the static presentations and in the traditional teaching ways.
- Help Learners to not spend a significant amount of time and effort revising and maintaining their new knowledge connecting it with the old knowledge.
- Help presenters to do interactive presentation without huge efforts.
- Visualize the Conceptual Mapping at each layer shown in figure 1 and show interaction and continuity from layer to layer and conceptual representations by seeding and harvesting of content like shown in figure 2.
- Development of a delivery strategy based on conceptual representation

B. Motivation of the research

From my studying and teaching experience I found that the students must connect their new knowledge with their old knowledge that makes them deeply understand their subjects. The concept map enables students to achieve that. But traditional concept mapping is time consuming process also it need more effort to be done and reviews.

Students found electronic concept mapping to be a way to encourage a focused discussion with others. They also found it is easily share. It makes the result from concept mapping understandable to others. There are many attempts to Develop Concept map tool. Here we will implement a tool that will support Populating conceptual representations by seeding and harvesting of content shown in figure 2 and apply field study on students which will enable us to evaluate this tool.

Search engine	**Data flow**	**Conceptual reps**	**Contributor**	**remarks**
Seeding concepts for search	<<<	Syllabus outline	Tutor	The process of populating CR by students should reflect level of engagement with content during learning
		Expanded bullet-points	Tutor	
		Populated from presentations	Student	
Harvesting docs for reading	>>>	Populated from reading	student	

Figure 2 - Populating conceptual representations by seeding and harvesting of content

C. Solution Approach

Since other conceptual mapping tools like (CMap, ICTool) don't care of different layers shown in figure 1 and representations by seeding and harvesting of content shown in figure 2 in concept map representation so we will implement a tool which will support concept mapping methodology using layers shown in Figure 1 and visualize this layers and interaction between them which will enhance concept mapping process.

D. Scope of the research

Development of a delivery strategy based on conceptual representation which will enable tutor to represent lecture using concept maps and increase interactivity between student and learner and make learner get rid of usual delivery methods e.g. Bullet points

III. CONCEPT MAPS

Concept maps are graphical tools for organizing and representing knowledge. They include concepts, usually enclosed in circles or boxes of some type, and relationships between concepts indicated by a connecting line linking two concepts. Words on the line referred to as linking words or linking phrases, specify the relationship between the two concepts. We define concept as a perceived regularity in events or objects, or records of events or objects, designated by a label. The label for most concepts is a word, although sometimes we use symbols such as + or %, and sometimes more than one word is used. Propositions are statements about some object or event in the universe, either naturally occurring or constructed. Propositions contain two or more concepts connected using linking words or phrases to form a meaningful statement. Sometimes these are called semantic units, or units of meaning. Figure 3 shows an example of a concept map that describes the structure of concept maps and illustrates the above characteristics.[6]

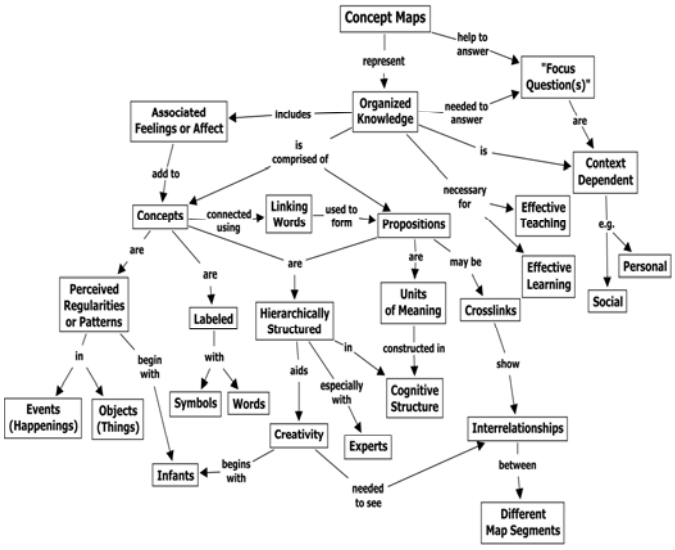

Figure 3 A concept map showing the key features of concept maps. Concept maps tend to be read progressing from the top downward.[5]

Concept Maps and Curriculum Planning

In curriculum planning, concept maps can be enormously useful. They present in a highly concise manner the key concepts and principles to be taught. The hierarchical organization of concept maps suggests more optimal sequencing of instructional material. Since the fundamental characteristic of meaningful learning is integration of new knowledge with the learners' previous concept and propositional frameworks, proceeding from the more general, more inclusive concepts to the more specific information usually serves to encourage and enhance meaningful learning. Thus, in curriculum planning, we need to construct a global "macro map" showing the major ideas we plan to present in the whole course, or in a whole curriculum, and also more specific "micro maps" to show the knowledge structure for a very specific segment of the instructional program. Faculty working independently or collaboratively can redesign course syllabi or an entire curriculum. For example, faculty working together to plan instruction in veterinary medicine at Cornell University constructed the concept map shown in Figure 4.

Using concept maps in planning a curriculum or instruction on a specific topic helps to make the instruction "conceptually transparent" to students. Many students have difficulty identifying the important concepts in a text, lecture or other form of presentation. Part of the problem stems from a pattern of learning that simply requires memorization of information, and no evaluation of the information is required. Such students fail to construct powerful concept and propositional frameworks, leading them to see learning as a blur of myriad facts, dates, names, equations, or procedural rules to be memorized.

For these students, the subject matter of most disciplines, and especially science, mathematics, and history, is a cacophony of information to memorize, and they usually find this boring. Many feel they cannot master knowledge in the field. If concept maps are used in planning instruction and students are required to construct concept maps as they are learning, previously unsuccessful students can become successful in making sense out of science and any other discipline, acquiring a feeling of control over the subject matter [13]

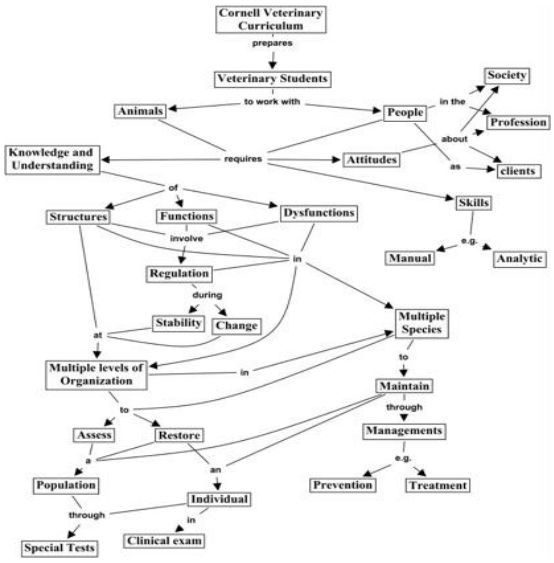

Figure 4. A concept map prepared cooperatively by the faculty of the College of Veterinary Medicine at Cornell University to show the over-all structure for a revised curriculum[13].

Interaction with content

Interaction with content relates to the generation and description of content. Generation is based on seeding and harvesting through search engines. Description of content is based on a framework that maps content at three levels: subject level, topic level and ontological level that is shown in figure 1. The schematics shown in figure 2 provide a concise depiction of the above principles.

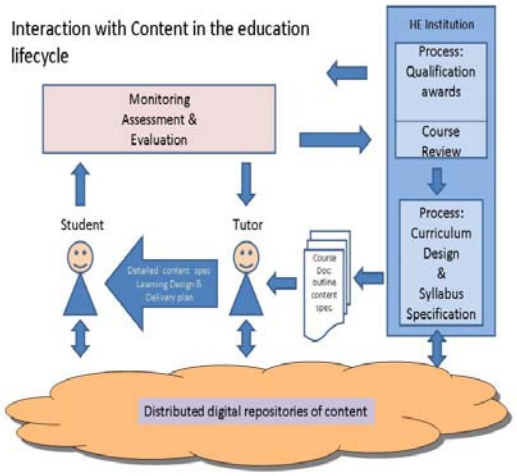

Figure 5.The curriculum lifecycle

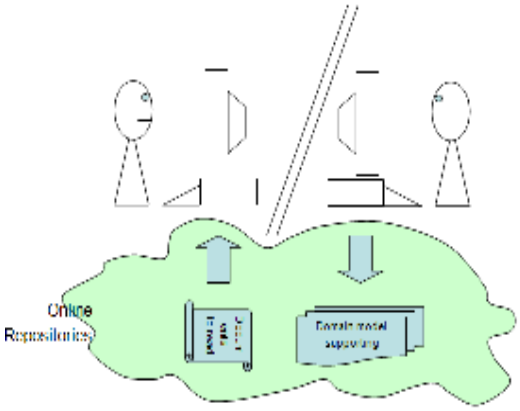

Figure 6 –Tutor-learner interactions through content

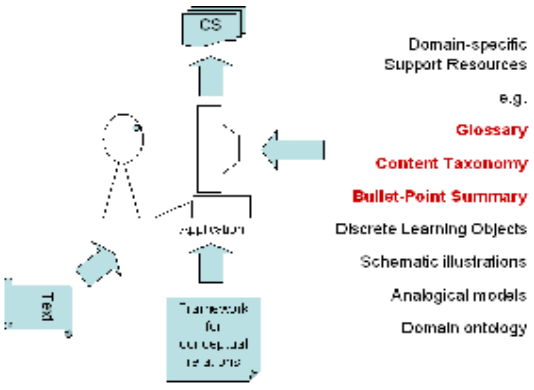

Figure 7: Learning support resource

IV. DIFFERENT HYPOTHESIS FOR DELIVERY METHODS

Since concept maps are approved to be better way for learning as its graphical representation for concepts and relationships and it represent concepts as long term memory of human save it So We introduce three strategies for delivery of content using concept maps:

1- Based totally in conceptual representations "map" and add only some rhetoric's and some Illustration objects and when we applied it into first chapter of knowledge engineering material we found that it causes confusion to the learners but when it was applied to students in a real session they preferred this way than normal sessions "using bullet points"

2- Usual delivery method in which we use bullets ,narratives , definitions and diagrams to explain concept before adding it to the map and when we applied it into first chapter of knowledge engineering material we found that concept maps useful to :

- Determine semantic field
- Determine sequential order
- And previous points used to provide focus as a follow up to the delivery
- Reviewing

3- Interactive delivery based on conceptual representation in which we mention a concept or set of concepts to fire learners' brains and then go though explaining them with an interactive way to save learners info. About concepts and add what I need to his info or modify his info about this concept check [appendix 1] for flow chart

We expect this strategy is the superior strategy in learning as it increase interactivity between student and learning program and learners "tutor" so we apply it to students after fishing the website that will help learner and student to apply this strategy

CONCLUSION A Concept Visualization tool has been developed for Representation of conceptual mapping and it's usage in Lectures delivery.

The implemented tool will help learners to deliver lectures in the help of conceptual delivery which will also help students to receive lecture in the way that his brain store it.

It was found that using conceptual Delivery using help of instructor "instructor led" or without help of instructor "instructor less" achieve more efficient results than using Normal Delivery Method.

Our Proposed tool will enhance the interaction between learner and students and give students hand on to start from what his instructor ended to build his concept map for each topic he is studying.

Also we found that the gap in exam degrees between students with different Levels has been decreased when using the proposed tool

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