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The Ruse Branch of the Union of Scientists in Bulgaria was founded in 1956. Its first Chairman was Prof. Stoyan Petrov. He was followed by Prof. Trifon Georgiev, Prof. Kolyo Vasilev, Prof. Georgi Popov, Prof. Mityo Kanev, Assoc. Prof. Boris Borisov, Prof. Emil Marinov. The individual members number nearly 300 recognized scientists from Ruse, organized in 13 scientific sections. There are several collective members too – organizations and companies from Ruse, known for their success in the field of science and higher education, or their applied research activities. The activities of the Union of Scientists – Ruse are numerous: scientific, educational and other humanitarian events directly related to hot issues in the development of Ruse region, including its infrastructure, environment, history and future development; commitment to the development of the scientific organizations in Ruse, the professional development and growth of the scientists and the protection of their individual rights.

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BOOK 5

"MATHEMATICS, INFORMATICS AND PHYSICS"

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COMPUTER – BASED CONCEPTUAL MAPPING FOR FACILITATION OF CREATIVE AND MEANINGFUL LEARNING IN THE COURSE OF "MULTIMEDIA SYSTEMS AND TECHNOLOGIES"

Valentina Voinohovska

Angel Kanchev University of Ruse

***Abstract**: Constructivism implies that every learner must construct her/his own knowledge structure, or cognitive structure, through her/his own efforts. Knowledge structures are built primarily through meaningful learning, not by rote learning or simply memorizing information. This paper illustrates an approach of using computer – based concept mapping tool that facilitates creative and meaningful learning and helps organizing and representing knowledge.*

***Keywords**: concept map, constructivism, computer – based, meaningful learning, quality of education*

INTRODUCTION

Last few years were marked by rapid technological advances and deep changes in many aspects of human activity. Such changes have stimulated much discussion about the role and processes of education, and about the role of information and communication technology (ICT) in teaching and learning.

The new standards identify several higher – order thinking skills and digital citizenship as critical for students to learn effectively for a lifetime and live productively. These areas include the ability to:

- Demonstrate creativity and innovation;
- Communicate and collaborate;
- Plan strategies to guide inquiry, make research, locate, organize, analyze, evaluate, synthesize and ethically use information from a variety of sources and media;
- Think critically, solve complex, multidisciplinary, open-ended problems, and take decisions;
- Use technology effectively and productively;
- Evaluate and select information sources and digital tools based on the appropriateness to specific tasks;
- Process data and report results;
- Making innovative use of knowledge, information and opportunities to create new products.

In order to meet the expectations of students who live in a technology - rich environment, the classroom must provide interactive opportunities which motivate and allow them to focus on learning [10, 14, 15]. Visual learning techniques include the use of digital technology to create diagrams, such as concept maps and webs, and use graphs, charts and images for analyzing and communicating information.

CONCEPT MAPS ESSENTIALS

Information visualization is a broad topic. Advances in technology and in understanding of cognition and perception have lead to new techniques and methods for visualizing information [6]. Workshops, symposiums, and conferences are frequently held on information visualization.

Knowledge visualization however, is a relatively new area for research. Novak proposed that the basic elements of knowledge are concepts and relationships between concepts are propositions. Concepts are defined as "records of events or objects,

designated by a label" [8]. Propositions consist of two or more concept labels connected by a linking relationship that forms a semantic unit [7]. According to many researchers using these propositions, we construct new knowledge by linking new concepts to our previous knowledge.

Structuring knowledge with visual representations during study time has the following advantages:

- Students easily recognizes visual symbols;
- Less text facilitates a word, phrase, or general idea scanning;
- Visual representation allows for general understanding;
- Students make abstract ideas visible and concrete;
- Reorganization of student's knowledge;
- Provide structure for thinking, writing, discussing, analyzing, planning and reporting;
- Explicit description of concepts and their interrelationships;
- Deep processing of knowledge, which promotes better remembering and retrieval and the ability to apply knowledge in new situations;
- Relating new concepts to existing concepts and ideas, which improve understanding and interpretation.

Concept mapping is a powerful learning technique consistent with constructivist learning theory. Constructivists [8, 11] theorized that the individual learner acquires knowledge by linking new information with past experiences to create a personal process for meaning – making. In constructivist learning, students are involved in knowledge construction and not knowledge absorption.

With the fundamental goal of fostering learning Novak [8] proposed that concept maps embody constructivist theory. Through constructivist approaches learners actively build their own knowledge, rather than adapting the teacher's interpretation of the world. In constructivist environments where students use concept mapping tools, learners are actively engaged in reflecting on their interpretation of the external world and constructing meaningful learning [3, 4].

Novak's experiences in using concept maps to help guide student learning were highly positive. They were supported by Vygotsky's [12] ideas of the importance of social exchanges in learning. Another idea that was supported is Vygotsky's concept of "Zone of Proximal Development" (ZPD). Vygotsky's studies showed that there was a level of cognitive development that allowed a learner to advance in understanding of a given domain of knowledge without coaching, and a higher level of understanding beyond which the learner cannot advance without coaching. He called this range of understanding the Zone of proximal Development.

Concept maps have been shown to be an effective for the education as tool for evaluation, displaying students' prior knowledge, summarizing what has been learned, note taking, planning, scaffolding for understanding, establish educational experiences, improving affective conditions for learning, teaching critical thinking, supporting cooperation and collaboration, and organizing content [2].

By concept mapping, students can learn meaningfully. In Ausubel's view, to learn meaningfully, students must relate new knowledge (concepts and propositions) to what they already know. He proposed the notion of an advanced organizer as a way to help students link their ideas with new information or concepts and claimed that new concepts can be incorporated into more inclusive concepts or ideas during learning. Jonassen, Peck, and Wilson [5] argued that meaningful learning has the following features:

- Active – learners interact with an environment and manipulate the objects in that environment, observe the effects of their interventions and construct their own interpretations;

- Constructive – learners integrate new interpretations with their prior knowledge;
- Intentional – learners articulate their learning goals, what they are doing, the decisions they make, the strategies they use, and the answers that they find;
- Authentic – learning tasks are real-world problems;
- Cooperative/collaborative – learners work in groups.

A concept map is a way of representing relations between ideas, images or words. Each word or phrase is connected to another and linked back to the original idea, word or phrase. Concept maps are a way to develop logical thinking and study skills, by revealing connections and helping students see how individual ideas form a larger whole.

Concept maps are flexible. They can be made simple or detailed, linear, branched, radiating, or cross-linked:

- Linear concept maps - one concept or event leads to another.
- Hierarchical concept maps represent information in a descending order of importance - the key concept is on top, and subordinate concepts are below.
- Spider concept maps - basic theme in the center of the map and sub-themes surround the main theme.
- Cross – linked maps - descriptive word or phrase and identify the relationship with a labeled arrow.

In a “well constructed” concept map [1]:

- Each pair of concepts, together with their joining linking phrase, can be read as an individual statement or proposition that makes sense;
- Concepts and linking phrases are as short as possible, possibly single words;
- The structure is hierarchical and the root node of the map represents the topic of the map.

Figure 1 shows an example of a concept map that describes the structure of concept maps and illustrates their characteristics.

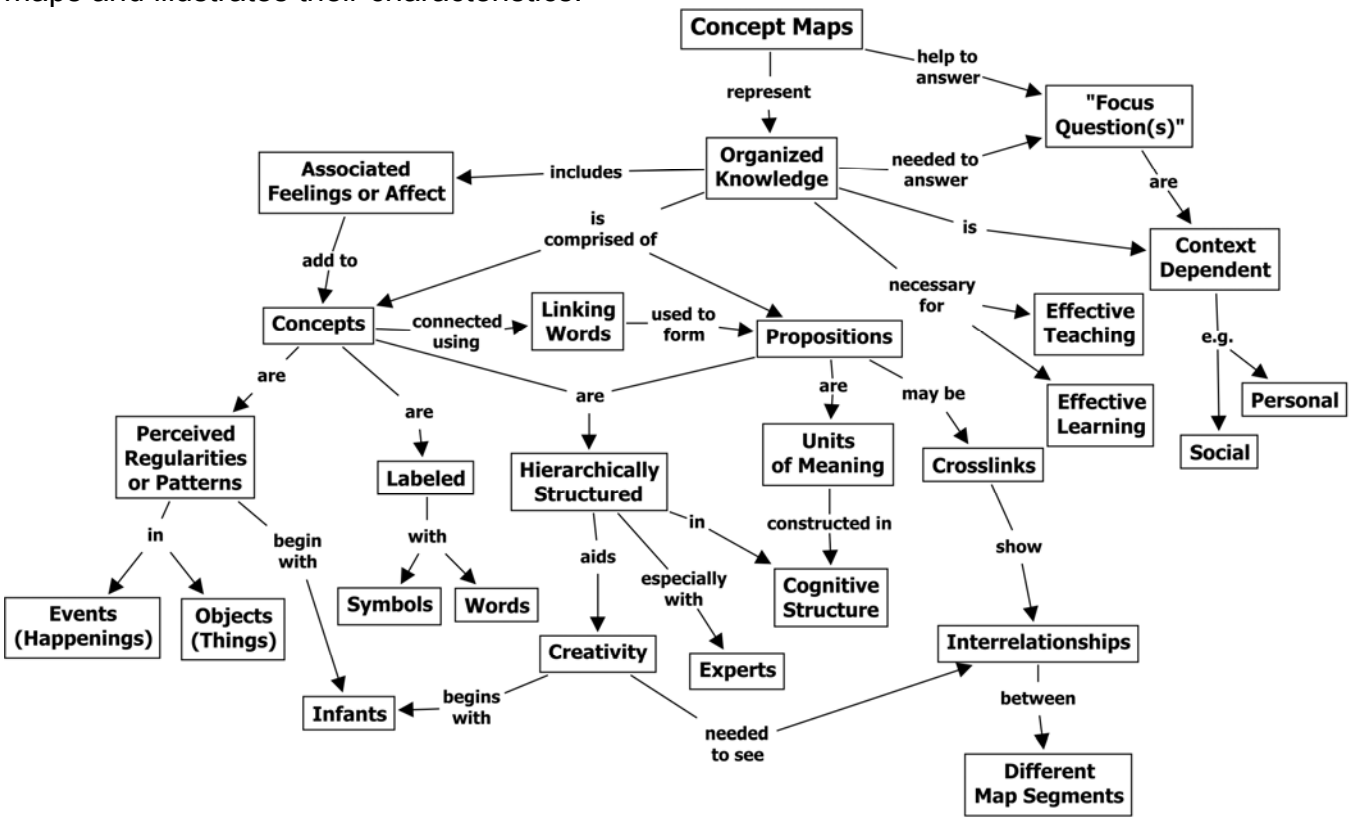


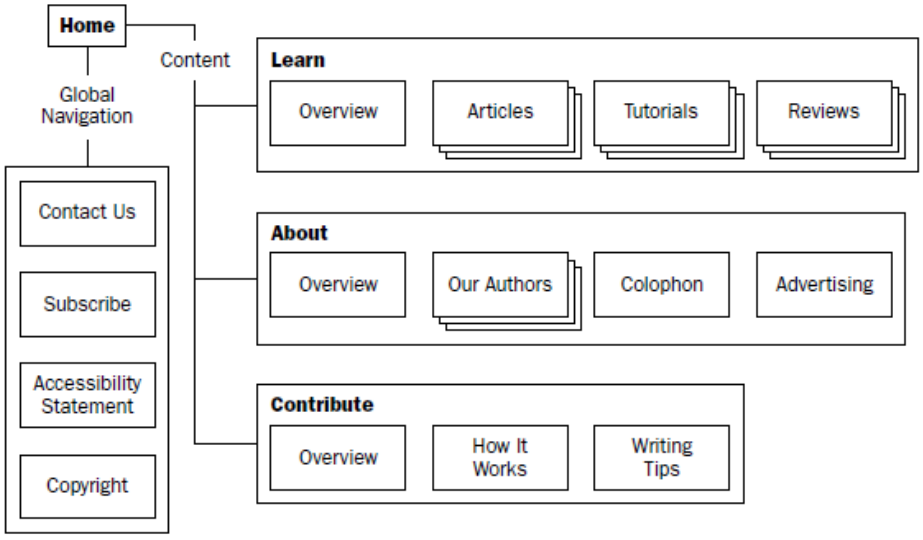
Figure. 1. A concept map showing the key features of concept maps [9].

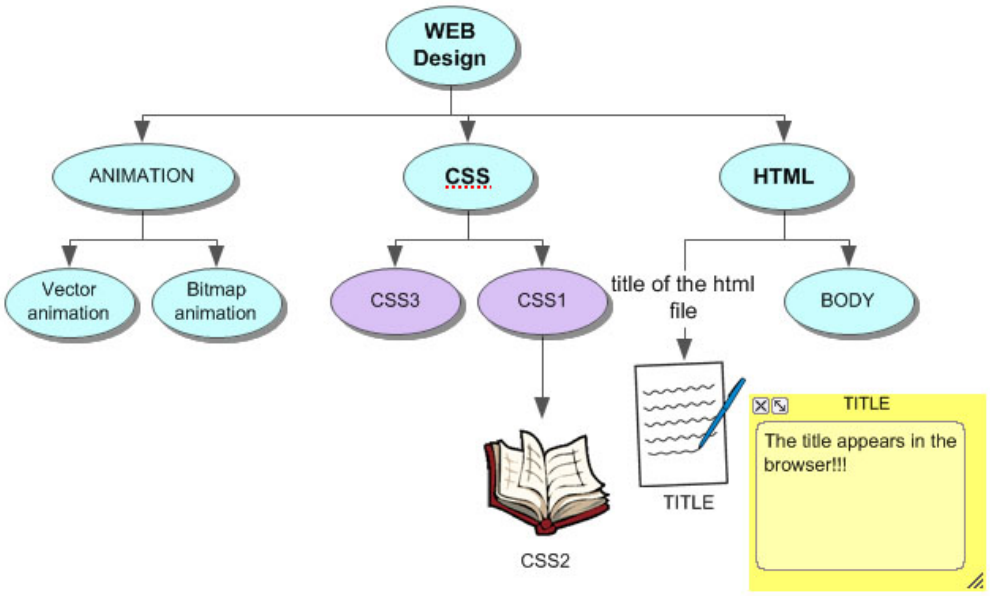
COMPUTER – BASED CONCEPT MAPPING STRATEGIES

In the course "Multimedia Systems and Technologies" students create visual models that facilitate creative thinking and help them organize, analyze, evaluate and present information by using computer – based concept mapping tool.

1. Visualize and develop ideas with graphical organizers and diagrams

- Brainstorm and capture ideas, clarify thoughts;
- Represent ideas visually using symbols, add new topic and subtopic;
- Use links to present relationships between ideas;
- Rearrange and connect ideas easily by replacing the branches;
- Add text or text phrases to links to explain relationships;
- Use different colors, shapes, patterns, shadows, fonts and styles to differentiate their ideas;
- Arrange diagrams into different tree charts;

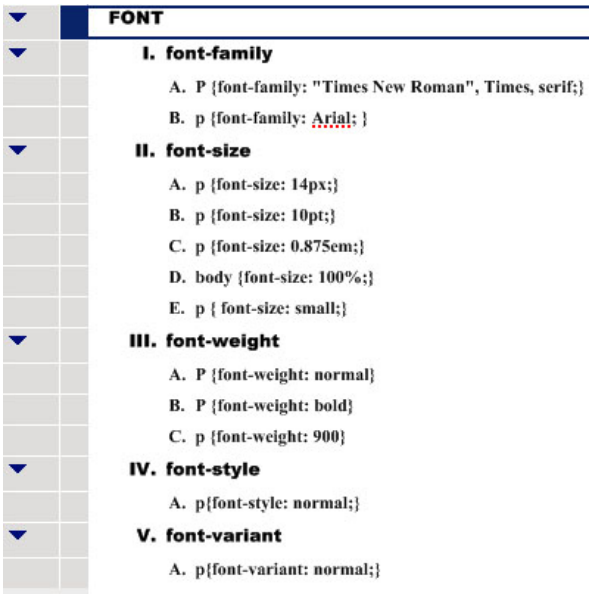


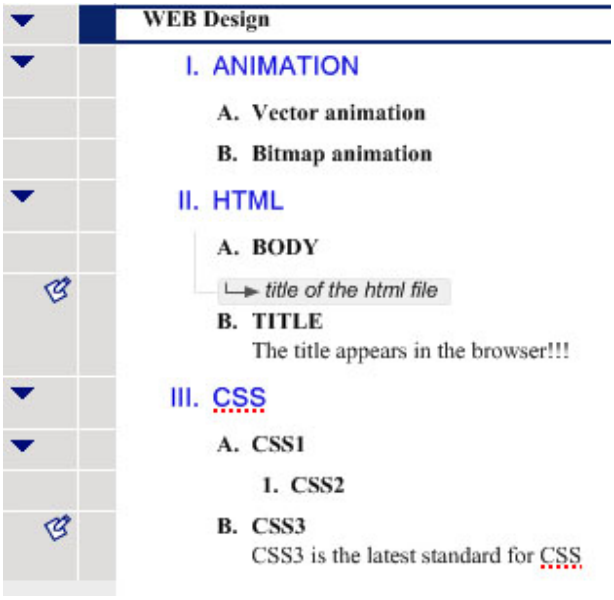


2. Plan and organize written work

- Capture ideas and information;
- Hide and show levels of detail to see the big picture or all of the content;
- Transfer the outline to word processor for formatting and finish the written work;

- Rearrange topics by dragging;
- Transform notes and paragraphs into individual topics to reorganize information easily and quickly;
- Plan projects and track ideas;
- Add topics at different levels;





3. Present Knowledge

Students present their work, on the basis of the content they have already developed. The collected information is expanded in presentations.

- Develop presentation using the content they have already have;
- Use professional themes to create visually appealing presentations. Customize themes to personalize them by adding graphics and changing background colors, fonts, and bullet styles;
- Add graphics from computer and Internet;
- Add video and sound files;
- Add speaker notes to slides;
- Use slide transitions;
- Print slides in various formats;

4. Engage Students with Collaborative Learning

Students actively engage in learning by collaborating on group projects, share documents, and receive guidance from the teacher during the entire process.

- Collaborate on group projects and sharing information to create collective knowledge;
- Share documents for review and suggestions. Adding comments directly into documents without overwriting original text, so students can see suggestions and respond with revisions to improve the quality of work;
- Share completed work with other students.

CONCLUSION

Effective education programs include a wide range of learning activities: selected readings, Internet searches, project work, report preparation and presentation, drawings, video presentations, collaborative research, and other activities. The study shows

knowledge visualization as an effective technique for teaching and learning. The use of modern computer – based mapping tool, an integration of knowledge and information visualization has the potential of impacting the management of knowledge, information, and education.

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CONTACT ADDRESS
Valentina Nikolaeva Voinohovska, Assist. Prof.
Angel Kanchev University of Ruse
Department of Informatics and Information Technologies
Tel.: +359 82 888 645
e – mail: valia@ami.uni-ruse.bg

КОМПЮТЪРНО – БАЗИРАНО СРЕДСТВО ЗА СЪЗДАВАНЕ НА ПОНЯТИЙНИ КАРТИ С ЦЕЛ ПОДПОМАГАНЕ НА ТВОРЧЕСКОТО И СЪДЪРЖАТЕЛНОТО УЧЕНЕ В КУРСА ПО „МУЛТИМЕДИЙНИ СИСТЕМИ И ТЕХНОЛОГИИ”

Валентина Войноховска

Русенски университет „Ангел Кънчев”

***Резюме**: Според теорията на конструктивизма всеки обучаем самостоятелно трябва да конструира своята собствена структура от знания. Структурата от знания се изгражда предимно чрез съдържателно учене, а не с учене на изуст и само запоняне на информация. В тази статия е описан подход за използване на компютърно – базирано средсво за създаване на понятийни карти, което насърчава творческото и съдържателно учене на студенте и им помага за организиране и представяне на знанията им.*

***Ключови думи**: понятийна карта, конструктивизъм, съдържателно учене, компютърно – базиран, качество на обучението*

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