Annals of "Dunărea de Jos" University of GALAŢI Fascicle XIII. Languageand Literature 2010. New Series. 29,17 (28), 1-10.

TEACHING MEDICAL TERMINOLOGY WITH MIND-MAPPING SOFTWARE

Prof. Reima Al-Jarf

Abstract

This article demonstrates how mind-mapping software can be used to help premedical students combine, learn, retain, apply and relate medical terminology sharing the same root/base, the same prefix or suffix, cognates, derivatives, and singular plural forms and relate details which radiate out from the centre. It shows how the mind-mapping software can be used to combine different prefixes and/or suffixes to the same root, different roots to the same prefix/and or same suffix, sorting out, classifying, grouping terms according to the prefixes, roots or suffixes they contain, and interpolating prefixes, roots and suffixes. By focusing on roots, prefixes, suffixes and derivatives and then looking for branches that radiate out and show connections between the terms, the students map medical terminology knowledge in a way which will help them understand and retain new medical terms.

Keywords: *mind mapping, concept mapping, medical terminology, premedical students, roots, prefixes, suffixes.*

Abstract

This article demonstrates how mind-mapping software can be used to help premedical students combine, learn, retain, apply and relate medical terminology sharing the same root/base, the same prefix or suffix, cognates, derivatives, singular and plural forms and relate details which radiate out from the centre. It shows how the mind-mapping software can be used to combine different prefixes and/or suffixes to the same root, different roots to the same prefix/and or same suffix, sorting out, classifying, grouping terms according to the prefixes, roots or suffixes they contain, and interpolating prefixes, roots and suffixes. By focusing on roots, prefixes, suffixes and derivatives and then looking for branches that radiate out and show connections between the terms, the students map medical terminology knowledge in a way which will help them understand and retain new medical terms.

Keywords: *mind mapping, concept mapping, medical terminology, premedical students, roots, prefixes, suffixes.*

Enseigner la terminologie médicale avec Mind-Mapping Software

Reima Al-Jarf

Résumé

Cet article montre comment le logiciel de cartographie conceptuelle peut être utilisée pour aider les élèves à prémédicale combiner, d'apprendre, de conserver, d'appliquer et concernent la terminologie médicale partage la même racine / base, le même préfixe ou suffixe, mots apparentés, les dérivés, les formes singulier et pluriel et relater les détails qui rayonnent à partir du centre. Il montre comment le logiciel de cartographie conceptuelle peut être utilisée pour combiner les différents préfixes et / ou des suffixes à la racine même, les racines différentes pour le même préfixe et / ou un suffixe même, le tri, le classement, le regroupement termes selon les préfixes, des racines ou suffixes qu'ils

contiennent, et en interpolant préfixes, racines et suffixes. En mettant l'accent sur les racines, des préfixes, les suffixes et les dérivés et la recherche de branches qui rayonnent et montrer les liens entre les termes, les élèves carte connaissances médicales terminologie d'une manière qui les aidera à comprendre et retenir de nouveaux termes médicaux.

1. Introduction

A mind map is a graphic organizer in which the major categories radiate from a central idea and sub-categories are represented as branches of larger branches**.** It can be used to generate ideas, take notes, develop concepts and ideas, and improve memory**.** It is a powerful tool that teachers can use to enhance and create a foundation for learning. It is helpful for visual learners as they are illustrative tools that assist with managing thought, directing learning, and making connections**.** It is a skill that cuts across ability levels and encompasses all subject matters**.** Using the e-map technique gives instructorsthe freedom to show interrelationships between concepts and content in a very visual and nonlinear structure that benefits their students**.** Mind mapping has considerable utility fortracking change in the course of learning, and has the capacity to distinguish between changes that are meaningful, and those that are not. Deep, surface and non-learning are tangible measures of learning that can be observed directly as a consequence of concept mapping (Buzan, 2000; Budd, 2004; Goldberg, 2004; Stephens & Hermus, 2007; Hay, 2007; Ruffini, 2008).

A review of experimental and quasi-experimental studies by Nesbit & Adesope (2006) in which students in Grade 4 to postsecondary learned by constructing, modifying, or viewing node-link diagrams and used concept maps to learn science, psychology, statistics, and nursing showed that across several instructional conditions, settings, and teaching methodologies, use of concept mapping was associated with increased retention of information.

In second language contexts, Chularut and DeBacker, (2003) investigated the effectiveness of concept mapping as a learning strategy. The ir findings showed a statistically significant interaction of time, method of instruction, and level of English proficiency for self-monitoring, self-efficacy, and achievement. For all four outcome variables, the concept mapping group showed significantly greater gains from pre-test to post-test than the individual study group. Students who used background knowledge, context, morphology, and dictionaries learn words more effectively and adapted a vocabulary web consisting of eight identical bubbles to provide students with a word map, intertwining most of the elements to clarify word meaning as essential to vocabulary instruction (Rosenbaum, 2001). When bilingual knowledge maps (BiK-maps) were used as tools for learning German-English word pairs by 72 undergraduates, BiK-map learners outperformed list learners on all dependent measures (Bahr & Dansereau, 2001).

In English for medical purposes, a review of the literature showed that there is a great need for integrating mind-mapping techniques in the teaching of medical terminology to premedical students who are non-native speakers of English. Results of a survey showed that students enrolled in the Nelson R. Mandela School of Medicine, Durban, South Africa felt that they lacked the basic conceptual foundations essential for the learning and understanding of physiology. Difficulties that the students identified were mainly terminological and conceptual in nature (Tufts and Higgins-Opitz, 2009). Since pre-medical students in general and Saudi pre-medical students in particular have difficulties learning medical terminology, the present study demonstrates how mind-

mapping software can be used to help premedical students connect, combine, learn, retain, apply and relate medical terms sharing the same root/base, the same prefix or suffix, word cognates, derivatives of the same word, singular and plural forms of medical terms from Latin and Greek and words with similar pronunciation. It shows how the mind-mapping software can be used to attach different prefixes and/or suffixes to the same root, different roots to the same prefix/and or same suffix, sorting out, classifying, grouping terms according to the prefixes, roots or suffixes they contain, and interpolating prefixes, roots and suffixes. By focusing on roots, prefixes, suffixes and derivatives and then looking for branches that radiate out and show connections between the terms, the students map medical terminology knowledge in a way which will help them understand and retain new medical terms.

For students majoring in the health sciences (medicine, dentistry, pharmacy, applied medical sciences), knowledge of medical terminology is an important element. By learning new medical terms, students can increase their listening, speaking, reading and writing terminology and can improve comprehension and production in English for medical purposes. Nassaji (2004) found that ESL students who have stronger depth of vocabulary knowledge make more effective use of certain types of lexical inferencing strategies than their weaker counterparts; and depth of vocabulary knowledge makes a significant contribution to inferential success over and above the contribution made by the learner's degree of strategy use. August, Carlo, Dressler & Snow (2005) also found that English language learners who experienced slow vocabulary development were less able to comprehend texts at the grade level than their English-only peers. Such students were likely to perform poorly on assessments in these areas and were at risk of being diagnosed as learning disabled.

2. Context

In Saudi Arabia, Arabic is the medium of instruction in the public schools until the end of high school. English is the medium of instruction in colleges of medicine and engineering. In their pre-medical year, premedical students take English for medical purposes (8 hours a week) and foundation courses such as biology, physics and biochemistry in English and they encounter too many new medical terms with which they are unfamiliar. In addition to reading and grammar, the English for medical purposes course introduces pre-medical students to the basics of medical terminology.

Results of a questionnaire-survey administered to a sample of pre-medical students at Umm Al-Quara University in Mecca, Saudi Arabia showed that medical terminology constitutes a major problem for beginning pre-medical students. Pre-medical students reported that they have difficulty in pronouncing, recognizing the component parts of medical terms and what each part means; in connecting the different terms derived from the same base; in recognizing, relating and distinguishing the different derivatives of a term, and spelling changes that take place when combining prefixes, roots and suffixes to form medical terms.

3. Curriculum, Tasks and Materials

Instructors teaching English for pre-medical students in Saudi Arabia use materials developed in-house, in addition to few chapters selected from published books on medical terminology. The amount of medical terms covered is too limited and is insufficient for enhancing the students' knowledge of medical terms to a level that would enable them to read and comprehend authentic medical texts and listen to and comprehend

medical lectures delivered in English, and recognizing and relating the singular and plural forms of Latin medical terms (Al-Jarf, 2009; Al-Jarf, 2007).

3.1 Skills Emphasized:

The medical terminology component of the English for Medical Purposes course that pre-medical students take aims to develop the students' ability to identify the following:

- Basic structure of medical terms: word root, suffix, prefix, combining vowel or consonant as in *epigastritis, transgastritis, cardiograpm, electrocardiogram gastrointestinal, gastric*
- Phonetic change that take place when a prefix is added before certain consonants when a prefix is added as in *apt: aptitude. Ept: inept*).
- Prefixes and Suffixes added to Latin bases such as:
    - *Tele: Telegraph, Telescope, Telegram, Telecast*
    - *Para-: parathyroid, paranormal, paramedical, paratyphoid, paraplegia*
    - *Psych: psychology, psychopath, psychometry, psycholinguistics, psychoanalysis, psychosis*
    - *Dia: diagram, diagnosis, diastole, diaphragm*
    - *Epi: epiglottis, epigastric, epigram*
    - *Pro: program, prognosis*
- Affixes referring to quantity such as:
    - *Biceps, triceps, quadriceps.*
    - *Twin, triplets, quartet, quintet.*
    - *Replicate, Duplicate, triplicate, quadruplicate, centruplicate.*
    - *Uniped, biped, tripod, centipede, millipede.*
    - *Double, triple, quadruple, quintuple.*
    - *Million billion, trillion, quadrillion quintillion.*
    - *Liter, centiliter, milliliter, deciliter.*
    - *Analysis, synthesis, diagnosis, prognosis.*
- Negative prefixes *in-, im-, il-, ir-, non-, un-, a-, an-, anti-, de-, mal-, mis-* as in:
    - *Antacid, antitoxic, antiseptic.*
    - *Atrophy, apathetic, amorphous, amnesia.*
    - *Disinfect, disconnect, disease.*
    - *Insomnia, incurable, intolerable, inglorious, incomplete.*
    - *Immature, immune, immutable, immense, immortal, impossible.*
    - *Illegal.*
    - *Non-alcoholic, non-smoker.*
    - *Misuse, mislead, misplace.*
    - *Malodorous, malignant, malpractice, malady, malnutrition, malicious.*
    - *Irregular, irreversible, irresistible, irreparable.*
    - *Unhealthy, unpleasant, uncommon.*
- Derivatives sharing the same base such as:
    - *Circle, circulate, circulation, circulatory.*
    - *Motive, motivate, motivation.*
- Opposites such as: *interior ≠ exterior; anterior ≠ posterior.*
- Latin singular and plural forms of medical terms such as: *bacterium, bacteria; stratum, strata, radius, radii; phenomenon, phenomena; vertebra, vertebrae.*

- Medical acronyms and abbreviations such as: *DNA, RBC, IV, OR, UV, MRI, IQ, MD, GP, ER, BP.*
  (Al-Jarf, 1994; Al-Jarf, 2010).

3.3 Instructional Strategy with Free Mind

In-class instruction goes through 6 stages: Orientation, presentation and modeling, guided practice, independent practice, extension activities, and assessment. Each stage is explained in below.

3.3.1 Orientation

To help pre-medical students categorize, visualize and recall relationships among medical terms under study, a mind mapping software called *"Free Mind 0.8.1"* can be integrated in in-class medical terminology instruction. In the first week of classes, the students are introduced to the mind-mapping software and purposes of using it. They are given the link and are asked to download *Free Mind 0.8.1* freeof charge. The components of the *Free Mind 0.8.1* homepage are introduced and explained.

3.3.2 Presentation and Modeling

The instructor can train students to use the Free Mind Software using an LCD projector or a smart board. Every week the software is used to create mind maps for the medical terms to be covered or those that have been covered with the help of the instructor. The following types of mind maps can be created: *(i) Phonological mind maps*which focus on words sharing the same pronunciation (ii) *Morphological mind maps* which focus on words or word parts sharing the same prefix, suffix, root and forms derived from the same word or root. (iii) *Syntactic mind maps* which focus on singular and plural forms; word families, parts of speech and derivatives (iv) *Semantic mind maps* which focus on synonyms and antonyms and words categorized according to the part of the body, system, disease …etc.

A mind map begins with placing a target concept or category in the middle of the screen. This concept or category is used as a basis for grouping, categorizing and sub-categorizing medical terms. Branches radiating from the central category are drawn for the sub-categories and examples sharing the same category or rule. Sub-categories, examples and words are elicited from students, grouped into related sub-categories and placed radiating out from the central category. The instructor introduces new terms and related concepts attached to them. For example, the instructor places the target category *"negative prefixes and suffixes"* in the middle of the screen. Branches and nodes are created for the prefixes and/or suffixes *'a- an-, in-, il-, im-, ir-, dis-, de-, anti-'.* For each prefix or suffix, a list of medical terms is prepared with the help of the students. Terms containing each negative prefix or suffix expand outwards into branches and sub-branches. Examples containing those prefixes or suffixes expressed are selected and printed using upper or lower case letters. Each word sits alone on its own line. The lines are connected, starting from the central image (See Mindmap 2).

Mindmap 1 shows an example of a phonological mindmap. The central focus is on pronunciation. Each of the main branches represent one silent letter or double letters and the examples that radiate from each main branch are examples containing that particular silent letter or double letters. Mindmaps 2, 3, 4 & 5 show morphological relations, mindmap 6 shows syntactic relations, mindmaps 7, 8 & 9 show semantic relations. Colors are used throughout the mind map. Associations are shown in the mind map. The mind map is kept clear by using a radiant hierarchy, numerical order or outlines

to embrace branches. The central lines are made thicker, organic and flowing, becoming thinner as they radiate out from the centre.

The students develop their own personal style of mind mapping. They draw empty lines, collect the words and classify them. They change colors to reenergize their mind. Sometimes the students are able to see relationships and connections immediately and can add sub-branches to a category. Sometimes they cannot, so they can just connect the subcategories to the central focus. Organization always comes later; the first requirement is to get few terms and categories out of their head and onto the screen.

During the mind mapping activity, the instructor serves as a facilitator. She provides technical support, answers students' questions and help with the mind maps, categories, examples representing each category in and out of class.

3.3.3 Guided Practice

Students practice connecting new medical terms studied in class with medical terms that they already know using *Free Mind 0.8.1*. out of class. They keep their phonological, morphological, syntactic, and semantic mind maps and continue to add sub-categories and terms to each map, every time a lesson is covered in class. With the help of the instructor, the students make word lists and add words related to each phonological, morphological, syntactic, or semantic mind map. New features, categories, skills are explored through discussion.

3.3.4 Independent Practice

The students continue to use *Free Mind* at home and continue to add words related to each. The students are handed out questions that require them to group, classify or connect medical terms studied on their own in class or at home. Mind maps can be created and added during, and after reading medical texts in the different courses.

3.3.5 Assessment

Students can keep their medical terminology mind maps in a folder or e-portfolio. Mind maps can be also posted in an online course. Students can exchange mind maps and may work on mind maps collectively.

4. Conclusion

The present study shows how the Free Mind 0.8.1 software is used in grouping, categorizing, and classifying medical terms on the basis of phonological, morphological, syntactic or semantic categories. Those mind maps can be used in introducing, categorizing, visualizing and reviewing medical terms and as mnemonic devices. Through a graphic depiction of words, these mind maps build upon what students know to help them see relationships with newly introduced medical terms. Students develop related rather than isolated knowledge of medical terms and develop skill in differentiating concepts as well as defining words.

These mind mapping strategies have been reported to improve word and concept knowledge as well as comprehension across grade levels, in a variety of content areas, and with a variety of learners, including struggling ESL, and learning disabled readers.

Semantic mapping increases cognitive processing, and develops the cognitive structure. Semantic mapping that involves the application of medical terms meanings with pre-medical students. Semantic mapping is highly motivating for adult students because it allows them to interact with teachers regarding the context of the lesson, rather than merely on a specific point of skill development. The ultimate goal of semantic mapping

is to introduce the students to a technique that they can use regularly to organize medical terms they have studied, relate them to what they already know, and expand their store of knowledge of medical terms while reading medical texts.

It is noteworthy to say that the aim of the mind mapping activity is not to teach the students how to apply the details of the *Free Mind* software. Focus should be on placing the phonological, morphological, semantic and syntactic category that would be used as a basis for grouping and classifying medical tems in the center, how to add branches for the details, how to add pictures and change the font color, size and case.

References

Al-Jarf, R. (2010). Translation students' difficulties with English Neologisms. Analele Universităţii "Dunărea De Jos" Din Galaţi Fascicula XXIV ANUL III (2). 431-437. Romania. ERIC ED613253.

Al-Jarf, R. (2009). Teaching Professional English to Saudi Students Studying Abroad. The International Language Conference on the Importance of Learning Professional Foreign Languages for Communication Between Cultures. The Faculty of Logistics, Celje, Slovenia. ERIC ED613145. doi:10.2139/ssrn.3851491

Al-Jarf, R. (2007). Teaching vocabulary to EFL college students online, Call-EJ Online 8 (2),1-16.

Al-Jarf, R. (1994). English and Arabic Word formation Processes for Translation Students. Google Scholar

August, Diane, Carlo, Maria, Dressler, Cheryl & Snow, Catherine (2005). The critical role of vocabulary development for English language learners. *Learning Disabilities Research and Practice, 20, 1,* 50-57.

Bahr, G. & Dansereau, D. (2001). Bilingual knowledge maps (BiK-Maps) in second-language vocabulary learning. *Journal of Experimental Education, 70, 1,* 5-24.

Budd, John W. (2004). Mind maps as classroom exercises. *Journal of Economic Education, 35, 1,* 35.

Buzan, Tony. (2000). *The mind map book*. New York: Penguin Books.

Chularut, Pasana & DeBacker, Teresa (2004). The influence of concept mapping on achievement, self-regulation, and self-efficacy in students of English as a second language. *Contemporary Educational Psychology, 29, 3,* 248-263.

Goldberg, Cristine (2004). Brain friendly techniques: Mind mapping. *School Library Media Activities Monthly, 21, 3,* 22-24.

Hay, David B. (2007). Using concept maps to measure deep, surface and non-learning outcomes. *Studies in Higher Education, 32, 1,* 39-57.

Nassaji, Hussein (2004). The relationship between depth of vocabulary knowledge and L2 learners' lexical inferencing strategy use and success. *Canadian Modern Language Review, 61, 1,* 107-134.

Nesbit, John & Adesope, Olusola (2006). Learning with concept and knowledge maps: a meta-analysis. *Review of Educational Research, 76, 3,* 413-448.

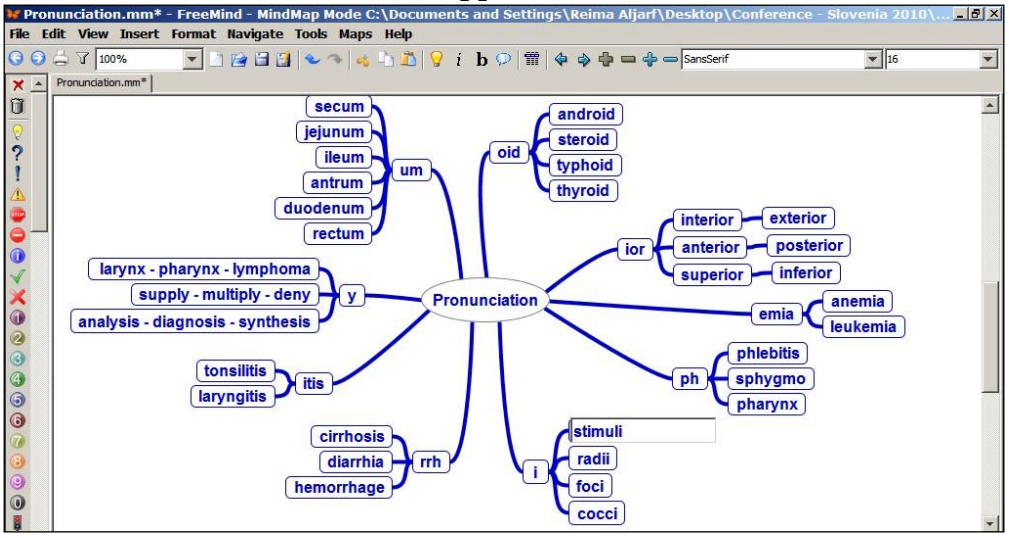
Rosenbaum, Catherine (2001). A word map for middle school: A tool for effective vocabulary instruction. *Journal of Adolescent & Adult Literacy, 45, 1,* 44-49.

Ruffini, Michael F. (2008). Using e-maps to organize and navigate online content. *EDUCAUSE Quarterly, 31, 1,* 56-61.

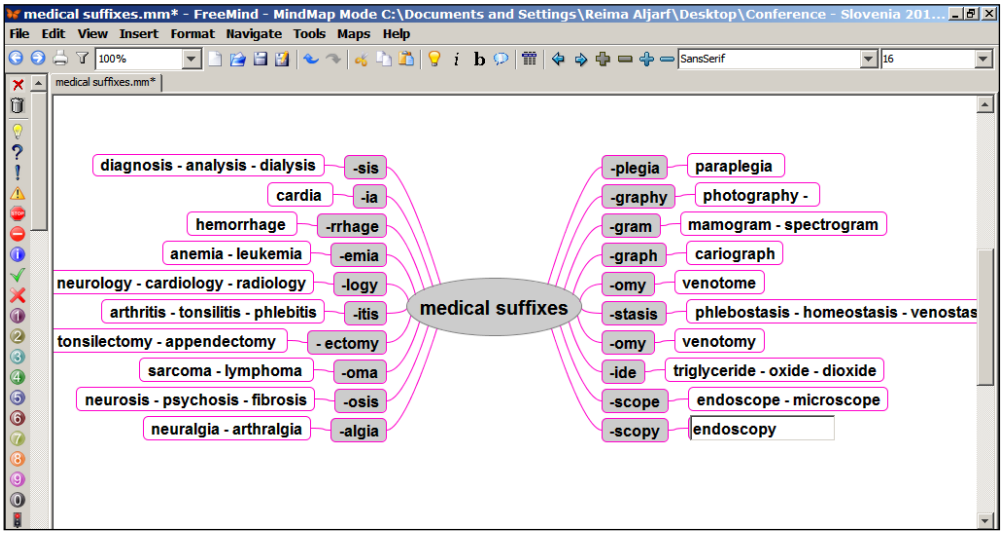
Stephens, Pam and Hermus, Cindy (2007). Making art connections with graphic organizers. *School Arts: The Art Education Magazine for Teachers, 106, 8,* 55.

Tufts, Mark & Higgins-Opitz, Susan (2009). What makes the learning of physiology in a PBL medical curriculum challenging? *Advances in Physiology Education, 33, 3,* 187-195.

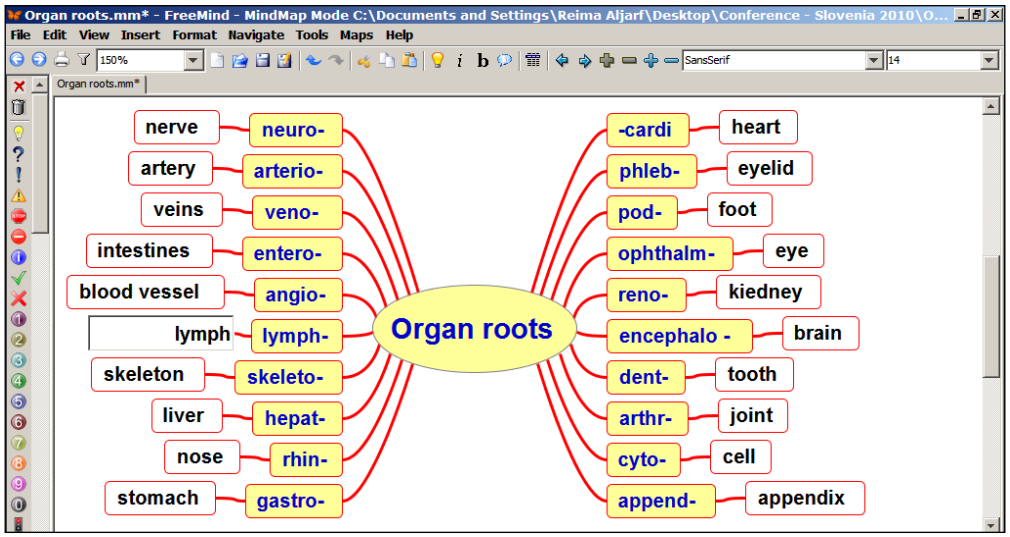
Appendix



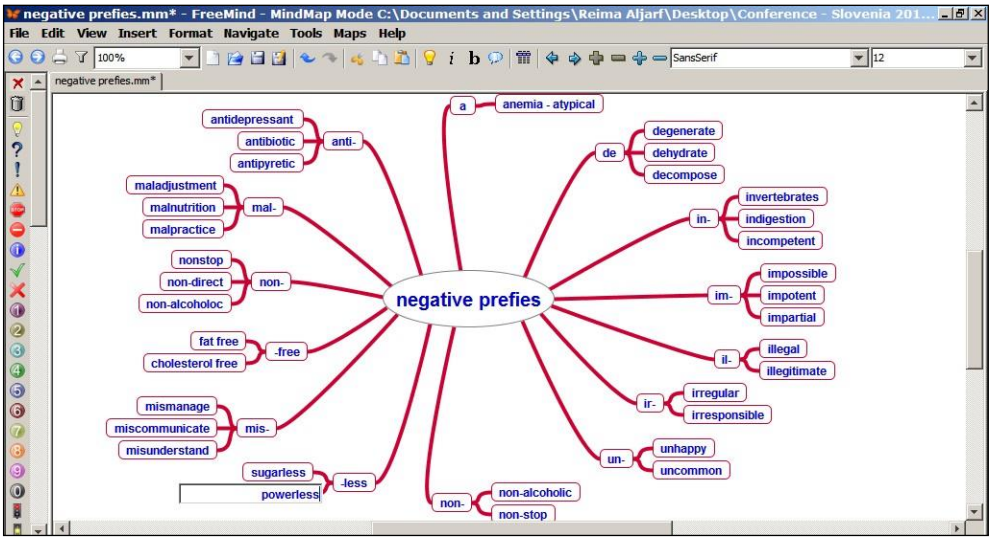
Mindmap (1): Pronunciation



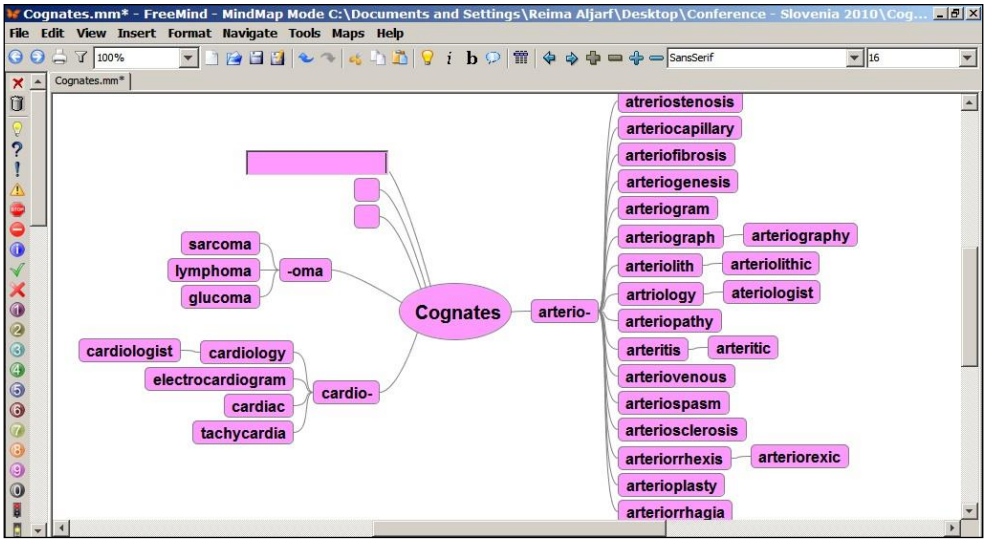
Mindmap (2): Medical Suffixes



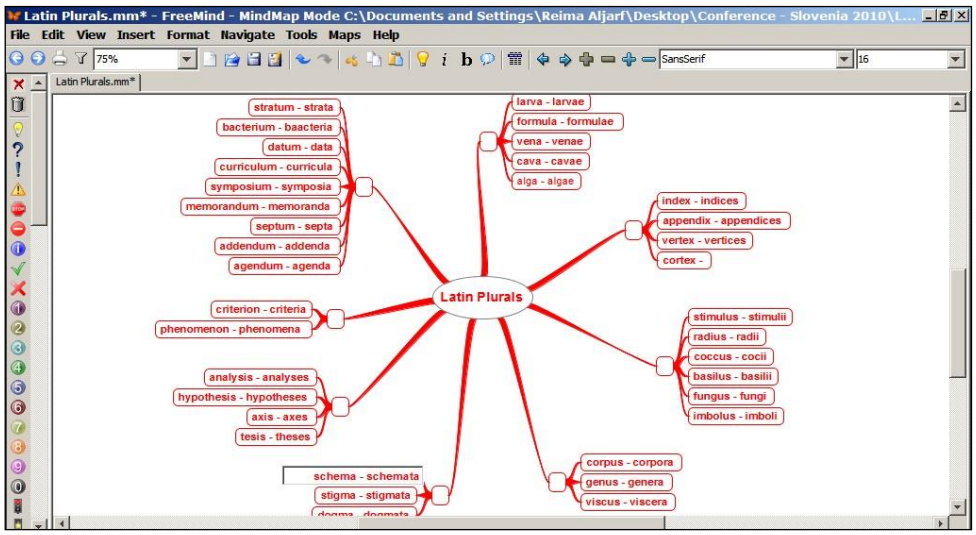
Mindmap (3): Organ Roots



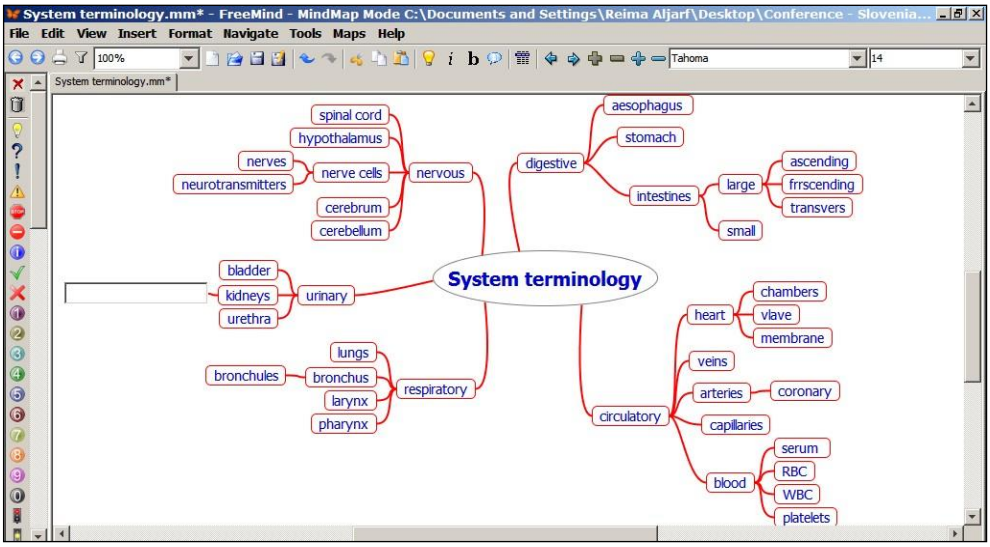
Mindmap (4): Negative Prefixes



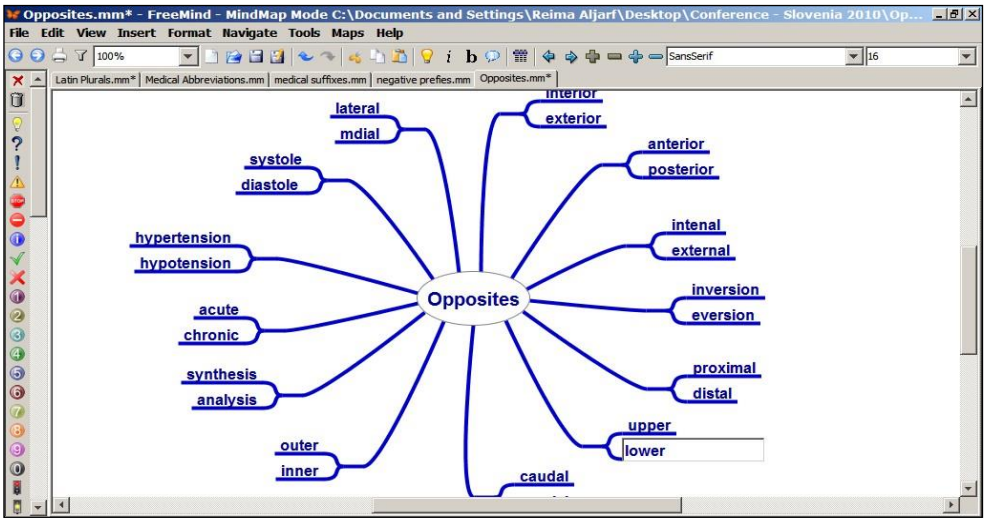
Mindmap (5): Medical Term Cognates



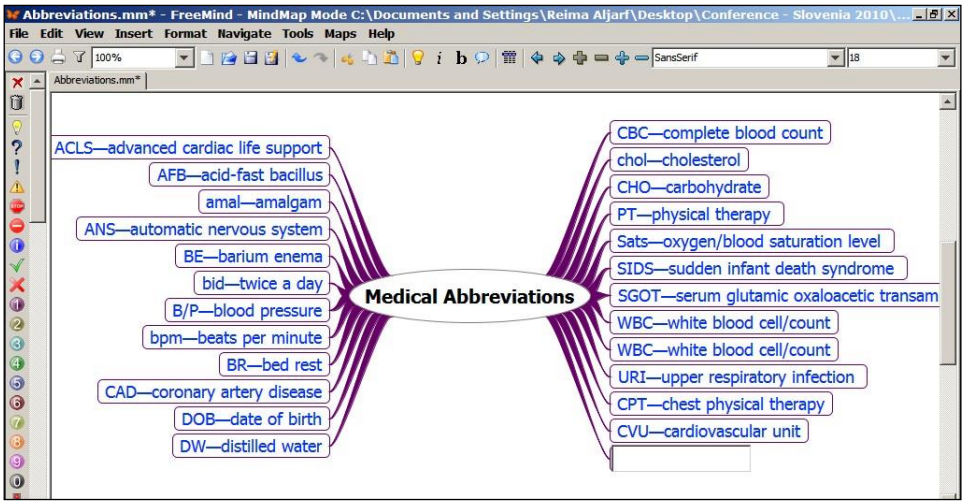
Mindmap (6): Singular and Plurals forms of Latin Terms



Mindmap (7): System Terminology



Mindmap (8): Opposites



Mindmap (9): Medical Abbreviations and Acronyms