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CONCEPT MAPPING AUTOMATIC CORRECTOR OF HEALTH CLINICAL CASES: A METHOD PROPOSAL AND PRELIMINARY RESULTS

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Abstract. The concept mapping (CM) is among teaching strategies that promote the development of critical thinking. In health educational formation, the CM can be used for solving health clinical cases (HCC). Previous research have indicated the benefits of this strategy. However, they point out the complexity of correcting CM for health clinical cases (HCC) solving as a disadvantage. The aim of this research is to present a method for developing and evaluating the CM quantitative automatic corrector for HCC. In addition to the preliminary results. It is a descriptive study of the developing and assessing method of a quantitative automatic corrector that assists the professors in correcting health clinical cases CM. The CM is a teaching approach used in undergraduate and graduate nursing students from Paulista School of Nursing of the Universidade Federal de São Paulo, PSN-UNIFESP, São Paulo, Brazil. The development of the automatic corrector led to a tool that automates the development of HCC and its answer list to facilitate the work of professors. It also structures the data to perform the correction of the CM. The natural language processing (NLP) is being tested as the ability to generate the automatic correction. The corrector is in undergoing improvement. The development of the automatic corrector is a possible task, however complex and challenging, because it uses various levels of language to perform word processing, and thus closer to the human correction.
Keywords: Concept Mapping, Natural Language Processing, CmapTools, Clinical Case.

1 Introduction

The health professional decision making process is a complex activity which involves cognitive procedural attitudinal skills, often taken in a short timespan. The qualified health professional combines structured and articulated knowledge, so he can apply it in an effective way to accomplish his goals and also safe for the patient. The concept mapping (CM) is among teaching strategies that promote the development of critical thinking. At the Universidade Federal de São Paulo, the CM teaching strategy is applied on clinical thinking to undergraduate and graduate nursing students from Paulista School of Nursing (PSN). Previous research have indicated the benefits of this strategy. However, they point out the complexity of correcting CM for health clinical cases (HCC) solving as a disadvantage. The evaluation of the CM done by students requires a laborious and detailed endeavor from professors. It occurs because a student clinical case solving CM may produce hundreds of concepts and connections (De Domenico et al., 2008; De Domenico, Piconez & Rivero de Gutiérrez, 2009; Ferreira, Cohrs & De Domenico, 2012). The Figure 1, in the zoomed in proposition, shows a student CM created with CmapTools® software, designed to solve a HCC relate to clinical and surgical nursing.

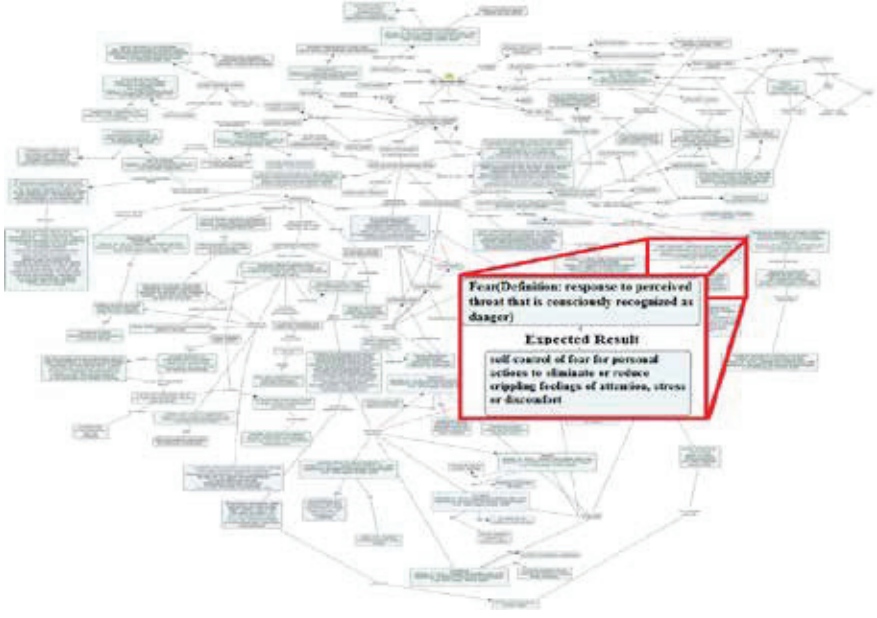

Figure 1. CM to solve a HCC, designed by an eighth semester nursing undergraduate of the Discipline of Nursing in Health Adult.

Therefore, the entire range of CmapTools® software resources that the students used for making CM was perceived as a fertile field to envision and develop an application that autocorrect CM (Ferreira, Cohrs & De Domenico, 2012). That was what drove the proposal of developing a web application that assists CM automatic quantitative correction.

The aim of this research is to present a method for developing and evaluating the CM automatic corrector for HCC. In addition to the preliminary results. We called the automatic corrector: Automatic Clinical Cases Correction Module (ACCCM).

2 Method

It is a descriptive study of the developing and assessing method of a web application that assists professors in correcting quantitative health clinical cases CM. The CM is a teaching approach used in undergraduate nursing courses and health science graduate courses at the Paulista School of Nursing of the Universidade Federal de São Paulo, PSN-UNIFESP, São Paulo, Brazil.

2.1 Development and Evaluation of the Automatic Corrector

The Figure 2 below shows the method used to develop and evaluate ACCCM. The CM automatic corrector web application consist of two modules. One module for elaborating the HCC and its answer list, another for performing automatic correction, which are the blue and orange items, respectively. The manual and automatic corrections, as well as the ACCCM accuracy, are represented by brown items. The green items stand for the CM student development environment based on the HCC. The white items are CmapTools® files: .cmap and .xml.

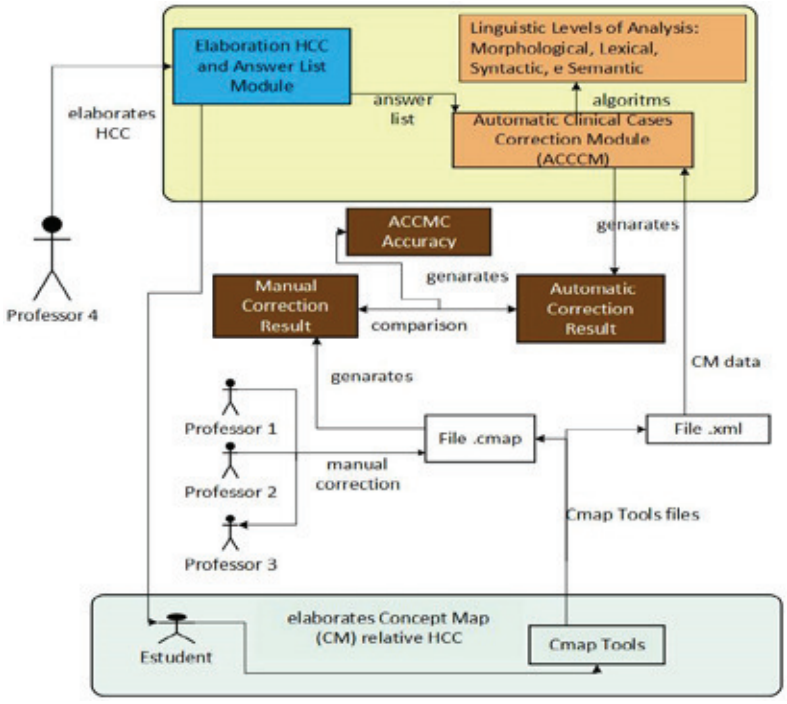

Figure 2. Development and evaluating method of the ACCCM

2.1.1 Structuring CM data

The students use the CmapTools® software to elaborate a CM based on HCC, the green item of Figure 2. The CM is elaborated taking into account six relevant items: relevant data (RD), concept review (CR), altered functional health patterns (AFHP), nursing diagnosis (ND), expected results (ER), and nursing interventions (NI). It is recommended for the students to initially include acronyms of each one of CM concept, which are represented by an ellipse in the CmapTools®. Thus, we can use CmapTools® to export the student's CM into XML format (see Figure 2 white item), what makes the ACCCM data structuring process easier.

2.1.2 Structuring HCC data

The development of the automatic corrector led to a tool that automates the development of HCC and its answer list to facilitate the work of professors. It also structures the data to perform the correction of the CM, displayed as blue item in Figure 2. This tool will set up the HCC and its answer list in six relevant items: RD, CR, AFHP, ND, ER, and NI. RD for setting HCC up and the other items for structuring answer list. The Figure 3 shows a HCC and answer list module highlighting a sub-item of RD: personal and family history.

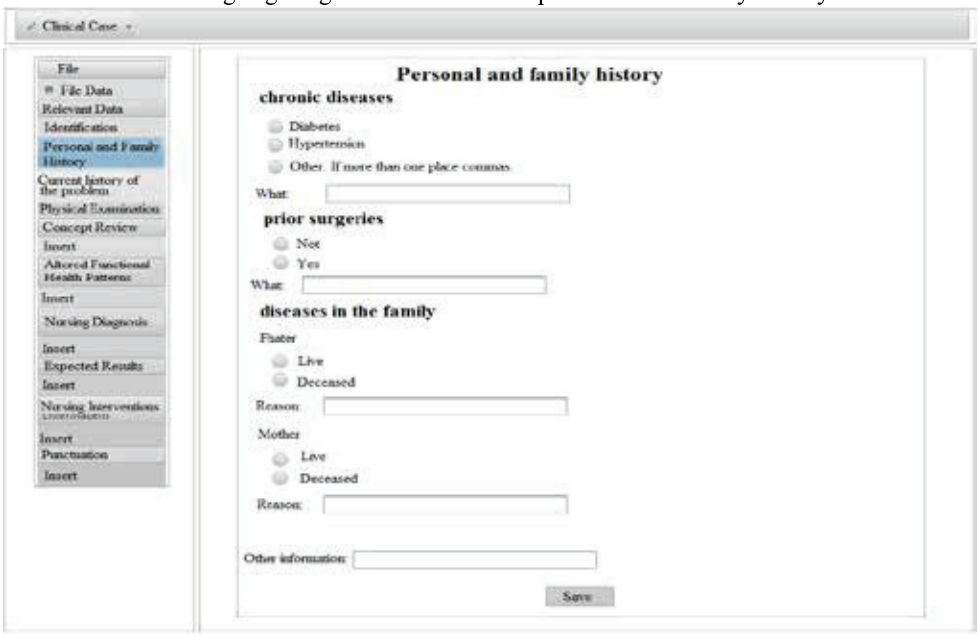

Figure 3. HCC and answer list Module

2.1.3 Quantitative correction for CM

As the CM developed on CmapTools® is formed by concepts and connections described by texts, we will use natural language processing (NLP) to help fixing CM concepts. As the analysis involves only CM concepts, it will be an automatic quantitative correction in HCC. The web application should be able to assess CmapTools® student clinical cases solutions, and score the results according to the correct responses. The NLP is an artificial intelligence subarea that analysis texts through computational techniques. It can be done in one or more linguistic levels, such as phonetic, morphological, lexical, syntactic, semantic and pragmatic. Thus, the software seeks to resemble the human communication and language (Liddy, 1998).

The ACCCM will gather data both from the answer list HCC module and the XML CM file, it is displayed as orange boxes in Figure 2. Thereafter, both are going to undergo processes in one or more linguistic levels. The Figure 4 shows the CM data-entry for the answer list, student CM data, and the multilevel analysis. The analysis process involves four levels: morphological, lexical, syntactical and semantic.

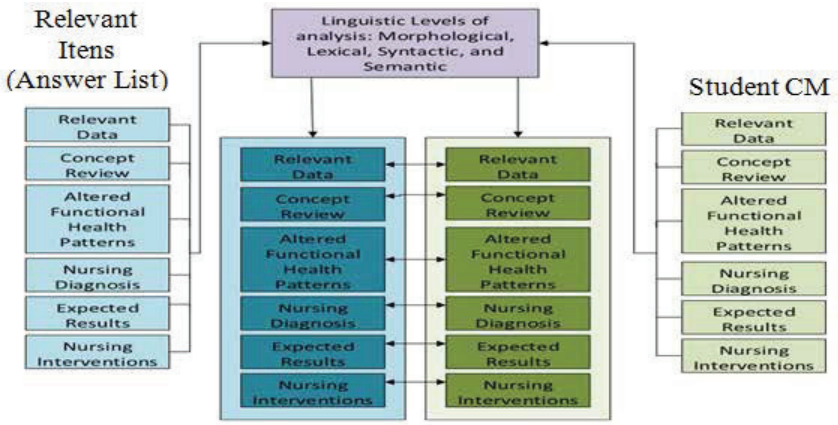

Figure 4. Graphic representation of clinical cases concept mapping data-entry

2.1.4 Clinical Cases Concept Mapping Accuracy Evaluation

The HCC resolution strategy by CM is proposed as one elective discipline for undergraduate and graduate students. It takes place on a computer lab, with CmapTools® software installed and ready in eighteen computers. The discipline offers twelve places for undergraduates from second or third year of the Nursing Undergraduate and six places for graduate students.

We will measure the web application accuracy through comparison of manual and automatic correction of the students CM (displayed as brown boxes in Figure 2). Three professors will execute the manual correction while the ACCCM the automatic one. We will propose an instrument to quantitatively evaluate the professors manual correction.

3 Discussion and Preliminary Results

The ACCCM is still under improvement phase. We performed several tests fixes but only for the morphological linguistic level. Subsequently, the Levenshtein distance algorithm compared all the data to find out similarities between words. This morphological analysis process was performed also as a proof of concept to inspect the usage of NLP for CM correction. Although the accuracy have not been measured in this linguistic level, the text processing strategy seems to be appropriate for this research.

The challenge is to use several linguistic levels to improve the correction, in a synchronical order between stages of the process. We intend to conduct the morphosyntactic process to set up a sentence syntactic structure. The morphological categories will be acquired with the assistance of a Lexicon. The semantic process will map out the syntactic structure of the sentence in its logical form.

After the development of the ACCCM, we will measure its accuracy by manual and automatic comparison of a CM created by an undergraduate enrolled into an EPE elective graduate program course.

4 Conclusion

The development of an automatic corrector is a feasible undertaking, yet complex and challenging task due to the need for multiple language levels to undertake the processing of text and approach it to the human process. It is a tool that will help professors to turn a CM correction into an easier task.

5 Acknowledgements

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