

Evaluation et acceptabilité des cartes conceptuelles comme méthode d'apprentissage dans les études médicales

Evaluation and acceptability of concept maps as a learning tool in medical studies

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RÉSUMÉ

Introduction : l'utilisation des cartes conceptuelles (CC) a été largement décrite dans les études médicales. Dans notre contexte, l'enseignement contextualisé est largement encouragé et promu. Cependant, les étudiants ne sont pas habitués à utiliser les CC.

Objectifs : Evaluer l'acceptabilité de l'utilisation des CC par les étudiants et la reproductibilité de 2 méthodes de scoring : hollistique et analytique dans le cadre de l'évaluation des différentes cartes.

Méthodes : les auteurs ont supervisé des séances de case-based-learning réparties en 2 séances chacune dans un service de Pathologie. Un cas historique décrivant un cancer du colon diagnostiqué chez un musicien Debussy (<http://fr.wikipedia.org/wiki/Debussy>) a été présenté lors de la première séance. A la fin de la première séance, les étudiants ont construit collectivement une CC. A la fin de la seconde session, les étudiants ont rempli un questionnaire de satisfaction. En plus, 2 évaluateurs ont évalué les CC en utilisant 2 méthodes de scoring associées à une carte élaborée par les experts. La reproductibilité des 2 méthodes de scoring a été évaluée en utilisant le coefficient kappa.

Résultats : 31 étudiants ont été inclus dans cette étude avec une moyenne d'âge de 21 ans. Les évaluateurs ont évalué 8 cartes conceptuelles. L'indice kappa était estimé à 1 avec la méthode hollistique et à 0.46 avec la méthode analytique reflétant respectivement une reproductibilité très forte et modérée. 15 étudiants ont rapporté leur satisfaction quand à l'utilisation de ce process. 10 étudiants ont exprimé leur intention de l'utiliser individuellement et 17 étudiants ont apprécié l'utilisation en groupe car ça a renforcé leur sentiment d'appartenance au groupe.

Conclusions : notre étude reflète l'acceptabilité de l'utilisation des CC par les étudiants en médecine et la possibilité d'évaluation de leur contenu de façon valide et fiable surtout en utilisant une carte maitresse élaborée par les experts.

Mots-clés

Carte conceptuelle, scoring, acceptabilité

SUMMARY

Background: the use of concept maps (CM) in medical studies has been largely reported in the literature. In our context, we used to promote case-based-teaching methods but students aren't used to construct CM.

Aim: To evaluate the acceptability of using CM by the students and the reproducibility of 2 methods of scoring, a holistic and an analytic one, associated to a master map in order to assess them.

Methods: the authors supervised a 2-session-case-based-learning performed in a department of pathology. One case dealing with a real story about a colon cancer diagnosed in the musician Debussy (<http://fr.wikipedia.org/wiki/Debussy>) was adapted and presented to the students. At the end of the first session, the students were encouraged to construct collectively a concept map. At the end of the second session, the students were asked to fulfill a questionnaire about their acceptability of the learning process. Besides, two raters scored all the concept maps using 2 different scoring methods associated to a master map. The reproducibility of both scoring systems was evaluated using the kappa coefficient.

Results: 31 students were enrolled in this study with a mean age of 21 years. The raters evaluated 8 CM. The kappa coefficient reached a value of 1 in the holistic scoring and a value of 0.46 in the hierarchical scoring indicating respectively a very strong and a moderate agreement between evaluators. 15 students reported their satisfaction about the use of CM collectively. 10 students expressed their will to use CM individually, 17 students felt that using the CM collectively made them feel to belong to a group but without expressing their own knowledge and reflecting their progress.

Conclusions: our study highlighted the acceptability of using concept maps in medical studies and the possibility of reaching valid and reproducible scoring methods especially when associating a master map.

Key-words

Concept map, scoring, acceptability

INTRODUCTION

The use of concept maps has been widely reported in many fields including economics, science, engineering and more recently in medical studies [1,2]. They represent a realistic representation of the reflexive practice of the students. This practice has been recently introduced under the effect of many cognitive theories putting the learners in the center of the learning approach instead of the teacher. The proficiency of constructing maps has to be acquired by the students before making them accustomed to it and aware of its potential in the learning process.

Many medical universities introduced the concept maps in their curriculum and reported its utility in achieving the pedagogical goals for the students, making them aware of their active role in the learning process and evaluating them. In our university, students aren't used to learn with concept maps. Our curriculum is centered on a student approach and the learning is mainly based on cases but without using concept maps. Our aim was to assess the acceptability of using concept maps by the medical students in our university and the tutors' ability to use them as an assessment mean.

METHODS

Population

Since 2013, we receive every year, in our Department of Pathology, seven 3-week rotations of 3 to 4 students each in the third year of medical training. The students were assigned randomly by the faculty board.

Learning activities:

Training objectives were listed in the students' university portfolio. These objectives were performed by the faculty staff and validated by the pedagogical committee. The objectives were divided into objectives related to technical skills, solving problems, ethical attitude and the critical appraisal of a scientific publication.

A diary about the daily activities of the students was available in the e-portfolio of the students [3]. It contained their repartition in the department and the different learning activities. Different methods of learning were displayed in our department including traditional methods which consisted in lectures dealing with the pathologies mentioned in the training board and integrative and participative methods consisting in case-based learning sessions [4].

Intervention

One case dealing with a real story about the colon cancer diagnosed in the musician Debussy (<http://fr.wikipedia.org/wiki/Debussy>) was adapted and presented to the students through a 2-session-case-based-learning. Before dealing with this case, the tutor presented a lecture session to the students about case-based-learning and about the use of concept maps in learning giving some published examples from the literature. The tutor aimed to explain to the students that the concept map process should not be so complex as to distract them from the major goals, which are the clarification of concepts and making them clearly and logically linked together.

During the first session, the tutor and the students developed an initial discussion of the case and the tutor encouraged them to highlight the major key words and the major concepts. Some difficult concepts were explained by the tutor during the first session. Then, the students were asked to perform a group concept map centered on that case. The concept mappers were given 60 minutes to construct the map on a white board. Figures 1a and b give two examples of concept maps produced during this session. This first map, representing their first knowledge, enabled them to recognize their learning needs and objectives. Between both sessions, the learners were asked to answer to achieve their learning needs by performing searches on the internet. The different sources and sites on the web were initially determined by the tutor. During the second session, the students were asked to analyse the group map with the tutor and to compare it to a master map, which was established by 2 authors (FM, MM). The master map is represented in figure 1c.

- Satisfaction questionnaire: During the second session of case-based-learning, the students were asked to fulfill a likert-scale-questionnaire about their satisfaction in using concept map. The authors adopted modified questionnaires published in the English literature [5, 6, 7].
- Concept Map scoring: the authors adopted 2 methods of assessment: a holistic method in which the mapper's overall understanding of the concepts represented by the map was judged and an analytic method based on the rating of the different links established by the students [5, 8]. In the second method, the criteria below were scaled by both examiners: identification of the key concepts, development of valid concept links, arrangement of the concepts in a logical manner, ability to show the meaningful connections between different concepts (cross links), links

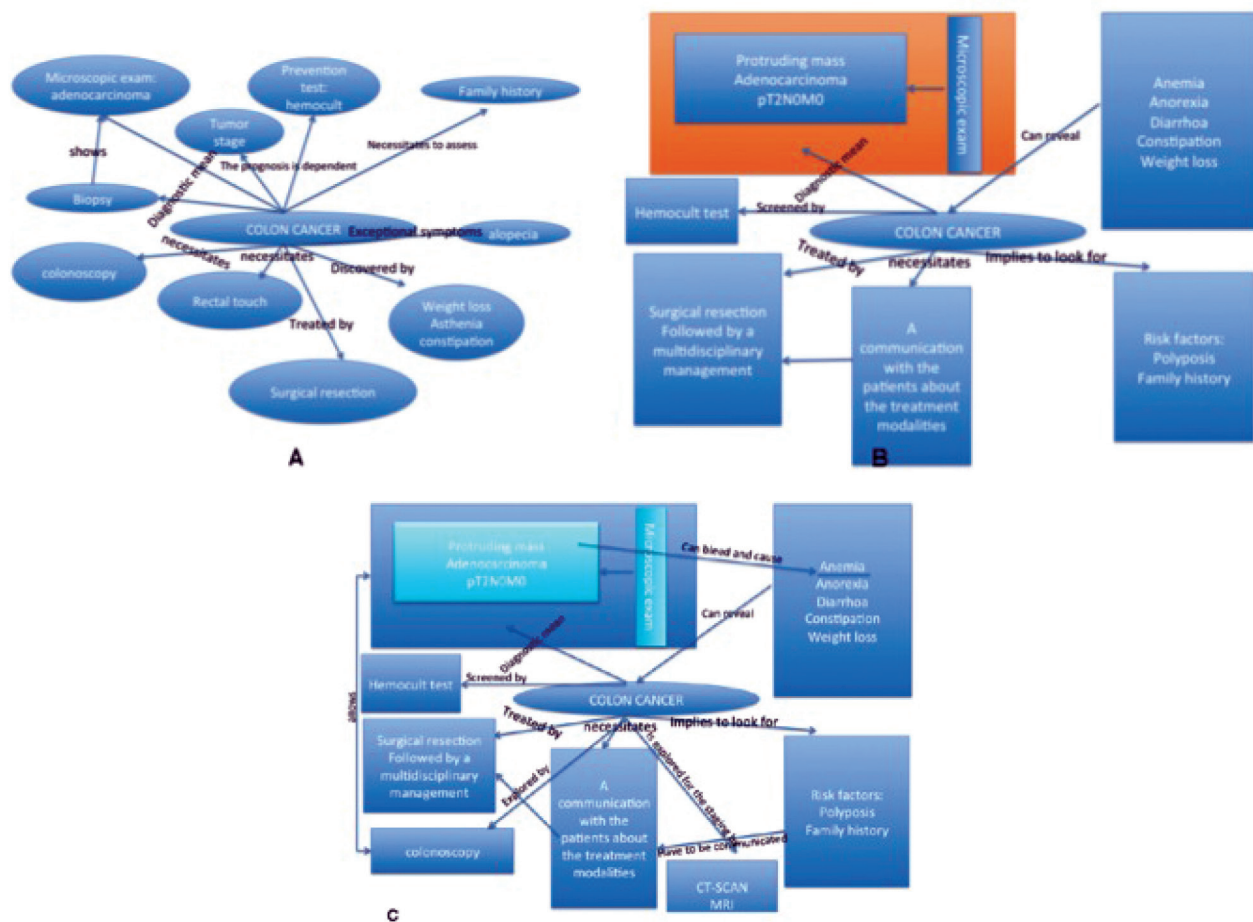


Figure 1: a/ a concept map constructed by the seventh group of students rated by both evaluators 6 and 8 according to the holistic scoring and 13 and 15 according to the analytic scoring, b/ concept map conceived by the fifth group and rated 7 and 8 according to the holistic scoring and 16 and 16 according to the analytic scoring, c/ the master map conceived by both raters.

within a concept (relationship link) and the clarity of the map. Each criteria was rated in comparison to the master map established.

- **Statistic method:** The inter-rater agreement was assessed using the kappa coefficient. Concerning the holistic scoring, the different scores attributed were kept within 2 intervals: scores <5 and scores >or equal to 5. The total agreement between raters was considered when the difference between both scores was inferior or equal to 1. Concerning the analytic score, the scores were distributed within 2 intervals: scores inferior to 10 and scores superior or equal to 10. The total agreement was considered when

the difference between scores didn't exceed 2 points. The interpretation of the Kappa values was made according to the table 3.

Ethics:

Ethical approval for the study was not required. Participants were made aware of the purpose of the study, the anonymous nature of the purpose, the anonymous nature of the dataset generated and the option to not respond if they so wished. This information served as the basis for an informed consent from each respondent.

Table 1: the questionnaire fulfilled by the students (5) (7)

Question/statement	Responses	N
I will use concept maps to prepare for exams and quizzes	Strongly agree	9
	Agree	2
	Neutral	3
	Disagree	17
I will use concept maps to help me understand what I read	Strongly agree	1
	Agree	5
	Neutral	5
	Disagree	20
I will use concept maps to understand or solve problems	Strongly agree	6
	Agree	10
	Neutral	5
	Disagree	10
I find it very useful to elaborate the concept map with my peers	Strongly agree	15
	Agree	1
	Neutral	5
	Disagree	10
What was the most difficult thing to elaborate the CM	Ordering my ideas	10
	Selecting linking words	1
	Placing relevant concepts	3
	Finding my place in the group	17
I feel that my understanding of the content knowledge increased in relation to the use of the CM	Very much	15
	Quite a lot	10
	To some extent	5
	Very little	1
I feel that making CM collectively highlighted my self accomplishment and my feeling of belonging to a group	Strongly agree	19
	Agree	1
	Neutral	7
	Disagree	4
I feel that this collective experience improved my communication skills	Strongly agree	20
	Agree	5
	Neutral	5
	Disagree	1

Table 2: qualitative scoring method (6)

Items	Rate (/20)
Concepts-concepts links	8
Relationship link	1
Cross link	1
List of examples/symptoms/signs	4
Picture/figure/equation	6

Table 3 : Reproducibility according to the kappa values.

Kappa values	Interpretation
<0	disagreement
0.0-0.2	Very weak agreement
0.21-0.4	Weak agreement
0.41-0.6	Moderate agreement
0.61-0.8	Strong agreement
0.81-1	Very strong agreement

RESULTS

Thirty-one students were enrolled in this study with 10 men and 21 women accounting for respectively 32% and 68%. The mean age of the students was 21 years (average 20 to 22 years).

- Assessment of the maps: the raters evaluated 8 concepts maps. The different scores attributed according to the method of assessment used are represented in table 4. Based on this assessment to the maps in figure 1a and 1b, the 2 raters assigned Map A holistic scores of 6 and 8 and analytic scores of 13 and 15 and Map B, holistic scores of 7.5 and 8 and analytic scores 16 and 16. The kappa reached a value of 1 in the holistic scoring and a value of 0.46 in the hierarchical scoring indicating respectively a very strong and a moderate agreement.

- Students' thoughts on concept maps: fifteen students reported their satisfaction about the use of concept map collectively. Ten students expressed their will to use it individually, 17 students felt that using the concept maps collectively made them feel to belong to a group but without expressing their own knowledge and reflecting their progress. Nineteen students felt that this experience helped them feel as a team. Twenty students perceived that this experience improved their communication skills. Seventeen students preferred using traditional methods of learning in order to prepare their exam. Twenty students expressed that until concept maps will be used as an evaluating method, they would prefer their own way of learning in order to achieve their goals.

DISCUSSION

This study highlights the acceptability of using concept maps by medical students after a training session. This method helped them illustrate the different gaps they're able to establish between different concepts. Our results highlight the need of the students to use them individually. In fact, 17 students expressed their need to use this method individually because they felt sometimes overshadowed by stronger characters in the group. On the other hand, they also expressed that this method improved their feeling of belonging to a group and ameliorated their communication skills. According to Novak, the inventor of the concept mapping, a concept map is a schematic representation of a group of concepts integrated to structured propositions. It represents a mean to clarify and structure the idea [9].

Table 4 : the different scores rated by both evaluators

	Holistic scoring (/10)							Analytic scoring (/20)						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Rater 1	6	5	3	8	7	2	6	15	11	5	15	16	5	13
Rater 2	5	4	1	9	8	3	8	9	8	2	18	16	7	15
P value	>0.05							>0.05						

The creation of leans between the different concepts and especially to the old knowledge is very important because the knowledge could be achieved when the lean between new and old knowledge is made. It also represents a mean of assessment of the students' knowledge and help to identify the different leans established in order to highlight the clinical thinking. This was founded on the principle of constructivism highlighting the role of the learners in constructing their own knowledge [8]. The advantages of concept maps consist in the visualization and the co-construction of meanings from the perspectives and experiences of the learners [8]. The goal of any tutor is to have a real idea of the different connections established in the student's heads and to materialize the structural nature of the new students' knowledge and the intrusions or distortions in their understanding of content and errors of omission [5]. Constructing a concept map obeys to different rules including the central positioning of the major concept, linking the different concepts, performing cross-links between concepts with different degrees of hierarchy, hierarchizing the different concepts, using different colors, when possible, with an established meaning without using an algorithm. Assessing a concept map implies to assess two tasks: the map construction and the concept map content. Different forms of concept maps constructions exist including mainly the spoke, the chain and the network structures. The spoke scheme contains a single level hierarchy with simple links and reflects no understanding of processes. The chain scheme consists in many levels of hierarchy but often unjustified reflecting a low integration of knowledge. The network scheme contains several justified levels of hierarchy with rich links and reflects a high integration of the knowledge [1]. Our students were encouraged to adopt a network structure. According to many authors, the difference between the novice concept maps and the expert concept maps is represented by simpler scheme adopted by the former and more cross-links developed by the latter.

The process of transforming novices into experts occurs whenever students begin to develop cross-links [1]. A map may be constructed by the evaluator based on students' responses to an activity or by the students themselves using pensils, papers and different artistic means [5]. This construction may be collective or individual. In our study, as the students weren't used to the concept mapping, they were encouraged by the tutor to do it collectively using the white board of the department. The tutor aimed through this experience to put emphasis on the team-building potential of such an exercise. Some authors reported that in comparison to individual concept mapping tasks, this method may induce an overshadowing of weak critical thinkers by strong critical thinkers [10]. This was reported by some students in our study. Many studies reported the utility of concept maps in increasing the motivation of the students and improving their critical thinking and problem solving skills [11, 12, 13, 14, 15, 16, and who value engagement in creative activities. This paper describes an innovative assessment approach for first year nursing students which addressed the development of a beginning knowledge base in therapeutic communication as well as critical thinking and writing skills. Each student was asked to design a wearable mask to display an abstract interpretation of the therapeutic communication skills required as a nursing student, followed by a discussion about therapeutic nursing communication. Results from an evaluation of the assessment are described using Bigg's (1995 17]. Assessing concept maps have been largely discussed in the literature with low consensus and different approaches. The major factors influencing the assessment of these maps are represented mainly by the variations in students' concept mapping proficiency, the variation in the content knowledge and the consistency with which the concept maps are evaluated. In our study, in order to reduce the influence of the first factor, the students were encouraged to construct a network concept map and the tutor tried to simplify the process of construction during

the training session. Many methods of scoring were listed in the literature and are basically classified into 3 major categories: a structural (holistic) system adopting overall scores that are assigned to the concept map's organizational structure, an analytic (relational, structural) system that measures the quality or importance of the map components and a mixed (hybrid) system [6, 18, 19] consisting of specific pre-established performance criteria, used in evaluating student work on performance assessments. Rubrics are typically the specific form of scoring instrument used when evaluating student performances or products resulting from a performance task. There are two types of rubrics: holistic and analytic (see Figure 1. Derivations from these different methods were also reported integrating a master map within the relational, holistic and structural methods [5]. The analytic system integrates the relational method, which assigns a value to hierarchical structure, concept-concept link and cross link and the structural method which, is based on the quality of individual links taking into account the structure of the concept map. The structural methods have been demonstrated to be sensitive to changes in students evolving knowledge [6, 20, 12, 2]. In a study about the reliability, validity and logistical practicability of concept map assessment, Mc Cure and coworkers proved that the mapping task has to be kept simple and recommended to use a relational scoring method preferably with a master map as an assessment tool [5]. In our study, we reported a good reproducibility between both raters using a holistic scoring with a master map in comparison to the analytic method using a master map. Our results may be explained by the construction of the master map by both raters and the refinement of the knowledge between both raters. Besides, our results have to be taken with caution because of the limited number of concept maps assessed. Some authors reported the necessity of associating either three raters and two different domain of concept mapping or five raters and one domain in order to achieve a good reproducibility [6]. Our experience highlights the possibility of reaching valid and reproducible scoring methods especially when associating a master map [1].

CONCLUSIONS

Our results put emphasis on the utility of using concept maps in medical studies and their ability to improve the communication skills of students, when used collectively.

The major limitation of our study is represented by the small sample of concept maps assessed. In further studies, we aim to assess the impact of using concept maps on the exams' scores.

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