

ITERATIVE CONCEPT MAPPING: THE ROLE OF PEER REVIEW

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Abstract. This case study adds to the iterative concept mapping and peer evaluation of concept maps literature base. Using a peer evaluation checklist and guidelines, graduate students' peer-reviewed concept maps developed over the course of a semester class. Each iteration of the concept maps continued to answer the same class developed question from the beginning of the semester. A quantitative review of the maps indicated that most maps changed between 25-30% from the initial concept map to the second iteration. Students (N=6) noted that the peer review encouraged them to develop the maps to continually answer the overarching question for the course. Each iteration of the students' maps built on the previous iterations and demonstrated the growth of knowledge and depth of understanding as evidenced by the relational links.

1 Introduction

Over the course of a college semester students invest time and energy into studying, reading, and creating artifacts that represent understanding and obtaining knowledge. One way to document and provide tangible results of this knowledge is by having students create a concept map through an iterative process. It is assumed as a student progresses through the semester that their concept maps will be more refined, evidence greater depth of knowledge, and will have meaningful cross connections.

2 Concept Maps Defined

Researchers identified concept mapping as a learning strategy that engages the learner in a meaningful learning experience (Novak, 1998; Novak & Cañas, 2006a, 2006b; Novak & Gowin, 1984). A concept map is a graphical representation of knowledge designed to explain an idea or concept. Novak (1998) described concept maps as a "knowledge representation tool" (p. 3). Concept maps are categorically a part of the graphic organizer family.

The active process of developing a concept map moves students from being passive to active learners (Clayton, 2006). The learner sifts through content taught to extract the most important concepts and then determines the relationship of the information to other known content and graphically presents the information in a logical and hierarchical manner. Novak and Gowin claimed that concept maps were "developed specifically to tap into a learner's cognitive structure and to externalize for both the learner and the teacher to see, what the learner already knows" (p. 40). It is like taking an Instagram of one's thoughts about the focus question the map is answering (Campbell, 2016).

3 Iterative Concept Maps

Iterative concept mapping also called serial concept mapping (All & Huckey, 2007) is a process whereby a person authors, modifies, and contributes to building a concept map about the same content over a period of time. Usually, iterations are completed after new instruction or experiences. In this study, the participants used one map over the entire semester and exported a .pdf or .jpg of the map at each iteration. The final map was the summative results.

4 The Study

Within this semester long study, graduate education students created four iterations of a map answering a question that was developed by the class at the beginning of the semester. The purpose of the research study included answering these research questions.

4.1 Research Questions

1. How does iterative concept mapping over the course of the semester indicate the graduate students' knowledge and understanding?
2. How does the peer review of maps effect the quality and structure of a concept map?

3. Do concept maps answering the same question reflect evidence of the individuals' experiences?

4.2 Methods

4.2.1 Participants

The participants for this case study were 6 graduate students from a large southeastern university in the United States of America. These students were either in educational technology certificate program or in a Masters' degree program in Education. Each participant had completed at least 9 graduate hours in education or already had earned a Master's degree. Five of the participants were currently teaching and the other was in an education related field. All participants were female. All participants completed all aspects of the study.

4.2.2 Procedure

At the beginning of the semester, participants were instructed on the principles of *Novakian Concept Mapping*. These lessons include the history of concept mapping, the purpose for concept mapping, elements of a concept map, and how to build a concept map. Participants practiced their own concept mapping efficacy by deconstructing existing maps to identify the elements of a map. Their map building skills were fostered through whole class, small group, and individual map building. Participants were then taught to evaluate sample maps as peer reviewing others' maps were a part of the iterative concept map assignment.

The class then developed a comprehensive question they would be answering throughout the course of the semester. The question was built based on their knowledge of the course content after having examined the syllabus and course description, reviewing the course projects, and indicating what they wanted to know as a result of completing the class. A predetermined schedule with peer review dates was assigned. The first, second, and fourth iterations required peer review. The third iteration's peer review was optional. The first, second, and third iteration required self-evaluation, the fourth iteration self-evaluation was optional. Finally, participants were required to complete a reflection about their map and about the process of building their maps. The instructor reviewed the first and final iterations.

Peer review was completed using a form that facilitated structure and form concerns as well as content. Peer reviews were required and shared with both students and the instructor. After the 4th iteration students combine all elements into a final submission that included each iteration of the maps, the peer reviews, the self-evaluations, and a final reflection of the entire project. Finally, the students met and for a student-led discussion about the process of creating maps and how they evidenced their learning.

At the completion of the semester, a coder analyzed the structural and content changes from the first map to the final iteration to determine percentage of change for both of these elements. Preliminary results are being shared.

4.2.3 Instruments

The Self-Evaluation Form: The self-evaluation form is completed by the student prior to sharing the map for peer review. The student self-evaluates the map and answers 2 open ended questions:

1. Can you identify any content that may need to be clarified or expanded on for better understanding?
2. Is this map representative of what you understand about the focus question?

The Novakian Concept Mapping Peer-Assessment: Peer review other peers' maps and identifies structural elements including links, structure (hierarchical), and relationships. The content of the map should answer the focus question and through this instrument peers can indicate to what level this is evident to them in their peer's map. Open-end questions included: Did you learn anything new from reading someone else's map?; Can you identify any content that may need to be clarified or expanded on for better understanding?

4.3 Results

An evaluation of the peer, self, and final reflections and the maps themselves were considered to obtain the results for each question.

1. *How does iterative concept mapping over the course of the semester indicate the graduate students' knowledge and understanding as reflected in the students' maps and final reflection?*

The student-developed focus question for the semester: How does educational technology impact teaching and learning practices. The class content was about technology resources in education.

An analysis of students' final maps indicates there were many changes. Only one map was not initially structured hierarchically; however, it was changed from a web format during the second generation. Another structural change was the highest concept. In the first iteration over half of the students used the question as the highest ordered concept. All but one participant changed that by the second iteration and that participant changed it by the third iteration.

Regarding evidence of learned content, each iteration was planned to be completed after a module was completed. It was anticipated that additional content would be added based on new knowledge acquired from the readings, instruction, and other assignments. A review of the maps indicated that most maps changed between 25-30% from the initial map to the second iteration. Propositions (concept, link, and concept) changed to be more specific and new propositions were added.

In their final reflections, students noted several differences evident in their final maps that did not appear in their first or other iterations. These changes included change in structure, more complex thought, sophisticated interrelationships, and depth of content.

2. *How does the peer review of maps effect the quality and structure of a concept map?*

The first and second self-evaluation and final reflections provided information directly from the participants related to the participant's perception of peer influence. All participants indicated on the first iteration that their peer's comments made them reassess and in most cases make changes to their maps. Comments from the second iteration included that participants took greater care in making sure their map could be read by someone else for understanding. Others said that they moved the question from the highest concept in the map to not be a part of the concept map but to appear on the map as a reminder. Students mentioned that they spoke with their peer evaluator to clarify misunderstandings and in the process it helped them articulate their own understandings.

3. *Do concept maps answering the same question reflect evidence of the individuals' experiences?*

Not only did the researchers consider the maps to provide the data to answer this question but the participants themselves organically realized that indeed their individual backgrounds and experiences were accounted for in every iteration of their concept map. Those who were teaching in the classroom referenced the grade or populations they taught. The other working in education mentioned their own educational background. One person wanted to include the name of an application but could not remember the name. She spent hours finding more resources and learning more content that was not assigned. Her personal research beyond the scope of class requirements were evident in the map.

5 Discussion

Participants were engaged in meaningful learning during the course of the semester as evidenced by their concept maps. The participants remarked they were engaged in critical thinking as they worked hard to synthesize what they were learning and in analysis as they considered how to make connections on their map. Concept maps provided the participants an overview of what they learned throughout the semester. One student remarked it required more brain power to complete a concept map of a semester work of material than it did to take a final exam.

Other results from the study may inform how peer evaluation is incorporated into subsequent studies. For instance, a plan was put in place in case someone did not complete their map or peer review by the deadline. Scaffolding how to peer review concept maps may be necessary. When one participant did not thoroughly complete their peer review, they were partnered with another person to review another map. After the initial iteration peer review, debriefing about the peer review process can aid in supporting subsequent peer reviews.

In this case study, the student-created concept maps evidenced students' comprehensive understanding of a semester's worth of teaching and learning. Individual's concept maps were modified and refined based on self

and peer analyses. Finally, in each of the final concept maps created individuals personalized their maps based on their own background and experiences.

The nature of a case study limits the generalizability of results from this study to other contexts. However, it does provide evidence that could be considered for designing a future research study. Concept maps have been studied and researched since their inception (Novak, 1967). Educators could consider incorporating concept maps as a formative and summative evidence of conceptual knowledge. This study adds to the literature base on iterative concept mapping and peer evaluation. In this case, including a peer review process after each iteration improved the development and quality of the participant's concept map. Future research is needed regarding peer review and iterative concept mapping.

References

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