

INDIVIDUAL CONSTRUCTION OF KNOWLEDGE IN AN ONLINE COMMUNITY THROUGH CONCEPT MAPS

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Abstract. This study investigated the use of an asynchronous online community of learning and inquiry and concept maps as strategies to facilitate individual construction of knowledge. The community of learning and inquiry proved to be an effective strategy for designing the interactive aspects of the online course and creating an environment to explore different ideas and concepts, share knowledge, and learn from each other. The concept maps facilitated students' individual construction of knowledge after participating in collaborative learning. Using the concept maps, students were able to prioritize information, integrate concepts, confirm knowledge, and construct new knowledge. The skills learned by using concept maps can be transferred to other learning situations.

1 Introduction

Learning in online communities has become more widespread in higher education with the advent of online education. Garrison (2003) indicates that the goal of the community of learning and inquiry in an asynchronous online environment is to promote “independent thinking in an inter-dependent collaborative community of inquiry” (p. 49). In this environment, learners have the potential to be part of meaningful social and cognitive experiences and gain higher-order learning. However, one may argue that the social nature of an online learning community focuses primarily in the experience of the community as a whole, rather than the individual learning outcome. Our study investigated an online course that used the community of learning and inquiry as the basis for designing an asynchronous online learning environment. In addition, concept maps were utilized as a tool to help students construct individual knowledge after participating in collaborative learning.

2 Concept Maps and Collaborative Learning

There have been a fair amount of publications on the topic of concept maps and collaborative learning in journals and conference proceedings. Many of these publications are descriptions of the authors' experiences using concept maps in various contexts within online environments. Themes from the literature include challenges in creating concept maps, the use of different concept map tools for facilitating students' thinking process, exploration of different instructional methods based on concept maps, use of concept maps to increase communication, the effect of collaborative concept maps on learning, and the integration of ideas and knowledge between learners during collaborative concept mapping.

Rábago (2004) describes the difficulties that students have creating concept maps, which in part is due to the lack of tools necessary to build them or a lack of knowledge about the concept map subject. Laampere, Matsak, and Kippar (2006) found technological and pedagogical challenges in creating concept maps in online environments because of the poor integration of concept map tools and learning management systems. Luckie, Harrison, and Ebert-May's (2004) experimental study revealed that the use of the CTOOLS Concept Connector facilitated students' visualization of their thinking process online.

Cabral, Zeve, Nicolao, and Amoretti (2004) explored methods to design instructional materials using concept maps. Calderón, Agüera, and Alfageme (2004) also looked at instructional approaches to use concept maps; the results of their investigation reported that concept mapping assisted students in acquiring or improving their skills in studying, thinking, and teaching.

Tarouco, Geller, and Medina's (2006) study addressed the benefits of using concept maps to increase organized communication among participants. An extensive literature review done by Basque and Lavoie (2006) described 39 studies on collaborative concept mapping at a distance and face-to-face, including topics such as the quality of concept maps, the effect of collaborative concept maps on learning, and the integration of ideas and knowledge between learners during collaborative concept mapping. One of the studies reviewed included Cañas et al., (2001), which focused on Latin American school children using asynchronous concept mapping and sharing them through a network called Knowledge Soup. Rice, Ryan, and Samson (1998) studied the use of concept maps in seventh grade life science classes to assess student learning.

A significant amount of these studies focused on K-12 students, but a few such as the one examined by Calderón, Agüera, and Alfageme (2004) explored the effectiveness of concept mapping as a tool for higher education. De Simone (2007) investigated and reviewed three commonly used applications of concept mapping in higher education. She compared physical concept mapping (hand drawing), mental concept mapping (creating the maps only in one's mind but not on paper), and electronic concept mapping with Inspiration software to share in an online environment. Fonteyn (2007) discussed the use of concept mapping in nursing education as an easy way to deepen understanding of concepts and stimulate critical analysis. MacNeil (2007) describes concept mapping as a means of course evaluation in an undergraduate wellness program. Students completed concepts pre-lecture and post-lecture which were later compared by complexity.

There is no doubt that the use of collaborative learning strategies plays an important role in the individual construction of knowledge. There seems to be a dearth of information considering individual construction of knowledge through concept maps in an online community of learning and inquiry. Therefore, the purpose of this study was to investigate an online course that used the community of learning and inquiry as the basis for designing an asynchronous online learning environment and concept maps as a tool to help students construct individual knowledge after participating in collaborative learning.

3 Conceptual Framework

Marzano and Pickering (1997) developed the Dimensions of Learning model to define the learning process. The model helps maintain the focus on learning, examines the learning process, and assists in mapping the curriculum, instruction, and assessment considering the five aspects of learning: (1) attitudes and perceptions, (2) acquire and integrate knowledge, (3) extend and refine knowledge, (4) use knowledge meaningfully, and (5) habits of minds. The five dimensions of learning served as the basis for analyzing the individual learning process and how the creation of concept maps assisted individual construction of knowledge in the online course.

The first dimension stresses the need to assist learners to develop positive attitudes and perceptions about the educational climate and tasks. These attitudes are developed when learners feel accepted by the teacher and peers and have a clear understanding of the task to be completed. Initial course exercises, such as self-introductions, helped in the development of group trust, and the availability of the instructor as well as the clarity of the syllabus facilitated in learners positive feelings toward tasks.

The second dimension tells us about the acquisition and integration of declarative knowledge (what we understand) and procedural knowledge (what we are able to do). In this course, learners acquired knowledge through group discussion of theories and principles, and integrated knowledge by internalizing and constructing individual concept maps.

The third dimension occurs when learners extend and refine the knowledge they initially acquired by debating multiple perspectives of an issue (different learners' points of view), analyzing the reasons and logic behind each view, and by changing or maintaining and defending their own perspectives when constructing the individual concept maps.

The fourth dimension focus on using knowledge meaningfully. Learners were encouraged to explore theories and principles and use personal experiences as examples during the online discussion. By applying the learned knowledge in contexts that were close to them, learners gained confidence in practicing using the new concepts. The required individual concept map engaged learners in a complex thinking process which involved decision making, problem solving, and invention.

The fifth and final dimension of learning, habits of mind, relates to the development of critical thinking. The acquisition of this skill was demonstrated by the progressive evolution, throughout the course, of the individual constructed concept maps. Learners demonstrated to be open minded and effective in responding to other's feelings and knowledge but at the same time clear and accurate at taking and defending a personal position that was reflected on their respective concept maps.

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4 Methodology

4.1 Online Course Context

The online course, *Distance Education for Adults*, used in this study was offered within a period of three years at a higher education institution in the Midwest of the United States. The purpose of this online course was to allow students to gain a set of skills to process and generate information and beliefs and to self-assess their own thinking processes through the analysis of concepts, theories, and research on distance education and development and assessment of distance education programs. Course content was distributed into five modules during which specific readings were assigned. Each module lasted two to three weeks. Learners were required to participate in online group discussions for each module, create concept maps of their understanding of the concepts addressed in the readings and online group discussions upon completion of each module and a synthesis concept map summarizing the whole course at the end of the semester, self-reflect on the concept maps immediately after they created them, and participate in a team project to develop a distance education program.

A face-to-face course orientation in the beginning of the semester and a meeting at the last day of the class were also part of the course. For the online portion of the course, students met virtually via the learning management system Desire2Learn (D2L). The face-to-face orientation included a scavenger hunt of D2L (i.e., learning about the different features of the course such as content information, discussion forums, announcements, gradebook, drop box, chat, links, and survey), completion of a learning style inventory and a "Getting to Know You Survey," and online message postings introducing themselves to the rest of the class. During the orientation, students gained access to the syllabus and course timeline with required due dates and course assignments.

The first week of the course was reserved for the course orientation. The instructor assigned individuals to groups and group members were involved in logistical tasks to prepare for the module discussions and team project. After completing each module, students received prompted feedback from the instructor on the individual participation in the group discussions, team project tasks, and concept map assignment. These strategies helped students develop positive attitudes and perceptions about the online environment (learning climate), feel accepted by the instructor and peers, and experience a sense of comfort and order.

4.2 Research Question

This study was based in the following research question: How can concept maps be an effective tool to construct individual knowledge after participating in an asynchronous collaborative online learning environment?

4.3 Data Collection and Analysis

Data for this qualitative study were collected using concept maps, reflective journals, and transcripts from online discussions (N=30) offered during a period of three years (2003 [n= 8], 2004 [n= 13], and 2005 [n= 9]). Concept maps, reflective journals, and transcripts were analyzed to identify patterns of achievement in the three courses. These three sets of data were used to compare the initial postings of the students and concept map creation with the contributions and concept maps at the end of the semester in order to analyze developmental changes in students' thinking processes. Data analysis of concept map reflective journals was guided based on students' perceptions and attitudes toward their individual construction of knowledge as a way to triangulate data.

Participants were asked to respond to the following reflective questions about their process of creating the concept maps:

- After creating the concept map, did you see relationships among concepts that you did not see before?
- What was the easiest relationship among concepts to depict? What were the most difficult relationships to depict? Why were they easy or hard to depict?
- Look at the concept map and think back to the online discussion you participated during this module. Is there a relationship between the concepts you read and the online discussion? Were there moments in the online discussion you felt disoriented or confused? Does the concept map provide any clues about why you felt this way?

5 Findings

In this online course, students participated in collaborative problem-solving and threaded discussions through asynchronous communication. These online discussions were established to promote learner-driven environments. Group members shared responsibility for their own learning as well as the learning of the group (Prester & Moller, 2001). It was through the concept map assignments that individual construction of knowledge was most evident. It became clear that learning was a developmental process throughout the semester as one student stated: "...I am gaining experience with each map..." Creation of concept maps and students' reflections of their own learning were important aspects of the course process. According to students' reflections, they felt that when creating the concept maps they were able to prioritize information, integrate concepts, confirm knowledge, and construct new knowledge.

5.1 *Prioritizing Information*

Students felt that creating concept maps assisted them in organizing their thoughts; articulating, clarifying, and understanding the discussion topics better; relating concepts in readings more clearly; and defining conclusions. Some of the students' reflections explaining how they prioritized information include:

- "Do I think the concept map is an accurate representation of what I learned from the two mediums? Yes, I believe so. I think anything I have the chance to articulate and to discuss and a museum helps me understand the topic better."
- "...it wasn't until I created my concept map that the connections became clear to me."
- "I used the maps I created before to refresh my memory..."
- "It was nice to be able to see the main concepts that I learned throughout the semester on one page."
- "The concept map gave me the ability to organize my thoughts."
- "When you see everything you are thinking about put into a diagram, it becomes clear how everything inter-relates to one another."

Students commented that there were so many different topics covered in a module that it would have been impossible to depict everything in a map, so they chose (prioritized) what they felt was most important.

5.2 *Integrating Concepts*

In addition to prioritizing information when creating the concept maps, students were able to integrate information better once they created their individual concept map. One student expressed this new ability this way:

When talking about a topic, it is difficult for me to express that concept without bringing in the examples, questions, and scenarios used in the online discussion. The two [content and online discussion] really become one. The literature is theoretical and distant to me until we discuss it, then it seems to have more merit or weight to it so that I can fully conceptualize and remember it.

Integrating concepts was accomplished when students synthesized information through the concepts as these two students stated, "Mapping has made it much easier to see and define conclusions from all of the readings and research in this area as well," and "Summarizing all of the readings through this concept map helped tie all of the information together and helped me reflect on which topics I enjoyed the most." As students gained more integrative abilities through the construction of the concept map, they were able to let go of the segments tied to particular chapters and began mapping the overarching concepts. One student expressed, "My concept map is a collaborative effort between online discussions and my own interpretations." It was a general comment from students that after composing the concept maps they were able to see relationships that had not been apparent when reading or discussing the content with others. Developing the concept map helped the students look at the readings from a different perspective. Figure 1 shows the course synthesis in the final concept map created by a student.

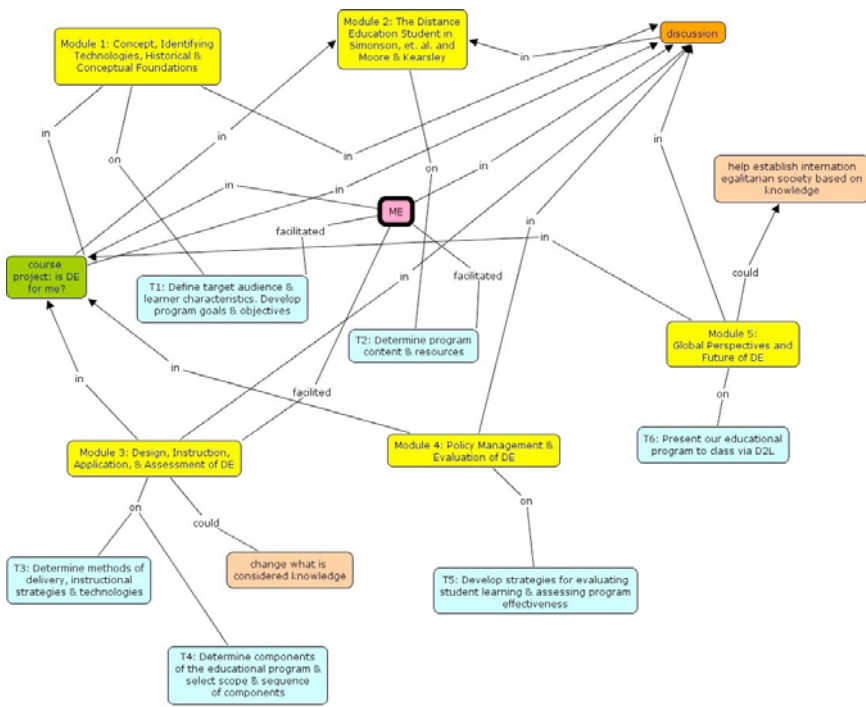


Figure 1. Final Concept Map

5.3 Confirming Knowledge

Students indicated that creating the concept map after the module discussion was a good way to reinforce their thinking and understanding relationships among concepts better. One student stated, “I didn’t see any new relationships after completing the concept map, just reconfirmed what I’ve known or learned over the semester.” Another student stated that “...the process of creating a concept map refreshed my memory about the discussion and reconfirmed my understanding.” After the creation of concept map for a few modules students realized that the concept maps not only helped them clarify some issues in the readings, but also forced them make their own connections and confirm what they had learned. Figure 2 shows how the final concept map confirmed knowledge for this student.

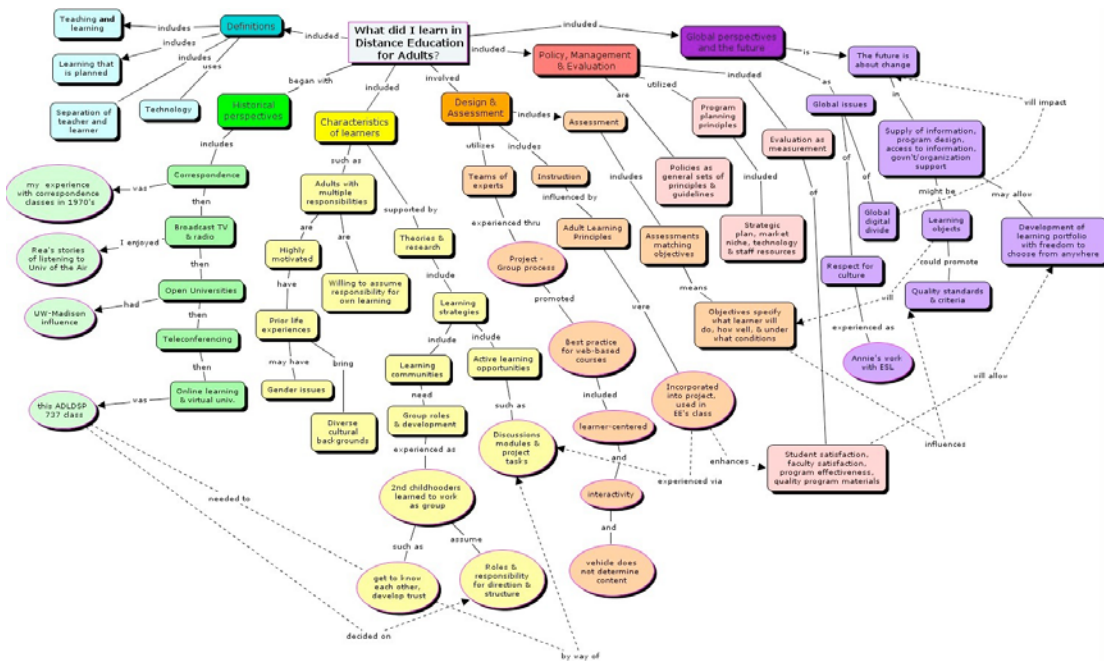


Figure 2. Final Concept Map

5.4 *Constructing New Knowledge*

Some students realized that after creating the concept map, they discovered several relationships among concepts that they didn't see before, as this student explained: "It is easier to see how the requirements in one area play out in another when they are mapped on a single sheet of paper." Over the period of the semester, students thought that the concept maps became personally meaningful to their learning. One student stated, "Both our online discussion and the concept map process helped me see relationships that I didn't consider before." Another student reflected on the different possibilities of creating the concept map based on the readings and discussions: "The association provided by the map has opened me up to interest in further exploration."

For the final concept map students had to create the synthesis of their own learning gained in the course. It was at this point in the course that most students recognized they were constructing new knowledge and taking responsibility for their own learning process. One student stated after completing the final concept map: "After taking responsibility for my learning, I realized the map was my knowledge or understanding of the readings."

6 Dimensions of Learning Model and Concept Mapping

The creation of concept maps in this study proved to be a developmental learning process that served to acquire and integrate knowledge, extend and refine knowledge, and use knowledge meaningfully as the focus of learning. The critical aspects of learning characterized by the Dimensions of Learning Model (Marzano & Pickering, 1997) are supported by the use of concept maps to facilitate individual construction of knowledge in the online community of learning and inquiry:

- The introductory phase of the course (face-to-face orientation) helped students develop positive attitudes and perceptions about the class tasks such as perceiving tasks as valuable and interesting, believing they had ability and resources to complete tasks, and having a clear understanding about the tasks.
- Students acquired and integrated knowledge through declarative knowledge (i.e., descriptions, process/cause-effect, scenarios, principles, and concepts) by constructing meaning, organizing concepts, and storing information through concept maps.
- Students extended and refined knowledge they initially acquired from readings and discussions through comparing, classifying, abstracting, and analyzing perspectives when synthesizing concepts through concept maps.
- Students used knowledge meaningfully when they were challenged to use knowledge in context meaningful to them, making learning authentic, practicing using the knowledge, and thinking and reasoning different than recalling and recognizing through the construction of concept maps. Students were engaged in complex thinking and reasoning through the creation of concepts maps because they had to make decisions in order to generate and apply criteria to select information to include in the concept map, problem solve in order to overcome constraints in way of accomplishing the concept map, and develop unique processes when creating the concept map to fulfill the assignment.
- The outcome of the concept map is the blueprint of the student's critical, creative, and self-regulating thinking, which Marzano and Pickering (1997) call "habits of mind." If students are able to use the habits of mind as a strategy for learning, the process of learning can be a rewarding one for the individual in any learning situation.

7 Implications for Practice

The findings of this study can have practical implications for designing online courses. One of the most valuable aspects of the construction of concept maps in an online course was the reflective component of the assignment. After completing the concept map, often students refined and expanded their knowledge by rethinking and recreating their original concept map. The process of creating the concept map made it clear to students the knowledge they had acquired through readings and the connections they made through interactions with others in the online discussion.

By experiencing the sense of comfort and order students develop positive attitudes and perceptions of the learning experience in general. It is important to give students time to establish and build the online learning community, so they feel a sense of comfort in the class environment.

The use of concept maps can be especially effective when students are learning new theories because students can critically analyze complex concepts and connect them with previous knowledge. The skill of critical thinking gained through creating concept maps can help students make use of knowledge meaningfully in other situations.

8 Conclusions

This study shows that concept maps are effective strategies for the individual construction of knowledge when students work in a community of learning and inquiry in an asynchronous online environment. The community of learning and inquiry was a good strategy for designing the interactive aspects of the online course and creating an environment to explore different ideas and concepts, share knowledge, and learn from each other. The concept maps facilitated students' individual construction of knowledge after participating in collaborative learning. Using the concept maps, students were able to prioritize information, integrate concepts, confirm knowledge, and construct new knowledge. With the widespread use of online learning communities in higher education, concept maps can be a valuable tool for enhancing individual learning and constructing personal meaning.

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