USING CONCEPT MAPS WITH ADULT STUDENTS IN HIGHER EDUCATION

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Abstract: The purpose of this study was to investigate the ways in which the use of concept maps influenced the learning processes of adult graduate students in the context of higher education. Two groups of students were taught to use concept mapping as a constructivist learning strategy and then were followed over the course of a year to determine the impact this strategy had on their learning. Results indicate that adult graduate students became more aware of their own learning processes, changed their learning strategies and articulated changes in their thinking. Implications for teaching and learning in higher education are drawn.

1   Introduction and Problem Statement

Adult graduate students often enter higher education programs relying on learning strategies that have worked well for them in the past (Merriam & Caffarella, 1999). These previous learning strategies often include rote learning, passive learning, memorization and recall of facts. Assisting adult graduate students to broaden their learning strategies is a major factor contributing to their academic success in higher education (Gibbons, 1990; Novak, 1990; Smith, 1982) and to their ability to function in the workplace. The purpose of this study was to assist adult students to enhance their learning through the application of teaching strategies that foster a constructivist approach to learning.

2   Conceptual Framework

Merriam and Caffarella (1999) define five different learning orientations including: behavioral, social, humanistic, cognitive and constructivist learning. They believe that within each of these learning orientations different assumptions exist about the nature of learning and the strategies that instructors can use to facilitate learning. Since the purpose of this study was to assist adult students to broaden their learning strategies, the constructivist learning orientation provided the overall conceptual framework for this study.

Constructivist learning has evolved to include multiple approaches and perspectives. For the purpose of this study, constructivist learning is seen as a cognitive approach that locates cognition and understanding within the individual. The most salient feature of this perspective is the "notion that learners respond to their sensory experience by building or constructing in their minds, schemas or cognitive structures which constitute the meaning and understanding of their world" (Saunders, 1992, p. 136). Constructivists, writing from this cognitive approach (Ausubel, 1986; Brunner, 1990; Novak, 1998; Piaget, 1966), express the belief that individuals create knowledge by linking new information with past experiences to create a personal process for meaning-making. Within a constructivist framework, the learner progressively differentiates concepts into more and more complex understandings and also reconciles abstract understanding with concepts garnered from previous experience (Novak, 1998). New knowledge is made meaningful by the ways in which learners establish connections among knowledge learned, previous experiences, and the context in which learners find themselves. Lambert et al. (1995) identify multiple principles of constructivist learning theory, which include the following major points: (1) knowledge and beliefs are formed within the learner, (2) learners personally imbue experiences with meaning, (3) learning activities should cause learners to gain access to their experiences, knowledge and beliefs, (4) learning is a social activity that is enhanced by shared inquiry, and (5) reflection and meta-cognition are essential aspects of constructing knowledge and meaning (pp. 17-18).

Novak (1998) operationalized constructivist learning theory by creating concept maps. "A concept map is a schematic device for representing a set of concept meanings embedded in a framework of propositions," (Novak, 1984, p15). Concept maps are created with the broader, more inclusive concepts at the top of the hierarchy, connecting through linking words with other concepts that can be subsumed. This tool helps facilitate understanding of conceptual relationships and the structure of knowledge. Novak (1990) found in an analysis of multiple studies using concept maps that the technique promoted novel problem solving abilities, raised mean scores on achievement of content units, decreased students' anxiety levels and increased students' positive attitudes toward the content of study.

In order to study how constructivist strategies impact the learning of adult students, constructivist teaching strategies were employed in two graduate courses in an adult education graduate program.

3 Research Questions

In this study, adult students were taught to use concept maps. The extent to which this strategy contributed to a change in learning strategies was assessed by evaluating; (1.) the change in student concept map scores during a one-year time frame, and, (2.) adult student response's to tape-recorded interviews. The following research questions were advanced to guide this investigation.

- Do constructivist learning strategies (i.e. concept maps) contribute to the success of the adult students?
- When adult students learn to use concept maps in one course, will that learning strategy carry over to subsequent courses in which the student enrolls?
- How does the use of concept maps as a learning strategy change the thinking of adult students?
- Can concept maps transform adult students' prior learning strategies?

4 Methodology

During semester one, adult graduate students in two different courses were taught to use concept maps as an integrated part of their course work. Students developed concept maps to reflect the course readings, plan course projects, and to compare and contrast information from course discussions. Twenty-one students from these courses were randomly selected and invited to participate in this study. Following IRB approval, students gave consent to have their course work reviewed and to be interviewed twice over the academic year.

A mixed-method design using both quantitative and qualitative analysis was created for this study. The first and final concept maps created by study participants in the first semester were scored according to the scoring formula created by Novak and Gowin (1984). Reliability was established by obtaining two independent scores on each map. Inter-rater reliability was established at .80. Data analysis included calculation of group means and comparison of these means using a dependent t-test.

At the end of semester one, interviews were conducted with participants about their use of concept mapping. During the interviews, adult graduate students were asked the following questions: 1. What was it like to use concept maps as a learning strategy? 2. What did you learn while doing concept maps? 3. Where else have you used the maps since the completion of your course (if at all)? 4. How was doing the maps the same or different than other learning strategies you have used previously? 5. What did you like most/or like least about using concept maps? 6. What changes, if any, did you see in your thinking ability since using concept maps? 7. What was the most significant learning you remember from this course? 8. If you were going to describe concept mapping to another graduate student, what would you say? 9. How do you see using/or not using this learning strategy in the future?

Study participants were followed during semester two. Concept maps created by the adult graduate students at the end of semester two were scored. At the end of semester two, study participants were interviewed a second time to determine if they continued to use concept maps as a learning strategy and how that strategy impacted their thinking and learning.

Interview data was analyzed using a modified constant comparative method (Glaser & Strauss, 1967; Patton, 1990). First, all interviews were coded and themes identified using the qualitative data analysis software package N*VIVO. Then, coded data were compared from the first set of interviews to the final set of interviews by developing a system of matrices for comparison and contrast (Miles & Huberman, 1994). Finally, a summary concept map was created to synthesize the themes identified in both sets of interviews.

5 Findings

Findings from this study indicate that using concept maps impacts adult graduate student learning. The presentation of findings from this study will first focus on the changes in concept map scores and then explore student interview data related to learning with maps and the use or non-use of maps at a one-year follow-up.

5.1　Changes in Concept Map Scores

In this study concept maps were collected from participants at three separate points. In the first semester of the study, the first and final map created by the students were collected and scored. During the second semester, the final map that participants created, (if they did create a map in semester two), was collected and scored.

Data analysis (Table 1) demonstrates a group mean of 44.81 on the first concept map and 121.43 on the final concept map of the first semester, for a difference of 76.62. The t-value comparing the first to final map was –6.614 (p=.001). The data indicate a statistically significant difference between the first and final map scores of the first semester.

Table 1
Changes in Concept Map Scores over First Semester

Variable	No. of Cases	Mean	Difference
First Map of Semester 1	21	44.81	-76.62
Last Map of Semester 1	21	121.43	

P = .001 t-value = -6.614

Students were followed during the second semester of the study, to determine if they continued to use mapping as a learning strategy and if they did how the maps compared to the first semester. Data indicate that 65% of students in this study continued to use mapping into the second semester. Data indicate the mean score for the last map during semester one was 121.43 and the mean score for the last map in semester two was 120.22, for a change score of –1.21. The data indicate no significant difference between those participants mapping at the end of semester one and those mapping at the end of semester two.

Participants were also interviewed at two points during this study, at the conclusion of semester one and at the conclusion of semester two. Participants were asked during the interviews to describe their experiences with mapping as a learning strategy and to analyze how their thinking had changed or not changed through the use of mapping. Participant responses were categorized into two areas for presentation of findings: learning with maps and map use on follow-up.

5.2　Learning with Maps

Study participants indicated that to learn effectively with maps, they first had to develop the skills in map construction and to understand the mechanics of mapping. Additionally, participants reported that often their initial reaction to mapping changed and developed over the time that they used mapping.

Participants stated that part of what they enjoyed about the process of mapping was the focus on organization, analysis and understanding. Participants indicated that through the process of organizing and analyzing, they developed a more holistic picture of what they were learning. One participant stated:

> *It made you look at whatever it was you were doing in its entirety. It made you look at it as a whole. And then start breaking it down by concepts and then you would rebuild it by linking . . . You feel the knowledge building. You just feel yourself seeing things differently than before you started doing that.*

However, some participants expressed three difficulties in developing maps: finding time to complete the maps, deciding on the level of detail to include and overcoming their lack of desire to change how they learned. Participants indicated that mapping as a learning strategy was too demanding and took up too much time.

> *. . . it is just another task to do when you feel overwhelmed. It takes more time than just reading the text . . . I think it has a lot more value than what it feels like you are doing at the moment.*

Participants also expressed how difficult it was to change learning strategies that they had used in the past. Changing old habits was time-consuming and difficult for most participants in this study. One participant indicated:

> *But, I guess what I hated the most was that I had to change my thinking mode. It is before, like, well, I am just reading this information, and I am picking out what I see is in the writing or what the writer is trying to present. I guess I just didn't like the idea of changing old habits and doing things differently.*

5.2.1   Understanding One's Own Learning

A major finding of this study was that concept mapping helped adult students to understand their own learning processes. Additionally, they were able to explain that they developed their learning processes through the use of learning strategies such as linking, developing interrelationships, creating meaning schemes, and constructing knowledge. Participants reported that the maps helped them to understand how they think, to think in a broader fashion, to search out complicated relationships, and to organize information so that they remembered it in a much more comprehensive way. For example,

> I learned a little bit about how I think based on how I put the concept map together. I learned a little bit about what challenges me, what comes easy to me. I tried to pick things to concept map that I didn't understand so that I would understand them afterwards.

Another participant described how she developed an understanding by moving from larger concepts to smaller concepts and back again.

> I learned to use another part of my brain. I learned also to think globally because this is going from big ideas and main ideas to smaller ideas, subtopics, so I learned to modify how I think about information. I also learned to show more linkage of information.

Finally, participants discussed how the maps helped them apply information to their experiences and at the same time remember that information in a new way.

> . . . instead of it being information given to me and stored away in my head, the most significant thing is that when I can apply things to my real life experience, I have a better time understanding them, better time remembering them. So to me that is a big deal.

5.2.2   Learning Strategies

As participants came to understand their own learning processes, they also articulated of a number of learning strategies that they employed as a result of creating concept maps. Participants reported that their understanding of how to link concepts, develop interrelationships, create meaning schemes, and construct a knowledge base developed through the use of mapping.

Linking. Participants in this study were asked to describe what was their most significant lesson learned from the courses they were enrolled in during the first semester. A large percentage of the participants expressed that learning to link concepts was a new learning strategy for them and a major discovery in their own learning. The following participant expressed the value in learning to link concepts this way:

> What I discovered in my own learning was that indeed there were connections between ideas and concepts that I hadn't picked up on just in reading the material. But it was in the diagramming of the concept map and I usually did it in two stages. My first stage was I threw enough stuff down on paper as I could [sic]. My second stage, I let it sort of sit and simmer like a pot on the back burner for awhile. Then I would come back and make some aha's, oh I see some relationships here. And that helped to open up the interconnectedness of what I had been looking at and didn't initially see.

Another participant expressed a common theme evident in many adult learners' experiences in this study. Participants indicated that they just had not thought about the relationships between concepts previously until confronted with a learning strategy that asked them to make those connections. When asked about significant learning strategies one participant stated:

> The linking. I never gave it thought before. The relationships between levels in the hierarchy and between different concepts within the map. That would probably change my approach to a lot of things now.

Interrelationships. Participants in this study also described a step beyond linking. They indicated that as a result of making links between concepts, they began to really understand and search out interrelationships between concepts that created new meaning for them. As one participant explained:

> As I did the concept maps, I was particularly sensitive to find what the interconnections were. I did our case studies and I went through the readings; whatever we had to concept map, I was more aware of

the connections, what are the relationships, because I knew eventually I had to produce that in the map.

Another participant described how after learning to make links, the process of developing interconnections helped him critique his own thinking by highlighting false connections he had made previously. As a result, he felt that finding the connections was a way of double-checking his understanding of new material.

After I did a couple of maps I realized that these were the things that I was trying to do mentally. Sometimes I would see the mistakes or let's say just mis-connections. Like no, this really doesn't connect to this. This really should connect over here. You could almost, like, check your math. It is like doing math the long way as opposed to taking some shortcuts. Every once in awhile you made a mistake and then you had to go back. It was kind of like long division.

Creating Meaning Schemes. A number of participants also indicated that subsequent to linking and searching out interconnections, the mapping exercise fostered the learning process or strategy of creating meaning schemes. Most participants described these schemes as a way to organize and structure information. Additionally, participants indicated that in the process of creating schemes of information their ability to recall the information was improved.

Well, doing the concept map forms the schemes for learning. It forced me where the author didn't put a framework, to put one. So I believe that although it takes longer to read and do a concept map in order to retain what you are doing or to develop an idea that way, that I definitely knew after doing a couple that the retention was going to be greater because the scheme was etched in your mind then.

Knowledge Construction. Finally, participants indicated that through the process of developing a concept map, they learned that linking, developing interrelationships and creating mental schemes all helped them develop their ability to construct a knowledge base for themselves. One participant expressed the way she began to understand the process of creating a concept map as similar to creating a mosaic. She stated:

I think that helped with the whole process because with a mosaic you have a bunch of little pieces and you are kind of figuring out what is the best way to array them, how many little pieces you have, and what comes after what. That concept plus the learning fell in with my understanding or belief of how adults learn. I guess it would be kind of a constructivist approach as we build on what we already know, we add too, we might reshape what we already have in our brains, based on what new stuff comes in. It may be reshaped or you may just add to your database. I felt like the concept mapping process really helped with that.

Another participant describes a similar connection between developing concept maps and constructing knowledge. She stated:

I really believe in concept mapping because I believe in constructing knowledge. Dialog, discovery, constructing knowledge, all that stuff. It really does fit in. Maybe that is why I do like it because it does give you a chance to kind of sort stuff out and construct knowledge.

5.2.3   Changes in Thinking

At the conclusion of the first semester of this study, participants were asked if their thinking changed as a result of the use of concept maps and, if so, how. Participants described how this strategy was different than other learning strategies and that their thinking did change. Participants expressed how they analyzed concepts in more depth and they felt they had the ability to make connections across multiple bodies of knowledge. For example, one participant stated:

It is different because any other strategy, taking notes, putting together a formal outline, one thing after another. Whereas, the concept map gets you to think outside of the box. It gets you to see how things relate rather than how one thing is broken down. So it was a different way of approaching something, taking a different perspective on learning, I thought, which was refreshing for me.

Finally, one participant indicated that the mapping process helped her to think better and also helped her to recognize that she really developed an understanding of what she learned.

I don't know if this makes sense, but concept mapping allowed me to think better. It really allows you to understand what you are reading and as you are doing it, you are putting it together, and all of a sudden when you are done and you think to yourself when you look at sort of the arrows that are going back and forth and the connections that you have made, and you sort of look at yourself and you think, wow, I guess I really get that. I get it thoroughly as opposed to something you just read and five minutes later you asked me what I just read and I am not able to answer the first question.

5.3   Follow-Up After One Year

One of the major research questions this study addressed was do adult graduate students continue to use concept mapping as a learning strategy even when they are in courses that do not require them to do so. In this study, 65% of adult learners reported that they did continue to use this strategy. Those participants who reported that they continued to use mapping explained that they did so for a number of reasons. They seemed to use maps to understand course material in subsequent graduate courses. They also relied on the maps as a way to understand particularly difficulty material. Many participants reported that when they felt "in trouble" in a course or that they "did not get it," they would try mapping out the material as a way to develop their understanding. Additionally, learners tended to use maps to frame projects for subsequent courses or work-related projects. One participant described how he had a big project to do at work and as a way to help his team understand the scope of the project, he mapped it out and shared the map with them. Another student described how she used a concept map in a subsequent class to demonstrate decision making.

The adult students who did not use concept maps in the subsequent semester (35%), reported that they chose not to because they were not required, they did not have time or they did not have the software they needed to develop the maps. However, the biggest barrier to creating maps for this group was time. Over and over again, these learners complained that the process took more time than they felt they could invest in their course work.

Interestingly, in this study both learners who used concept maps in subsequent semesters and those who did not still reported changes in their thinking at one-year follow up. For example, students who used the mapping tended to report that the maps increased their focus, understanding of relationships, and thinking processes. The following quote is from a learner who did use the maps in the follow up semester:

I am more conscious, especially in the class I just had, I was conscious of how do these different concepts interrelate. What are the connections that I am making in my mind? That is why I went to the concept map. Because my mind was doing stuff, but I wanted to get it down on paper so I could look at it.

On the other hand, the learners who chose not to use concept maps in subsequent semesters still reported changes in their thinking. These learners reported being able to identify interconnections, organize information and develop mental schemes for their reading. The following quote is from a learner who had not used mapping in the subsequent semester:

Although I haven't used them, I think in the way I organize my textbook and in how I write some of my notes, that it is actually a variance of a map. I never used those little stickies before. I highlight them in different colors now. What I will try to do is try to group them according to color, so that when go back I can tell that this one kind of goes with this one which is yellow. This one is hot pink and I have found that it helps to organize in that way.

6   Discussion

Results of this study indicate that adult graduate students learned to develop concept maps and, through the process of using this constructivist learning strategy they developed their thinking abilities and grew to understand their own learning processes. Interestingly, 65% of students continued to use this strategy at one-year follow-up even when enrolled in courses where it was not required that they do so.

A number of issues surfaced in this study. First, it was surprising that many adult graduate students participating in this study began with so little understanding of their own learning processes. Second, it was evident how resistant some students were to changing their learning processes, even when they were unsure of the nature of those learning processes. It took a great deal of work for many students who participated in this

study to find the willingness to try this learning strategy and to learn how to use concept maps. Finally, it was interesting to note that once study participants did understand their own learning, they continued to move forward in developing their thinking abilities even if they did not use the concept map explicitly.

Results of this study support previous work on concept mapping (Novak & Gowin, 1984; Novak, 1998), but also seem to indicate that there is long-term change in participants thinking abilities as a result of learning to develop maps. Additional longitudinal research is needed to substantiate this finding.

7 Implications for Adult and Higher Education

This study has implications for faculty in adult and higher education programs. Students in this study demonstrated that concept maps helped them to understand the learning processes of linking, developing interrelationships, creating meaning schemes and constructing knowledge bases. Once they were able to learn in this fashion and explain their own learning, they were much better prepared to function in future graduate courses and as educational professionals promoting learning and change. A number of students shared examples and cases where they used mapping in their organizations to analyze performance projects, develop strategic plans, teach leadership, support decision-making and brainstorm new ideas. The major implication here, for faculty in adult and higher education, is that adult student often do not understand their own learning processes and need practice with learning strategies that will help them develop their learning and thinking abilities. Once students develop more complex learning strategies, they are then better prepared to think critically and analytically about specific content they are learning.

The biggest challenge for faculty in adult and higher education programs is changing teaching approaches to incorporate what we know about adult student learning. Using concept maps necessitates that faculty have a good understanding of constructivist learning and the ways in which maps represent students' thinking. To use this strategy effectively faculty need to create their own concept maps that demonstrate subsumption, progressive differentiation and integrative reconciliation (Novak & Gowin, 1984). Finally, to use mapping faculty need to be willing to foster an approach to learning as meaning construction. This means that the focus of courses shifts from teaching and presenting information to learning and creating meaning. The role of the faculty member shifts from content expert to facilitator of learning. Often this is a demanding change that requires a new way of thinking about teaching and learning.

In summary, this study indicates that concept maps can effectively promote learning of adult students and thus, can be added to the teaching strategies of faculty in higher education. The maps contribute to student success, foster a long-term change in thinking, and contribute to changing adult students' learning strategies. The maps support both constructivist teaching and learning approaches and may have wider applicability to the work world as well.

8 Acknowledgements

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