Concept Mapping on iPads with Baiboard HD to Promote Student Learning

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This paper explores how the use of concept mapping, with and without technology support, assists students in learning complex concepts to which they may have had limited previous exposure. Undergraduate preservice teachers were engaged in a group-based concept mapping activity wherein they created three concept maps over the course of several weeks in a large lecture class. Students were randomly assigned to groups, and groups were randomly assigned to treatment conditions: concept mapping on paper versus concept mapping using an iPad app. Concept maps were scores for complexity and accuracy and scores were compared across time and between conditions. Concept map score were also correlated with student performance on related test items. The application of concept mapping and iPads in collaborative group work for undergraduate preservice teachers will be discussed.

Concept Mapping

There are many different types of educational tools used within the classroom to promote greater understanding and assess student knowledge. One of these tools is concept mapping. Concept maps have been around for more than 25 years in an educational setting (Daley, 2010). The idea originated with Dr. Joseph Novak out of Cornell University where during the transcription of thousands of hours of audio recordings the research team developed an analysis technique that transformed the information to a hierarchical structure of concepts and relations (Novak, 1983). Eventually this idea developed into what is now known as concept mapping (Cañas, 2004).

What is Concept Mapping?

As defined by Novak and Gowin (1984), concept maps are a "schematic device for representing a set of concept meanings embedded in a framework of propositions" (p. 15). The concept map that is developed by the learner about a specific topic is then a working framework of their current cognitive structure (Daley, 2010). A student is usually given a topic or specific question and then creates a graphic that includes concepts enclosed in geometric shapes that are connected to one another with meaningful linking words or phrases (Novak, 2006). Concept mapping allows the learner to anchor new ideas and concepts with previous knowledge in order to gain a greater understanding of new information (Novak, 1977). Although the notion of linking new concepts to previous knowledge to foster meaningful learning is not a new idea, using concept mapping as a tool to encourage this behavior is relatively recent.

Concept Mapping as an Educational Tool

Previous research has demonstrated the benefits of using concept mapping in business organizations and curriculum development, but the majority of research has focused on the use of this tool in education settings to encourage meaningful learning (Novak & Gowin, 1984). According to Ausubel's assimilation theory, meaningful learning occurs when a person consciously relates new knowledge to relevant concepts or propositions that they already have (1963). When learners create a concept map of new material they are forcing themselves to create meaningful connections between other ideas which does not always come easily. This process of making the learner discover connections results in what Bloom (1956) identifies as high levels of cognitive performance through evaluation and

synthesis of knowledge. Given these processes, concept mapping is an easy and effective way to encourage high cognitive performance among students and is therefore an effective learning tool (Novak et al., 1983; Novak & Gowin, 1984; Novak & Musonda, 1991). Now with the introduction of many technological advances in education settings, concept maps have taken on different media.

Collaborative Learning and Concept Mapping

Collaborative learning is an instructional technique in which the students with various performance levels work with one another in small groups toward a common goal (Gokhale, 1995). Working within small groups increases interest among the group members and also promotes critical thinking (Gokhale, 1995). A study by Johnson and Johnson (1986) shows that collaborative learning groups had higher levels of thought and retained information longer than those who worked independently. Working in small groups gives the group members opportunities to participate in discussions, take responsibility for their own learning helping them to become critical thinkers (Totten et al., 1991). Collaborative learning is a helpful technique in taking others' understandings and assimilating them with one's own, a technique that lends itself nicely to concept mapping. Concept mapping is a helpful technique for individual learning, but can also greatly benefit from collaborative learning. Multiple parties can profit from working on a specific concept map together by brainstorming concepts and discussing relations between concepts (Cicognani, 2000). Also while developing the map, different parties can offer modifications to create a more comprehensive and thorough map (Cicognani, 2000). These benefits make concept mapping an apt learning technique to be used with collaborative learning and therefore collaborative concept maps were used in this study.

Mapping with iPads

With rapid changes in mobile device technology and adoption rates, there is an increased need for educators to be aware of and engage in the use of these devices (Anderson 2004). Students and staff are increasingly familiar with new devices and are eager to incorporate them into their research and education practices, therefore universities will need to prepare technically and pedagogically to these demands (Anderson, 2004). One of the devices that is rapidly gaining popularity and attention is the tablet computer. Many undergraduate students already own or will own a tablet computer or other mobile device to use during their college experience (Jones et al., 2010; Margaryan et al., 2011). In a study conducted by Morris et al., (2012) students who used a tablet computer in a trial period (without change to curriculum to account for tablet use) used their tablets extensively over the use of laptop computers for data retrieval, lecture recording and also accessing learning resources. Another critical benefit of tablet device usage in classroom settings is collaboration. Situated learning theories describe the benefits of social interactions to the learning process through interrogating and sharing views and understandings (Vygotsky, 1978). Tablets have the advantage of communicating with one another easily allowing interactions and collaborations between learners (Naismith et al., 2004). This ability is especially beneficial when using higher level cognitive strategies such as concept mapping.

Current Research

The current study investigates at how the use of tablets can enhance the collaborative process of creating a concept map. Previous research shows the benefits of concept mapping to engage students' high level cognitions (Novak et al., 1983; Novak and Gowin, 1984; Novak and Musonda, 1991). With a rapid change to more mobile technologies in the education realm, current research needs to understand and determine the most effective way to integrate newer technologies and beneficial learning strategies. Previous research has demonstrated positive effects of tablet use in higher education as well as the positive effects of concept mapping on student learning. The current research project explores whether creating concept maps on a tablet can facilitate collaborative learning more effectively than creating concept maps using pencil and paper.

Method

Participants. Participants were 92 students enrolled in a junior-level developmental psychology course for education majors. The majority of participants were female, and between 18 and 22 years of age.

Measures. Our data set is composed of both group-level and individual-level data. At the group level, each group created three assigned concept maps with approximately one week elapsing between each assignment. At the individual level, each student completed a reflective assignment in which students responded to specific prompts regarding concept mapping under two different conditions (on paper versus using an iPad app), and their views about how they might use concept mapping in their own future classrooms. We also collected individual performance data on exam items related to the content of the concept maps.

Procedures. Students were randomly assigned to 30 groups of about three students each. These groups remained stable across the three concept mapping assignments. Concept maps were completed during class time so groups collaborated face-to-face while also jointly creating their concept maps. At time 1, students were introduced to concept mapping as an instructional strategy, and were also introduced to app Baiboard HD. BaiBoard HD, published by LightPlaces Ltd, is described as "a free online meeting playground service that enables real-time collaborative drawing with its feature-rich drawing tools and collaborative services." Students were instructed to use Baiboard HD to create a concept map illustrating relationships among 15 assigned concepts concerning families and child development. This concept map serves as a baseline measure of mapping performance.

At time 2, students were asked to create a concept map to illustrate the relationships among 21 concepts from Piaget's theory of cognitive development. Students in groups 1-15 were instructed to create the concept map on paper. Students in groups 16-30 were instructed to create the concept map on Baiboard HD. At time 3, students were asked to create a concept map to illustrate the relationships among 14 concepts from Vygotsky's theory of cognitive development. Students in groups 1-15 were instructed to create the concept map using Baiboard HD. Students in groups 16-30 were instructed to create the concept map on paper. An example of a concept map created with Baiboard can be found in Figure 1. An example of a concept map created on paper can be found in Figure 2.

Figure 1.

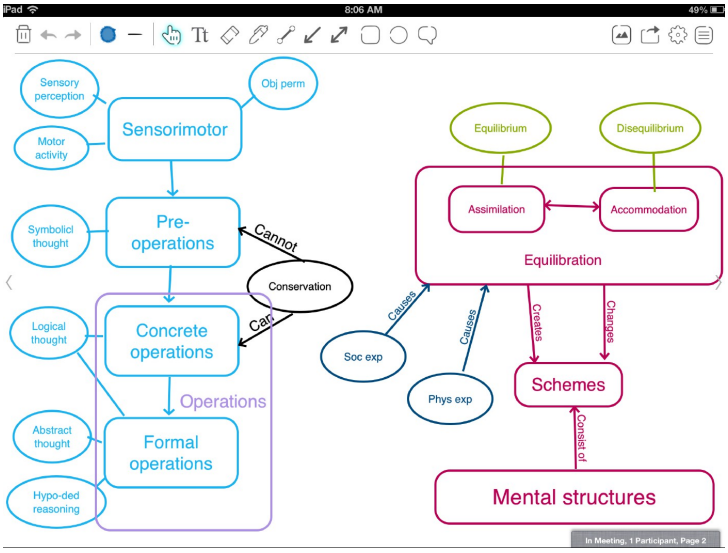
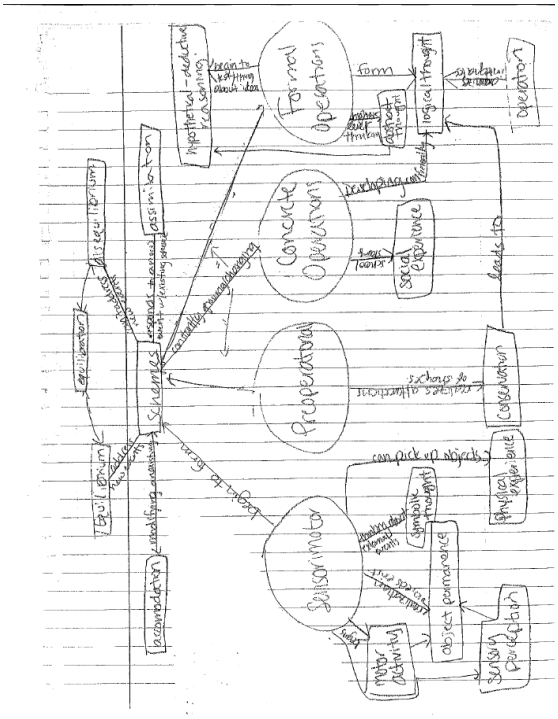


Figure 2.



Analysis plan. Data are in hand and coding of concept maps is underway. All concept maps will be coded for complexity and accuracy using established coding techniques. Multiple coders will be utilized to establish inter-rater reliability of coding schemes. Subsequently, concept map scores will be used in two statistical analyses. First, concept map scores will be correlated with individual performance data on exam items related to the content of the concept maps. This will allow us to determine whether students whose groups create more complex and/or accurate concept maps earn higher scores on corresponding exam items. Second, concept map scores will be analyzed using a 2 (condition: paper vs iPad) by 2 (time: map 1, map 2, map 3) design to determine whether scores on concept maps differ by condition, by time, or by the interaction of condition and time. Student reflections will be content analyzed to reveal patterns in their thoughts about (a) concept mapping as a learning aid, and (b) paper versus iPad as a concept mapping platform.

Findings will be discussed in terms of the effectiveness of concept mapping as a learning strategy and, in particular, whether iPads offer any additional advantages over pencil and paper when concept mapping in a collaborative environment.

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