2012

The Effects of Mind Mapping Activities on Students' Motivation

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Jones, Brett D., et al. The Effects of Mind Mapping Activities on Students' Motivation. International Journal for the Scholarship of Teaching and Learning 6.1 (2012), 1-21.

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Disciplines
Education | Educational Methods | Educational Psychology

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Introduction

Interest in understanding the use of concept maps for instructional purposes has grown significantly in the past three decades (Nesbit & Adesope, 2006). Yet, many questions remain unanswered related to how concept maps can be used most effectively to promote students" motivation and learning in higher education courses (e.g., Doorn & O"Brien, 2007). Although there are many ways to use concept maps in educational settings (see Novak & Gowin, 1984), we were most interested in how they could be used to extract meaning from textbooks. Further, we wanted to investigate the use of a type of concept mapping called "mind mapping" (Buzan & Buzan, 1993). Given the importance of social interactions in learning settings (Saloman & Perkins, 1998), we questioned whether socially mediated learning experiences were important in the mind mapping process. As a result, the primary purpose of our study was to examine whether different types of socially mediated mind mapping activities would have different effects on factors related to students" motivation and effort.

Background

Mind Mapping

The means of representing ideas in diagrams with node-link assemblies has been termed concept mapping (Novak & Gowin, 1984), knowledge mapping (O"Donnell, Dansereau, & Hall, 2002), and mind mapping (Buzan & Buzan, 1993). When used as a part of instruction, these types of mapping techniques have been shown to increase students" achievement scores (Horton et al., 1993) and knowledge retention (Nesbit & Adescope, 2006). Nesbit and Adesope (2006) defined a concept map as "a type of graphic organizer that is distinguished by the use of labeled nodes denoting concepts and links denoting relationships among concepts" (p. 415). Typically, when used in an instructional setting, students who complete a concept map place concepts or ideas in ovals (or any shape), organize the ovals in some type of logical manner that shows the relationship among them (which may or may not be hierarchical), and connect the concepts to one another with lines that might or might not be labeled (Novak & Gowin, 1984). Mind mapping is slightly different from concept mapping in that the mind mapping process starts with a topic at the center of the graphic (Buzan & Buzan, 1993). Important concepts and phrases are then linked to the center topic on branches which can continue to branch into other concepts and phrases. In addition, the text can be accompanied by images, and color can be used for emphasis or to faciliatate organization.

Mind maps help students learn information by forcing them to organize it and add images and color to it (see Figure 1 for an example mind map that is shown without color). These maps have been shown to lower extrinsic cognitive load because students are creating a two-dimensional space to tie in ideas and concepts that relate together (Nesbit & Adesope, 2006). Mind maps allow students to create a visual image to enhance their learning (Budd, 2004) and can be used as a metacognitive tool that allows them to make connections to material in meaningful ways. For example, Farrand, Fearzana, and Hennessy (2002) found that mind maps not only aided medical students in studying, but also encouraged a deeper level of learning, especially when paired with a problem-based learning curriculum. Mind maps have also been used as reflective tools that allow for broader associations to be made to the material (Budd, 2004). Using mind maps also helps teachers vary their teaching methods which may be more likely to reach diverse learners (Nesbit & Adesope, 2006).

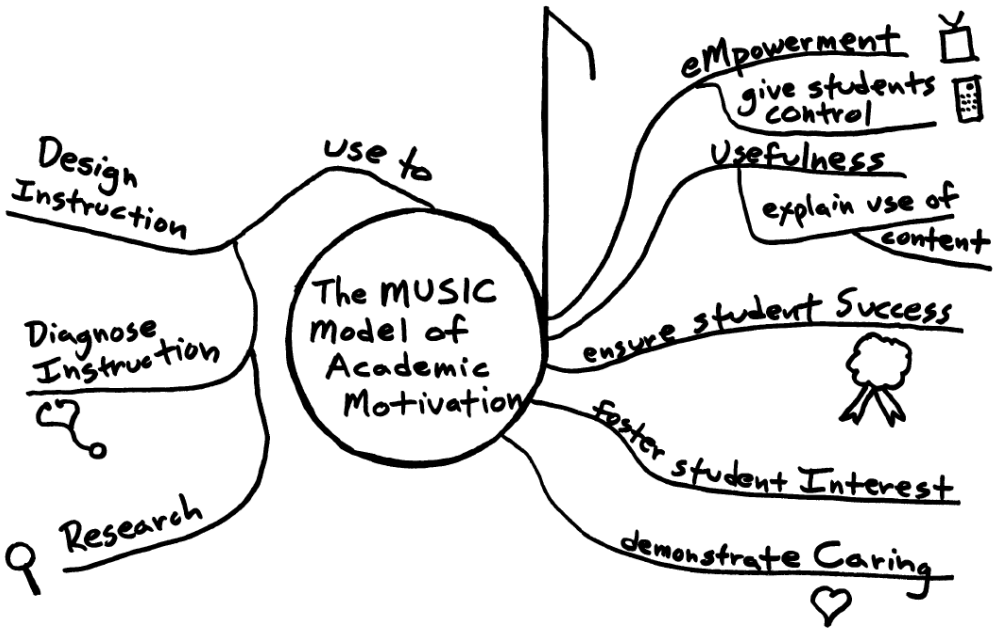

Figure 1. Example mind map

Socially Mediated Learning

Mind mapping activities require students to actively engage in their learning, often by connecting their prior knowledge to new information. When creating a mind map, a student frequently interacts with a textbook, notes from class, an instructor, classmate, or study group. Viewed from a sociocultural perspective, the student"s learning in all of these interactions would be mediated by a social agent: an individual, group, or a cultural tool such as a textbook or set of class notes (Salomon & Perkins, 1998). The concept of socially mediated learning has been highly influenced by Vygotsky"s (1978) belief that that society greatly influences learning and that "every function in the child"s cultural development appears twice: first, on the social level, and later, on the individual level" (p. 57). Thus from a sociocultural perspective, learning is not a transfer of information from teacher to student, but the process of participating in the active construction of knowledge and meaning through interactions with others and with the environment (Saloman & Perkins, 1998).

When constructing a mind map, students are actively engaged with cultural tools in a way that, even when a student is working alone, his or her learning is socially mediated. However, as Saloman and Perkins (1998, p. 17) note, an individual"s learning can be socially mediated at different levels, from a lower level of social mediation (e.g., when an individual student interacting with a textbook and set of drawing materials creating a mind map), to a medium level of social mediation (e.g., when a teacher or tutor engages with the student to scaffold an activity or ask a question; Mariage, Englert, & Garmon, 2000), to a high level of social mediation (e.g., when a group of peers work collaboratively to complete a project; Ching & Kafai, 2008; de Abreu & Elbers, 2005; Gladwin & Stepp-Greany, 2008; Huong, 2007). In all of these examples, the focus is on the individual"s learning within a social context.

The MUSIC Model of Academic Motivation

The MUSIC Model of Academic Motivation (Jones, 2009) consists of five primary components

that have been derived from research and theory as ones that are critical to student engagement in academic settings, including: empowerment, usefulness, success, interest, and caring (see www.MotivatingStudents.info). The name of the model, MUSIC, is an acronym based on the second letter of "eMpowerment" and the first letter of the other four components. It is sometimes useful to divide the interest and caring components further into two sub-components each (i.e., situational interest, individual interest, academic caring, and personal caring), for a total of seven components in the model (Jones, 2010a, 2010b; Jones & Wilkins, 2011). The MUSIC model was developed to help instructors better understand how current motivation research and theories can be applied to instruction (Jones, 2009, 2010b). The model has also been used as a theoretical framework to examine the impact of instruction on students" motivation (e.g., Jones, Bryant, Epler, Mokri, & Paretti, 2011; Matusovich, Jones, Paretti, Moore, & Hunter, 2011). In this section, we provide a brief overview of the MUSIC model components that are described in more detail in Jones (2009).

The first component of the MUSIC model, *empowerment*, refers to the amount of perceived control that students have over their learning. When students are empowered, they believe that they have the ability to make choices. Much of the research related to empowerment has been conducted by researchers studying attribution theory (Weiner, 2000) and self-determination theory (Deci & Ryan, 1985, 1991; Ryan & Deci, 2000). Empowering students fulfills their need for autonomy (Deci & Ryan, 1985, 1991). The *usefulness* component of the MUSIC model involves the extent to which students believe that the content material is useful to their short- or long-term goals. Students" goals are important because their motivation is affected by their perceptions of the usefulness of what they are learning for their future. Research related to the usefulness construct has been conducted by future time perspective theorists (De Volder & Lens, 1982; Kauffman & Husman, 2004; Tabachnick, Miller, & Relyea, 2008), as well as Eccles and her colleagues who have studied utility value as part of their work on the expectancy-value model of motivation (Eccles et al., 1983; Eccles and Wigfield, 1995; Wigfield & Eccles, 2000).

The *success* component of the MUSIC model is based on the idea that students need to believe that they can succeed if they put forth the appropriate effort. Students feel successful when they perceive that they are competent in the course requirements. Self-perceptions of competence (i.e., one"s beliefs about one"s abilities) are central to many motivation theories, such as self-concept theory (Marsh, 1990), self-efficacy theory (Bandura, 1986), self-worth theory (Covington, 1992), goal orientation theory (Ames, 1992), and expectancy-value theory (Wigfield & Eccles, 2000).

The *interest* component of the MUSIC model can be separated into two theoretically distinct components: situational interest and individual interest (Hidi & Renninger, 2006). For the *situational interest* component, students" positive emotion and engagement is activated through a context-specific environment that causes students to be interested in the content material for at least a brief period of time. Students who enjoy a class activity would have a situational interest if this enjoyment was short-lived and did not endure much past the class activity. In contrast, students who find a topic to be of interest over time and believe that the topic is personally important would have an *individual interest* in the topic.

The *caring* component of the MUSIC model specifies that students have a need to establish and sustain caring interpersonal relationships, either with an instructor or other students. It is derived from research in the areas of belongingness, relatedness, connectedness, affiliation, involvement, attachment, commitment, bonding, and sense of community (e.g., Baumeister & Leary, 1995; Ryan & Deci, 2000). The caring component can be divided into

two components: academic caring and personal caring (Johnson, Johnson, & Anderson, 1983). *Academic caring* specifies that students need to believe that their instructor cares about whether or not they successfully meet the course objectives. For *personal caring*, students need to perceive that their instructor cares about their general well-being and welfare.

Research Questions

The purpose of this study was to answer the question: How do three types of socially mediated learning activities that involve mind mapping affect factors related to students" motivation? We placed the mind mapping activities on a spectrum from low social mediation (the activity was completed individually outside of class time), to medium social mediation (the activity was completed individually in class with the instructor available for help), to high social mediation (the activity was completed in class within a group with other students and the instructor available for help). We addressed the following research questions within the context of an undergraduate course that used mind mapping activities to help students learn content knowledge from a textbook.

1. For each level of social mediation, how highly do students rate the MUSIC model components and their effort?
2. Is there a statistical difference in students" scores for the MUSIC model components and effort ratings among the levels of social mediation?
3. To what extent are students" scores on MUSIC model components statistically correlated with their effort?
4. Why do students prefer certain mind mapping activities over others?

Method

Mixed Methods Research Design

To achieve the goals of our study, we implemented a concurrent mixed methods design using identical samples whereby the quantitative component was dominant over the qualitative component (Onwuegbuzie, & Collins, 2007). Using Collins, Onwuegbuzie, and Sutton"s (2006) typology, the purpose of our mixed methods analysis was significance enhancement: to elaborate, illustrate, enhance, and clarify the findings from the quantitative results; and to compare the results from the quantitative data with the qualitative findings (i.e., to provide triangulation).

Participants

Participants included undergraduate students enrolled in one of two sections of an undergraduate educational psychology course at a large university in the southeastern United States. A total of 40 students participated in the study, including 16 students (40.0%) from one course section and 24 students (60%) from another section. Most of the participants were female (n = 34, 85%), with 22 (55%) juniors and 18 (45%) seniors participating. The majority of the students reported that they were Caucasian (n = 34, 85%), whereas four students (10%) reported that they were Asian or Pacific Islander, and two students (5%) reported that they were Hispanic.

Procedure

Participants were solicited from an introductory educational psychology course that covered topics such as learning theories, problem solving, metacognition, motivation, and

assessment. The course was divided into two sections that were taught by different instructors. The instructors worked collaboratively to develop a common syllabus to ensure that students in both sections received similar course experiences.
The study was approved by the Institutional Review Board at the university where the study was conducted. Students were introduced to the study and invited to participate during one of the classes by two of the authors who were not the course instructors. Students were told that their participation in the study was voluntary, that their decision to participate would not have any effect on their course grade, and that their participation would involve allowing the researchers to use their responses to three questionnaires that assessed their beliefs about the mind map assignments used in the course. Students provided their consent to participate in the study by signing an Informed Consent form that two of the authors collected during class.

Participants completed a total of three online questionnaires, one after each of the three mind mapping activities that occurred in three consecutive weeks. Two of the questionnaires contained similar questions, whereas the third questionnaire included additional opened-ended items that asked students to reflect on and compare the three mind mapping activities. Students completed the online questionnaires outside of class time after they completed the mind map assignment and prior to starting the next mind map assignment.

Mind Mapping Activities
The three mind mapping activities were grouped into three levels of social mediation as follows: the individual out of class mind map (Map 1, lowest level of social mediation), the individual in class mind map for which students could seek help from the instructor (Map 2, middle level of social mediation), and the group in class mind map for which students worked in groups to create a mind map (Map 3, highest level of social mediation). For Map 1, students were given the assignment during class time, but were required to complete the map outside of class time using their textbook and class notes. For Map 2, students were given one hour in class to complete the map and hand it in to the instructor at the end of the class. The instructor was available during the class to answer students" questions. Students were told not to work with other students in the class on their map. For Map 3, the instructor placed students into groups of three or four and students were told to work together to create one map. The content material for each of the maps was based on a chapter that students read from the textbook. The instructors gave students the instructions (see Appendix A) and discussed how the grading rubric would be used (see Appendix B).

The instructors assigned the three mind maps in different orders to reduce the likelihood that differences between groups could be attributed to (a) a novelty effect in which students rated the first activity differently from the second and/or third activities because it was new to them, and (b) the fact that students had learned strategies for creating mind maps after their experiences in creating the first one or two maps, and therefore, were more adept at creating maps. One instructor assigned the mind maps in the order of Map 1, Map 2, and Map 3; the other instructor assigned the maps in the order of Map 2, Map 3, and Map 1.

Quantitative Instruments, Items, and Analysis
The quantitative data were analyzed using SPSS™ (version 18.0) a statistical software package for the social sciences. We analyzed the data using descriptive statistics, a *t*-test, ANOVAs, and correlations, as described in the Results section.

MUSIC model components and effort
To measure the six MUSIC model components and effort, we used the same instruments as those presented in Jones (2010). These seven instruments consisted of items that were

rated on 7-point Likert-format scales. The items in each instrument were averaged to create a mean score for each instrument. All of the instruments were found to have acceptable reliability estimates as documented by the following Cronbach alpha values: empowerment (5 items, α = .92), usefulness (3 items, α = .90), success (4 items, α = .92), situational interest (3 items, α = .92), individual interest (3 items, α = .91), and academic caring (4 items, α = .97). Personal caring was not measured because we expected that by the middle of the semester (when these activities took place), students would have already formed a strong belief about the instructor"s personal caring that would not likely differ across the three mind mapping activities. Because the items in the Jones (2010) study were targeted at the course level and we were interested in the determining students" beliefs at the activity level in the present study, we changed the word "course" in the Jones (2010) items to "mind mapping activity" in the present study. One example item from each instrument follows: for empowerment, "My instructor encouraged me to ask questions during the mind mapping activity" (1 = *strongly disagree*; 7 = *strongly agree*); for usefulness, "In general, the mind mapping activity was useful to me" (1 = *strongly disagree*; 7 = *strongly agree*); for success, "During the mind mapping activity, I felt confident in my ability to complete the activity" (1 = *very untrue*; 7 = *very true*); for situational interest, "How much did you enjoy participating in this mind mapping activity" (1 = *strongly disliked*; 7 = *enjoyed a lot*); individual interest, "Doing well on the mind mapping activity was very important to me" (1 = *strongly disagree*; 7 = *strongly agree*); academic caring, "During the mind mapping activity, I believe that my instructor cared about how much I learned" (1 = *never*; 7 = *always*); and effort, "I put a lot of effort into this mind mapping activity" (1 = *very untrue*; 7 = *very true*).

Ranking of activities for preference, enjoyment, and learning
In the third questionnaire, students were asked to rank the three mind mapping activities from 1 to 3 based on preference, enjoyment, and which activity helped them learn the content the best. Students were forced to assign only one ranking (ties were not permitted) to each of the three activities for preference, enjoyment, and learning.

Qualitative Items and Analysis
Qualitative data was gathered through the open-ended questionnaire items. Two questions asked them about the things that they liked best and least about creating their mind map. Additionally, in the final questionnaire, after students ranked the three mind mapping activities (based on preference, enjoyment, and which activity helped them learn the content the best)**,** they were asked to explain their rationale for why they ranked the activities as they did.

Open-ended best and least items
Two of the authors independently developed an initial open coding of participants" responses to the questions: "What are some of the things you liked best about creating your mind map?" (which led to 140 codes) and "What are some of the things you liked least about creating your mind map?" (which led to 84 codes). The researchers then sorted the open codes into the MUSIC categories of eMpowerment, Usefulness, Success, Interest, and Caring. Once the codes for each question were sorted, the researchers developed a shorter list of subcategories to describe the main groups of codes within each MUSIC category. Next, they coded both questions separately using the MUSIC subcategories. When the sets of codes were compared, it was determined that the researchers agreed on 45% of the codes for the "Best" question and 42% of the codes for the "Least" question. Because the percentage of agreements was low, the two researchers met to review the coding and to come to a consensus regarding the most appropriate codes for each response where differences occurred. As a further validity check, the two authors met with a third author

(who had not initially coded the responses) and they all verified that the final coded responses were consistent with the MUSIC model categories. One author then summed the number of codes for each sub-category and for each MUSIC category at each level of social mediation to develop an understanding of the level at which each MUSIC category was represented at each level of social mediation.

Open-ended ranking items
Students were asked to explain their activity rankings for their preferences, enjoyment, and learning. Two of the authors read all of the explanations for the students who ranked each map first for preference, enjoyment, and learning, and they identified the common themes.

Results

Research Questions 1 & 2: Mean Ratings of the MUSIC Model Components & Effort

To address the first and second research questions, we computed descriptive statistics for each level of social mediation and compared the differences for each of the MUSIC model components and effort. The first research question asked: For each level of social mediation, how highly do students rate the MUSIC model components and their effort? The means and standard deviations for each level of social mediation, MUSIC model component, and effort are provided in Table 1. The mean value for empowerment for Map 1 is not shown because the items asked about the instructor"s role during the mind map activity which did not make sense for an activity that was completed outside of class time without access to the instructor.

Table 1. Comparison of Mean Values for Each MUSIC Model Component and Effort by Level of Social Mediation

	Level of social mediation[a]			**ANOVA**	
Variable	Map 1 *M* (*SD*)	Map 2 *M* (*SD*)	Map 3 *M* (*SD*)	*F*(2)	$\dot{\eta}^2_P$
Empowerment	---	5.52 (0.86)	5.52 (0.96)	---	---
Usefulness	5.10 (1.16)	4.89 (1.21)	4.79 (1.16)	0.72	.02
Success	5.72 (1.10)	5.84 (0.88)	5.98 (0.76)	0.81	.02
Interest Situational	4.75 (1.09)	4.94 (1.21)	4.88 (1.27)	0.27	.01
Interest Individual	5.05 (1.02)	5.12 (1.13)	4.92 (1.05)	0.35	.01
Caring Academic	5.88 (1.34)	6.28 (0.90)	6.03 (1.07)	1.36	.03
Effort	5.08 (1.25)	5.18 (1.05)	4.99 (1.16)	0.26	.01

Notes. All items were rated on a 7-point Likert-format scale. Empowerment was not measured for Map 1.
[a] Map 1 is the individual out of class map, Map 2 is the individual in class map, and Map 3 is the group in class map
[*] $p \leq .05$

To determine whether students rated one or more of the MUSIC model components higher or lower than the others within any one level of social mediation (i.e., to compare the mean values of the components in any one column in Table 1), we used a repeated measures ANOVA to compare the means of the MUSIC model components for the three levels of social mediation. We conducted one repeated measures ANOVA for each of the three groups of students followed by post-hoc tests of pairwise comparisons (using a Bonferroni adjustment for multiple comparisons). We found a statistical difference among the six MUSIC components for Map 1 ($F[3.3] = 10.16$, $p < 0.001$, $\dot{\eta}^2_P = 0.21$), Map 2 ($F[3.1] = 19.10$, $p < 0.001$, $\dot{\eta}^2_P = 0.33$), and Map 3 ($F[2.8] = 22.76$, $p < 0.001$, $\dot{\eta}^2_P = 0.37$). The post-hoc tests revealed that, for all of the groups, academic caring was rated statistically higher than all of

the other MUSIC components except for success, which was rated as highly as caring, but not higher than some of the other components. Although there were some statistical differences among some of the variables in the groups, there was considerable overlap among the other four variables (empowerment, usefulness, situational interest, and individual interest). Figure 2 shows a graphical representation of the data from Table 1.

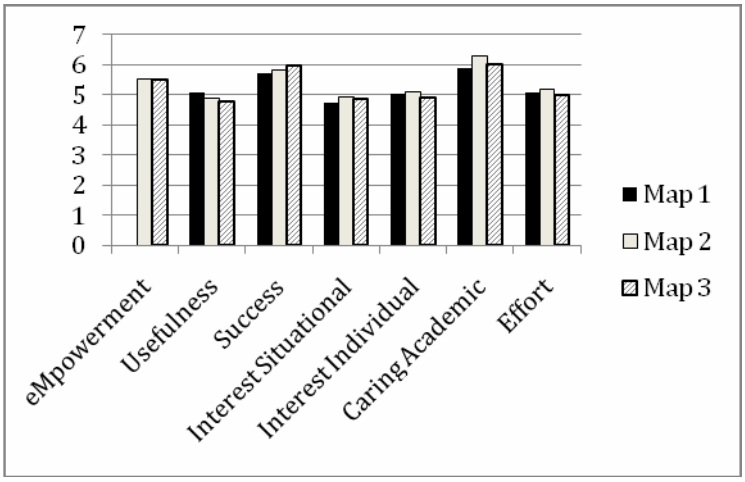

Figure 2. Mean ratings for the six MUSIC model components and effort

To answer the second research question and determine whether there were mean differences among the three groups (i.e., to compare the mean values in any one row in Table 1), we conducted one repeated measures ANOVA for the MUSIC model components (excluding empowerment) and effort. There were no statistical significances among the three levels of social mediation for any of the MUSIC model components or effort (see Table 1). We used a paired-samples *t*-test to compare the mean values for empowerment for Map 2 and Map 3 and found no statistical difference between them, $t(39) = 0.00$, $p = 1.00$. The similarities in the mean values for the three map activities can be seen in Figure 2 (i.e., the bars in Figure 2 for any one MUSIC component, and effort, are similar in height).

Research Question 3: Relationships Between MUSIC Model Components and Effort

We computed Pearson correlation coefficients to answer the third research question: To what extent are students" scores on MUSIC model components statistically correlated with their effort? As shown in Table 2, all of the MUSIC model components, regardless of level of social mediation, are statistically correlated with effort except for empowerment in Map 2 and for success in Map 1.

Table 2. Intercorrelations Among Levels of Social Mediation

	Effort		
Variable	**Map 1**	**Map 2**	**Map 3**
1. Empowerment	---	.28	.52***
2. Usefulness	.69***	.65***	.74***
3. Success	.23	.37*	.48**
4. Situational interest	.67***	.77***	.68***
5. Individual interest	.83***	.81***	.83***

6. Academic caring	.46**	.38*	.32*

Note. Empowerment was not measured for Map 1.
* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

Research Question 4: Preference of Mind Mapping Activities

Research Question 4 asked: Why do students prefer certain mind mapping activities over others? To address this research question, we asked them to consider the three mind mapping activities and rank them according to which they preferred the most, enjoyed the most, and learned the content the best from; additionally, we asked them to explain their answers. We also asked students what they liked best and least about creating the mind maps.

Students' Ranking of Preferences, Enjoyment, and Learning Content. On the third (i.e., final) questionnaire, we asked students to rank the three mind mapping activities from 1 to 3 with respect to how much they preferred the activity, enjoyed the activity, and learned content from the activity. The results are presented in Table 3. No clear pattern emerged from these rankings, indicating that students" perceptions of preferences, enjoyment, and learning differed. The only ranking that more than half of the students agreed on was that Map 3 was more enjoyable than Map 1 or 2.

Table 3. Students"RankingsofMindMapActivities

		Ranking		
Item	**Map**	**1**	**2**	**3**
Preferred	1. Individual out of class	14 (35.0%)	12 (30.0%)	14 (35.0%)
	2. Individual in class	9 (22.5%)	16 (40.0%)	15 (37.5%)
	3. Group in class	17 (42.5%)	12 (30.0%)	11 (27.5%)
Enjoyed	1. Individual out of class	10 (25.0%)	12 (30.0%)	18 (45.0%)
	2. Individual in class	4 (10.0%)	20 (50.0%)	16 (40.0%)
	3. Group in class	26 (65.0%)	8 (20.0%)	6 (15.0%)
Learned the most	1. Individual out of class	16 (40.0%)	12 (30.0%)	12 (30.0%)
	2. Individual in class	11 (27.5%)	19 (47.5%)	10 (25.0%)
	3. Group in class	13 (32.5%)	9 (22.5%)	18 (45.0%)

Note. Students ranked the social levels on a scale using 1 (preferred/enjoyed/learned most), 2 (preferred/enjoyed/learned second most), and 3 (preferred/enjoyed/learned least).

We decided that it was important to determine whether the students who preferred a particular map the most also enjoyed it the most and learned the most content from it. Of the 14 participants who ranked Map 1 first as their preferred activity, nine also ranked it first for enjoyment (four ranked it second and one ranked it third); nine also ranked it first for learned the most (five ranked it second). Thus, most students who preferred Map 1 the most also enjoyed it the most and learned the most content from it. Of the nine students who ranked Map 2 first as their preferred activity, only three also ranked it first in most enjoyed (three ranked it second and three ranked it third). However, six of these students also ranked it first for learned most (two ranked it second and one ranked it third). All 17 of the participants who ranked Map 3 first as their preferred activity also ranked it first as their most enjoyed activity. Only eight of the 17 who ranked Map 3 first for preferred also ranked it first in learned the most from (three ranked it second and six ranked it third). Therefore, even though some students preferred and enjoyed Map 3 the most, less than half believed that they learned the most from it when compared to Map 1 and 2.

Ranking Explanations

We asked students to explain why they ranked the activities the way that they did and we read all of the explanations for the students who ranked each map first for preference, enjoyment, and learning. The themes we identified are presented in Table 4.

Table 4. Themes of Responses for Students who Ranked Each Map First

Item	Map 1	Map 2	Map 3
Preference	More time to try harder More resources More comfortable working at home Fewer distractions	Do not have to do it on own time Instructor available to help	Can learn from others" ideas Liked the interactions with others and the social aspect
Enjoyment	Liked working on own More efficient Freedom as to when to complete it	More freedom	Enjoyed hearing new ideas Enjoyed the interaction and conversing Able to ask peers questions Able to ask instructor questions
Learning	Active practice Connected ideas on own Chance to reflect Forced to read and learn Had time to connect ideas	Fewer distractions led to more focus More learning in class setting	Had new ways of looking at ideas Did not have to think out connections Did not have to do all the parts Able to get help

Things Students Liked Best About Creating Mind Maps

When we asked students what they liked best about Map 1, usefulness (39% of the codes), situational interest (35% of the codes), and empowerment (23% of the codes) were the main categories that emerged, together accounting for 96% of the codes (see Figure 3). Success (4% of the codes) was reported much less frequently and caring was not reported at all for Map 1. Students described both the immediate usefulness of the activity, "I liked seeing how the information was connected," and longer term usefulness, "I liked that it helped me organize my thoughts and I can always look at it for a quick review." The majority of responses for situational interest described the students" interest in the creativity and use of color in the activity such as, "I love being able to use color and drawings to help convey the message and add meaning to the words." Students" responses related to empowerment were focused on the level of control and freedom they felt when completing their mind map. As one student noted, "I was comforted knowing that I had complete control over the design of my mind map."

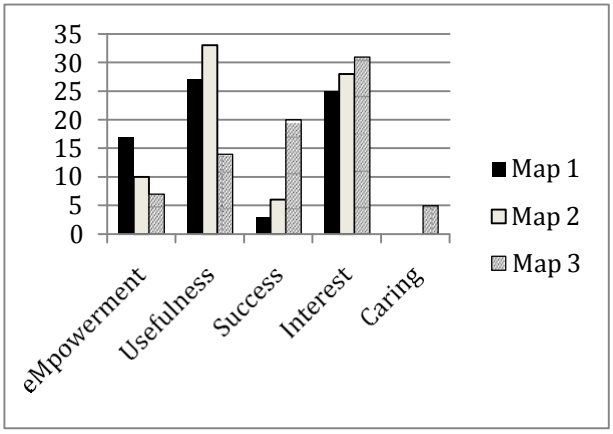

Figure 3. Frequency of codes for students" responses to things that they liked best about creating mind maps

Similar to Map 1, usefulness (43% of the codes) and situational interest (36% of the codes) were the categories that emerged the most when students described what they liked best about Map 2 (see Figure 3). Fewer responses were coded into empowerment (13% of the codes), success (8% of the codes), and caring (0% of the codes). Students described the activity as useful because completing the mind map helped them to learn and recall the concepts, to organize, and to see connections between the concepts. One student explained, "I believe that this activity made me think deeper then [*sic*] I normally would about a subject;" whereas another reported that "it made me really think about how each component connected to the main concept and relate it to my life." Students" responses related to situational interest were similar to Map 1: they enjoyed having the opportunity to use color and draw. As one student noted, "I got to use colorful markers and paper so it made the activity more stimulating and exciting."

The responses for Map 3 were somewhat different than Map 1 and 2. Situational interest (41% of the codes) and success (26% of the codes) emerged as the main categories describing what students liked best about Map 3 (see Figure 3). Students provided fewer responses coded into usefulness (18% of the codes), empowerment (7% of the codes), and caring (6% of the codes). The majority of situational interest codes were related to the enjoyment of working in a group; for example, "I liked being able to be in the group instead of having it be an individual effort." Similarly, when student responses related to their feelings of success, they described the benefits of collaborating with group. As one student noted, "I liked working within a group. It helped bring important aspects that I myself might not have picked up on and brought into the mind map on my own."

Things Students Liked Least About Creating Mind Maps

Success (56% of the codes) emerged as the key category through which students expressed what they liked least about all levels of social mediation. The other categories had fewer responses, including interest (14% of the codes), empowerment (12% of the codes), usefulness (9% of the codes), and caring (10% of the codes) (see Figure 4). Students had several main concerns related to the success component because the maps challenged their abilities by making them be artistic, include images, come up with ideas, and combine individual"s ideas (when working in their group on Map 3). One concern that was expressed by some students for all the maps was that they were not an effective learning tool for the individual student. A student working on Map 3 noted: "I study and remember better with making organized listings" (as opposed to making a mind map of the

information). With respect to Map 2, a student reported: "I thought there were more effective study tools I have used in order to comprehend information." After creating Map 3, one student responded: "I am not a huge fan [of the mind mapping], I prefer to write out more linear outlines." However, for Map 1 (compared to Maps 2 and 3), students were more likely to describe challenges related to coming up with ideas, for example: "There is so much information that can go into something like this is it"s hard to condense it and choose what really relates to my topic." When working individually on Maps 1 and 2 students remarked that they were concerned about the expectation to be creative. In response to Map 1, one student noted: "I am not creative and I felt it required you to be so. That was semi-difficult and made me not so excited about completing this activity." Similarly, with respect to Map 2, a student replied: "I have more of an analytical personality, so to attempt to be creative/inventive/artistic was very challenging to me." Students expressed concerns with the time constraints related to completing the mind map in class for Maps 2 and 3. For Map 2, one student noted: "I didn"t have enough time to finish, and finishing what I start is important to me." This feeling was repeated by another student about Map 3: "Time constraints are always hard to deal with, especially when in a group activity and everyone has ideas to add but not everything can be done." However, for Map 3 the largest amount of codes related to success was related to students" concerns with working in a group. One student noted: "It was the hardest mind map because it was a task of trying to combine four different people"s approaches to mind maps which is harder than you think!"

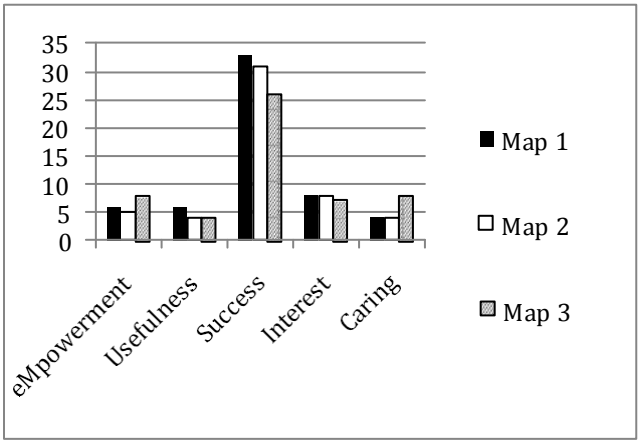

Figure 4. Frequency of codes for students" responses to things that they liked least about creating mind maps

Discussion

Research Questions 1, 2, and 3

The first research question asked: For each level of social mediation, how highly do students rate the MUSIC model components and their effort? The mean values for the six MUSIC model components were all above the mid-point of the Likert-format scales, indicating that students believed that: the mind mapping activities were somewhat empowering and somewhat useful, they were capable of succeeding, they were somewhat interested in the activities, they found the activities to be somewhat important, and that the instructor almost always cared about whether they succeed academically. Because all of these MUSIC components are important to students" motivation (Jones, 2009), we can generally state that these mind mapping activities were somewhat motivating to students. This is also

evidenced by the fact that students reported that they put some effort into the activities. Given the range of students" responses, and the fact that the standard deviations were about 1.1 for most of these components, we also know that there was variation in students" responses: some students found the activities more motivating and some found them less motivating. Academic caring and success were rated higher than most of the other components and the mean scores across activities for these two components were about a 6 on a 7-point scale. Thus, we conclude that many students felt that the instructor cared about their success and that they could succeed at these types of mind mapping activities. Success was a concern for students though, as evidenced by the fact that several students discussed that they were worried that they would not be as artistic as they needed to be or that they would not be able to come up with ideas for their map. In the end, students felt successful or they would not have rated the success items so highly.

The second research question asked: Is there a statistical difference in students" scores for the MUSIC model components and effort ratings among the levels of social mediation? We documented no statistical differences in average scores for the MUSIC model components or effort across the three mind mapping activities. Thus, based on this information alone, it appears that the three activities are equally as effective at motivating students. We provide a more complete discussion of these results with the qualitative findings in the sections that follow.

The third research question asked: To what extent are students" scores on MUSIC model components statistically correlated with their effort? The fact that all of the components correlated with effort provided some validity for our choice of using the MUSIC Model of Academic Motivation as a framework to examine the mind mapping activities. In other words, it would be useless to examine students" perceptions of the MUSIC components if they were not correlated with students" effort or some other important outcome. The MUSIC model predicts that higher scores on the MUSIC components should be associated with increased student effort (Jones, 2009), which was what we documented in this study.

Research Question 4

Research Question 4 asked: Why do students prefer certain mind mapping activities over others? The ranking data related to students" preferences, enjoyment, and learning showed some patterns, especially when we analyzed the data related to how students who preferred certain maps enjoyed them and learned from them. Although students had a variety of perceptions, students tended to prefer Maps 1 (individual out of class) and 3 (group in class) more than Map 2 (individual in class). One reason that students preferred Maps 1 and 3 more than Map 2 might be that these activities are more common in other university courses than the Map 2 activity which required students to work on the assignment individually during class time, but did not allow them to talk to the other students. Students might have felt less comfortable completing the Map 2 activity than working with others in class or out of class independently. Nonetheless, the quantitative results in Table 1 indicated that students were as equally motivated to engage in all of the mapping activities.

To explain students" preferences, we examined how students who preferred each map rated their enjoyment and content learned. The majority of students who preferred Map 1 also enjoyed it the most and felt that they learned the most content from it. The students who preferred Map 2 seemed to prefer it more because they believed that they learned from it rather than because they enjoyed it. It is possible that enjoyment was not as high because students felt the pressure of their classmates" presence in the same classroom without the benefits of working with them. That is, they could see the progress that other students were

making as they sat in the classroom, but they could not ask their classmates for help or suggestions.

All students who preferred Map 3 also enjoyed Map 3 the most. The results presented in Table 4 indicate that these students enjoyed Map 3 because they found the higher level of social mediation to be enjoyable. They enjoyed hearing new ideas, interacting and conversing with peers, and asking peers and the instructor questions. This finding lends support to the idea that when some students worked in collaborative groups with their peers to create the mind maps and were in the presence of the instructor for immediate and direct guidance, they enjoyed the activity the most. This finding is consistent with the emphasis of sociocultural learning (Salomon & Perkins, 1998) for which the social context of learning must be taken into consideration when planning instruction.

But unfortunately, over half of the students who selected Map 3 as the one they enjoyed the most did not select Map 3 as the one they learned the most from completing. This finding suggests that although students enjoyed working in groups in class, they perceived that they learned more from working on the maps individually. The results in Table 4 indicate that students who learned the most from Maps 1 and 2 (which were completed individually), reported reasons that are consistent with effective learning strategies (see Ormrod, 2008): they engaged in active practice; they had more time to read, connect ideas, and reflect; and they were more focused because they experienced fewer distractions. These types of learning strategies were not prevalent in the responses of students who rated Map 3 their first choice. Instead, students who reported learning the most from Map 3 stated that they had new ways of looking at ideas, did not have to think out connections, did not have to do all the parts, and were able to get help. These responses suggest a lower level of individual responsibility for students" learning; and instead, indicate more reliance on others. Given the importance of being active during the learning process, we speculate that it is possible that students did indeed learn more content material when they worked individually; but more evidence is needed to verify this assertion. Future studies could examine the amount of student learning that results from working individually versus working in a group for these types of tasks.

To examine students" preferences of mind mapping activities further, it is useful to compare the results of Figure 3, Figure 4, and Table 4. The primary differences in the percentage of codes shown in Figure 3 are that students reported more responses that were coded as usefulness and empowerment for the maps completed individually (Maps 1 and 2) and more responses coded as success for the map completed in groups (Map 3). These findings are consistent with the themes presented in Table 4. Students likely found Maps 1 and 2 useful because they learned more, as discussed previously. It is also clear from the themes in Table 4 that students felt more empowered for Maps 1 and 2; they discussed liking to work on their own, that they had freedom as to when to complete the map, and that they had more freedom in general. Students likely reported more success codes for Map 3 than Maps 1 and 2 for the reasons presented in Table 4: they could learn from others" ideas, they had new ways of looking at ideas, they did not have to do all the parts, and they were able to get help. When asked what they liked least about the mind maps, students commented specifically about the fact that they worried that they might not be creative enough or be able to develop enough ideas. Their concerns would likely be fewer if they worked in groups, instead of individually, because they would be able to rely on their group members for some help. Working in groups was not easy though and some students found it challenging to complete the maps in groups. Others reported feeling less successful completing Map 3 because of the difficulty involved in combining approaches and ideas within a group. Thus,

although some students enjoyed the social interaction in groups, they worried about whether they would be successful in completing their map well.

Limitations

The findings of this study must be interpreted within the context of the limitations. First, the sample size of 40 was sufficient, but not very large. Including more students in the sample would allow researchers to make more statistical comparisons between sub-groups of students. Second, the mind map activities were implemented in an educational psychology course. Perhaps students in courses of different sizes or of a different type (i.e., courses in different content areas or that use different teaching approaches), or students who might not choose to enroll in an educational psychology course, would have different beliefs about the mind mapping activities. Third, all of the data collected were self-reported on a questionnaire. For many of the constructs, self-report was the only way to obtain the data because they were beliefs or interests which are hard to observe directly. However, future researchers should consider other means of data collection, such as interviews, to better understand the connections between students" preferences, enjoyment, and perceived learning. Future studies could also be strengthened by basing students" beliefs about learning not only on a self-report measure, but also on some type of quantitative measure (e.g., test scores, objective mind map grades).

Conclusions and Implications

The findings from this study indicate that there were not average differences in students" perceptions across three different socially mediated mapping activities for the MUSIC model components or effort. But when forced to rank the mapping activities, students varied in their reported preferences, enjoyment, and learning, which allowed us to examine differences in some subgroups of students. Taken as a whole, the results led us to conclude that although the average ratings on the three mind mapping activities were similar, students have a variety of beliefs about the activities and what they can learn from them. Given the differences in students" rankings of the mapping activities, it appears that an instructor cannot satisfy all students" learning preferences with the same mapping activity. Thus, one implication is for instructors to vary their mapping activities to increase the likelihood that they will meet the learning preferences of students. Although we are not advocating for instructors to teach to a particular learning "style," research does indicate that varying instructional methods can lead to greater student interest and engagement (see Bergin, 1999), which is why we recommend implementing different types of activities when possible.

A second implication of these findings is that instructors should allow students to choose from among a variety of mapping activity options. By allowing students to choose whether to complete the map individually out of class, individually in class, or with a group in class, instructors would give them control over their learning, which in itself should lead to greater engagement as predicted by the empowerment component of the MUSIC model (Jones, 2009). Our experience as students and instructors leads us to believe that students might not always make the best choice in terms of what is most beneficial to their learning because they might be focused on other academic goals (e.g., getting a high grade instead of learning the most). However, forcing students to complete one activity instead of another would likely do little to change these goals, but would have the advantage of providing students with empowerment and allowing them to best meet their learning preferences if they choose to do so.

A third implication is that instructors should consider how the mind mapping activities affect students" motivation and learning, not just one or the other. Because of the trend in higher education to make students more "active" learners, instructors might believe that simply placing students in groups is sufficient to actively engage them in their learning. The results of this study suggest that the activities that students perceived as being more preferred or enjoyable were not always the ones that they perceived they learned the most from. Students reported that they were actively interacting with their group members, but not all of them believed that they learned as much from this type of active interaction process as when they actively constructed the maps on their own. As a result, instructors need to carefully consider why they are placing students in groups and what the effects of doing so might be on students" motivation and learning.

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Appendix A

Mind Map Instructions

Directions: Create a mind map organizing your understanding of the reading.

Remember the steps of mind mapping:

Step one: Brainstorm:

1. Write the topic in the center of a blank page.
2. Use colors, pictures, words, and symbols to record any ideas, topics, researchers, or theories that are associated with the topic. You can place these anywhere on the page. Associate freely and do not filter out ideas at this point; anything and everything is okay.

Step 2: Organization:

3. Map the relationships between the ideas or key points using lines, arrows, colors, and words to link them.
4. Identify the type of relationship between ideas or points, such as: contrasts, similarities, cause and effect. Write these relationships along the linking lines.

Step 3: Mind Map:

5. Once you are comfortable with the associations and organization in your brainstorm, then use the ideas that you have developed to draw out your final mind map.

These instructions were adapted from information at the *Language and Learning Online* website at Monash University, and are available at http://www.monash.edu.au/lls/llonline/quickrefs/25-brainstorming.xml

Appendix B

Mind Map Grading Rubric

Grade	Rubric
A	**Important concepts** – are the important concepts included? Most all of the important concepts are included. **Organization** – does the organizational structure make sense? The organization is clear and makes sense. **Detail** – is there enough detail to describe the important concepts? There is a lot of specific information that describes the important concepts. The student could use the map to study for a test without using the book and get an "A" on a test. **Color and Images** – are color and images used effectively to help the retention of the material? Color is used in an appropriate manner to help with organization and to help foster retention of the material. Several images are used to facilitate retention.
B	**Important concepts** – are the important concepts included? Some of the important concepts are not included. **Organization** – does the organizational structure make sense? The organization is clear and makes sense, but could be better (e.g., it"s crowded). **Detail** – is there enough detail to describe the important concepts? Specific detail that describes the important concepts is missing in some critical areas. **Color and Images** – are color and images used effectively to help the retention of the material? Color is there, but does not really help with organization or help to foster retention of the material. Only a few images are provided.
C	**Important concepts** – are the important concepts included? Some of the important concepts are not included.

	Organization – does the organizational structure make sense? The map is not well organized (e.g., it"s crowded, similar concepts are not grouped together). **Detail** – is there enough detail to describe the important concepts? Specific detail that describes the important concepts is missing in several areas. **Color and Images** – are color and images used effectively to help the retention of the material? Color and images are very limited.
D or F	**Important concepts** – are the important concepts included? Many of the important concepts are not included. **Organization** – does the organizational structure make sense? The map is not well organized (e.g., it"s crowded, similar concepts are not grouped together). **Detail** – is there enough detail to describe the important concepts? Specific detail that describes the important concepts is missing in many areas. **Color and Images** – are color and images used effectively to help the retention of the material? Color and images are very limited to non-existent.