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The Effect of Concept Mapping on Preservice Teachers' Reflective Practices when making Pedagogical Decisions

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Abstract

The purpose of this study was to determine the effect of using concept mapping to promote reflective instructional decision-making among junior level education preservice teachers when planning lessons for elementary and secondary students. The researchers were interested in determining if there was a connection between the use of concept mapping to help preservice teachers improve their instructional decisions when planning lessons and their reflective practices when striving to improve the quality of their lessons. The eighty-five participants in the study were junior education majors enrolled in an introductory education course (Planning and Teaching Strategies for Effective Classroom Practice). This course provided opportunities for reflection of classroom practices, curriculum design and planning. The intervention group consisted of forty-one ($n = 41$) preservice teachers and the control group consisted of forty-four ($n = 44$) preservice teachers.

Keywords: Concept mapping, reflective processes, pedagogy, instructional decisions.

In 2002 President Bush stated, "The effectiveness of all education reform eventually comes down to a good teacher in the classroom. A good teacher can literally make a lifelong difference". Teacher education programs assist prospective teachers on the road to becoming effective teachers by providing the basic knowledge and skills necessary. The ability to reflect on one's work and improve practice based on these reflections are important pieces to becoming an effective teacher. University instructors assist preservice teachers by teaching them about the instructional situations they will encounter in the classroom and asking them to reflect on their observations. According to Moore (2003), field experiences hold great potential for providing preservice teachers the opportunity to practice instructional decision making and reflective practice. Through reflection, preservice teachers analyze classroom situations in order to make appropriate pedagogical instructional decisions as they plan lessons. These decisions are key to effective instructional planning and teaching. Their skill in reflection will be a vital skill as preservice teachers enter the teaching workforce.

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The training process for preservice teachers often includes planning several days of lessons related to a common theme or concept. Lim, Cheng, Lam and Ngan (2003) pointed out that many preservice teachers demonstrate difficulty making content connections when planning sequential lessons that span several days. The skill to effectively organize and reflect upon the content during planning can be a key to assisting preservice teachers with this task. Zeichner and Liston (1996) stated that preservice teachers who practice reflective teaching give careful thought to the instructional choices made throughout the process of planning and teaching. They also anticipate and assess the impact their choices have on student learning. According to Veal and MaKinster (1999), the theoretical basis for reflective practices includes constructivism, metacognition, and the notion of pedagogical reasoning. In order to help preservice teachers adequately construct knowledge in regard to effective instructional planning, it is important for them to be aware of the process of learning. Constructivism is a theory of how people learn - the belief that we construct knowledge in unique ways, based on our prior knowledge and experience. Metacognition involves a person's awareness of the process of learning. Pedagogical reasoning defines the process of identification and selection of strategies for representing key ideas in the lesson. Reflection requires preservice students to think about what they know as well as how students learn and to understand that this impacts their effectiveness as teachers.

Several research studies have been conducted that investigated reflective practices of preservice teachers. One such study, conducted by Bainer and Cantrell (1995), identified nine dominant themes or categories of reflective units on which preservice teachers reflect. Their findings revealed that preservice teachers improved in their reflective abilities when addressing issues related to teaching and learning and they achieved somewhat higher levels of reflection when focusing on these nine themes. Another study conducted by Penso, Shoham, and Shiloah (2001), focused on combining the development of teaching skills with reflective activity. Their findings pointed to the need to consider ways of creating opportunities for the development of reflective thinking among preservice teachers, which could promote the development of their ability to think critically and be flexible in solving problems. A third study, conducted by Lim et al. (2003), studied the effect of semantic mapping on the reflective and thinking skills of kindergarten teachers. They found that visual maps were excellent as a medium for displaying a network of visual information. Implications for further study included using mapping as a way to categorize, link and organize concepts while planning lessons.

Hyerle (1996) recommended the introduction of a common visual language, such as concept maps, to help in the development of reflective thinking. When consistent and flexible patterns of thinking are introduced, applied, and reinforced, a deeper level of understanding of interrelated thinking processes could develop over time. The use of a common tool, such as concept maps, by the university instructor in the teacher education class provides a "common visual language" so that all preservice teachers have a similar format when discussing planning and instructional practice. Fraser (1993) pointed out that a concept map is intended to externalize an individual's cognitive structure. Through the actual process of constructing a concept map, the individual can also make new connections and recognize concepts which should be added.

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Fosnot (1996) stated that reflection of both content and the learning process is paramount to the development of effective lessons. The findings of a study conducted by Weiss and Pasley (2004) reported that of the 350 representative lessons studied, only 15% were classified as being of high quality. The researchers pointed out that many lessons judged to be highly effective included a variety of experiences that enabled students to tap into multiple pathways in developing or reinforcing a concept. Martin (1994) conducted a study in which he taught education majors to use concept maps to develop lesson plans. Professors in the study stated that their students viewed concept mapping as a way of providing a more comprehensive understanding of what they were preparing to teach, eliminating sequencing errors, and enabling teachers to develop lessons that are truly interdisciplinary.

Reflecting on decisions involved in producing high quality lessons is only the beginning. In order to be considered effective teachers, preservice teachers are required to demonstrate pedagogical content knowledge as well. Veal and MaKinster (1999) defined pedagogical content knowledge as the ability to translate subject matter to a diverse group of students using multiple strategies and methods of instruction and assessment while understanding the contextual, cultural, and social limitations within the learning environment. These pedagogical strategies included: planning, teaching methods, evaluation, group work, questioning, wait time, feedback, individual instruction, lecture, demonstration, and reinforcement. According to Hyerle (1996) the process of developing pedagogical content knowledge can be aided by the use of visual webs.

Brooks (2004) stated that the uncontested purpose of our education system is to teach for meaning, prepare students for the varied worlds beyond school, foster students' deep understandings of content areas, and lead students to achieve and to develop the disposition to want to achieve. Searching for meaning is the purpose of learning, so teaching for meaning is the purpose of teaching. With this in mind, Brooks (2004) further stated that researchers have extensively studied concept mapping in K-12 learning environments as a tool to help learners understand the concept of similarities and differences, cause and effect, part as opposed to whole and analogical sets. Yet the education system does not stop with the K-12 learning environment. Understanding these types of relationships is an essential component of conceptual change and cognitive growth in the development of content meaning in all departments at institutions of higher education as well.

Kinchin (2000) pointed out that work by Novak has shown concept mapping to be a classroom technique that can enhance learning in the sciences. Harpaz, Balik, and Ehrenfeld (2004), studied the use of concept mapping as a method for advanced learning in nursing education. Nursing school students and instructors were asked to compare concept mapping with traditional teaching methods of instruction. Their findings suggested nursing programs could benefit from incorporating the use of concept mapping as a teaching method. Other programs at institutions of higher education have explored the use of concept mapping to help university students develop a deeper understanding of the content. Freeman (2004) conducted an experiment using a typical business consulting scenario that involved two treatment groups enrolled in a US business school. Results of

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this experiment showed the concept map to be a good communication tool, beneficial, easy to use, and useful to undergraduate university students.

The findings from these cited studies aided the researchers in conducting this study and drawing conclusions based on results of its findings. The implementation and findings from this study are discussed in the following sections.

Statement of the Problem

The purpose of this quasi-experimental research study was to determine the effect of using concept maps to promote reflective instructional decision-making among junior level preservice teachers when planning lessons for elementary and secondary students. The effect on the quality of lesson plans prepared by junior level preservice teachers using traditional instruction and concept mapping was compared to junior level preservice teachers who planned lessons using more traditional methods of instruction. Another purpose of the study was to examine the effect of concept mapping on the reflective processes of junior level preservice teachers when making pedagogical instructional decisions.

Hypotheses

Hypothesis #1:

The lesson plan quality of junior level preservice teachers using concept mapping and receiving traditional instruction will not differ significantly from the lesson plan quality of junior level preservice teachers receiving only traditional instruction.

Hypothesis #2:

The reflective practices of junior level preservice teachers making pedagogical instructional decisions using concept mapping and receiving traditional instruction will not differ significantly from the reflective practices of junior level preservice teachers making pedagogical instructional decisions receiving only traditional instruction.

Limitations of the Study

One limitation of this study was one of the researchers instructed participants and scored lesson plans and reflective journals of both groups. Experimenter bias could result in the instructor/researcher unintentionally transmitting expectations about the outcomes of the study to the participants, subsequently affecting their behavior. Kaptchuk (2003) stated that awareness of subjectivity will make assessment of evidence more honest, rational, and reasonable. Nevertheless, awareness of the systematic errors that can occur in evaluative processes may facilitate the self regulating forces and help produce reliable knowledge. Precautions taken to avoid the risk of experimenter bias consisted of numbering the papers rather than having students write their names on lesson plans and journals, mixing the lesson plans and journals of the treatment and control groups when scoring and, the

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recruitment of an outside scorer to insure reliability. A second limitation may have been that the course was taught during a full summer school term. This could have added to the intensity of the course; however, the preservice teachers received the same amount of contact time with the instructor, the same content and had to meet the same requirements as in the regular fall or spring terms.

Delimitations

A delimitation of the experimental study was that the researcher used four junior level classes during a full summer term. The time frame for full summer courses was a two month period, from the beginning of June to the end of July. The summer classes were taught two times a week for two and one-half hours per class session. The fall and spring classes were taught two times a week for one and one-quarter hours per class session. Summer school students attended a total of fourteen class sessions while fall and spring students attended a total of twenty-eight class sessions, yet contact hours were equal.

Design

A quasi-experimental nonequivalent design was used in this study since the research participants were not randomly assigned to the experimental and comparison groups. The independent variable was the intervention method – concept mapping plus traditional instruction and traditional instruction only. The dependent variables were the scores on the Reflective Journal/Teacher Work Sample (TWS) and the Student Teacher Assessment Instrument (STAI) Checklists.

Participants

The convenience sampling for this study consisted of eighty-five university students in four junior level education classes. The groups were formed by the university's course enrollment procedures, with all participants meeting prerequisite requirements for the course. Prerequisite requirements included the completion of 45 hours of core curriculum, a grade point average of 2.50 or above, passing scores on the Praxis 1: Pre-Professional Skills Tests, successful ("C" or better) completion of junior level pre education courses, and approval by the Teacher Education Committee. Each class consisted of no more than thirty-five students. Students agreed to participate by signing a consent form.

Table 1 contains demographic information about the participants' age ranges. The majority of the participants (58%) were in the traditional twenty to twenty-five year age range. Twenty-six of the forty-nine participants in this range were in the intervention group while twenty-three were in the control group. Twenty-three percent (23%) of the students were in the non-traditional twenty-six to thirty-five age range. Nine of this 23% were in the intervention group while eleven were in the control group. The remaining nineteen percent (19%) consisted of participants that were over thirty-five years of age.

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Seven participants over the age of thirty-five were in the intervention group with nine in the control group.

Table 1. Age of Participants.

Age Range	Intervention	Control	Number	Percent
20-25	26	23	49	58%
26-30	6	5	11	13%
31-35	3	6	9	10%
36-40	2	2	4	5%
41-45	2	5	7	8%
46-50	2	2	4	5%
Over 50	1	0	1	1%
Total	41	44	85	100%

Table 2 indicates the number and percentage of traditional and non-traditional students in both the intervention and control groups. As shown in this table, the percentage of traditional and non-traditional students was closely distributed, with 49% being traditional and 51% being non-traditional. The number of participants in the traditional group were evenly distributed, with twenty-one in both groups. Non-traditional participants in the control group (23) slightly outnumbered the traditional participants in the intervention group (20).

Table 2. Traditional or Non-Traditional Classification of Participants.

Classification	Intervention	Control	Number	Percent
Traditional	21	21	42	49%
Non-Traditional	20	23	43	51%
Total	41	44	85	100%

Table 3 shows the number of participants representing three education programs, elementary, secondary, and special education. The largest percentage of the participants (84%), were elementary majors, followed by 14% of the participants in the secondary program and 2% of the participants in the special education program. The elementary and secondary participants were evenly distributed between the intervention and control groups. The two special education participants were in the control group with no special education participants in the intervention group.

Table 3. Program Classification of Participants.

Classification	Intervention	Control	Number	Percent
Elementary	35	36	71	84%
Secondary	6	6	12	14%
Special Education	0	2	2	2%
Total	41	44	85	100%

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Table 4 shows the percentage of male and female participants, with the large majority of participants (85%) being female. The distribution of male students shows that more male participants were found in the intervention group and more females were in the control group.

Table 4. Gender of Participants.

Classification	Intervention	Control	Number	Percent
Male	9	4	13	15%
Female	32	40	72	85%
Total	41	44	85	100%

The study was guided by two hypotheses. Instruments used to gather quantitative data included a pre-test (one-day lesson plan checklist), a post-test (three-day lesson plan checklist), and a TWS reflective journal checklist.

Instruments

Quantitative data to assess lesson plan quality was obtained from a pretest and a posttest. The Student Teacher Assessment Instrument (STAI) one-day lesson plan checklist provided pretest data and the STAI three-day lesson plan checklist provided posttest data. The STAI instrument was developed by a committee of university faculty, considered experts in the field, from the teacher preparation institutions in the state. This instrument is used by all institutions in the state to assess preservice teachers. It was based on six standard domains developed by the Interstate New Teacher Assessment and Support Consortium (INTASC). Domains included: planning and preparation, communication and interaction, teaching for learning, managing the learning environment, assessment of student learning, and professionalism and partnerships. Content validity is determined by a judgment of whether the items on the checklist measure what they are intended to measure. After initial use of the checklist, revisions were made to the items to insure their validity. The score range for this instrument was 0 – 35 points. Selected items from the STAI were used to gather data to assess lesson plan quality for this study. Both checklists assessed the following STAI standard indicators on a scale from one to four:

1) Specifies or selects learner objectives for lesson.
2) Specifies or selects teaching procedures for lessons.
3) Specifies or selects content materials and technology for lessons.
4) Specifies or selects materials and procedures for assessing learner progress.
5) Uses information about students to plan and organize instruction.
6) Uses knowledge of students' backgrounds, interests, experiences and prior knowledge to make instruction relevant and meaningful.
10) Uses acceptable written communication in lesson plans and student material.

Quantitative data from the Teacher Work Sample/ Reflective Journal provided information for assessing pedagogical decisions. The Teacher Work Sample (TWS) provides evidence of a preservice teacher's ability to design and implement standards-based instruc-

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tion, assess student learning and reflect on the teaching and learning process. Each section of the TWS checklist contained three components that guided students' responses. The components were scored on a scale from one to three. The TWS instrument was designed by the Renaissance Partnership for Improving Teacher Quality and is a Title II federally funded project with offices at Western Kentucky University. The score range for this instrument was 0 – 96 points. Information assessed using this instrument included:

Instructional Design
Analysis of Student Learning
Instructional Decision-Making
Reflection of Teaching and Learning

Results of a study conducted by Denner, P., Norman, A., Salzman, S., Pankratz, R., and Evans, S. (2004) provide initial support for important aspects of content validity for the Teacher Work Sample when used for the purpose of assessing teacher candidates' ability with respect to teaching process standards. Their findings demonstrated that the teacher work sample performance provided a credible means for teacher education programs to verify teacher candidate performance levels. Faculty were trained in using both the instruments to insure inter-rater reliability. This facilitated the consistent rating of student work across all raters.

The concept maps were graded using a holistic rubric created by Novak and Gowin (1984). They provided three theoretical foundations that are used for a holistic scoring rubric for assessing students' conceptual growth of ideas using concept maps: clarifying, expanding, and assimilating. Each of these areas is essential for conceptual growth.

The holistic scoring rubric called MAPPER (Minimum to Reflective) is based on the level at which students are applying their thinking processes to content learning and how students generated and organize their ideas to construct a final product. At the lower level (Minimum to Attending), students demonstrate a relatively simplistic understanding of the content. At the middle level (Participating), students have integrated unique (Patterns) of information and conceptual depth. The higher levels (Effective and Reflective) are demonstrated by students' final products that reveal novel applications and reflectiveness on the process.

Intervention and Control Conditions

Traditional lesson planning instruction consisted of teacher lecture, class discussion, group activities, individual conferences, and the introduction of various instructional tools and strategies for effective planning. Individual conferences with preservice teachers were conducted to ensure understanding of the lesson planning process. The STAI template, with lesson plan components, was used as a guide for instruction along with the course text and STAI manual. Prior to planning the three-day lesson, the intervention group was provided instruction on the construction of concept maps. Instruction consisted of a power-point presentation and a demonstration by the course instructor. Instruction

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was followed by an activity in which preservice teachers brainstormed ideas on a chosen topic and constructed a concept map to share with the class. The students in the intervention group were then instructed to develop a concept map based on their chosen topic for the three-day lesson plans. Both groups prepared their three-day lessons during the following weeks. Students in both the intervention and control groups turned in a three-day lesson plan. In addition, preservice teachers in the intervention group turned in their concept map. The three-day lesson plan was graded using the posttest instrument. Both the intervention and control groups turned in their Teacher Work Samples/ Reflective Journals one week later, which were assessed using the TWS/Reflective Journal Checklist. These instruments provided the quantitative data for the study.

Data Analysis

The purpose of this study was to determine the effect of using concept maps to promote reflective instructional decision-making among junior level preservice teachers when planning lessons for students in grades K-8. Specifically, the two areas to be studied in conjunction with the use of concept mapping were the quality of the lesson plan completed by junior level preservice teachers and the effect on their reflective processes when making pedagogical instructional decisions.

Analysis of the data for Hypothesis 1

Hypothesis 1 stated: The lesson plan quality of junior level preservice teachers using concept mapping and receiving traditional instruction will not differ significantly from the lesson plan quality of junior level preservice teachers receiving only traditional instruction. Descriptive statistics were computed to determine the mean scores for the pretest and posttest for both groups. An analysis of covariance (ANCOVA) was conducted in which the posttest mean of the intervention group was compared with the posttest mean of the control group with the pretest scores used as a covariate.

An independent samples *t*-test was used to test null Hypothesis 1. Before testing the significance of the difference in post-test scores, the researcher conducted a t-test to compare the pre-test mean scores for the intervention group and control group. Pre-test scores of the intervention group (M = Mean = 25.12, $S.D.$ = 5.19) were found to be significantly higher, $t(83) = 2.80$, $p = .006$, than the pre-test scores of the control group ($M = 22.23$, $S.D. = 4.31$).

A one-way ANCOVA was conducted to compare post-test scores for the intervention and control groups while controlling for differences in pre-test means. A preliminary analysis evaluating the homogeneity-of-slopes assumption indicated that the relationship between the covariate and the dependent variable did not differ significantly as a function of the independent variable, $F(1,81) = .126$, $p < .72$. The dependent variable used in the ANCOVA was the three-day lesson plan (post-test). The covariate was the one-day lesson plan (pre-test). Results of the ANCOVA, $F(1,81) = .592$, $p = .44$, $\eta^2 = .007$, supported the null hypothesis. Although the effect size was moderately high ($d = .67$), no statistical significance was found between the intervention group ($M = 29.585$, $S.D.$ =

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3.2919) and the control group (*M* = 27.398, *S.D.* = 2.6667). Therefore the null hypothesis was not rejected.

Table 5. T-test Results for Pre-test Scores.

Group	*F*	*p*	*t*	*df*	*p*	Mean	*SD*	*N*
Intervention	.836	.363	2.80	83	.006	25.12	5.19	41
Control			2.79	77.98	.007	22.23	4.31	44

Table 6. ANCOVA Results of Comparisons of Intervention and Control Groups.

Groups	Sum of Squares	*df*	Mean Square	*F*	*p*
Between	3.77	1	3.77	.592	.44
Within	515.83	81	6.37		

Analysis of the data for Hypothesis 2

Quantitative data from the reflective journal checklist was used to test hypothesis 2 which stated: The reflective practices of junior level preservice teachers making pedagogical instructional decisions using concept mapping and receiving traditional instruction will not differ significantly from the reflective practices of junior level preservice teachers making pedagogical instructional decisions receiving only traditional instruction.

Descriptive statistics were computed to provide information on the mean scores and standard deviations for both groups. To test the hypothesis, a *t*-test was run to determine the level of statistical significance ($p < .05$) of an observed difference between the sample means.

The *t*-test allowed the researcher to compare the mean post-test scores for the intervention and control groups. Scores on the reflective journal for the interventions group (*M* = 91.585, *S.D.* = 5.7052), were found to be significantly higher, $t(83) = 3.83$, $p < .001$, than the reflective journal scores for the control group (*M* = 82.034, *S.D.* = 14.9901). The effect size was moderately high ($d = .64$). The null hypothesis was rejected.

Table 7. T-test Results for Reflective Journals.

Group	*F*	*p*	*t*	*df*	*p*	Mean	*SD*	*N*
Intervention	15.24	.000	3.83	83	.001	91.59	5.71	41
Control			3.93	55.95	.001	82.03	14.99	44

Novak and Gowin (1984) created a holistic scoring rubric for assessing students' concept maps. They provided three theoretical foundations that are used for a holistic scoring rubric for assessing students' conceptual growth of ideas using thinking maps: clarifying, expanding, and assimilating. Each of these areas is essential for conceptual growth.

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These three areas are also worthy filters for looking at how students construct their ideas for completing final products, or for evaluating performance and objectives.

The holistic scoring rubric called MAPPER (Minimum=1 to Reflective=5) is based on the level at which students are applying their thinking processes to content learning and how students generated and organize their ideas to construct a final product. At the lower level (Minimum to Attending), students demonstrate a relatively simplistic understanding of the content. At the middle level (Participating), students have integrated unique (Patterns) of information and conceptual depth. The higher levels (Effective and Reflective) are demonstrated by students' final products that reveal novel applications and reflectiveness on the process.

Analysis of the concept map scores provided the researcher with the information presented in Table 8. Of the forty-one participants in the intervention group, twenty-nine of the participants (71%) scored three or higher on their concept maps. Twelve of the forty-one participants (29%) scored a one or two. This statistical data indicates that the majority of the students had a clear understanding of how to accurately construct a concept map.

Table 8. Concept Map Scores.

Score	Frequency	Percent
1	5	12%
2	7	17%
3	11	27%
4	4	10%
5	14	34%
Total	41	100%

Discussion of Results and Conclusions

Analyzing data acquired from a one-way analysis of the covariance (ANCOVA) to test hypothesis 1, revealed that no significant difference was found in the lesson plan quality of junior level preservice teachers using concept mapping and receiving traditional instruction and the lesson plan quality of junior level preservice teachers receiving only traditional instruction. Junior level preservice teachers often find it difficult to plan multiple lessons of high-quality that connect concepts related to a central theme. Even though Hypothesis 1 was not rejected, the notion that using concept mapping as a way to help preservice teachers organize lessons would appear to be educationally sound since research has shown that visual tools graphically link mental associations in order to create a pattern of information. Novak (n.d.) pointed out that one of the reasons concept mapping is so powerful for the facilitation of meaningful learning is that it serves as a kind of template to help organize knowledge and to structure it, even though the structure must be built up piece by piece with small units of interacting concepts.

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Figures 1-4 provide examples of content area concept maps submitted by participants.

Figure 1.

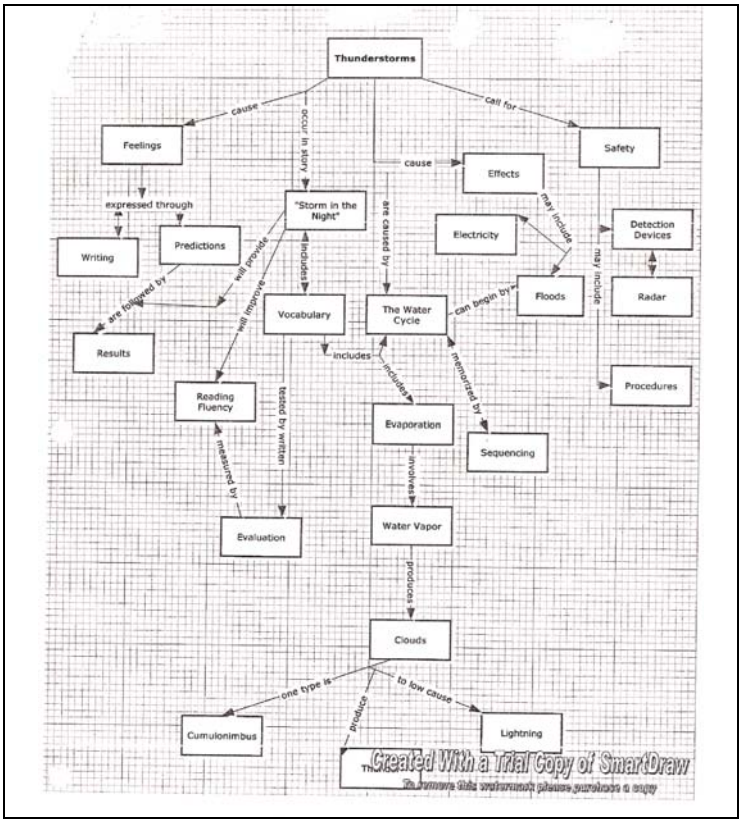

Figure 2.

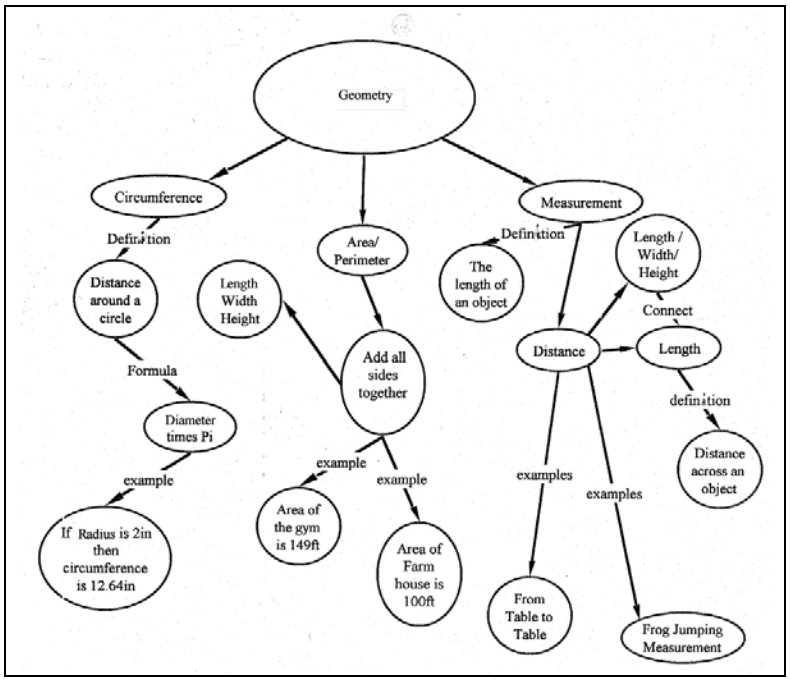

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Figure 3

.

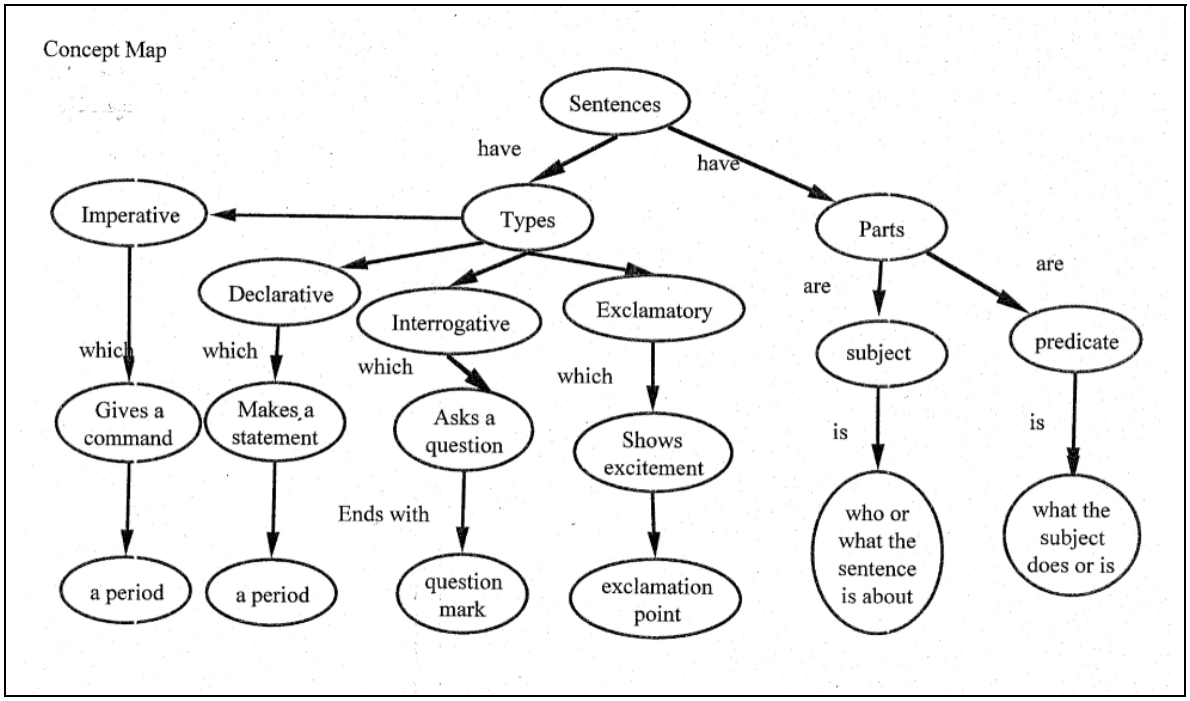
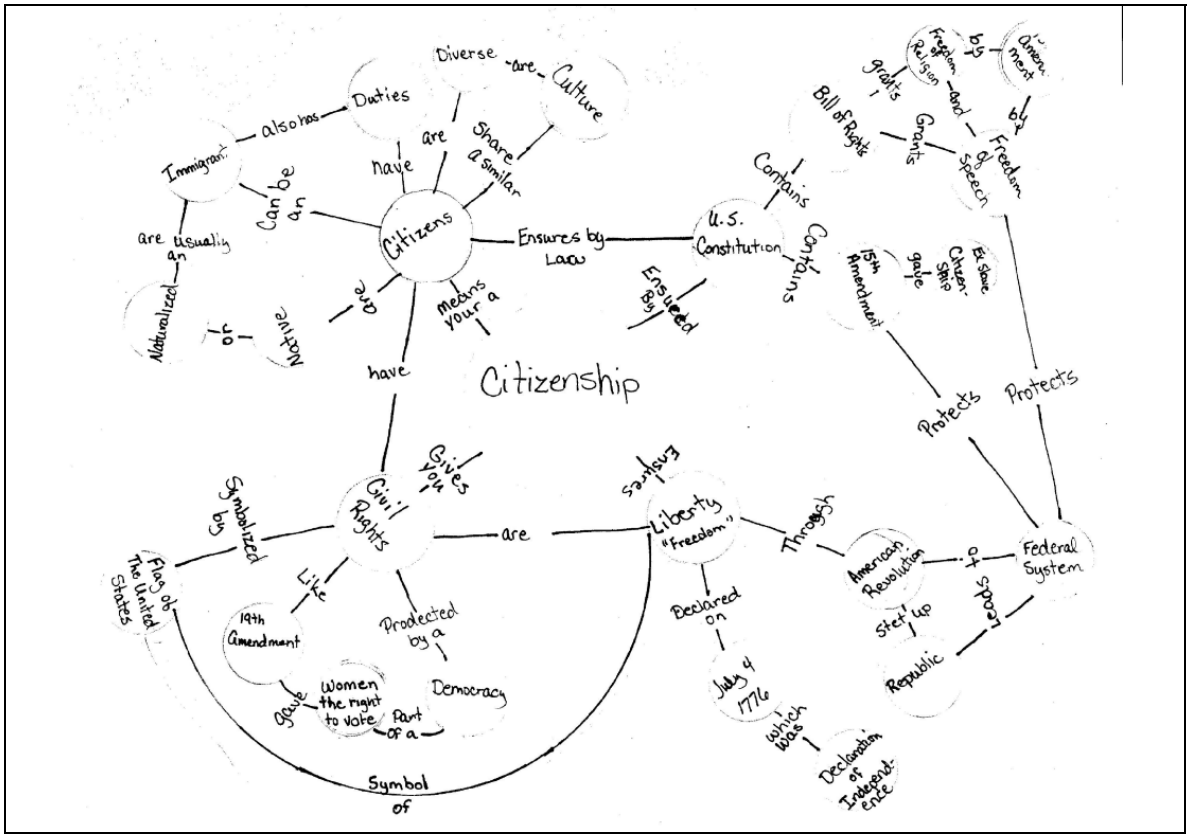


Figure 4.



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One possible explanation of these results could be the quality of traditional instruction each group received. Several strategies to assist in making the connections between concepts for effective planning were included in the course. In addition, each student received specific feedback and individual assistance through one-on-one conferences with the instructor. One instrument used to provide quality traditional instruction on how to plan effective lessons was Hierarchy for Effective Lesson Planning (HELP). This hierarchy provided direction for including procedures that involved students in rich and authentic learning experiences while taking into account the student's sensory engagement with the material. Holmes (2002) specified the levels of experiences teachers should include in instructional activities as follows: 1) real world experiences, 2) real world artifacts, 3) representations of real-world artifacts, 4) pictures and visuals, 5) written descriptions, and 6) oral descriptions.

Another example of quality traditional instruction included a deductive strategy introduced to both groups to assist in developing effective lessons was Madeline Hunter's Decision Line. This deductive approach to instruction included seven-steps to effective lesson planning and focused on the application of research to help teachers make more informed and appropriate decisions in the classroom. These steps included an anticipatory set, objectives/standards, teaching and modeling, guided practice, check for understanding, independent practice, and a closure. Numerous inductive strategies were also included in the traditional instruction, including unguided inquiry, learning cycle, concept formation, cooperative learning, concept attainment, and inquiry training. This extensive use of instructional planning strategies included in both the control and treatment group may have affected the results.

A possible contributing factor to the results of this finding could be the length of the study. Ruiz-Primo, Araceli, and Shavelson (1997) indicated that students can be trained to construct concept maps in a short period of time with limited practice. Taking a closer look at students' maps, the researchers determined that practice improved map characteristics, yet even with limited practice at constructing concept maps, students were able to demonstrate their knowledge on the topic assessed.

Findings from the ANCOVA conducted to test Hypothesis 1 led the researchers to test for a possible correlation between individual concept map scores and the quality of students' lesson plans. To test for a possible correlation, gain scores on the pre- and post-test for the intervention group and concept map scores were analyzed to determine if there was a correlation. No significant correlation between gain scores on the pre- and post-test for the intervention group and the concept map scores was found. These results were unexpected since the researchers had anticipated that higher scores on the concept maps would result in higher scores on lesson plans.

During the research process, some students indicated difficulty in constructing the concept maps. These students commented that it would have been easier for them to just plan and write the lesson plans rather than trying to construct a concept map first. The

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researchers then began to question if scores on concept maps indicated a clear understanding of how to construct concept maps. Scores on the concept maps indicated that the majority (71%) of the preservice teachers in the intervention group had a clear understanding of how to accurately construct a concept map. This finding led the researchers to question whether these comments by students were related to their different learning styles and multiple intelligences.

Hypothesis 2 stated that the reflective practices of junior level preservice teachers making pedagogical instructional decisions using concept mapping and receiving traditional instruction would not differ significantly from the reflective practices of junior level preservice teachers making pedagogical instructional decisions receiving only traditional instruction. Quantitative data from the Teacher Work Sample/ Reflective Journal Checklist provided information for assessing pedagogical decisions. Each section contained three components that guided students' responses. The components were scored on a scale from one to three, with one being the lowest rating and three being the highest rating. Information assessed using this instrument included:

- Instructional Design
- Analysis of Student Learning
- Instructional Decision-Making
- Reflection of Teaching and Learning

Analysis of the results of a t-test used to test Hypothesis 2 revealed that a significant difference was found. These findings implied that the construction of a concept map during the lesson planning process would help preservice teachers be more reflective in their instructional decision making. This finding was of special interest to the researchers because of its potential impact on the training of preservice teachers. Cruickshank, Jenkins, and Metcalf (2006) perhaps the most important benefit of reflection in preparing to teach is that it enhances our learning about teaching. They also pointed out that it is important for university instructors to determine what preservice teachers need to reflect on in order for them to become reflective practitioners and to improve the quality of their lessons.

Recommendations Based on Findings

The results of this study indicated no difference in lesson plan quality among students using concept maps to plan instructional lessons and those not using concept maps. Martin (1994) noted that responses from follow-up questionnaires indicated concept maps intrinsically portray the essentials of sound lesson preparation, and thus are seen as ideally suited to guide teachers in their development of lessons. The method and timeline in which the preservice teachers were introduced to concept mapping in the treatment group may have had an effect on the outcome in this study. The researchers recommend the gradual development of concept maps in conjunction with planning lessons rather than completing the concept map prior to writing the plans.

With respect to the reflective practices of preservice teachers when making pedagogical instructional decisions, findings from this study support Hyerle's (1996) recommendation

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that concept mapping should be perceived as an effective tool to enhance the reflective process. However, it was found in this study that some junior level preservice teachers preferred not to use concept maps. This could be due to individual learning styles or a result of multiple intelligences. It could also be a result of the length of time the preservice teachers had to become familiar with and use the concept mapping strategy. Again, the gradual development of concept maps in conjunction with planning lessons might positively affect the results.

Recommendations for Further Study

It is recommended by the researchers that further study be conducted on how perceptual modality preferences and multiple intelligences impact the construction of concept maps. During the research process, some preservice teachers demonstrated frustration with the process of creating a concept map, stating that developing the concept map was harder than writing the lesson plans. Lim et al. (2003) indicated the need for further study using mapping as a way to categorize, link and organize concepts while planning lessons. The researchers recommend conducting a longitudinal study of preservice teachers spanning from the junior year to the end of the senior year, to better determine the effectiveness of using concept mapping in the planning of units of study. In addition, including a survey to determine students' style of learning or multiple intelligence as well as their attitudes about concept mapping may provide valuable information. It is also suggested that research be conducted to determine what effect the quality of traditional instruction has on the effectiveness of a tool such as concept mapping.

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