EFFECTS OF THE UNIT ORGANIZER ROUTINE IN SEVENTH GRADE SCIENCE

by

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ABSTRACT

This investigation examines the effects of using the Unit Organizer Routine in an inclusion seventh grade science classroom. The study included 126 male and female students and spanned approximately three months. Results showed that the instructional tool may have contributed to improvements in understanding of content concepts, some facets of science self-efficacy, self-regulatory behaviors and academic performance.

INTRODUCTION AND BACKGROUND

I performed this action research project at East Valley Middle School in East Helena, Montana, where I have taught seventh grade life science since 2007. East Valley serves approximately 402 students, and like the town of East Helena, it does not have a culturally diverse population. Eighty-two percent of students are of Caucasian descent, 13% are of Native American descent, two percent are Hispanic, and three percent are of other ethnic backgrounds.

According to the United States Census Bureau (2009), East Helena has a population of approximately 1,759 individuals. Seventy-two percent of adult residents are employed in the labor force. Two percent of adults have an associate's degree, and 17% have a bachelor's degree or higher. With the exception of the interaction with teachers in school, many students do not interact with adults who place a high emphasis on the importance of education.

The study group included seventh grade students from five life science classes. There were 63 girls (50%) and 63 boys (50%). The mean age of the students was 13 years, 1 month when the study ended. The population of students encompassed a range of student achievement levels. Of the 126 students, six qualified for special education services, 17 participated in the Title 1 program, and 44 received free or reduced lunch (EHPS District Office, 2012). The treatment was used for three units of study including living things and classification, ecology and cells. The non-treatment unit was conducted first and it covered the metric system and measurement.

The idea for this action research study came from a professional development program about the Unit Organizer Routine that I attended in February 2010 with my

seventh grade team members. The Unit Organizer showed the potential to address one of the significant challenges faced by our seventh grade teaching team—encouraging a diverse group of learners to envision the big picture presented within a unit of study, while simultaneously, modeling concept review strategies. It is common for seventh grade students to become so enthralled with the discreet details of a unit that they neglect to see how the pieces intertwine.

Focus Question

Interest in tools designed to promote effective learning within the middle school classroom led me to my primary focus question: How does instruction using the Unit Organizer Routine affect content area understanding of middle school concepts? In addition, I wanted to investigate how use of the routine affects perceived self-efficacy, self-regulated learning, and academic performance.

CONCEPTUAL FRAMEWORK

As students transition from elementary school to middle school, they often experience decreases in self-esteem and motivation to learn (Eccles et al., 1993). Students may begin to believe that they are no longer capable of performing academic tasks, and in turn, begin to devalue such tasks (Bandura, 1997; Pajares, 1996). This can lead to decreased use of academic self-regulatory processes such as failure to set goals, failure to utilize study strategies, and in some cases, failure to attend school (Zimmerman, 2002). Eccles et al. (1993) explains that these declines are probably due to a conflict between psychological needs and the changing academic demands of the middle school

environment. Students experience the need to feel autonomous in a less structured learning environment, and they are developmentally more capable of assuming independence and personal control (Pintrich & Schunk, 2002). However, students are often provided with fewer choices about curriculum activities and decreased opportunities to exercise personal responsibility. This can lead to self-defeating cycles of motivational beliefs (Eccles et al., 1993). Simultaneously, teachers expect students to independently engage in more rigorous study habits outside of school which require students to possess an expanded repertoire of study strategies (Zimmerman, 2002). Unfortunately, low-achieving students and students with learning disabilities often have limited knowledge of such strategies. They often struggle in their efforts to plan for academic success, monitor their learning, and evaluate their understanding of new concepts; therefore, it is critical for teachers to integrate learning strategies into their classroom routines (Weinstein, Husman, & Dierking, 2000; Zimmerman, 2002). Implementation of the Unit Organizer Routine has the potential to enhance students' perceived self-efficacy and students' ability to regulate their learning which are interrelated factors that contribute to academic success.

The Unit Organizer Routine

Development of the Unit Organizer Routine

Middle school curriculum predominantly focuses on content teaching and learning. State standards typically include domain-specific and general concepts. Bulgren and Scanlon (1997-1998) define a concept as "a word or phrase representing a meaningful category or class of events, ideas, actions, or objects" (p.292).

Comprehending concepts provides the basis for knowledge attainment and application in content areas (Meyer, 1991).

The Unit Organizer Routine is a visual device that arranges and presents unit content and related information (Boudah, Lenz, Bulgren, Schumaker, & Deshler, 2000). It was developed in order to help educators face some immense challenges as they attempt to meet their students' needs such as: (a) an increase in the amount of curriculum content to be taught in an unchanging amount of time, (b) the community's expected increase in student test scores, (c) teaching information that is often extremely complex and abstract, and (d) meeting the diverse needs of students within the general education setting. The routine seeks to address these challenges by enabling teachers to present the content of a unit in an organized, interactive way to students. Specifically, the teacher explains to students what will be learned in the unit, identifies relationships between unit concepts, connects the current unit topic with past and future unit topics, and highlights activities that will be completed in order to promote learning (Lenz, Bulgren, Schumaker, Deshler, & Boudah, 2004).

Purpose of the Unit Organizer Routine

The Unit Organizer Routine frames unit information in order to help students accomplish several learning outcomes (Lenz et al., 2004). Students should be able to (1) recognize how the unit can be part of a larger sequence of ideas or a series of units, (2) visualize a way to organize concepts, (3) identify the relationships associated with knowledge; prioritize learning tasks, (4) monitor learning progress and accomplishments, and (5) distinguish what has been learned from what still need to be learned through self-questioning.

Unit Organizer Design

The Unit Organizer framework utilizes several learning strategies, or techniques, that are valuable to specific learning tasks performed by students (Bulgren & Scanlon, 1997-1998). The design is part of an instructional approach called *strategy integration* (Bulgren & Lenz, 1996; Wong, 1994). Research shows that when learning strategies are introduced to students in conjunction with content learning, the strategies are used more effectively by students (Borkowski & Muthukrishna, 1992; Wong, 1994).

The Unit Organizer design enables students to "become oriented to where they *have been* in learning, where they *are*, and where they *are going* in learning" (Lenz et al., 2004, p. 2). The Organizer consists of a two-page handout containing ten sections. The first page displays the overall organization for the unit content, relationships, questions and tasks. The second page presents an ongoing structure for organized note-taking. Students are typically issued a blank copy of the organizer and then together, the teacher and students fill it out in an interactive way. The ten sections of the Unit Organizer include the following items and strategies (Lenz et al., 2004):

1. Current Unit—Students record the name of the current unit of study.
2. Last Unit—Students record the name of the previous unit of study.
3. Next Unit—Students record the name of the upcoming unit study.
4. The Bigger Picture—Students identify and record the general theme encompassing the Last Unit, Current Unit and Next Unit of study. This allows students to identify themes shared by multiple units.
5. The Unit Map—The teacher and students interactively create a concept map of the unit as the class progresses through content material. Arrows connect key

concepts and linking phrases in order to help children understand relationships between terms (Vanides, Miki Tomita, & Ruiz-Primo, 2005).

6. Unit Relationships—Students record relationships shared between various unit concepts. Examples include "cause and effect," "compare and contrast," and "advantages and disadvantages."
7. Unit Self-Test Questions—Students generate a list of questions pertaining to unit content. These questions can be used for self-assessment prior to the unit exam.
8. Unit Schedule—Students create a dated schedule of unit events. It may include lesson topics, homework assignments, activities, labs, quizzes and tests. This schedule helps students to manage their study time.
9. Expanded Unit Map—Students add subtopics, specific details and critical vocabulary terms to the Unit Map (or to specific sections of the map). This space creates a condensed set of class notes that can later be used to review unit content.
10. New Unit Self-Test Questions—Students write questions pertaining to content from the next unit. This helps students to identify relationships between current and future content concepts (Lenz et al., 2004).

Implementation of the Unit Organizer Routine

In order for routines and learning strategies to enhance content area understanding of middle school concepts, two critical elements must exist—student awareness of the learning process, and student involvement in the learning process (Bulgren & Scanlon, 1997-1998). The teacher does not use direct instruction to communicate content material included in the Unit Organizer, but instead clarifies that students will complete the Organizer in partnership with the teacher. In this way, students participate in the

knowledge-building process. Also, the teacher explains how they will use various concepts and processes in the unit of study. Researchers recommend that in order for the results of an organizational routine to become embedded within the learner, it needs to be used consistently over an extended period of time (Tan, Vaille, & Venille, 2008).

Self-regulated Learning

Educators strive to help students become masters of their own learning, a topic that has become known as *self-regulated learning* (Zimmerman & Schunk, 1994). A self-regulated learner is "metacognitively, motivationally and behaviorally active in their own learning process" (Tan et al., 2008; Zimmerman, 1989a, p. 4). These students approach educational tasks with confidence, diligence, and ingenuity (Zimmerman, 1990). Self-regulated learners recognize when they understand an academic concept and when they do not. When self-regulated learners become aware of an academic weakness, they take the necessary steps to overcome it. In particular, self-regulated learners view learning as a process that can be controlled through diligent effort applied to the academic task at hand (Perry, Phillips, & Hutchinson, 2006), and timely use of appropriate learning strategies (Dweck & Leggett, 1988). In summary, self-regulated learners assume complete responsibility for their academic achievement (Zimmerman, 1990; Zimmerman & Martinez-Pons, 1986). These characteristics help to explain why self-regulated learners develop a deeper understanding of subject matter and often experience success in school and beyond.

An important aspect of self-regulation during the middle school years is the use of learning strategies. Self-regulated learners expand their repertoire of learning strategies

and, in turn, perform better academically than learners who have not developed their strategy use (Zimmerman, Bandura, & Martinez-Pons, 1992). Educators are encouraged to utilize instruction that invites students to reflect on and improve their current strategies, as well as evaluate and incorporate methods used by peers. Such actions encourage increased comprehension of concepts and establish a deeper association between understanding and attainment (Hiebert & Wearne, 1996).

Self-regulated Learning and Academic Performance

Research shows that student use of self-regulated learning strategies significantly influences academic achievement (Zimmerman, 1990). A study conducted by Zimmerman and Martinez-Pons (1988) highlights the complexity involved in teaching students how to self-regulate their academic learning. In their first investigation, 80 high school students were interviewed about their use of self-regulated learning strategies. Students were presented with a number of common contexts or descriptions of academic dilemmas related to studying and class preparation. Participant responses were recorded and scored according to the number of defined self-regulated learning strategies employed in the hypothetical situation. Students' strategy use score was then compared with their academic performance in school. Findings revealed that strategy use increased with academic performance, and strategy use could be used to predict a learner's academic track with 93% accuracy.

In a second study designed to further establish validity of the previous findings, high school teachers were asked to rate student use of self-regulated learning strategies using a Likert Scale survey (Zimmerman & Martinez-Pons, 1988). Data analysis

combined these ratings with students' verbal and mathematical standardized achievement test scores and considered student general ability. Final results indicated that students' use of self-regulated learning strategies contributed to their academic achievement apart from their general ability.

The Unit Organizer and Academic Performance

The Unit Organizer Routine has been shown to positively impact student academic performance (Lenz et al., 1993; Lenz et al., 2004). A study conducted through the University of Kansas Center for Research on Learning examined use of the strategy over an eight month period in six secondary social studies and science inclusion classrooms. Researchers observed teachers as they presented several units using the Unit Organizer Routine. Students were asked to create a concept map of the unit using Post-it notes and then explain connections between various concepts and terms. When unit test scores were analyzed, results showed an increased understanding and retention of unit content by students with learning disabilities, low-achieving students and average-achieving students as evidenced by a significant increase in summative test scores over baseline. Additionally, students of teachers who implemented the strategy consistently scored an average of 15 percentage points higher on unit tests than students who used it sporadically.

A similar study conducted by Bulgren, Schumaker, and Deschler (1998) was designed to evaluate the effectiveness of a Concepts Teaching Routine in enhancing the performance of students with learning disabilities in secondary-level mainstream classes. Student understanding of content was evaluated before and after implementation of the

strategy. Results indicated that students with learning disabilities demonstrated gains in their performance on Tests of Concept Acquisition and in note-taking when the Concept Teaching Routine was utilized in the classroom. Improvements in performance on regular tests were related with the Concept Teaching Routine combined with test review procedure.

The Unit Organizer and Self-regulated Learning

Several facets of the Unit Organizer Routine suggest that it can be used as a self-regulated learning tool in the middle school classroom. In general, self-regulatory tools help students focus on the process of learning, rather than on just the outcomes. Research indicates that this quality has several benefits for learners including the ability to enhance perceived self-efficacy (Zimmerman & Martinez-Pons, 1988).

Self-regulated learning can be described as a three-step cycle. The first step involves self-evaluation and monitoring, the second includes goal-setting and strategic planning, and the third step uses strategy implementation and monitoring (Zimmerman, Bonner, & Kovach, 1996). Following this sequence of steps, the cycle repeats itself. Researchers suggest several ways to incorporate these strategies into the classroom routine. Many of their suggestions are present in the Unit Organizer Routine. In fact, Zimmerman et al. suggests that teachers distribute forms for students to monitor specific aspects of their studying in order to help them to clarify learning objectives, plan for assignment due dates, take notes, and prepare for tests. Components of the routine that promote *planning* include the The Bigger Picture, the Unit Schedule, Unit Relationships and the New Unit Self-test Questions. Sections that encourage *monitoring* are the Unit

Map and Expanded Unit Map. Finally, the Unit Self-test Questions and recreation of the Expanded Unit Map prior to the test facilitate *self-evaluation* (Lenz et al., 2004).

Use of Concept Maps

Cognitive organizers such as The Unit Map are used to promote self-regulated learning (Tan et al., 2008). Concept maps help students maintain academic engagement, concentrate on important content, manage material, and maintain a productive atmosphere for learning (Weinstein & Mayer, 1986). In addition, concept maps are valuable tools for students within the science classroom. Vanides et al. (2005) explain that as students are introduced to new science concepts, "they embark on a cognitive process of constructing meaning and making sense by consciously or subconsciously integrating these new ideas with their existing knowledge" (p. 28). This cognitive strategy creates an opportunity for students to make connections between critical unit concepts, recognize relationships between science terms, and evaluate their comprehension of unit content material. In summary, concept maps invite children to achieve deep learning of unit concepts rather than merely surface learning, or rote memorization of facts (Vanides et al., 2005; Tan et al., 2008). This process facilitates better storage and retrieval of recently acquired knowledge (Vanides et al., 2005).

Self-efficacy and Academic Performance

The attitude of *self-efficacy* refers to the belief in one's capabilities to achieve a goal or an outcome (Bandura, 1997). The interdependence between self-efficacy and performance is best explained by Bandura (1997):

> The evidence is relatively consistent in showing that efficacy beliefs contribute significantly to level of motivation and performance. They predict not only the behavioral changes accompanying different environmental influences but also differences in behavior between individuals receiving the same environmental influence, and even variation within the same individual in the tasks performed and those shunned or attempted but failed. (p. 61)

There is evidence to support the idea that students' self-efficacy beliefs influence their academic performance by fostering the desire to achieve (Pajares, 2002; Schunk, 1995). For example, findings from a path analysis study conducted by Pajares and Miller (1994) indicated that math self-efficacy beliefs have stronger direct effects on mathematics problem solving than factors such as math self-concept, perceived math usefulness, past experience with mathematics, and gender.

Schunk (1995) contends that there is a reciprocal relationship between self-efficacy and academic performance. Student behaviors frequently influence self-efficacy. He explains that when children work on tasks, they visualize their advancement toward their academic goals. In turn, progress indicators toward their learning goals suggest to children that they are able of achieving academically, which augments self-efficacy for continued learning (Schunk, 1995). For example, a study conducted by Britner and Pajares (2006) investigated the degree to which Bandura's suggested sources of self-efficacy predict the science self-efficacy beliefs of 319 middle school science students. Findings indicated that successful learning experiences, or *mastery experiences*, significantly enhanced self-efficacy.

Self-Efficacy and Self-Regulated Learning

Investigations of self-regulated learning came about in response to interest concerning proactive learners. Researchers wanted to know how and why such students were inspired to develop a personal initiative in their school subjects, commit to academic success and acquire a sense of responsibility. Studies revealed that in order for these qualities to surface, students required a strong sense of self-efficacy and the ability to self-direct their own learning (Zimmerman, 1998).

A dynamic relationship exists between self-efficacy beliefs and self-regulated learning variables (Pajares, 2002; Pintrich & De Groot, 1990; Zimmerman 1989, 1998, 1990). According to Pajares (2002), research in this domain indicates that children who see themselves as capable of performing well academically "use more cognitive and metacognitive strategies and persist longer than those who do not. Also, students with stronger academic self-efficacy make better use of cognitive strategies and self-regulatory practices through use of metacognitive strategies" (p. 20). Also, Schunk (1989) suggests that students with a developed sense of academic efficacy exhibit an increased persistence, interest in, and desire to improve their academic learning and performance—qualities of self-regulated learners.

Adept self-regulated learners display a heightened sense of self-efficacy in their academic capabilities; this shapes their personal learning goals, along with their motivation to pursue these challenges (Zimmerman, 1989a, 1990, 2000). Schunk (1983) investigated the effects of self-monitoring on children's perceived self-efficacy in the context of math competency. He found that children who self-monitored their own learning progress exhibited higher feelings of efficacy, increased persistence, and

increased skill, compared to students who were either not monitored, or monitored by the teacher. Liew, McTigue, Barrois and Hughes (2008) also examined the connection between adaptive/effortful control and self-efficacy in young children. Findings indicated that self-regulatory processes positively influenced self-efficacy beliefs in reading and math.

Schunk and Ertmer (2000) relay that students who doubt their learning capabilities are not likely to utilize their self-regulatory skills in a proficient manner. For this reason, educators should not attempt to promote self-regulation and self-efficacy independently, but attempt to address them simultaneously through instruction.

A Triad for Success in the Classroom: Self-efficacy, Strategy Use and Self-regulation

Results from a study conducted by Pintrich and De Groot (1990) revealed an intimate connection between student motivation, self-regulated learning, and cognitive strategy use. The research team administered the Motivated Strategies for Learning Questionnaire (MSLQ) to 173 seventh graders from eight science and seven English classes. This 44 item Likert Survey is divided into five sections. The first three sections examine students' motivation—perceived self-efficacy, intrinsic value of learning, and test anxiety. The last two sections question students' cognitive strategy use and self-regulatory behaviors. Next, performance data from tests, quizzes, homework and essays was collected and correlated with the self-report data. Regression analysis showed that positive self-efficacy and self-regulation were the best predictors of academic performance, indicating that "students need to have both the 'will' and the 'skill' to be successful in the classroom" (p.38).

Zimmerman, Bandura and Martinez-Pons (1992) studied the role that self-efficacy beliefs and goal setting played in self-motivated academic achievement. Path analysis was used to examine the relationship between several variables and found that academic self-efficacy was the mediating factor between self-efficacy for self-regulated learning and academic performance. A direct relationship existed between academic self-efficacy and performance as well as an indirect relationship between self-efficacy and goal setting.

Cleary and Zimmerman (2004) instituted a self-regulated training program called the Self-regulated Empowerment Program (SREP) designed to empower adolescent students to participate in positive, motivating learning. Student self-regulation beliefs and study strategies were pre-assessed using microanalytic techniques. Next, students were trained to use specific strategies using a self-regulation feedback loop. Strategies included graphing, cognitive modeling, cognitive coaching, and structured practice sessions. Results showed that his procedure taught children how to set goals incorporating various learning strategies, monitor learning progress, analyze effective the goals, and then make effective adjustments.

In summary, these investigations have been instrumental in showing the intricate tie between student ability to utilize self-regulated learning strategies, acquire a sense of academic self-efficacy, and experience success in the classroom. As students develop their repertoire of cognitive skills, they experience more academic success and hence, an enhanced sense of self-efficacy. This, in turn, motivates self-regulated learning. Students who experience academic success usually associate the positive experience with effort and are likely to become motivated to set academic goals.

Conclusion

The Unit Organizer Routine is a classroom teaching and learning tool (Lenz et al., 2004) that helps students to focus on the process of learning rather than on just the outcomes (Zimmerman, 1998). The multi-step routine encourages students to employ self-regulatory processes including goal setting, self-monitoring, and self-reflection. Research shows that students who are trained in these areas experience higher levels of self-efficacy and academic achievement (Schunk, 1996; Wood, Bandura, & Bailey, 1990). Use of self-regulatory tools is critical in middle school instruction because studies show that as students make the transition into middle school, they often feel decreases in self-efficacy and motivation, which may lead to breakdowns in academic self-regulation, all of which affect academic performance (Bandura, 1997; Eccles et al., 1989; Pajares, 1996). Utilization of self-regulatory tools enables students to recognize the connection between achievement and strategy use. In turn, students are likely to see that success in school is under their control (Cleary & Zimmerman, 2004).

METHODOLOGY

Treatment

The treatment for this study consisted of students being introduced to the use of the Unit Organizer Routine. Students were issued a blank copy of the two-page visual device at the beginning of each new unit. After initial introduction to the use of the routine, students completed the first page of the handout in partnership with the teacher. For the remaining days of each unit, the first 5-10 minutes of each period were devoted to

completion of the second page of the device with a focus on adding to the Unit Map, reviewing the Unit Self-test Questions, and identifying Unit Relationships. Prior to the unit exam, students were given 30 minutes to work with a partner to recreate the unit concept map and review for the test using the Unit Self-test Questions. The treatment period spanned three units and lasted approximately three months during the 2011-2012 school year. The research methodology for this project received an exemption by Montana State University's Institutional Review Board and compliance for working with human subjects was maintained.

Data Collection

Data to address the research questions were collected through five main strategies: (1) active participant observation of classroom activities, (2) collection of artifacts, (3) survey of students' attitudes, (4) student interviews, and (5) assessments of content concepts. A triangulation matrix of data collection activities undertaken and a detailed description of each follows (Table 1). A total of three student interview sets were conducted. Students were selected based on a shuffled computerized list; some students participated in more than one interview. Each interview set included nine participants who performed at varying academic achievement levels (low, medium and high), as determined by Montana State Criterion-referenced test (CRT) scores. The same CRT achievement score ranges were also used to analyze data collected by ability level for eight of the data collection procedures.

In order to acquire data about how the Unit Organizer Routine impacted students' self-regulated learning strategies, I observed students in the seventh grade science

classroom over a period of three months. I acted as an active participant observer. I incorporated the Unit Organizer Routine into my daily lessons and then observed student reactions to the strategy. During several lessons, data were recorded as field notes, the focus of which were comments about student use of self-regulated learning strategies. Samples of Unit Organizers were also collected and photocopied (Appendix A). A sample of the active participant field notes can be seen in Appendix B.

To further assess self-regulated learning strategy use, all seventh grade science students were instructed to respond to a four item Study Habits Self-reflection (Appendix C). The questions addressed time management in preparation for a unit exam, study strategy use, and effort applied to the study process. Three items were objective, where students identified the descriptive phrase that best represented their study habits and the level of effort applied to the study process. The percent of students who responded to each statement was then calculated and compared before and after implementation of the treatment units. The fourth item was open-ended; it asked students to identify resources, materials and methods used to prepare for tests. The mean number of study strategies used by students was tabulated for the seventh grade class as a whole and then compared before and after use of the Unit Organizer Routine.

I used a structured formal interview to investigate perceived changes in self-regulated learning strategy use following implementation of the Unit Organizer Routine (Appendix D). A total of nine students were interviewed—three low-achieving, three middle-achieving, and three-high achieving. Students were randomly selected and interviews were conducted before and after implementation of the treatment. The seven questions were adapted from a study conducted by Zimmerman and Martinez-Pons

(1990), and presented students with specific contexts related to self-regulated learning strategy use. For example, one question asked, "Most teachers give important tests at the end of marking periods, and these tests greatly affect report card grades. Do you have any particular method for preparing for an especially difficult test?" For each context, students were asked to specify the methods they would use. If the students gave an answer, they were asked to depict any additional methods used. If the student failed to offer a method, a probe was given (see the last question in each context). If the student still neglected to report any self-regulated learning strategies, questioning was discontinued for that learning context. Responses were qualitatively compared between pre and post treatment interviews and analyzed for general changes in the number and type of study strategies used.

In an effort to examine how the Unit Organizer Routine affected student perceived science self-efficacy, students were administered an eight-question, modified segment of the Motivated Strategies for Learning Questionnaire (MSLQ) before and after the three month treatment period (Appendix E). Students were instructed to respond to items on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). This portion of the questionnaire was originally utilized in a study conducted by Pintrich and DeGroot (1990) and contained eight items such as, "I'm certain I can understand the ideas taught in science class." Both the mode and the percent of students who selected each level of agreement were compared between pre and post treatment questionnaires.

To further examine science self-efficacy, structured formal interviews were conducted with three randomly selected low-achieving, middle-achieving, and high-achieving students before and after implementation of the Unit Organizer Routine

(Appendix F). Students were presented with ten vocabulary words from the current unit of study. For each word presented, students were instructed to estimate their confidence that a teacher would assess their definition as correct. For both interview parts, students were told to report their confidence on a percent scale (0% = no confidence to 100% = complete confidence). Responses were compared and analyzed for changes in self-efficacy that occurred during the three unit treatment period.

Students completed a three-item self-reflection both before and after using the Unit Organizer Routine for three units (Appendix G). The questions addressed student confidence in their ability to experience success in science class, and confidence in their ability to understand difficult content material. Comparison of student responses revealed students' perceived changes in science self-efficacy.

Academic performance was measured by acquiring data on student performance on classroom tests. Pre and post assessments were given to all of the seventh grade students in order to determine the percent improvement. Pre-unit assessments were identical to post-unit assessments. An average for each assessment score was first calculated, and then the difference between the average pre-assessment score and post assessment score was determined. Next, the percent improvement was compared between treatment and non-treatment units.

Following completion of the three treatment units, all seventh grade science students completed a Science Concepts Student Self-reflection that asked questions about how they believed the Unit Organizer may have affected their understanding of science concepts (Appendix H). The survey also asked students to identify parts of the Unit Organizer that were most helpful to them as learners and to identify any parts of the

routine that they would change. The part that students identified as most helpful was assigned a score of three points, second most-helpful scored two points, and third most-helpful received one point. The number of points earned by each was then added together and divided by the total number of points to create a frequency score that ranged between zero and one.

To further analyze how the routine influenced understanding of science concepts, nine students were randomly selected and interviewed following each of their unit exams. Interviews included three low-achieving, three middle-achieving, and three high-achieving students. Students were given a set of index cards containing brief statements about the major concepts in each unit. Next, students were asked to organize the concepts and then connect the concepts using arrows to show the relationships between terms (see photo in Appendix I). Finally, students were asked to verbally interpret the concept map. Maps were collected as a research artifact and scored according to the Concept Map Rubric (Appendix J). Concept understanding for the nine students was tracked throughout the course of this research study and then compared between treatment and non-treatment units. This and other data sources described above are summarized in Table 1 below. Together they provide triangulated data for my focus and sub-questions regarding implementation of the Unit Organizer Routine.

Table 1
Triangulation Matrix

Focus Questions	Data Source 1	Data Source 2	Data Source 3
Primary Question: 1. How does instruction using the Unit Organizer Routine affect content area understanding of middle school concepts?	Structured formal concept map interview (treatment and non-treatment)	Artifact collection: concept map (treatment and non-treatment)	Post-treatment student reflection about use of Unit Organizer Routine (post-treatment)
Secondary Questions: 1. How does use of the routine affect student perceived self-efficacy?	Pre and post treatment MSLQ questionnaire	Structured formal interview (treatment and non-treatment)	Pre and post treatment self-reflection
2. How does use of the routine affect self-regulated learning?	Pre and post treatment Study Habits Self-Reflection	Active participant observation (field notes)	Pre and post treatment structured formal interview
3. How does use of the routine affect academic performance?	Comparison pre and post unit test scores for classification unit	Comparison of pre and post unit test scores for ecology unit	Comparison of pre and post unit test scores for cells unit

DATA AND ANALYSIS

Understanding Unit Concepts

Concept Map Interview

The purpose of the Concept Map Interview was to compare how effectively students were able to organize unit concepts before and after use of the Unit Organizer

Routine. Prior to the interview, seventh graders received directions about how to make a concept map and were given opportunities to practice concept map construction. The nine students who participated in the interview were able to create more accurate concept maps for the three treatment units than they were for the non-treatment unit.

The average concept map score for the non-treatment unit was 65%. High-achieving students averaged 84%, mid-achieving students 71%, and low-achieving students 42% (Table 2, Figure 1). As a whole, students scored highest following the first treatment unit on classification where the mean score for all students was 95%. Both high-achieving and mid-achieving students averaged 100%; low-achieving students averaged 88%. Eight of the nine students were able to organize all main concepts and details into a map without error. Scores were similar for the second treatment unit over the basic principles of ecology, where the mean concept map score was 86%. High-achieving students averaged 98%, mid-achieving students 90%, and low-achieving students 67%. Following this unit, the most common mistake was placing concept details under the wrong subconcepts. All students accurately used arrows to connect terms and unit ideas. The mean concept map score for the third treatment unit on cells was 90%. High-achieving students averaged 100%, mid-achieving students 88%, and low-achieving students 82%.

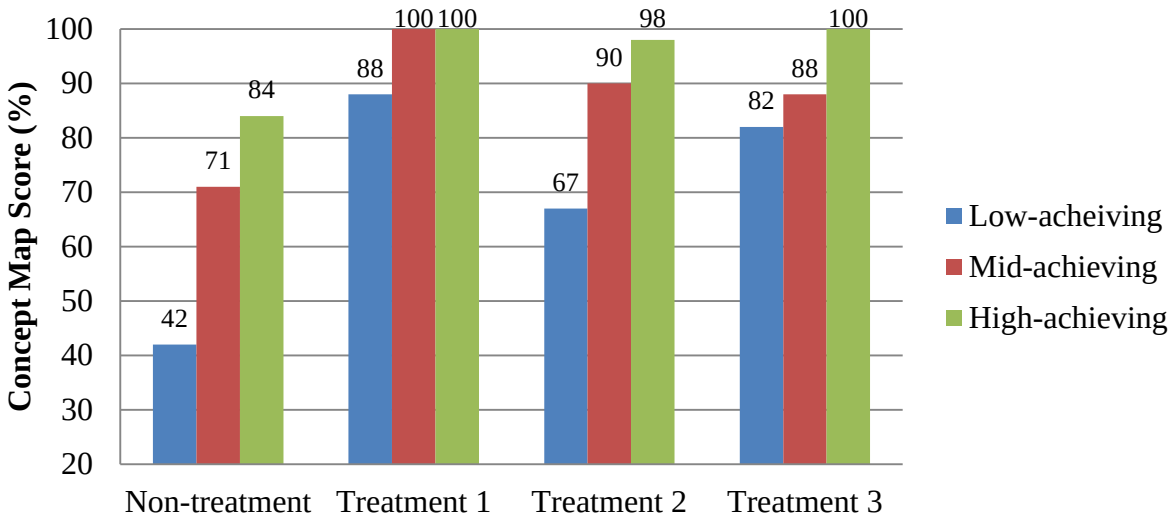


Figure 1. Unit concept map interview scores for treatment and non-treatment units, (*N= 9).*

Overall, results from the concept map construction and interview indicate that students were better able to organize unit concepts after exposure to the Unit Organizer Routine. The greatest improvement was seen in low and mid-achieving students who initially struggled with organizing basic components of the map. Following use of the routine, students were better able to accurately identify the main idea and sub-concepts within a unit, arrange the concept map in an appropriate shape, use arrows effectively to depict relationships between concepts, use linking phrases to connect concepts, and place details under the appropriate subconcepts.

Science Concepts Self-reflection

Following implementation of the three treatment units, 121 students completed the three item Science Concepts Self-reflection about use of the Unit Organizer Routine in class (Appendix H). Students discussed whether or not they viewed the routine as a useful learning tool and why. Second, they evaluated which components of the student

handout were most useful. Third, students explained what they would change about the routine.

When asked whether they felt it was a useful tool for learning unit concepts, 80% of seventh graders said yes (Table 2). When grouped by ability level, 79% of low-achieving students saw the routine as useful, 76% of mid-achieving students agreed, and 91% of high-achieving students found it useful.

Table 2
Science Concepts Self-reflection Results (*N*=121)

	Percent of Students Who Viewed the Unit Organizer Routine as a Useful Learning Tool in Seventh Grade Science Class
All Students	80
Low-achieving	79
Mid-achieving	76
High-achieving	91

The majority of students explained their answers. Most students who found the routine useful added that it was a helpful study tool, both in the classroom and at home. One high-achieving student wrote, "I can understand what goes where in the chapter. And if I'm confused about something, I can always look at the Organizer and it's easy to find. It really helps." A low student commented, "…because it's very helpful for partner studying to just look over it for an overview of the unit. You can ask each other better questions." A mid-achieving student said, "It helps me find the big ideas of that unit."

Students who did not find the routine useful often offered minimal explanations such as "I don't use it (at home)." Some preferred to use other study resources such as the book or flash cards. Others commented that they did not like layout of the Unit

Organizer because the space provided for writing was too small. Two low-performing students commented that they viewed the routine as too time consuming.

The second question asked students to identify the component of the Unit Organizer Routine that they viewed as most helpful for studying, second most helpful, and third most helpful (Table 3). The majority of students rated the Unit Map as most helpful with a score of (.35). One low-performing student said that the "concept map stops you from mixing up the information in the chapter." A high-performing student wrote, "That is where all of the useful information goes and its gets more specific." Several students liked how the map separated the main big idea of the unit from main points and details. Others remarked that they liked how the linking phrases showed how various components of the map were related to one another.

Students also saw the critical vocabulary section as useful at (.21). Most students remarked that this section helped them to identify and study important vocabulary for the test. The Unit Self-test Questions were ranked third most useful at (.19). Overall, students commented that they found this section useful because it gives students an idea about what questions will be like on the test. Other students said that they used it for quizzing themselves or a partner over the most critical information in the chapter.

Table 3
Usefulness Rating for Various Components of the Unit Organizer Student Handout in Descending Order (*N*=121)

Component of the Unit Organizer Student Handout	Student Rating
Unit Map/Extended Map	.35
Critical Vocabulary	.21
Unit Self-test Questions	.19
Unit Names (First, Current, Next)	.10
Unit Schedule	.07
Bigger Picture	.06
Unit Relationships	.01

The final question asked students what they would change about the Unit Organizer Routine. Most suggestions were related to the small size of the student handout. Several students commented that they wanted the definitions of the critical vocabulary next to the words. Another popular suggestion was to transform the Unit Self-test questions into a separate study guide with more questions and space for students to write their answers.

In summary, students considered the Unit Organizer Routine to be a valuable learning tool in seventh grade science, particularly high-achieving students. The Unit Map was the most recognized feature of the student handout since it displayed a visual depiction of how unit concepts were related. Students who did not view the map as valuable often also conveyed a general dislike of the study process, or they were extremely high-achieving students who clearly understood unit concepts and saw the tool as time consuming and unnecessary. Most student suggestions about how to improve the Routine were related to the layout of the student handout.

Student-perceived Science Self-efficacy

Self-efficacy Questionnaire

In order to measure changes in self-efficacy, seventh grade science students took a five-point, eight item Self-efficacy Questionnaire before and after implementation of the three treatment units (Appendix E). One hundred and twelve students took the pre-treatment survey and 123 took the post-treatment survey. Modes were compared between pre-and post treatment results (1 = strongly agree to 5 = strongly disagree). Results showed some minor changes in student perceived science self-efficacy.

For the seventh grade class as a whole, mode did not change in response to five items. These items were related to student confidence in their ability to do well in seventh grade science, and belief in their ability to understand basic skills, basic science concepts, and difficult or complex course material. Modes from these items ranged from four to five. Mode increased from four to five in response to three survey items all of which were related to performance grading:

- I believe I will receive an excellent grade in seventh grade science class.
- I'm confident I can do an excellent job on the assignments and tests in seventh grade science class.
- Considering the difficulty of this class, the teacher, and my skills, I think I will do well in this class.

When further analyzed by ability level, modes did not change for high-achieving students. Most appeared to begin the study with very positive feelings of self-efficacy and these feelings were maintained. Five of the eight modes started and ended with

student ratings of five. Mode increased in response to two items for mid-achieving students. For low-achieving students, the mode decreased in response to three items:

- I'm certain I can understand the most difficult material in seventh grade science class.
- I'm confident I can do an excellent job on the assignments and tests in seventh grade science class.
- I'm confident I can understand the most complex material presented by the teacher in seventh grade science.

However, the mode did shift from three to four in response to the item, "I'm confident I can understand the basic concepts taught in seventh grade science class." These results indicate that low-performing students experienced some improvement in how felt they understood basic content concepts but some decline in their ability to understand complex content material.

On the whole, results from the MSLQ Questionnaire show that seventh grade science students may have experienced small changes in self-efficacy. Increases were more often related to how students felt they would perform in my class rather than how well they understood the course material. Low-performing students displayed the lowest science self-efficacy and decreased in response to three items.

Self-efficacy Student Reflection

In addition, students were asked to explain their feelings about science self-efficacy in a pre and post treatment three-item reflection (Appendix G). Themes were noted in student responses. First, the majority of high-achieving students displayed an overall feeling of confidence in regard to their ability to do well on tests and assignments

and understand the content material. High-achieving students used words such as "outstanding" and "excellent" to describe their academic performance in seventh grade science. No high-achieving students expressed feelings of poor confidence in response to any of the questions. Performance and confidence were often associated with effort and studying. One student commented, "I am very confident about my assignments and tests. I keep my worksheets from the chapter so I can either look back at them or study off of them. Not to mention I actually pay attention (in class)."

Most mid-achieving students relayed feelings of confidence both before and after the treatment units, while some took a middle stance, and others exhibited low confidence. Some mid-achieving students showed increases in confidence between pre and post-treatment reflection responses. In response to the item, "How confident are you about understanding all of the content material that we learn in this class by the time we take the test?" one student wrote, "Not very confident," prior to using the Unit Organizer Routine, but after the treatment units she said, "I am confident when I can tell a friend what the page is about because if I can teach something to my study partner I know I've got it down." Mid-achieving students often associated confidence with grades received on their tests and assignments. One girl explained, "I'm confident because I want to get a good grade. When I get a good grade I feel good."

Some low-achieving students also showed increases in self-efficacy. In her explanation of how well she viewed her performance on assignments, one student explained in her post-treatment reflection, "I think I'm going to do well now, but I didn't at the beginning of the year. It was kind of complicated at first to understand everything but now that I'm getting it I think I will do well." Other low-achieving students

maintained a view of poor science self-efficacy. Some students wrote that they felt they understood the information, but they had a difficult time remembering it later. Others explained that they usually felt confident in class, but later experienced test anxiety and received a poor grade.

Overall, the Self-efficacy Student Reflection showed that high-achieving students entered into the study with a high self-efficacy, and later, continued to maintain this view. High students often attributed their capabilities to time and effort applied to the study process. Mid-achieving students also displayed fairly positive feelings of self-efficacy and often mentioned their concern to receive good grades on assignments and tests. Low-performing students expressed a mix of feelings; some saw increases throughout the span of the study while others continued to see themselves as less capable after implementation of the three treatment units.

Self-efficacy Interview

Students also participated in a structured formal Self-efficacy Interview in which they were presented with ten vocabulary words and then asked to relay their understanding of each term on a scale of zero to 100% (Appendix F). The structured formal interview showed increases in science self-efficacy with eight out of nine participants (Figure 2). Low-achieving students averaged 63% before using the Unit Organizer Routine and 70% after using it, a 7% increase. The mean score for mid-achieving students was 61% prior to treatment, and 80% following treatment, an increase of 19%. High-achieving students increased by 10%, from 84% before treatment to 94% after treatment. The student whose score decreased was a low student whose initial score was 95% and final score was 77%.

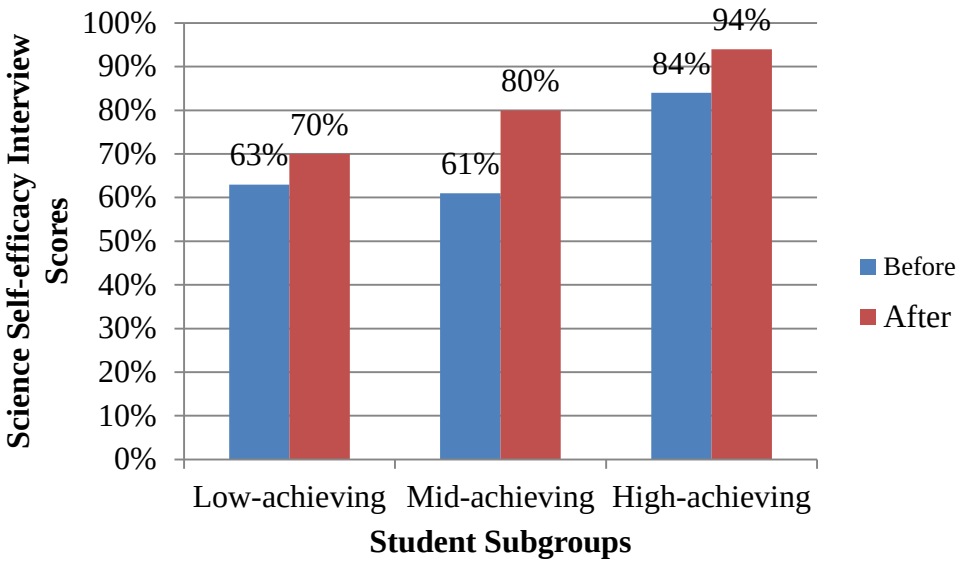


Figure 2. Science self-efficacy interview scores for low, mid, and high-achieving students before and after treatment (*N*=9).

Self-regulated Learning

Self-regulated Learning Interview

The purpose of the Self-regulated Learning Interview was to observe for changes in learning strategy use before and after exposure to the Unit Organizer Routine (Appendix D). Nine students were interviewed—three low-achieving, three mid-achieving, and three high-achieving students.

High-achieving students were able to identify one or more strategies for each of the seven study practice questions. For the most part, student responses were nearly identical between pre-treatment and post-treatment interviews for all three students. The one area that did show some change was *reviewing content concepts*. All three high-achieving students were able to identify new review strategies in the post-treatment interview. One student who initially identified doing "my study guide" and "looking over important information in the book" for review strategies, later added that she

"studied old worksheets," "have my parents quiz me over the information in the Unit Organizer," and "then I quiz myself again before I go to sleep at night." It was also noted that all three high-achieving students were able to identify additional review strategies in case they did not achieve the success desired with their initial strategy.

Mid-achieving students showed a general increase in self-regulated learning strategy use. One theme observed was that only one student mentioned practice quizzing as a review strategy in the pre-treatment interview, but all three mentioned it in the post-treatment interview at least twice. A student who failed to list any test review strategies in the pre-treatment interview, later answered, "At home I quiz myself using a Unit Organizer with a map that's not filled out. If I still don't remember stuff then I look at my other (completed) one or check the book."

Low-achieving students experienced increases in the number of strategies used overall, and use of quizzing as a strategy prior to the test. In addition, they showed improvement in the strategy related to *organizing and transforming information*. Two of the three low-achieving students could not identify a strategy in this area during the pre-treatment interview, and one tried but failed to explain an effective strategy. She initially stated, "I read the book and write down the stuff that we learned and then take the information and write it as a paper." In the post treatment interview, she explained in detail, "Well, first I find the main idea, write it down as a topic sentence and then write about the details. Eventually I have an outline and after that I write a rough draft." Low-achieving students also experienced strategy use increases in the area of *self-evaluation*. Two students who could not identify a method for checking over a completed assignment in the initial interview, later named strategies such as having a parent look over their

assignment. Two of the three low students did not show improvement in the area of *assigning self-consequences*. When faced with fun things to do other than homework, one still chose to participate in the fun activity, another showed a decrease in this area of self-discipline, and the third maintained a middle stance of participating in the fun activity first but completing her school-related priority later.

Results indicated that self-regulated learning strategy use generally improved for seventh grade science students following implementation of the Unit Organizer Routine. Most high-achieving students entered into the study already using several strategies, and only showed minor improvement. Mid-achieving students experienced the most improvement in the area of test preparation. Low-achieving students showed improvements in multiple areas of strategy use.

Study Habits Self-reflection

Results from the four-item Study Habits Self-Reflection were also used to identify changes in self-regulated learning—in particular, how seventh grade science students prepared for tests before and after implementation of the Unit Organizer Routine (Appendix C).

In general, results showed that student use of time in class to prepare for tests became less effective over time (Figure 3). Baseline data revealed that 57% of students reported effective use of time in class to prepare for tests, while 37% claimed to use their time wisely on some days but not on other days. Six percent said they did not use their time wisely at all. Following treatment, only 41% reported to use their time wisely in class to study every day. Fifty-five percent said they did on some days but not on others, and four percent said they didn't use their time wisely at all.

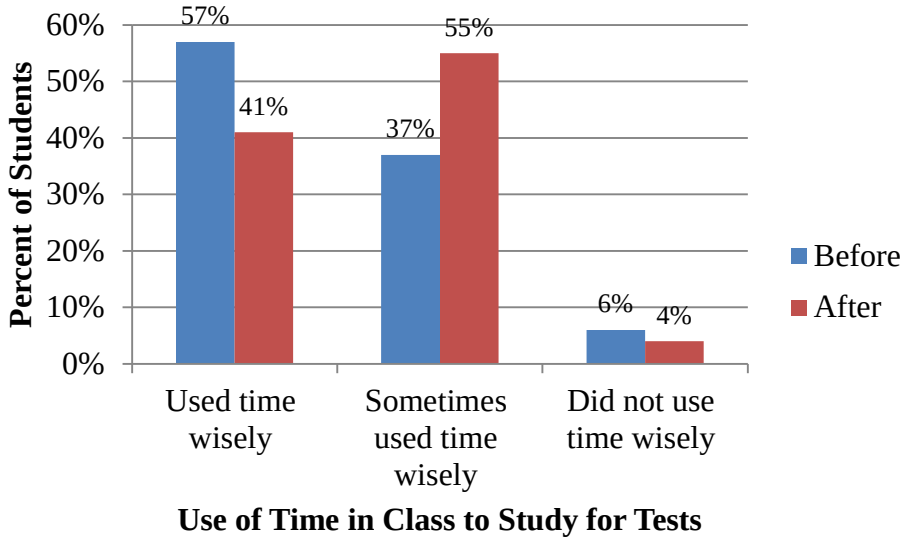


Figure 3. How students described their use of time in class to prepare for tests before and after implementation of the treatment (*N*=126).

Students showed improvement over time when asked about time spent at home in preparation for tests after using the Unit Organizer (Figure 4). Prior to using the routine, twenty-seven percent reported to study at home until they felt well-prepared, 50% studied until they felt somewhat prepared, and 23% said that they did not study at home at all. After using the Unit Organizer Routine, only 19% claimed to not study at home, whereas 43% said they studied at home until somewhat prepared, and 38% reported they studied at home until they felt well prepared.

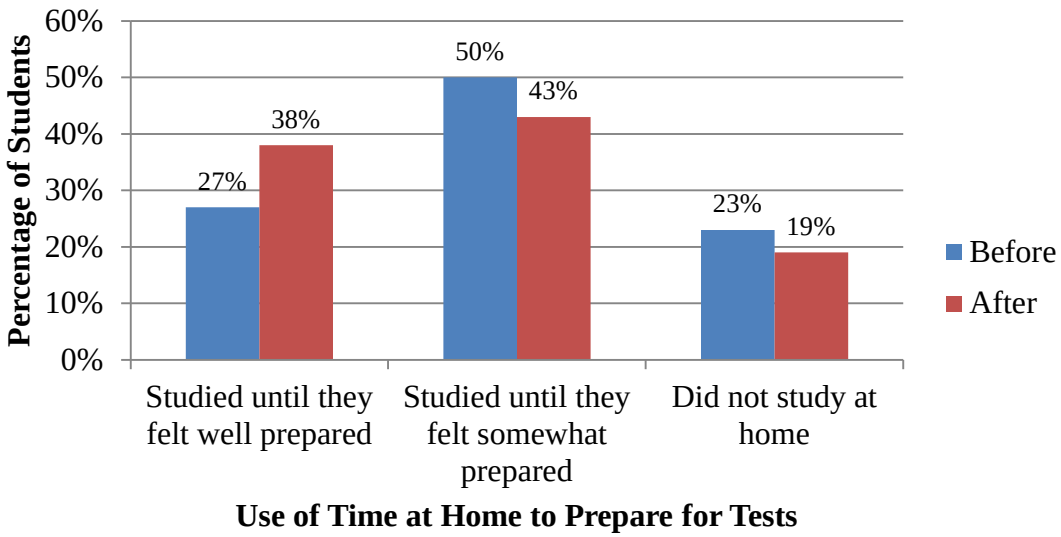


Figure 4. How students described their use of time at home to prepare for tests before and after implementation of the treatment, (*N*=126).

Students were asked to list resources and materials used to prepare for tests (Figure 5). The majority of seventh graders reported using teacher-made study guides (55%), and peers or family members as a resource (42%). Several students used both resources simultaneously. One student commented, "I used the study guide a lot. I studied the material and then had my parents quiz me on the material. I studied until I felt prepared for the test." Other popular resources included the text book at 12% and graded worksheets at 11%. The average number of resources/materials used per student was 1.52 before introduction of the Unit Organizer Routine.

Following use of the routine, 77% referenced using the Unit Organizer student handout, 60% reported using the textbook, and 47% found it useful to study with a partner. Other common resources used included graded worksheets (23%), flash cards (13%) and the internet (6%). After the treatment units, the average number of resources used per student was 2.59. Overall, student use of resources and materials to prepare for

tests increased after being introduced to study techniques using the Unit Organizer Routine.

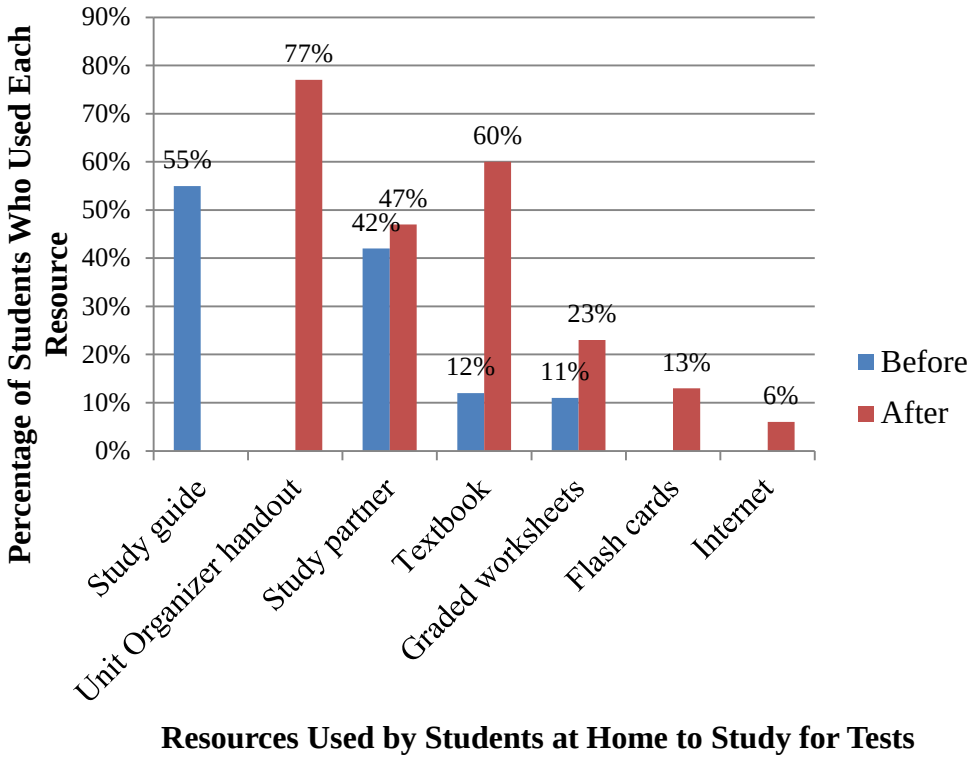


Figure 5. Percentage of students who reported to use various resources and materials at home to study for tests before and after treatment, (*N*= 126).

The last item asked students to evaluate their level of effort applied to the study process on a scale of one to five, with five being the highest. Overall, effort increased following the three treatment units. Four percent of seventh graders claimed to apply almost no effort prior to the treatment units. They used comments such as, "I don't study," and "I don't care" to describe resources and materials used. Following treatment, this dropped to two percent. Twelve percent rated their effort at a level two and 26% at level three before use of the Unit Organizer. After using it, only eight percent marked level two and 23% chose level three. The latter often reported using only one study

strategy with little detail in the description, while those who reported using effort levels four and five tended to use more detail in their descriptions and identified multiple resources and materials. A student who claimed to apply a great deal of effort to the study process explained, "My mom has me take a practice test based off of the study guide, I use flash cards, and I also use my notes that I take out of the book at the end of the chapter." The number of students who chose higher effort levels increased after implementation of the Unit Organizer Routine. Prior to treatment, 47% selected effort level four and after treatment this increased to 50%. Eleven percent of students selected level five before treatment and this increased to 18% following treatment.

In summary, the Study Habits Self-reflection revealed that students used their class time less effectively to prepare for tests following the three treatment units, while they used time outside of class more effectively to review. In addition, the average number of study resources/materials used per student increased by 59%. This was complemented by a dramatic increase in the percent of students who reported using various study resources. In general, the level of effort that seventh grade science student applied to the study process increased.

Field Observations

Field observations were conducted while students used the Unit Organizer Routine as a study tool on test review days in order to identify changes in ability to prepare for tests. Following a demonstration of the various ways to use the student handout, students were placed in partner pairs and instructed to quiz one another on chapter content for 30 minutes. During the first treatment unit on classification, students initially struggled with how to use the tool. Most of their quiz questions stemmed from

the Unit Self-test Questions. Students had a difficult time creating their own questions about the unit content. Another "safe zone" was asking questions from the Critical Vocabulary section. Questions were simple and often began with phrases such as, "Tell me what ___ means," or "How would you define ___?" In most cases, at least one student knew the answer to each question, but at times this was not the case, and partner pairs would need to either consult the Expanded Unit Map, or the text for answers. High-achieving students felt more comfortable with developing quiz questions from the Unit Relationships section and the Unit Map.

Prior to the ecology and cells unit test reviews, I repeated my demonstration of how to create questions from the student handout and encouraged students to focus on studying all sections of the handout. With practice, low and mid-achieving students began to feel more comfortable with using the Unit Map. Often, students would take turns seeing how much of the concept map they could "teach" their partner. Students provided each other with more open-ended prompts such as, "Tell me everything that you know about how the environment is organized into different levels." Sometimes students were able to list the detailed points, but more often, students stopped at some point through the details and asked for a hint. It was common for students to ask their partners for a second chance at describing that particular concept. One student commented that sometimes a person can think they know the details of a concept, but until they try to explain it to another person, they don't really know for sure.

After having experienced the Unit Organizer Routine for three units, most students appeared comfortable formulating quiz questions for their partners and using the Unit Organizer student handout as a study tool. General questions and comments

between partner pairs showed that following use of the student handout as review tool, students were better able to distinguish between what they knew and what they still needed to study prior to the test.

Academic Performance

Pre and post unit assessment scores show that students experienced more improvement in academic performance following the three treatment units that they did following the non-treatment unit (Figure 6). Student's mean score on the classification pretest was 20%, and on the post-assessment in changed to 81%, an increase of 61%. The mean score on the ecology assessment increased from 33% to 83%, an increase of 50%. Finally, the cells assessment score increased from 30% to 88%, an increase of 58%. Students averaged a 44% on the measurement (non-treatment) pretest, and 80% on the post-test, an increase of only 36%.

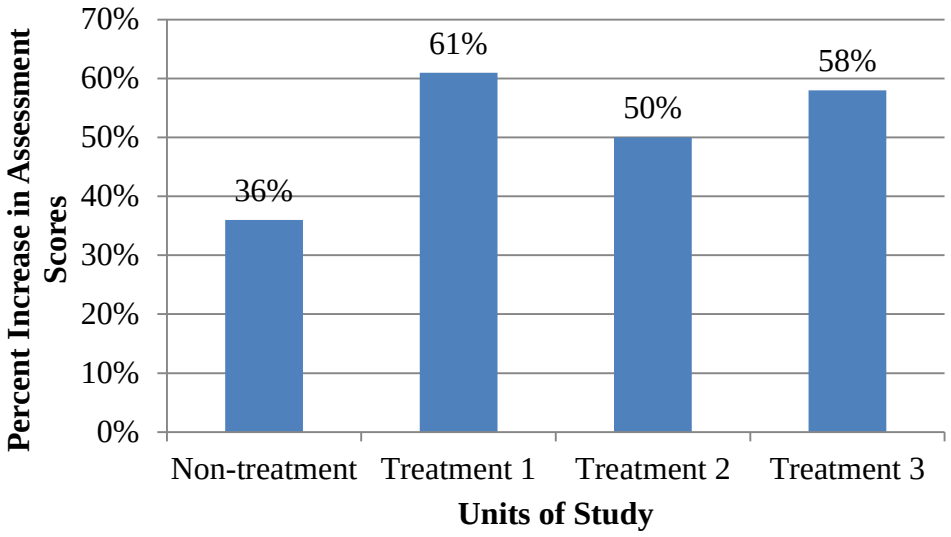


Figure 6. Percent increase between pre and post unit assessments, (*N*=126).

Performance on the pre and post assessments was also analyzed by subgroup (Table 4, Figure 7). Results showed that low and mid-achieving students improved the most on the classification test. Low-achieving students' assessment scores increased by 60% and mid-achieving students' scores increased by 62%. High-achieving students improved the most on the cells test with a score increase of 62%. All students improved the least for the non-treatment unit. Low-achieving students increased scores by 35%, mid-achieving students by 39%, and high-achieving students by 34%. Except for the cells test, mid-achieving students improved the most between pre and post assessments. Scores between low and high-achieving students tended to parallel one another except for in the cells unit. It is also evident that high-achieving students tended to improve the least between pre and post assessments, except for in the cells unit.

Table 4
Score Increases Between Pre and Post Unit Assessments (*N*=126)

	Non-treatment	Treatment 1	Treatment 2	Treatment 3
All students	36	61	50	58
Low-achieving	35	60	48	57
Mid-achieving	39	62	50	56
High-achieving	34	60	46	62

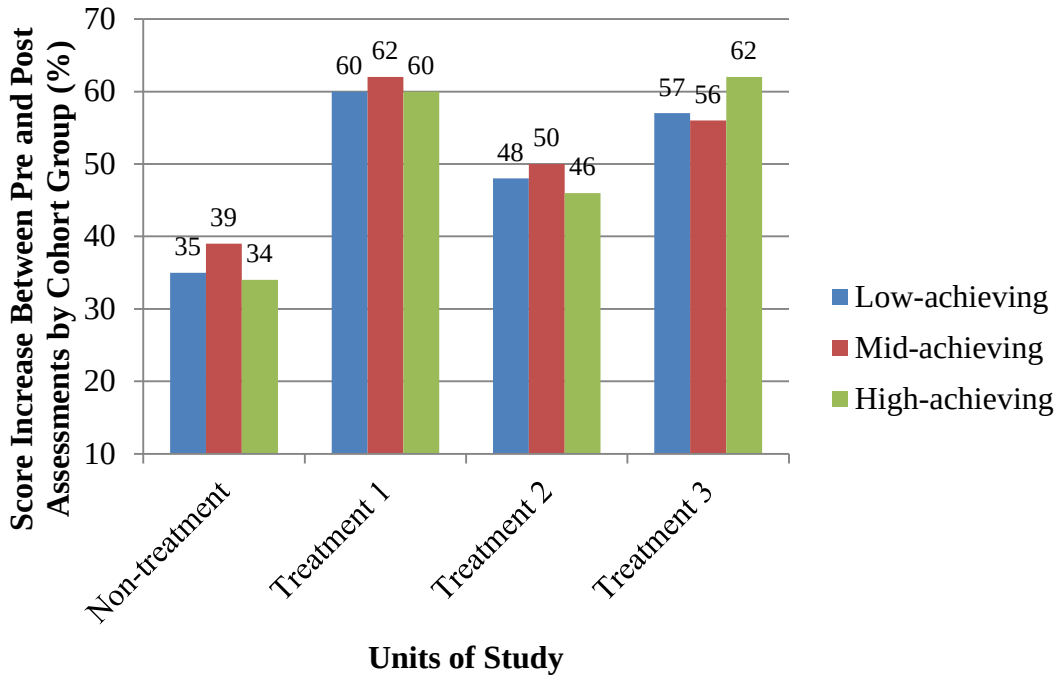


Figure 7. Percent increase between pre and post unit assessments for low, mid and high-achieving students, (*N*= 126).

Conclusion

In general, this study shows that use of the Unit Organizer Routine in seventh grade science may help to develop student awareness of the learning process while enhancing understanding of seventh grade science concepts. Throughout the course of the study, improvements were observed in the areas of understanding science concepts, self-regulated learning strategy use, and academic performance. Little change was observed in the area of student-perceived science self-efficacy which is likely related to the short length of this study.

INTERPRETATION AND CONCLUSION

This study provides evidence that the Unit Organizer Routine can contribute to an increased understanding of seventh grade science content concepts. Results from the concept map construction and Concept Map Interview showed that students were better able to identify the main concept of a unit, differentiate the main concept from sub-concepts, and organize unit details according to subtopic, following use of the Unit Organizer Routine.

Scores increased the most for low-achieving students who struggled most with organizing unit concepts in the non-treatment unit. This finding supports the designer's rationale for the development of the Unit Organizer Routine—it was intended to target students who struggled academically and/or struggled with abstract thinking. This result also aligns with a finding from the Self-efficacy Questionnaire. Low-performing students felt that they better understood the basic concepts taught in seventh grade science units after having used the Unit Organizer Routine.

It is apparent that the Unit Map was found to be most useful for seventh grade science students because it allowed them to identify relationships between the big idea of the unit, and important unit subtopics and details. Overall, the majority of seventh graders felt that the routine was a useful tool both in the classroom and at home.

This investigation also showed that the Unit Organizer Routine may contribute to increases in some facets of student perceived science self-efficacy. Results from the Self-efficacy Questionnaire revealed that students' belief in their ability to perform well in the classroom improved following treatment. This finding may partially be related to improved test scores in the treatment units. However, student's belief in their ability to

understand difficult and complex science material showed little change. Low-achieving students were the exception, as their self-efficacy decreased in three areas related to both performance and understanding of complex content material. This could be related to different factors. Research conducted by Erik Erickson (1980) has shown that in order for self-efficacy to improve, a student must receive "wholehearted and *consistent* recognition of accomplishment." Even for low students who were able to achieve increased academic success with use of the routine, this study may have been too short to observe many changes in self-efficacy. Also, the decrease in self-efficacy could be related to personal factors such as changes in emotional state, rather than performance or behavioral factors (Pajares, 2006). The Student Self-efficacy Student Reflection revealed that most high-achieving students began the study with high self-efficacy which they often attributed to effort and utilization of various study techniques. Most of these students had a history of academic mastery experience; they expected this of themselves and continued to achieve it because they believed they could. High-achieving students also have a tendency to be "teacher pleasers" in general, and they may have felt the need to respond appropriately to the student self-reflection questions. Mid and low-achieving students showed mixed feelings and provided specific reasons for their academic struggles such as test anxiety or lack of confidence in their ability to exercise a particular academic skill. Results from the Self-efficacy Interview showed that self-efficacy was initially lowest in mid-achieving students but this group showed the most improvement following use of the Unit Organizer Routine.

Results from this study also showed that the Unit Organizer Routine facilitated self-regulated learning strategy use in seventh grade science. High and mid-achieving

students experienced improvement in their abilities to review concepts and prepare for tests, and low-achieving students identified increased use of multiple self-regulated learning strategies following use of the routine. The Study Habits Self-reflection showed that overall, students spent more time studying at home; however, some felt that they could have made better use of their time in class to learn content concepts. In addition, individual students identified using a greater number of study resources to prepare for tests. By the third treatment unit, I witnessed many overall changes in how students used resources available to them to study for tests when I acted as an active participant observer. While students created quiz questions for each other using the Unit Organizer Handout, they often cross-referenced concepts from the handout with the textbook, or from student handouts, and in doing so, they exuded more confidence while studying that they did for the first treatment unit.

When students used the Unit Organizer Routine, differences between pre and post assessment scores improved for the three treatment groups. Overall, results from this study indicate that this tool is likely to have played a role in the increased successes of seventh grade science students. Improvements may be related to changes in self-belief or habits of mind, academic skills, self-regulatory practices, or a combination of the three interconnected factors.

VALUE

The experience of designing and implementing this capstone project led to three significant changes in my approach to teaching. The first area is in unit planning. Prior to using the Unit Organizer Routine, I planned my units week by week. I was careful to

display my lesson topics and homework assignments on the board on Mondays so that students could organize their agendas in advance. I often found that midway through the week, I would decide to create a new lesson about a related content concept, add a new lab, or integrate a new content concept. I thought of myself as a flexible teacher and considered this an asset. Using the Unit Organizer Routine in my class has allowed me to see how important it is to plan exactly which content concepts I wish to teach before I introduce the unit, establish the relationships between these concepts ahead of time, and then communicate them to students. By planning all lessons prior to beginning the unit I noticed several positive effects. First, I felt more confident, relaxed, and less rushed for time once I began teaching a particular unit. The calendar had already been presented to students; they knew what to expect and stopped asking me what we would be doing each day as they entered the classroom. I was not dividing my after school time between planning for the next day and other teaching tasks. I also discovered that students approached the unit with a better sense of direction toward the content presented. They could prioritize content concepts and see the relationships between concepts better by cross-referencing the Unit Calendar with the Unit Map. Students' questions became more insightful and often-anxious students appeared more confident. To date, my perception is that most of my units incorporate use of the Routine and are better planned than they have ever been. I still intend to change many lessons, but will do so before beginning the unit. One of my professional goals for next year is to use the Unit Organizer for all of my units.

The second area of change in my teaching involves my use of learning strategy integration. For the last couple of years, my professional focus involved creating and

using high-quality, engaging lessons plans for each of my units. My intention was to find the most meaningful way possible for students to learn unit content in a way that captivated their interest. What I did not realize was that many students still struggled academically with the high-quality lessons if they did not possess a repertoire of learning strategies in their toolbox with which to practice and store this newly acquired content knowledge. The Unit Organizer Routine presented a perfect avenue for integrating the communication of content concepts with use of several learning strategies. Some of these strategies that I used were part of the actual routine such the Unit Map and the student-generated Unit Self-test Questions. The Student Handout provided an effective tool for peer quizzing on test review days. When students developed and asked questions to one another they were better able to distinguish content material that they understood from material they did not understand. The Unit Map encouraged me to integrate basic outlining skills and the Critical Vocabulary Section identified a list of words that could be transferred into student made flash cards. After using the Routine, students appeared much more confident in their ability to prepare for unit tests, especially middle and low-achieving students who at times did not know how to begin the process of studying. One of my professional goals is to keep reinforcing these study strategies in conjunction with introducing new content with the hope that consistent strategy use will better prepare my students with the tools they need to succeed in high school.

The third area of change in my teaching is related to student self-efficacy beliefs and the research process. Before beginning this project I was unaware of the strong tie between student self-efficacy beliefs and academic performance. This may be partially due to personal bias related to my own positive experiences as a middle school student. I

did not realize the extent to which confidence plays a significant role in an adolescent's achievement of academic success. It is standard practice for teachers to track student performance and achievement throughout the learning process, but it's not considered the norm to monitor how students view their capabilities as they progress through unit content. My data collection techniques—the questionnaire, the interview questions and the student self-reflections provided enormous insight for me to see exactly who lacked confidence in their ability to experience academic success in my science class. This allowed me to provide additional interventions and encouragement to students with poor self-efficacy beliefs. I have made it a professional goal to continue use of comparable techniques in order to identify children who lack confidence in their abilities. The most rewarding aspect of this study was seeing changes in students who initially held poor self-efficacy beliefs. Some participants appeared to experience both academic and personal growth after using the Unit Organizer Routine.

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APPENDICES

APPENDIX A

UNIT ORGANIZER SAMPLE

THE UNIT ORGANIZER

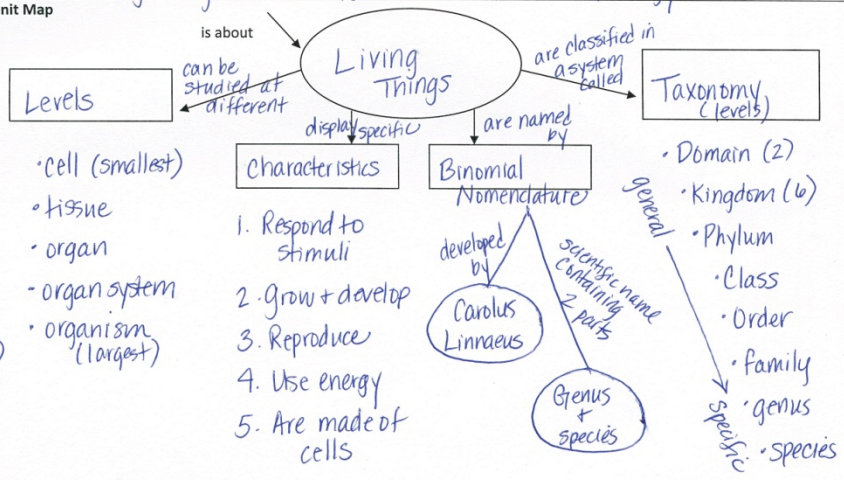
BIGGER PICTURE: ← Biology →

LAST UNIT	CURRENT UNIT	NEXT UNIT
Measurement	Living Things + Classification	Ecology

UNIT SCHEDULE

10|24	What is life activity
10|25	Life + energy
10|26	Life on Mars lab
10|27	Life in extremes lab
10|28	Org. of life rotation stations
10|31	Homeostasis activity
11|1	6 Kingdoms Zoo
11|2	Zoo design
11|3	Alien classification
11|4	Taxonomy + Linnaeus (Levels)
11|7	Scientific names activity
11|8	Dichot. Keys
11|9	Dichot Keys
11|10	Test review
11|11	Test

Unit Map



UNIT SELF-TEST QUESTIONS

- What are the characteristics of living things?
- What do living things need to survive?
- Why do biologists classify organisms?
- What are the levels of classification?
- How are dichotomous keys useful?
- How are organisms classified into Domains + Kingdoms?

UNIT RELATIONSHIPS

- smallest to largest (rank 5 levels of life)
- broad to specific (levels of classification)
- autotroph vs. heterotroph
- prokaryote vs. eukaryote
- unicellular vs. multicellular

CRITICAL VOCABULARY

organism cell unicellular multicellular stimulus response development autotroph heterotroph homeostasis classification taxonomy binomial nomenclature prokaryote eukaryote ~~tissue organ organ system Linnaeus domain Kingdom~~ phylum class order family genus species

APPENDIX B

RESEARCHER FIELD NOTES SAMPLE

Field Notes Sample

Date	Observation
12/8/12	Students worked in partner pairs to prepare for the ecology test. Partners asked each other quiz questions using the Unit Organizer Student Handout as a guide. Most students began by using the Unit Self-test questions. After that students either targeted the Unit Map or the Vocabulary section. Students became more confident with their questioning strategies and appeared to feel more comfortable using the handout as a study tool. Most appeared to have a "system" worked out with their partners. Some students will took turns asking questions within a specific section of the handout. Other groups ran through an entire section once (being the questioner/answerer) and then switched roles after they finished the section. While using the Unit Map, students typically began their questions with phrases such as "Tell me everything you know about…" If the answerer reached a point where they couldn't think of the next detail within that subtopic, the questioner usually gave them a hint. Several partner pairs started (again-as with the classification unit) thinking that they knew more that they actually did. I noticed two groups stop to take time out to simply study the Unit Map details and later resume quizzing. One student commented that you really know you understand something when you can teach it to someone else.

APPENDIX C

STUDY HABITS STUDENT REFLECTION

Study Habits Self-Reflection

Directions: Please answer the following questions with honesty. Participation is voluntary.

1. How would you describe your use of time in class to prepare for this test?

   ___ I didn't use my time wisely in class.

   ___ I used my time wisely in class on some days but not on other days.

   ___ I used my time wisely in class every day.

2. How would you describe your use time at home to prepare for this test?

   ___ I did not study at home because I forgot about the test when I got home.

   ___ I did not study at home because I had other things to do instead of study.

   ___ I did not study at home because I already felt well prepared for this test.

   ___ I studied at home until I felt somewhat prepared.

   ___ I studied at home until I felt well prepared.

3. In the space below, list any resources or materials that you used to prepare for this test (study partners count as a resource).

4. On a scale of 1-5, how much effort did you use to prepare for this test?

I applied almost no effort				I applied a great deal of effort
□	□	□	□	□
1	2	3	4	5

APPENDIX D

SELF-REGULATED LEARNING INTERVIEW QUESTIONS*

** Based on Zimmerman & Martinez-Pons, 1990*

Self-regulated Learning Interview Questions

Directions: Please answer the following questions with honesty. Participation is voluntary.

1. Assume your teacher is discussing with your class the difference between prokaryotic and eukaryotic cells. Your teacher says that you will be tested on the topic the next day.
    - Do you have a method that you would use to help you learn and remember the information being discussed?
    - What if you were having trouble understanding or remembering the information discussed in class?*

2. Assume your teacher asks students in your class to write a short paper on a topic such as the characteristics of living things. Your score on this paper will affect your progress report grade.
    - In such cases, do you have any particular method to help you plan and write your paper?
    - What if you are having difficulty with the topic?*

3. Teachers usually expect much accuracy with students' science homework that contains math-based problems. Many of these assignments must be completed without the help of a teacher.
    - Is there any particular method you use when you don't understand a math problem at home?
    - What if the assignment deals with a very difficult type of problem?*

4. When completing homework assignments such as science reports, do you use a particular method for checking your work after it is finished?
    - What if it is a difficult assignment?*

5. Most teachers give important tests at the end of grading periods, and these tests greatly affect progress report grades.
    - Do you have any particular methods or strategies for preparing for an especially difficult test?
    - What if you are preparing for an especially difficult test?*

6. Many times students have a difficult time completing homework assignments because there are more interesting things that they would rather do such as playing video games, texting, or hanging out with friends.
    - Do you have any particular method for motivating yourself to complete your homework under these circumstances?
    - What if you are trying to meet a rapidly approaching due date?*

7. Some students find it easier if they can arrange the place where they study.
    - Do you have a particular method for arranging the place where you study?
    - What if you are having difficulty concentrating on our school work?*

APPENDIX E

SELF-EFFICACY PORTION OF THE MOTIVATED STRATEGIES FOR LEARNING QUESTIONNAIRE (MSLQ)*

* *Based on Pintrich & DeGroot, 1990*

Self-Efficacy Self Report Questionnaire

Directions: Mark the box that best describes your attitude. Please answer the following questions with honesty. Participation is voluntary.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I believe I will receive an excellent grade in this class.	☐	☐	☐	☐	☐
I'm certain I can understand the most difficult material in this class.	☐	☐	☐	☐	☐
I'm confident I can understand the basic concepts taught in this class.	☐	☐	☐	☐	☐
I'm confident I can understand the most complex material presented by the teacher in this class.	☐	☐	☐	☐	☐
I'm confident I can do an excellent job on the assignments and tests in this class.	☐	☐	☐	☐	☐
I expect to do well in this class.	☐	☐	☐	☐	☐
I'm certain I can understand the skills being taught in this class.	☐	☐	☐	☐	☐
Considering the difficulty of this class, and my skills, I think I will do well in this class.	☐	☐	☐	☐	☐

APPENDIX F

SELF-EFFICACY INTERVIEW QUESTIONS*

** Based on Zimmerman & Martinez-Pons, 1990*

Self-Efficacy Interview Prompts

Science Vocabulary

For each word presented below, estimate how sure you are that you can define it correctly. You must give your answer in ten seconds or less, so you will not have time to write a definition. Give your best estimate of your confidence (any number between 0% and 100%) that your definition will be assessed as correct by a teacher. Some words are very difficult, and most students cannot define them. It is important that you do not guess but give a realistic estimate of whether your answer is correct. If you are completely unsure of your answer, mark 0%; if you are not sure of it, mark 50%; if you are completely sure of your answer, mark 100%. Participation is voluntary.

APPENDIX G

SELF-EFFICACY STUDENT REFLECTION

Self-Efficacy Self-reflection

Directions: Please answer the following questions with honesty. Participation is voluntary.

1. How confident are you about doing well on the assignments and tests in seventh grade life science? Explain.

2. How confident are you in understanding all of the content material that we learn in this class by the time that we take the test? Explain.

3. Overall, how would you describe your academic performance in life science class so far this year? Explain.

APPENDIX H

SCIENCE CONCEPTS STUDENT SELF-REFLECTION

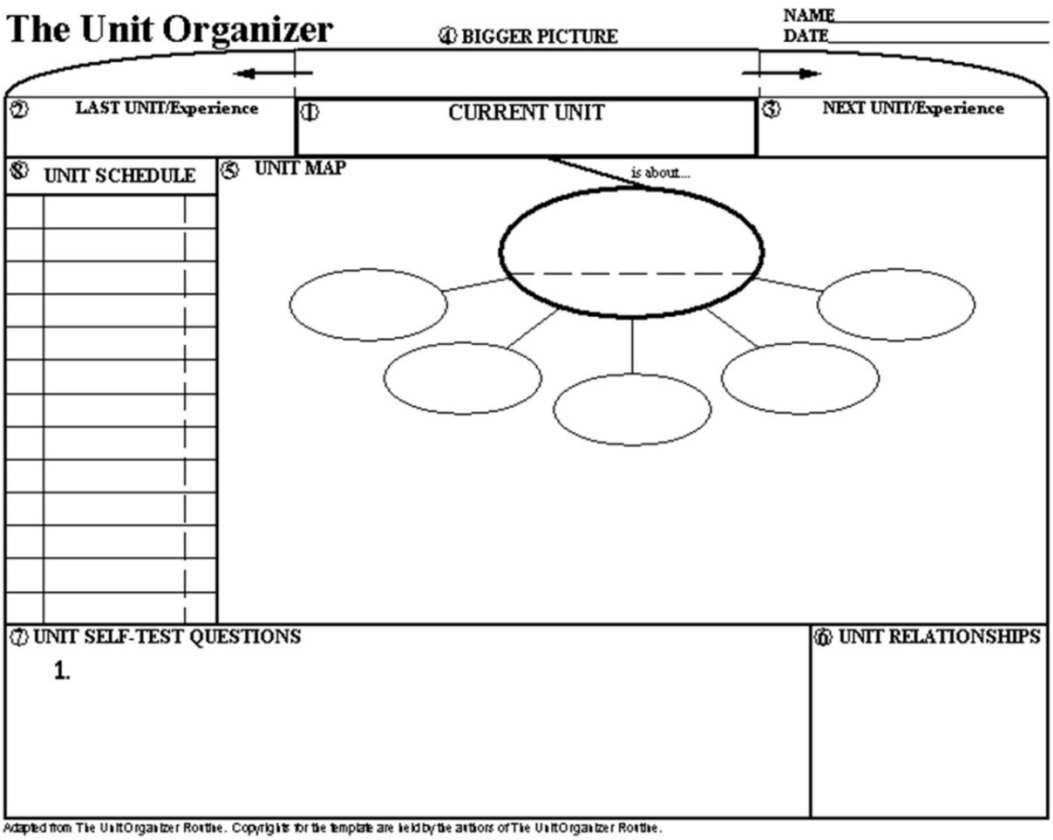
Student Reflection: Use of the Unit Organizer Routine

Directions: Please answer the following questions with honesty. Participation is voluntary.

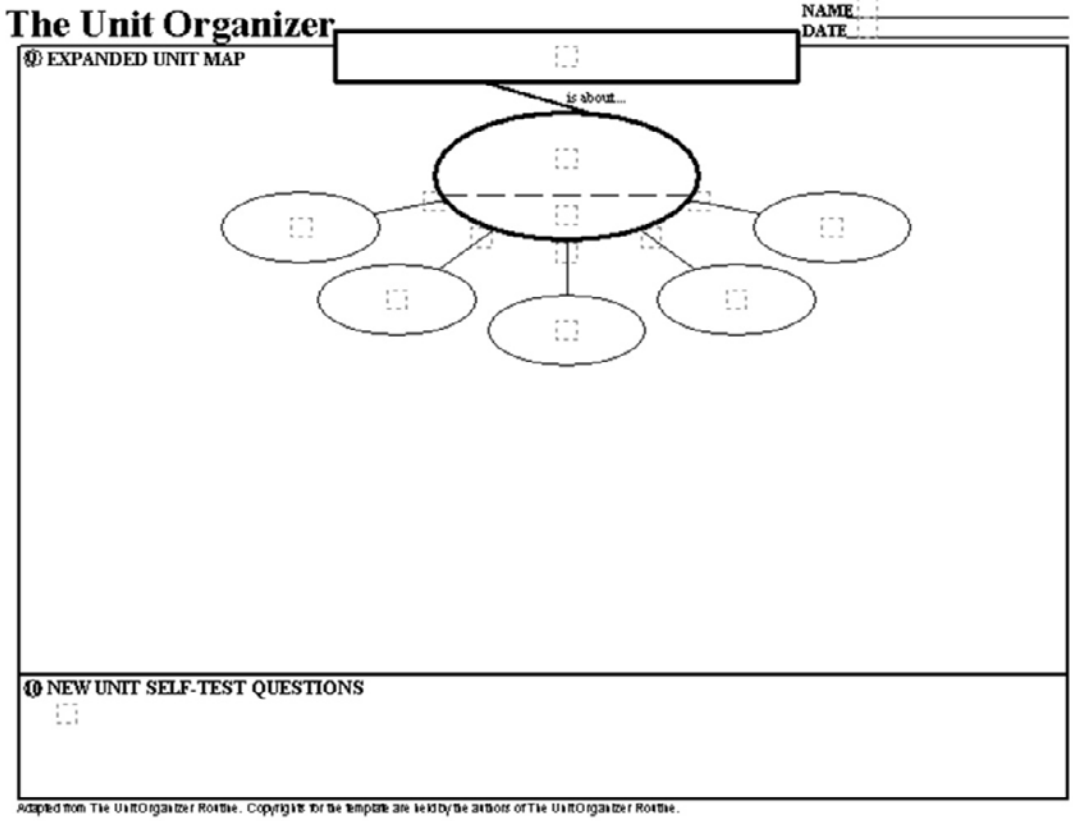
1. We have been using the Unit Organizer Routine for the last three units of study. Do you feel that the Unit Organizer has been a helpful learning tool for you in science class? Explain your answer in detail.

2. View the picture of the Unit Organizer on the next page. Which of the following part(s) of the Unit Organizer Routine have been most helpful to you? Explain in detail.

3. Is there anything that you would change about how we use the Unit Organizer Routine?



Adapted from The UnitOrganizer Routine. Copyrights for the template are held by the authors of The UnitOrganizer Routine.



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APPENDIX I

CONCEPT MAP INTERVIEW QUESTIONS AND RUBRIC

Concept Map Interview Rubric

	3	2	1	0
Major concept recognition	Correctly identified both the major topic of the unit, and all unit subtopics	Correctly identified the major topic of the unit, plus 2-3 subtopics or did not distinguish between major topic and subtopics	Correctly identified the major topic of the unit, plus 1correct subtopic	Did not identify the correct unit topic or subtopics
Use of arrows to show unit relationships		Accurately used arrows to show relationships between main topic, subtopics and details	Accurately used arrows to connect major topic and subtopics, but inaccurate use of arrows between subtopics and details	Inaccurate use of arrows to identify unit relationships
Organization of unit concepts	Grouped all unit topics, subtopics and details in a way that demonstrates deep understanding of content concepts	Grouped all unit topics, subtopics and details in a way that shows basic understanding of content concepts	Grouped unit topics, subtopics and details in a way that shows partial understanding of content concepts	Inaccurately grouped content concepts
Student Name: _____ CRT Score: _____ Map Score ___8				

Interview Questions:

Explain how you constructed this concept map.

a. Why did you put the cards in the places that you chose?
b. Explain how the concepts shown are related to one another.

APPENDIX J

MEASUREMENT UNIT PRE AND POST ASSESSMENT

Measurement Unit Assessment

Directions: Answer the following questions to the best of your ability.

1. List at least 5 units of measurement that belong to the metric system.
_____ _____ _____ _____
_____

2. Name these measurement tools:







A_____ B_____ C_____ D_____ E_____

3. Look at the measurement tools A, B, C, D & E shown above.

Which tool would I use to measure exactly 22 mL of water? ___
Which tool would I use to measure the length of my hand? ___
Which tool(s) would I use to measure approximately 100 mL water? ___ ___
Which tool would I use to measure the mass of an egg? ___

4. Does each tool measure MASS, VOLUME, TEMPERATURE, or LENGTH?

A_____ B_____ C_____ D_____
E_____

5. Check the unit of measurement that a scientist would use for each task.

Measure the width of pencil:	Measure the distance from here to Townsend:	Measure a volume of liquid cough medicine:
___ inches	___ miles	___ milliliters
___ centimeters	___ meters	___ ounces
___ millimeters	___ kilometers	___ grams
Measure your body mass:	**Measure the volume of gas in my car:**	**Measure the mass of a domino:**
___ pounds	___ milliliters	___ ounces
___ kilograms	___ liters	___ grams
___ liters	___ gallons	___ centimeters

6. Why do scientists use a standard measurement system (only one system of measurement units)?

APPENDIX K

CLASSIFICATION UNIT PRE AND POST ASSESSMENT

Living Things and Classification Unit Assessment

Directions: Answer the following questions to the best of your ability.

1. Listed below are examples of living (which includes once-living) and nonliving things. Put a check next to the things that could be considered living.*

___ tree	___ boy	___ cloud
___ rock	___ wind	___ feather
___ fire	___ rabbit	___ grass
___ bacteria	___ egg	___ peanut
___ cell	___ molecule	___ mushroom
___ butterfly	___ leaf	___ potato

2. Rank the following in order from smallest to largest. (smallest = 1, largest = 6).

__ organ system __ cell __ organism __ tissue __ molecule __ organ

3. Listed below are examples of groups that scientists use to categorize organisms. Place a check in front of the words that are examples of Kingdoms from the classification system.

___ Mammals	___ Order	___ Class
___ Eubacteria	___ Domain	___ Amphibians
___ Mollusks	___ Reptiles	___ Animals
___ Phylum	___ Archaebacteria	___ Fungi
___ Genus	___ Domain	___ Protists
___ Autotroph	___ Family	___ Birds

4. List the 8 levels of classification (from most general to most specific).

_____ _____ _____ _____
_____ _____ _____ _____

5. According to the system of binomial nomenclature, which of the following is a properly written scientific name?

a. Acer rubrum
b. *Acer rubrum*
c. Acer Rubrum
d. acer rubrum

6. Which of the following is an example of an autotroph?
    a. a lion
    b. a tree
    c. an eagle
    d. a mushroom

7. Review the chart below.

Some Types of Trees			
Common Name of Tree	**Kingdom**	**Family**	**Species**
Bird cherry	Plants	Rosaceae	*Prunus avlum*
Flowering cherry	Plants	Rosaceae	*Prunus serrula*
Smooth-leafed elm	Plants	Ulmaceae	*Ultimus minor*
Whitebeam	Plants	Rosaceae	*Sorbus aria*

Which one of the four trees is most different from the other three? Explain your answer.

** Based on Keeley et al., 2005*

APPENDIX L

ECOLOGY UNIT PRE AND POST ASSESSMENT

Ecology Unit Assessment

Directions: Answer the following questions to the best of your ability.

1. Identify each symbiotic relationship described below as an example of mutualism (M), commensalism (C), or parasitism (P).

   ___ A bee pollinates a flower.
   ___ A vampire bat drinks the blood of horses.
   ___ A remora fish attaches itself to the underside of a shark without harming the shark, and eats leftover bits of food from the shark's meals.

2. In general, which of the following is a true statement about population size? Circle the best answer.

   a. If birth rate is less than death rate, population size increases.
   b. If death rate is less than birth rate, population size decreases.
   c. If birth rate is greater than death rate, population size increases.
   d. If death rate is greater than birth rate, population size increases.

3. The environment has different levels of organization. Place the following levels in order from smallest (1) to largest (5).

   ___ community ___ organism ___ ecosystem ___ population ___ biosphere

4. Three different bird species all live in the same trees in an area, but competition between the birds rarely occurs. Which of the following is a likely explanation for this lack of competition? Circle the best answer.

   a. The three species occupy different niches.
   b. The three species eat the same food.
   c. The three species have a limited supply of food.
   d. The three species live in the same part of the trees.

5. An organism's habitat is made up of biotic factors and abiotic factors. Identify each of the following factors as biotic (B) or abiotic (A).

___ wind	___ flower	___ fire
___ gravel	___ water	___ rain
___ fish	___ rabbit	___ grass
___ bacteria	___ egg	___ snow
___ temperature	___ molecule	___ sunlight

6. Organisms obtain their energy in different ways. Classify the following organisms according to how they obtain their energy.

   (P = producer, H = herbivore, C = carnivore, O = omnivore, S = scavenger, D = decomposer)

___ bear	___ mushroom	___ deer
___ vulture	___ wolf	___ hawk
___ pine tree	___ rabbit	___ sunflower
___ cougar	___ grass	___ mouse

7. Draw an example of a four-link food chain in the space below. Use arrows to show the direction of energy flow through the food chain.

APPENDIX M

CELLS UNIT PRE AND POST ASSESSMENT

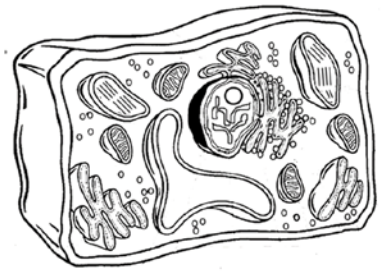
Cells Unit Assessment

Directions: Answer the following questions to the best of your ability.

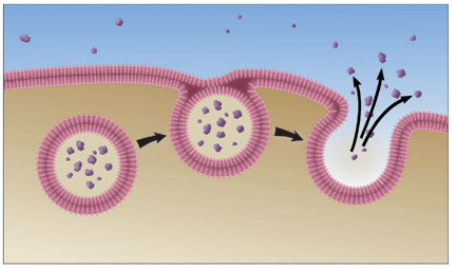
1. Imagine you could examine the objects and materials listed below with a powerful microscope. This powerful microscope will allow you to see evidence of cell structure. Put a check next to the objects or materials that are made up, or were once made up, of cells.*

___ dandelions	___ stomach	___ water
___ skin	___ hot dog	___ salt
___ proteins	___ DNA	___ paramecium
___ sand	___ vitamins	___ nucleus
___ milk	___ oranges	___ saliva
___ bone	___ leaf	___ molecules

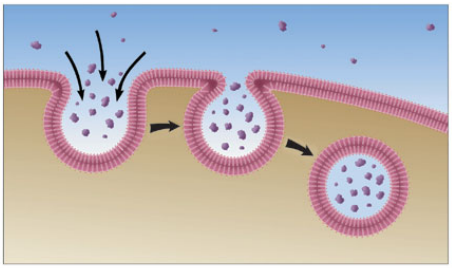
2. Identify this drawing as a plant cell or an animal cell. Justify your answer by describing how the structures of this cell compare to plant and animal cells.



3. Name the transport processes shown in the illustrations below.



A. _____



B. _____

4. Indicate whether each of the following characteristics belongs to prokaryotic cells (P) or eukaryotic cells (E).

___ no nucleus	___ bacteria	___ no membrane-bound organelles
___ membrane-bound organelles	___ linear-shaped DNA	
	___ nucleus	___ circular-shaped DNA

5. The cell membrane is made mostly of a double layer of molecules called _____. Circle the best answer.

    a. lipids
    b. nucleic acids
    c. proteins
    d. carbohydrates

6. Which of the following is an example of an element? Circle the best answer.

    a. cell
    b. hydrogen
    c. water
    d. starch

7. Scientists describe cell membranes as being <u>selectively permeable</u>. What does this mean?

** Based on Keeley et al., 2005*