EFFECTS OF NOTETAKING INSTRUCTION ON

3RD GRADE STUDENT'S SCIENCE LEARNING

AND NOTETAKING BEHAVIOR

by

PAI-LIN LEE, M.Ed.

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ABSTRACT

The research examined effects of notetaking instruction on elementary-aged students' ability to recall science information and notetaking behavior. Classes of 3rd grade students were randomly assigned to three treatment conditions, strategic notetaking, partial strategic notetaking, and control, for four training sessions. The effects of the notetaking instruction were measured by their performances on science test information taught during the training, a long-term free recall of the information, and number of information units recalled with or without cues. Students' prior science achievement was used to group students into two levels (high vs. low) and functioned as another independent variable in analysis.

Results indicated significant treatment effect on cued and non-cued recall of the information units in favor of the strategy instruction groups. Students with higher prior achievement in science performed better on cued recall and long-term free recall of information. The results suggest that students as young as at the third grade can be instructed to develop the ability of notetaking that promotes their notetaking behavior.

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CHAPTER I

INTRODUCTION

Today, mankind is undergoing what is arguably the most critical change ever experienced in human history (Huitt 1999). As Huitt postulates, people in the past boasted the greatest success by being most skilled at killing animals, possessing more land, and owning the most capital, in the hunting age, in agriculture society, and in industrial society, respectively. The definition of success in the information age is totally different from these societies. Knowledge is the central focus of today's society (Toeffler, 1990): "He who has access to knowledge has the power" (p.20) and has the best chance to be successful (Toeffer, 1990, 1995).

One indicator of this change is that students in the 21st century are held accountable for learning a certain set of skills, and teachers need to teach students the requisite knowledge and skills necessary not only for survival, but for success in school (Huitt, 1999). Because favorable results of learning strategies are reflected in students' academic performance, students who possess superior learning skills may be assumed have a greater opportunity to improve their learning, and more chances for success in school in the very competitive 21st century. Notetaking may be one of the more important skills student learn for further success.

Unfortunately, many students from elementary school to college have not been taught the skills needed for success for academic performance (Fry, 1996). There are many reasons for this, but researchers suggest that some likely reasons include that teachers lack training about how to teach study skills (Thomas, 1993) or teachers may believe that teaching skills is the job of special education. These and other reasons contribute to study skills' not being taught much (White & Greenwood, 1991).

Researchers contend that after a student successfully learns a specific piece of knowledge or a skill, he or she will face a variety of other tasks and situations where the knowledge and skill are demanded. Since it is difficult, if not impossible, for the learners to prepare for all of these eventualities, teachers should teach students learning strategies so that the learner can generalize the strategies to accommodate potential future demands, which is the rationale behind strategy instruction (Singer, Cauraugh, Lucariello, & Brown, 1985).

Prior Research

Learning Strategies

Learning strategies may be defined as "intentional use of one or more cognitive processes to accomplish a particular learning task" (Ormrod, 2004). Researchers have identified many learning strategies that benefit students' learning, such as elaboration (Dole et al., 1991; Pressley, 1982; Waters, 1982; Weinstein, 1978; Wittrock & Alesandrini, 1990), organization (Britton et al., 1998; Gauntt, 1991; Kail, 1990; Wade, 1992), notetaking (Benton, Kiewra, Whitfill, & Dennison, 1993; Cohn, Hult, & Engle, 1990; Hale, 1983; Kiewra, 1989; Shrager & Mayer, 1989), identifying important information (Dole et al., 1991; Reynolds & Shirey, 1988), and summarizing (Davis &

Hult, 1997; Dole et al., 1991; Jonassen, Hartley, & Trueman, 1986; King, 1992; Rinehart, Stahl, & Erickson, 1986; Wittrock & Alesandrini, 1990).

Among these learning strategies, notetaking above all, incorporates most of these strategies actions. Notetaking provides students with opportunities to elaborate information presented to them (Barnett et al., 1981; Kiewra, 1989; King, 1992), and helps them focus on important information (Brown, Campione, & Day, 1981; Doctorow, Wittrock, & Marks, 1978; Kiewra, 1985; Taylor, 1982). Additionally, notetaking functions as an external storage for information (Benton et al., 1993; Kiewra, 1991), and furnishes cues during retrieval (Carter & Van Matre, 1975). Not surprisingly, researchers have found that the frequency and quality of notetaking are correlated with students academic performance (Baker & Lomardi, 1985; Boyle, J. 1996; Boyle & Wishaar,2001; DiVesta & Gray, 1972; Fisher & Harris, 1973; Hale, 1983; Hartley, 1983; Kiewra, 1985, 1989; Simbo, 1988; Shrager & Mayer, 1989; Suritsky & Hughes, 1996; Thomas, 1993).

Learning Strategies Instruction

Many studies suggested that students should be taught study skills, because of the enhancing effect of the skills/strategies on learning (Schunk, 2004). Some argue that it is never too early to learn organization skills such as notetaking (Smith, Teske, & Gossmeyer 2000; Thomas, 1993). Student-taught learning skills, including notetaking, improved their academic performance in various subject areas (Hartley, 1983; Hughes, C, & Suritsky 1994; Kiewra, 1985; Ornstein, 1994). Researchers also showed that a learner's inadequacy knowledge of study skills is a major reason that students encounter academic difficulty during their school years or later in college (Rafoth, Leal, & DeFabo, 1993; Thomas, 1993). Wittrock (1974) has also suggested that learning strategies and learning content knowledge are both important elements to learning outcomes.

Recently, researchers have shown the effectiveness of strategy instruction. For, example, researchers have shown that problem-solving strategies taught to high school students improve their performance on job-related problems (Hutchinson, 1993, 1996). Strategy instruction has also been used to help disabled students reduce text-anxiety and improve performance on tests administered in mainstream classrooms (Hughes & Schumaker, 1991). Reading strategies were taught to help second and third grade students comprehend reading materials (Feldt & Felt, 2001). One meta-analysis study result also showed benefits of strategy instruction via modeling (Swanson, 1999).

Even though students have been taught about learning strategies, they still may not use strategies effectively. For example, Kiewra (1988) suggests that notetaking involves "attending to the lecture, locating targets in long-term memory, holding and manipulating the attended information in working memory, encoding ideas into long-term memory, and transcribing relevant notions" (p.41). Students who simply jot down all the information during lecture in the class without review, or pay attention to the class without taking any notes, find these strategies insufficient (Kiewra, 1991). Researchers also found that strategies should not be taught as a separate topic; instead, they should be taught throughout the curriculum as part of academic tasks (Pressley & Woloshyn, 1995;

Pressley & McCormick, 1995). This principle of strategy instruction should also apply to notetaking training.

Overall, there is an abundance of research related to the effectiveness of learning strategies, but relatively few researchers focus on training of strategy instruction. Some researchers have asserted that students can become effective notetakers by receiving systematic notetaking instruction such as learning from an expert (King & Stahl, 1985; Stanley, 1986).

Factors Affecting Effective Use of Strategies

Prior knowledge is one of the most important factors affecting students' storage of information in the long-term memory (Ausubel et al., 1978). Likewise, prior knowledge plays an important role in learning and using strategies. According to Pressley (1987), when materials activated students' prior knowledge, a more sophisticated strategy is used. When prior knowledge is inadequate, a less favorable outcomes occurred. It stands to reason that students with different levels of prior knowledge may respond to instruction of notetaking differently.

Notetaking has been proven to be an effective learning strategy (Benton, Kiewra, Whitfill, & Dennison, 1993; Cohn, Hult, & Engle, 1990; Hale, 1983). Among many formats of notetaking instruction, the strategic notetaking, in which written prompts were provided to prompts, guide students in catching main points, summarizing, and organizing lecture information (Boyle, 1996, 2001; Boyle & Wachaar, 2001), has been shown to be an effective learning tool in the classroom at college and high school level;

moreover, the strategic notetaking is a useful tool in learning for both normal students and students with special needs. This technique assists students in using "metacognitive skills (i.e., organizing information and combining new information with prior knowledge) during lectures, thereby increasing their engagement during notetaking (Boyle, 2001, p.223)". Boyle (1996, 2001) argues that through using metacognitive skill, students were actively engaged in the learning process, thereby enhancing their understanding of the lecture.

Although the effectiveness of notetaking has been well demonstrated, most of the studies have been done with high school or college students in the United States. In this study, the researcher investigated the effects of notetaking instruction to elementary students. Although the study was done with Taiwanese elementary students, it was anticipated that findings would benefit students in other cultures. As indicated by researchers, fundamental learning strategies should function similarly among children in different cultures, and strategic notetaking methods should not be expected to be a culturally dependent tool. As Gutek (2003) states:

> "Montessori believed that because they possessed a universal human nature that children everywhere possessed these physiological and psychic powers. The phases of human development, therefore, were universal in that individuals experience the same stages in the development process regardless of their culture, race, or ethnicity." (p. 182)

Purpose of Study

The purpose of this study was to examine the effectiveness of notetaking strategy instruction on students' notetaking behavior and learning in order to find a suitable instructional mode for teaching notetaking to elementary level students.

Design of the study

This study utilized a 3 X 2 factorial design, with six experimental conditions constituted by the type of notetaking instruction (control, full notetaking strategic, and partial notetaking strategic) and the category of prior knowledge (high vs. low) which was defined based on students' performance on a Science midterm examination score. Students' writing speed was used as a covariate. Specifically, these six conditions include: control group with low prior knowledge, control group with high prior knowledge, strategic notetaking with low prior knowledge, strategic notetaking group with high prior knowledge, partial strategic group with low prior knowledge, and partial strategic group with high prior knowledge.

Research Questions

The major questions of this research were based on the strategic notetaking method which Boyle found to be beneficial to students' academic work because it was developed from the metacognitive concept of cognitive learning theory.

The research questions for this study are as follows:

1. Does instruction in a notetaking strategy affect students' notetaking behavior and learning?
2. Will students' prior knowledge account for significant difference in notetaking behavior and learning?
3. Is there an interaction for performance between students' prior knowledge and the type of notetaking instruction they receive?

Definitions

The following basic definitions are important to understand the conceptual framework of this study:

1. High prior knowledge: It refers to the information that students already learned relative to a new topic. In this study, students' third grade mid-term examination scores were used to measure their prior knowledge. Those students, whose mid-term examination scores were higher than mean scores, were categorized as high prior knowledge group.
2. Low prior knowledge: It refers to the information students already learned relative to a new topic. In this study, students' third grade mid-term examination scores

were used to measure prior knowledge. Those students, whose mid-term examination scores were lower than mean scores, were categorized as low prior knowledge group.

3. Cued information units (CIU): It referred to the number of information units the classroom teacher had written on the board while he/she lectured about the materials.
4. Non-cued information units (NCIU): It referred to the number of information units orally delivered by the teacher without giving either verbal cues or written cues. The NCIU also consisted of 21 non-cued units of information.
5. Multiple-choice comprehension test: The14 items multiple-choice comprehension test was used to measure factual information presented in the videotaped lecture "Underwater Creatures."
6. Long-Term Free Recall (LTFR): Students' long-term recall of the lecture information was measured by students' performance on a free-recall task two days after watching the instruction videotape.
7. Notetaking: a process of recording lecturing information in class. This process involved careful listening, identifying main ideas, writing down the information, summarizing information gained from the lecturer, and cued recognition, and preview. It allowed the notetakers to "transcribe whatever subjective associations, inferences, and interpretations occurred to him while listening" (DiVesta & Gray, 1972, p. 8).

8. Learning strategy: It referred to a consciously controlled set of studying skills used to achieve cognitive purposes (Ormrod, 2004).

CHAPTER II

REVIEW OF THE LITERATURE

As early as 1920, researchers of notetaking showed that this skill had a positive relationship to students' academic performance. For example, Crawford (1925) found that lecture notetakers could recall significantly more information than non-notetakers. Howe (1970) found that textual information had a 34% of chance being recalled if it was contained in their notes, but only a 5% of chance being recalled if it was not contained in their notes. Kiewra & Fletcher (1984) found that there was a high correlation (.72) between the number of main points in notes and the immediate cued recall performance. For both lecture and textual notes, it has been suggested that the more words recorded in students' notes, the higher performance they could achieve (Crawford, 1925; DiVesta & Gray, 1972; Fisher & Harris; 1973; Hartley & Marshall, 1974; Kiewra & Fletcher, 1984).

Learning Strategy and Information Processing Model

Norman (1980) argued that it is the time for teachers to teach learning strategies to their students in order to "develop the general principles of how to learn, how to remember, how to solve problems" (p.97). Many explanations for why learning strategies are important are based on an information processing model. For example, Weinstein and Mayer (1986) defined learning strategies as "behaviors and thoughts that a learner engages in during learning and that are intended to influence the learner's encoding process" (Weinstein & Mayer, 1986, p.315). The information encoding process is believed to have three stores: sensory register, a short term memory, and a long term memory (Atkinson & Shiffrin, 1968). Based on Atkinson & Shiffrin (1968), the sensory story functions as holding information briefly for preliminary cognitive processing; the working memory (or short-term memory) holds information for a brief time after it is attended to, so that it can be processed and then moved to long-term memory; the information stored in the long-term memory becomes our knowledge, which we can use to solve our daily problems, and enjoy our lives. Above the three stores of information processing, the executive component (control process) is responsible for ongoing monitoring and management of information among the different processing systems (Eggan & Kauchuck, 1999). Research has indicated that learning strategies can more effectively enhance individuals' ability to information processing (Flavell & Wellman, 1977; Molely, Olson, Halwes, & Flavell, 1969; Ornstein, Naws, & Stone, 1977).

Learning Strategy Instruction and Prompting

Strategies Instruction

Kiewra (2002) postulated that the reason that students are ineffective learners is because they are not taught how to use learning strategies. This could be due to factors such as the teachers lack of training in teaching study skills (Thomas, 1993), and the teachers belief that it is the job of special education to teach study skills (White & Greenwood, 1991). Even though some courses were offered to help students learn how to learn in the context of study skills courses (Gall, Gall, Jacobsin, & Bullock, 1990; Pintrich, Mckeachie, & Lin, 1987; Simpson, Hynd, Nist, & Brrell, 1997), most researchers agree that it is better to offer the learning strategy instruction throughout the curriculum as part of the actual academic tasks that students encounter (Pressley, & Woloshyn, 1995).

Many tasks students generally encounter in the classroom were carefully analyzed by researchers in order to determine what steps or procedures could lead students to successful performance in the academic environments (Pressley & Woloshyn, 1995). Such task analyses have been carried out in several different content areas such as mathematics (Mayer, 1986), problem-solving (Gick, 1980), reading comprehension (Garner, 1987), and writing (Hayes & Flower, 1980). Pressley and Woloshyn (1995) suggested the task analytic approach may help teachers provide strategy training.

Pressley & Woloshyn (1995) also suggested that instructors can help students enhance learning strategies by the way they provide strategies instruction. They provided four steps: first, introduce it, describe it, and model it. Second, sell the strategy by telling the students how it works. Third, generalize the skills by tell students where they can also apply them. And fourth, make this skill perfect by practicing it. The notetaking training techniques of this study follow this suggestion. However, these four steps were further split into a nine steps strategies instruction model for strategies instruction elaborated by Pressley & Woloshyn (1995). The model demonstrates the following principles for strategy instruction:

1. Teach a few strategies at a time, intensively and extensively, as part of the ongoing curriculum; in the beginning, teach only one at a time, until students are familiar with the "idea" of strategy use.
2. Model and explain each new strategy.

3. Model again and re-explain strategies in ways that are sensitive to aspects of strategy use that are not well understood. (Students are constructing their understanding of the strategy a little bit at a time.)
4. Explain to students where and when to use strategies, although students will also discover some such metacognitive information as they use strategies.
5. Provide plenty of practice, using strategies for as many appropriate tasks as possible. Such practice increases proficient execution of the strategy, knowledge of how to adapt it, and knowledge of when to use it.
6. Encourage students to monitor how they are doing when they are using strategies.
7. Encourage continued use of and generalization of strategies, for example, by reminding students throughout the school day about when they could apply strategies they are learning about.
8. Increase students' motivation to use strategies by heightening students' awareness that they are acquiring valuable skills that are at the heart of competent functioning with learning tasks.
9. Emphasize reflective processing rather than speedy processing; do all possible to eliminate high anxiety in students; encourage students to shield themselves from distraction so they can attend to the academic task" (Pressley & Woloshyn, 1995, p. 12).

Prompting Students to use Strategies

Knowing the effective strategy is one thing, practicing (using) it is another. Pressley & Woloshyn (1995) suggested that students usually do not know when and where to use effective strategies, therefore, the strategy instructor should directly explain to the students the effective use of strategies.

According to Pressley and McCormick (1995), if children in the middle elementary grades are not prompted to use their knowledge of strategy utility in making strategy selections, they may fail to use it because of the lack of the metacognitive capacity. Moreover, more prompts are needed with younger children. However, the development of cognitive and metacognitive ability during the grade-school years, the need for assistance will be reduced. For example, Flavell, Friedrichs and Hoyt (1970) found that over 50% of preschoolers were unrealistic in their prediction of the length of a series of pictures they could recall after the presentation of the pictures; less than 25% of the second graders or third graders were unrealistic; and very few of fourth graders were unrealistic. However, if children fail to use efficient memory strategies, they can be taught to use them (Pressley & McCormick, 1995).

Pressley, Ross, Levin, & Ghatala (1984) conducted a research study examining the effects of the "prompt." Participants of this study were told to consider the results of how they had performed on previous tests using a different strategy. When the children were prompted, the more effective strategy was chosen 89% (vs. 42%) of the time. Pressley, Levin, and Ghatala (1988) conducted another research study to find out how long an effective method can be maintained with or without comparing it with a less effective method. The result showed that students who learned an effective method (imagery) without comparing it with a more familiar (but less effective) method showed less maintenance of the effective method two weeks later; while the effective method was more likely to be maintained when students were given a chance to compare the results of learning with different learning strategies. For as young as second graders, more explicit instructions are needed to guide these children to pay attention to their strategy use (Pressley & McCormick, 1995). Hence, the strategy instructors should keep in mind that young learners may always need to be reminded to employ effective strategy for favorable results.

Prior Knowledge

Prior knowledge plays an important role in the use of strategies. According to Pressley and McCormick (1995), knowledge provides grist for the strategy mill, which implies that some strategies can only be performed if other related knowledge has already been acquired. They argued that students with higher prior knowledge on certain subjects would learn much better than students with lower prior knowledge, because prior knowledge activates relevant schema. Once a schema is activated, it helps the learners focus attention on information and allows inferences, which enhances learning. However, learning strategy coupled with prior knowledge can maximize learning, as Pressley pointed out "even if students make some automatic associations to prior knowledge as they do a task, that does not mean that learning might not be improved additionally using strategies" (p. 84).

Woloshyn, Pressley, and Schneider (1992) provided a telling demonstration of the relationship among prior knowledge, learning strategy, and performance. In their study, when German college students used elaborative interrogation ("why ?" learning strategy) to learn new information on Germany, they did much better than they did in learning information on Canada. This was because German college students already had extensive prior knowledge about Germany. The researchers postulated that the superior learning of new information on Germany was due to students' prior knowledge of their home country. The same results were obtained with Canadian college students: with the elaborative interrogation strategy, they learned new information on Canada much better than they did with the information on Germany. This research indicated that when people possess prior knowledge they were more likely to perform better on the later task.

Ausubel (1978) argues that prior knowledge is one of the most important factors affecting long-term memory storage. People who have a large body of knowledge can relate their new experiences to prior knowledge and so can more easily engage in such processes as meaningful learning and elaboration.

One could conclude that advance prior knowledge leads to effective learning of content and strategy. For children, teachers' guidance in activating students' prior knowledge might be needed. The Strategic Notetaking Method invented by Boyle (1996) was designed with this in mind.

Mechanism of the Enhancing Effects of Learning Strategy on Learning

Learning strategy has been defined as strategies that are "composed of cognitive operations over and above the processes that are a natural consequence of carrying out a task, ranging from one such operation to a sequence of interdependent operations. Strategies are used to achieve cognitive purposes and are potentially conscious and controllable activities" (Pressley, Forrest-Pressley, Elliott-Faust, & Miller, 1985, p.4). However, theorists disagree on the above statement. Some believe that any use of an effective learning process is a strategy, and others argue that it is strategic only when used intentionally (Flavell et al, 1970; Lange, 1978).

A cognitive approach views learning as an active process that occurs within the learner and can be influenced by the learner (Weinstein & Mayer, 1986). Weinstein and Mayer have provided a framework for analyzing the teaching-learning process, which is presented in Table 2.1.

Table 2.1. Framework for Analyzing the teaching-Learning Process.

Teacher Characteristics (what the teacher knows)	Learner Characteristics (What the learner knows)
Teaching Strategy (What the teacher does during teaching)	Learning Strategy (What the learner does during learning)

Encoding Process

(How information is processed)

Learning Outcome

(What is learned)

Performance

(How learning is evaluated)

Cited from Weinstein & Mayer (1986). The Teaching of Learning Strategies. In. M. Wittrock (Ed.). *The Handbook of Research on Teaching.* New York: Macmillan.

According to Weinstein & Mayer (1986), teaching a learning strategy can benefit learners by providing specific learning methods and strategies appropriate to the task. The use of a strategy during the learning process can affect the encoding process (process of putting the information into memory system), which in turn affects learning outcome and performance (Weinstein & Mayer, 1986). Therefore, using a learning strategy has a strong relationship with learning performance because it affects one's encoding process.

Based on findings of research in last two decades, researchers have identified several effective learning strategies. These findings indicate that identification of important information in which learners discriminate important ideas and trivial details and only store the important points in memory (Dole et al., 1991; Reynolds & Shirey, 1988), meaningful learning where a learner connects new information with existing information (Ausubel, 1978, Ormrod, 1999), internal organization where a learner creates relationships among pieces of information within a body of knowledge (Britton et al., 1998; Gauntt, 1991; Kail, 1990; Wade, 1992), elaboration where a learner adds extra information from his/her personal knowledge base to the presented information to make it complete and meaningful (Dole et al., 1991; Pressley, 1982; Waters, 1982; Weinstein, 1978; Wittrock & Alesandrini, 1990), and visualization where a learner creates visual imageries of information presented so information is stored in dual-format in the long-term memory (Defanti, Johnson, Moher, & Ohlsson, 2004; Taber, Quadracci, & Javery, 2002). These studies showed that when the strategies were used in learning tasks, students' performance in memory and comprehension improved.

According to Weinstein and Mayer (1986), the uses of learning strategies can affect students' encoding process, which in turns influence their learning outcome. The enhancing effects of the learning strategies on learning become evident when they are examined from a perspective proposed by Cook and Mayer (1983). According to Cook and Mayer (1983), encoding consists of four components:

* Selection: the learner actively pays attention to some of the information that is impinging on the sense receptors, and transfers this information into working memory;

* Acquisition: the learner actively transfers the information from working memory into long-term memory for permanent storage;

* Construction: the learner actively builds connections between ideas in the information that has reached working memory.

* Integration: the learner actively searches for prior knowledge in long-term memory and transfers this knowledge to working memory. The learner may then build external connections (Mayer, 1982, 1984) between the incoming information and prior knowledge (p. 317).

There is a strong relationship between learning strategy and encoding process. Weinstein and Mayer (1986) claimed that learning strategies "may be used to achieve certain goals for influencing the cognitive processes in encoding" (p. 317). For example, rehearsal behaviors seem to be aimed mainly at selection and acquisition of information whereas organizational and elaboration behavior seems expected to relate to construction and integration of information (Weinstein & Mayer, 1986)

Alao & Guthrie (1999) conducted a research experiment dealing with the relationship between prior knowledge, learning strategy use, interest, learning goals and conceptual understanding. Seventy-two fifth graders from three science classrooms participated. The Learning goal, Interests, and Strategy use Questionnaire (LISQ) was used to measure students' learning goal, interests, and strategy use on the knowledge of ecological science concepts (food chain, ecosystem). However, the LISQ items were reworded to focus students' attention on the science class and ecological science concepts. Students' first knowledge test score was the measure of prior knowledge and second knowledge test score was the measure of conceptual understanding. The prior knowledge test assessed students' understanding of ecological science concepts, especially the relationship and interdependence of plant and animal.

They found that after controlling students' prior knowledge on the understanding of ecological science concepts, the multiple regression analysis showed that strategy use predicted a significant amount of the variance in conceptual understanding, indicating that students who possessed better learning strategy in the ecological science class performed better than those who possessed less effective learning strategies.

Overall, then, learning strategies appear to enhance students' performance due to their effect on learning. Moreover, instruction about how and when to use learning strategies is likely to enhance students' performance with academic tasks.

Notetaking and Learning

Most researchers agree on the point that simply taking notes without review can favorably influence students' performance (DiVesta & Gray 1972; Palkovitz & Lore, 1980). For example, Kiewra et. al (1991) found that notetaking enhanced students' performance on cued recall and synthesis test (require the ability to make connections among the topics).

The first variable was related to notetaking function: encoding (take notes/no review), encoding plus storage (take notes/ review), and external storage (borrow notes/

review). The second variable was notetaking technique (conventional notes, linear notes, and matrix notes).

The materials for the conventional note taker included four sheets of lined papers; they were not allowed to take notes while watching the 19-minute videotape (the topic was related to Creativity). The participant in the linear notes group received information regarding five types of creativity with the nine common dimensions (e.g., definition, examples, and myths) listed beneath each of the types, with spaces between ideas for notetaking. Participants in the matrix notetaking group were given information that content five types of creativity named along the horizontal axis and nine dimensions describing the types of creativity listed along the vertical axis. Students in the encoding group were allowed to complete the recall test without an opportunity for review; they then took the synthesis test. Students in the encoding plus storage group reviewed their notes after watching the videotape, and then took both recall and synthesis test. Participants assigned to the external storage condition only reviewed the notes from their counterpart without taking any notes; they then also took both tests. The participants in the control group just viewed the videotape without taking any notes. Following the videotape lecture, they were administered both tests immediately.

Results showed that participants in encoding plus storage (take notes and review) had higher scores on both recall and synthesis test compared with the notetaking only group. This finding can be explained by the repetition effect; the encoding group (notetaking without review notes) had access to the information one time, while the encoding plus storage group had access two times (Kiewra & Duboils, 1991). The external storage group performed better than encoding group on the synthesis test. This can be explained by the review of notes, when time permits, that facilitate generative processing (Kiewra & Duboils, 1991). Also, students in both matrix notes and linear notes groups performed better than the conventional group (no notetaking). The conclusion was that students who took specific forms of notes performed better than non-notetakers while listening in the classes.

Another study on the benefits of notetaking was conducted by DiVesta and Gray (1972). These researchers found that those who took lecture notes had significantly higher scores than those who did not take notes. This research suggested that the encoding process of notetaking could help active learners, such as those who took notes during lecture, perform better on the later learning tasks.

For students with learning disabilities, researchers have suggested that written language is one of the most difficult academic areas for students to learn (Graham & Harris, 1993; Hughes & Smith, 1990). These difficulties include simple tasks such as spelling, punctuation (Hughes & Smith, 1990; Poteet, 1979), to higher level strategic skills such as detection of writing errors (Ellis & Colvert, 1996). Boyle & Weishaar (2001) found beneficial notetaking results by using strategic notetaking on the recall and comprehension of lecture information for high school students with learning disabilities. In his research, 22 learning disabled and four educable mentally handicapped (EMR) 10-12th grade students were randomly assigned to either an experimental or control group.

The experimental group consisted of students in a strategic group. The strategic group received two sessions (100 minutes) of notetaking training previously. During training, students were taught to take notes while viewing a videotaped lecture. The participants in the control group were provided with lined paper and instructed to use conventional notetaking procedures to record notes from the videotape. After training, both the notetaking group and control group viewed a 28-minute videotape taken from *Scientific American* magazine (the topic was about desert frogs and Sican metal workers). There were two sessions in which the instructional procedures were performed. During the two sessions the students were trained to take notes by using strategic notetaking form while watching the first videotaped lecture. During the third session, the experimental and control groups were asked to watch the second videotape, record their notes, and complete immediate free recall and comprehension measures. The control group was provided lined paper and asked to conventional take notes while watching the tape. On the fourth session, experimental and control students were placed together and asked to complete the long-term free recall measure.

Results indicated that the learning disabled students in the experimental group scored significantly higher on all the measures, including immediate free recall, long-term free recall, comprehension, and number of notes recorded. These results lead the researchers to conclude that notetaking training enhances learning disability students' various learning tasks, if they receive appropriate learning instruction.

Notetaking can also promote higher levels of cognitive ability such as problem solving transfer. For example, Pepper & Mayer (1986) found that notetakers performed significantly better than non-notetakers on a problem-solving test. Shrager & Mayer (1989) found that notetaking can foster generative learning on the tests of problem-solving transfer and semantic recall. Researchers believed that notetaking enhances learning partly because of the generative learning process it possesses (Kiewra, 1991). Wittrock, Marks, & Doctorow (1975) pointed out that

> "generative processing is that actively generating relations among the parts of the learning material or between the learning material and one's prior knowledge produces greater learning than less generative forms of learning; examples of generative processing include the student's development of summaries, graphs, tables, analogies, examples, and conclusions" (p. 240).

In a research study conducted by Shrager and Mayer (1989), the participants were divided into four groups – high prior knowledge with notetaking (14 students), high prior knowledge without notetaking (15 students), low prior knowledge with notetaking (17 students), and low prior knowledge with notetaking (14 students). Lectures on 35-mm camera were used as learning material, and four measurements served as dependent variables. These included semantic recall (test that asked students to write all that they could remember from the lecture), problem-solving transfer (test that contains four essay problems such as, designing camera), verbatim recognition (consists of 12 pairs of sentence with one taken from the lecture and the other conveying the same meaning), and verbatim fact retention (10 factual questions). As predicted, results indicated that notetakers did much better on semantic recall and solved transfer problems better than non-notetakers among lower prior knowledge students. There were no statistically significant differences shown between notetakers and non-notetakers with higher prior knowledge students on all the four dependents variables. Shrager and Mayer (1989) concluded that generative learning processing can be developed by instructional methods, such as notetaking skills, which is especially true for students who have little prior knowledge (they were not normally engaged in this generative process learning) on the specific subjects for the learning tasks of problem solving and recall. It has been suggested that only when students use generative processing they can achieve maximum learning and performance (Doctorow, Wittrock, & Marks, 1978). These results are consistent with Snow and Lohman (1984) who proposed that less skilled learners required more systematic and structured instruction than high skilled learners. Once the lower skilled learners acquired a specific mode of instruction, they would benefit more than the higher achievers, while the conventional methods are more effective for higher skilled learners.

The previous mentioned studies were all favorable results of notetaking. Examining the studies with non-significant effects of notetaking on learning, Ladas (1980) found they all had problems with methodology or unnaturally rapid presentation rates that caused no positive support for notetaking (Ladas, 1980). For example, Ladas' (1980) study summarized previous notetaking researches in which Ladas criticizes Eisner and Rohde's (1959) study as lacking an untreated control group. In their study one group was given the opportunity for notetaking during lecture and the other took notes immediately after watching the video tape. According to Ladas, an experimental research should have an untreated control group, that is, the control group is not allowed to take notes at all. Further, Ladas suggested that the result of Eisner and Rohde's experiment study should not be interpreted as indications that notetaking has no favorable result, because their research lacked the appropriate use of control group for comparison. Other research findings with no difference in the effect of notetaking on learning were those when statistical power was lacking. Ladas pointed that if the power is low, then the probability of rejecting the null hypothesis or of finding the significant result is low. According to Ladas (1980), a study (McClendon, 1956) on notetaking was often cited as demonstrating no support for notetaking; this study only tested for encoding processes of notetaking but not the whole notetaking process. Ladas argues that subjects should be given the opportunity to review the notes. In his summary of notetaking research, Ladas (1980) therefore criticizes:

> "The process of summarizing research is a process of condensation....This analysis shows a tendency for the condensation process to result in a blurring of details, overgeneralization, or even misinterpretation. Miscategorized studies, and studies where findings of no difference have a likely alternate explanation, should not be used to detract from the positive evidence." (p. 602)

Ladas concludes that the previous studies' conclusion that there was no significant difference between notetakers and non-notetakers was inadequate.

Notetaking Instruction

Among all learning strategies studies, notetaking has probably received more attention than others because it is effective and easy to teach and learn. Before introducing to the notetaking instruction, a review of literature regarding notetaking functions, critical components of notetaking, and previous notetaking training programs is necessary. In addition, teaching methods which enhance students' notetaking activity will also be discussed.

Traditionally, notetaking has had two functions, the encoding of information and the external storage function. However, these two functions were not clearly differentiated; according to Kiewra et al. (1991), the encoding and external storage were combined. Thus, there might be a "possibility that different techniques for notetaking might produce differential encoding or external storage effects have not been adequately addressing" (Kiewra, DuBois, 1991, p. 240). Kiewara and DuBois reclassify the three functions of notetaking as: encoding (simply taking notes), external storage (borrowing notes/reviewing), and encoding plus external storage (taking notes and reviewing). These three functions are briefly introduced in the following section.

Functions of Notetaking

Encoding. DiVesta and Gray (1972) noted the importance of encoding compared to the external storage function in learning. They stated that encoding is one of the notetaking functions in which learners reorganize information and transform the data in the notetakers' own words. Kiewra (1991) pointed that this process involves careful listening, recognizing main ideas, jotting down information, summarizing the learned information, recognizing cues, and even previewing. Researchers have found that this process enhances learning by activating participation and extending long-term memory; therefore it facilitates learning (DiVesta & Gray, 1972; Kiewra, 1991).

Hartley & Cameron (1967) noticed that students are generally not good notetakers; the researchers showed that students took down less than half of the critical ideas in their notes. Hughes (1994) compared 30 college students with learning disability with 30 students with no learning disability on the number of cued and non-cued information recorded in their notes. The results showed that learning disabled students were significantly lower on the cued receiving and that 56% total cued information (the cued information taken down by students divided by total cued information provided by the instructor) was found in notes of the non-learning disabled students, only 36% by the disabled students. Hughes remarked that notetaking is indeed a very complex activity for some students; therefore, it is not an easy skill. Baker and Lombardi (1985), who examined college students enrolled in an introductory psychology course, also found that among forty participants, fewer than 25% of the propositions that the instructor judged worthy of inclusion and 47% of the targeted information (main ideas) were included in students' notes. In recent research, Kiewra (2002) found that students were recording "sketchy notes, and creating outlines" (p.71). Therefore, although the skills for taking good notes enhance the encoding process needed for better learning. These skills are apparently lacking among many of the college students who participated in these studies.

External Function (Review). The storage function of notes is defined as an external source of memory that allows students to review others' notes without taking notes in the classroom and thereby enhancing their learning outcome (Fisher & Harris, 1973). Kiewra et al. (1991) define "storage function" as reviewing notes without encoding, which is, borrowing others' notes without going through the process of writing down the notes themselves. As suggested by the researchers, this function is fairly common in college, and little if any research related to this process is found.

Encoding plus Storage (Take Notes plus Review). Kiewra et al. (1991) have classified the third function of notetaking as encoding plus storage, a procedure in which students take their own notes during class and review them later. DiVesta and Gray (1972) found that students who took notes performed significantly better than those who did not, and students who were permitted to review their notes performed even better on the free recall of the main idea than the notetaking only group. Researchers were not surprised by this finding because it could be explained by the repetition of material (DiVesta & Gray, 1972). Fisher and Harris's (1973) research also showed a similar result. Their study consisted of 112 participants, among four treatment groups, who (a) took no notes and only reviewed the lecturer's notes, (b) took no notes—made a mental review, (c) took notes—made a mental review, and (d) took notes-- reviewed the lecturer's notes. Their results showed that students who took notes and reviewed their own notes did significantly better on short-term free recall and on an objective test compared with the other four treatment groups.

As previous mentioned, Kiewra et al. (1991) found that students who took notes and reviewed them did better on recall performance compared to the other groups.

Critical Notetaking Components

According to review of the literature, the most cited notetaking skills found to be effective are paraphrasing, use of abbreviation, writing down technical terms, writing a summary, reviewing notes, and taking notes plus reviewing. Paraphrasing refers to the transformation of the instructor's lecture information to the learner's own words. It is the use of short hand, simple words, and pictures, to improve writing speed (Bretzing, Kulhavy, & Caterino ,1987; Josel 2001; Odvard 2001). Jotting down technical terms and the interrelations between concepts (Robin & Martello, 1979) mark the important terms related to the lecture. Writing a summary actively reorganizes and synthesizes the information (Boyle, 2001; Davis & Hult, 1997; Writtrock & Alesandrini, 1990). Reviewing notes is also important (Czarnecki, Roski, & Fine, 1998; Hartley, 1983: Kiewra, 1991; Robin & Martello, 2001; Smith, Teske, & Gossmeyer, 2001) in that it helps students to remember the outlines of the lecture notes. Taking notes plus reviewing operates as encoding information plus storage and it can significantly enhance students' achievement (Kiewra, 1991).

Notetaking Training Programs

Students are not usually good notetakers. Hartley & Cameron (1967) contended that students were generally not good notes taker; their study showed that students took down less than half of a lecture's critical ideas in their notes. Kiewra (2002) has also observed that students took unclear notes. Baker and Lombardi (1985), with college students registered in the introductory psychology course, also found that most students took either unrelated or incomplete sentences in their notebooks. Therefore, notetaking seems a skill that the majority of college students value (Dunkel & Davy, 1989) but fail to do in an effective way. Therefore, it is important that teachers emphasize the importance of these learning skills at all levels of school so that students can be successful in their academic performance.

Overall, there is an abundance of research related to effectiveness of notetaking skills; however, there are relatively few research studies that focus on training program development. Some researchers assert that students can become effective notetakers by receiving systematic notetaking instruction from experts, then practicing it themselves and improving their notetaking by comparing their own notes with peers' (King & Stahl, 1985; Stanley, 1986).

Some training programs emphasize the importance of the procedure for "scaffolding" students' notetaking skills in the following manner: modeling at the beginning of the training process and gradually fading later on (Robin, Martello, Roxx, & Archable, 1979), giving a protocol of notetaking examples for the purpose of notetaking comparison in order to further enhance students' notetaking ability (Czarnecki, Roske, & Fine, 1998; Robin & Martello, 1977; Roxx, & Archable 1977).

The various effective notetaking tools recommended by different researchers were "CALL UP" and "A Notes" mnemonic strategies (Czarnecki, Roski, Fine, 1998), AWARE strategy (Suritsky., & Hughes, 1996), Matrix notes (Kiewra, 1991), Guided Notes (Lazarus, 1991), and the strategic notetaking form (Boyle, 1996, 2001; Weishaar & Boyle 1999). Some of these methods will be briefly introduced here:

In modeling processes, according to the training program demonstrated by Robin Martello, Roxx, and Archable (1977), the instructor modeled correct notetaking by placing the detailed outline of the lecture on the blackboard. The outline includes level 1: major critical points and technical terms; level 2: definitions of terms and similarities, and level 3: differences between concepts, major details, and subtle discrimination. As the instructor lectures on each critical point in his outline, he requests students to record this information in their notes.

The "CALL UP" mnemonic skill utilizes many notetaking elements commonly used by middle and high school students with learning disabilities, who were being instructed in inclusive settings (Czarnecki, Rosko, & Fine, 1998). The six letters stand for:

- C: Copy from the board or transparency
- A: be Aware of main ideas
- L: Listen to the cue words/phrase that identify main idea-write down in the margin

- L: Listen to the questions and answers from teachers and students
- U: Utilize the textbook to help review and understand information
- P: Put the information in your own words and write these statements in your notes between main ideas (under each main ideas skipping 6 lines was recommended)

Czarnecki, Rosko, & Fine (1998) recommended using "A Notes" when reviewing notes after school. The steps of this method included the following:

a. Ask yourself the question, "Do my notes have a date and topic?"
b. Name the main ideas and details in your notes and mark or underline them
c. Review notes again to find the ideas that are also in the text, highlight them
d. Make an effort at margin notation and use SAND strategy (star important ideas, place arrows to connect ideas, number key points in order, and when possible use abbreviations and write them next to the item (Czarnecki, Rosko, & Fine, 1998).

Another useful tool for notetaking is the Guided Note method, which lists the main points of a verbal presentation and provides spaces to fill in the rest of the definition or details (Lazarus, 1991). The Guided note was found to produce better results on test performance than when students used conventional notetaking method (Lazarus 1991). The Guided Note method is typically two or three pages in length and the teacher often simultaneously uses transparencies that contain the main points listed in the Guided Note (Lazarus 1991) which provides a good prompt. Using the Guided Note method may greatly benefit students in the encoding process of information, especially concerning the selection and construction components. Based on Cook and Mayer's (1983) assertion on encoding process, the Guided Note can help students in the selection process by causing them to actively pay attention to information.

Among various kinds of effective notetaking methods that promote learning, the Matrix Note was very effective when the information was comparable between each of the main ideas (Kiewra, 2002, 1991). For example, students could compare animals (lion and tiger) that belong to the same category. Kiewra and Dubois (1991) found the use of Matrix Note was more beneficial than linear notes and conventional notes at test performance, because the Matrix Note permits more complete notetaking, and ideas were recorded in a more interrelated way in a matrix. However, Matrix Note is limited in its effective application to only when the information is comparable. The Matrix Note is a type of graphic organizer (Ormrod, 1999). When various pieces of information are organized in an interconnected way, the information is stored more effectively in the brain and students tend to remember more completely (Ormrod, 1999). Ormrod argues that one way to make learning more effective is to present information in a more organized way. Graphics not only facilitate students' learning by organizing information, they also offer a way to encode information verbally and visually (Jones et al., 1989).

According to Dansereau (1995), it is helpful for students to use graphic representation of the information to be learned in the classroom, such as a map, flowchart, pie chart, or matrix. In contrast, the researcher believes the graphic Matrix Note is suitable only when the information is readily categorical comparable. For information that is difficult to put in categories, the effectiveness of Matrix Note will be reduced. Therefore, the popular Matrix Note method was not included in this study.

Compared to the various conventional notetaking methods, the Strategic Notetaking method, which is characterized by written guides, can encourage students to actively involve in the learning process, thus improving their performance on the test of long-term word recall (Boyle., & Weishaar, 2001).

Strategic Notetaking Form Instruction

Kiewra (1988) suggests that to acquire learning strategy, training might be required; he states that training should identify how a particular strategy facilitates a particular learning outcome and how the training keep learners aware of the application of the strategy when in novel situations.

Boyle (2001) developed the strategic notetaking method as follows:

In the first 50-minute notetaking training, the instructor should

1. Explain to his students how the strategic notetaking form is developed and its purpose
2. Review the strategic notetaking sheet (described in next section), point out the crucial prompts on each page
3. Turn on the video and begin modeling the use of strategic notetaking by writing notes on the form and by using a "think aloud" technique to verbally convey his thoughts to students

4. Stop the tape and explain to students what he/she has written on the notetaking form
5. Point out how to record words and phrases and how not to record the lecture verbatim. Also point out that grammar and spelling are not a concern as long as notes are legible and are conveyed to students
6. Solicit questions
7. Play next section of videotaped lecture, and practice to fill in the form with students
8. Stop videotape, solicit questions
9. Discuss students' responses from their written notes
10. Repeat the whole procedure and end the first training session

In the second 50-minutes notetaking training session:

1. The students watch the same videotape and use new strategic notetaking form. The videotape is not stoped until the end of the lecture.
2. Students are encouraged to take notes continuously even though some are faster and some are slower.
3. The teacher collects notes from students, reviews them for accuracy and completeness, and verbally reinforces for correctly recorded notes.

The purpose of the training was to accustom students to the speed of the lecture and improve their fluency in using strategic notetaking form (Boyle, 2001). As Boyle explains (1996, 2001), the strategic notetaking form used in this research was developed with the metacognitive skills in mind. The metacognitive skills involve cognitive processing, such as organizing information and combining new and previous knowledge together (Palinscar & Brown, 1984) which makes the generative learning happen and maximizes the learning as mentioned previously.

Partial Strategic Notetaking Form Instruction

The partial strategy notetaking form of instruction will be introduced, which is based on the cognitive load theory (Sweller & Chandler, 1991). However, the instruction of this form is entirely similar to that of the strategic notetaking form, except that, 50% of the information will be provided on this form in advance. According to Atkinson and Shiffrin's (1968) information processing theory, information is processed in the short-term memory, which is limited in the amount of information it can possess. When the short-term memory is overloaded, some materials drop out of it (Rafoth, Leal, & DeFabo, 1993). Therefore, one way to help students jot down more information in their notes is to lessen their cognitive load, thereby allowing students more cognitive space to process lecture information (Sweller & Chandler, 1991).

Katayama & Robinson (2000) tried to lighten college students' cognitive load by using a "partial" graphic organizer, which contained 50% completed outline and students were required to fill in only the rest of the missing information. In their research, the partial graphic organizer was compared with two other formats of graphic organizer- complete graphic organizer and skeletal graphic organizer- and three other outline forms of notetaking, such as skeletal outline, complete outline, and partial outline. The result showed that the partial graphic organizer outperformed all the others. Katayama and

Robinson (2000) argued that by providing 50% of the information in the partial graphic organizer, students would experience a lessened cognitive load and lesser learning difficulty. However, in this dissertation, the idea of providing partial information was used along with the strategic notetaking form to test the efficiency and to examine the benefits that the students (high vs. low prior knowledge) would receive from it.

Introduction to Strategic Notetaking Form

The strategic notetaking form (abbreviation one shown in Appendix 1, cited from Boyle & Wishaar, 2001) consisted of several portions: the first portion required students to identify the topic and describe their understanding about the topic (serves to combine the topic with their prior knowledge). Students frequently do not recognize the connection between new and prior existing knowledge; therefore, it is difficult for them to understand the relationship between the new information and prior knowledge (Stodolsky et al., 1991). This difficulty impedes meaningful learning. Some theorists recommend that through prior knowledge activation method (the ways of retrieving related knowledge from long-term memory to working memory), students can learn something new more efficiently (Ormrod, 1999). For meaningful learning to occur, Ausubel et al. (1978) suggested that students must have both new and existing knowledge in working memory at the same time. Therefore, the step of "describe what you know about the topic" on the strategic notetaking form functions as prior knowledge activation, which could help meaningful learning to occur, making students understand the material better.

Next, students were asked to "name three to seven main points with details of the topic" in the strategic notetaking form. Boyle (2001) believes that this step would help students encode information into long-term memory more efficiently, thereby preventing its decay. Students were asked to summarize the lecture information into three to seven points; in this way, students were assisted in the long-term storage of lecture material (Boyle, 2001). The section on "summary, a quick description of how the ideas are related," has also been recommended to facilitate learning and make the information more durable in memory (King, 1992; Wittrock & Alesandrini, 1990). As Boyle notes, "We believed that summarizing (or categorizing) in the next [this] step would aid students at encoding and storage of information in long-term memory" (Kiewra et. al., 1991, cited from Boyle, 2001, p.137). Both "name three to seven main points", and "summary" steps were repeated through the end of the lecture as long as notetaking was needed. Below "summary," students were asked to jot down new concept, but the reason for this step was not specified in Boyle's study. However, it is likely that the new concept could help students quickly review the information and pay attention to new concept, which are usually relatively important information for understanding the lecture materials, and later review.

The last part of strategic notetaking form is to "write five main points of the lecture and describe each point." According to Boyle (2001), this step helps students to review quickly the whole lecture topic. Kiewra (1991) has noted that the review process of notetaking can enhance the connection among lecture ideas and between the ideas and prior knowledge; the review process leads to generative learning, which produces greater learning (Wittrock, Marks, & Doctorow, 1975). The researcher suggested that this step might become more powerful if students are able to make a graph to include all the main points, because as Ormrod (1999) has argued, when various pieces of information are organized in an interconnected way, the information is stored more effectively in the human brain which will help in remembering the information more completely. An abbreviated strategic notetaking form is included in Appendix A.

Some researchers have indicated that when students make good use of generative processing then they can achieve maximum learning and performance (Doctorow, Wittrock, & Marks, 1978). The strategic notetaking technique was first introduced by Boyle for general college students in 1996, which proved to be highly beneficial for students' learning. The strategic notetaking method activates the generative processing of learners during taking lecture notes (Boyle, 1996), thus helping students to actively generate relations among the parts of the learning materials and between new materials and prior knowledge (Boyle, 1996). Boyle (1996, 2001) found that the strategic notetaking can be effective with almost any type of information. Moreover, the strategic notetaking has been empirically proven to be very effective on students learning, especially on the aspects of immediate free recall, long term recall comprehension tests, and the number of words encoded in students' notes.

The strategic notetaking form has been used only in the United States since 1996 for college and high school level students with and without learning disabilities. Students at no other levels and from no other culture outside the United States have ever participated in studies using this method before. Strategic notetaking method's previous beneficial results on students' academic performance warrant the researcher's introduction of this method to classrooms in Taiwan, and its highly structured format also encourages the researcher to try to employ this method with even younger students, namely third graders.

Cultural and Developmental Appropriateness of Notetaking

Some might question the appropriateness of instructing nine-year-old Taiwanese students about notetaking strategies. There are reasons to believe that this approach is both culturally and developmentally appropriate. First, regarding cultural appropriateness, the researcher believes the Strategic Notetaking Method is an appropriate choice for Taiwanese students. For example, Asian American cultures showed preference for learning that is similar to the dominant Euro-American culture, in which a quiet sitting, attention to lecture, and independent studying in the classroom is expected (Slaughter-Defoe et al., 1990). In addition, the highly structured nature of strategic notetaking form method matches the preferred learning style of East Asian ethnic students, who favor structured information/materials (Chiang, 2000). Chiang interviewed and observed 33-Asian American students (ages 6-21), originally from China, Hong Kong, Japan, Korea, and Taiwan. She concluded that East Asian-American students tended to prefer structured learning style and direct instruction compared to Mexican-American, African-American, Native-American, and Hmong; and also the Asian-American students reported that structured teaching and clear expectations helped them to focus on the content being taught.

Second, researchers have shown that even children as young as five years old can behave strategically when engaged in learning tasks. For example, in Moley, Olson, Halwes, and Flavell's (1969) research, they found that these children were able to acquire the categorizing/organizing strategy of instruction well.

Piaget (1965) suggested that children at ages eight to twelve belong to the concrete operational stage, which illustrates that elementary school children start developing abstract thinking. Compared with preschoolers, they can solve problems by using newly acquired logical thinking. Recently, Piaget's estimate of children's cognitive development has been criticized as too conservative (Brainerd, 2003). He pointed out that

> "it has been consistently established that as a result of rather brief instructional session (e.g., 10-20 minutes of perceptual training or rule demonstration or corrective feedback), children readily learn concepts that they do not spontaneously acquire until some years later, concepts that Piaget thought could only emerge through a slow morphogenetic process" (p. 284).

Trawick-Smith (2003) indicated that children at primary years consciously directed their own memory processes, organized information, and paid attention to the important information by using their metacognitive function. Appel et al. (1972) showed pictures to children of four, seven, and eleven years old. The children were given two instructions: "to look at the pictures" and "to remember the pictures." The four year olds acted the same way under both instructions. The seven and eleven year old children employed study strategies when the prompt of "to remember the pictures" was given. This example illustrated that older children were more aware of what they needed to do, and performed the task by employing learning strategies, because of the cognitive developmental differences (between four, seven, and eleven year old children).

Audet, Hickman, & Dobrynina, (1996) suggested that notetaking can facilitate teaching in the science classroom if the teacher directs students to write notes in a thoughtful and reflective way. Baxter, Bass, and Glaser (2001) noted that writing notes has become increasingly popular in elementary science education. However, researchers noted that while students' notebooks recorded details of the science activity procedures and the results, they also lacked entries on thoughtful inquiry. The researchers recommended that the science teachers suggest appropriate notebook use in the elementary science classes.

CHAPTER III

METHODOLOGY

Participants

Participants in this study were 103 third-grade students in the Natural Science classes offered in a rural elementary school in southern Taiwan. The students' ages ranged from 9 to 10. There were 43 females and 60 males. Among these students, ten students' data were withdrawn because the students were either diagnosed as having learning disability (six cases) or as not present (three cases) at all of the training sessions. A student's data was deleted because the student was detected as an outlier by statistical Mahalanobis method. Therefore, the total sample consisted of 93 students. Three clusters were randomly selected from six classes in the third grade classes of this school. The three classes were assigned to a strategic notetaking method condition, a partial strategic notetaking method condition, and a control condition, with the sample size of 30, 34, and 29, respectively.

Materials and Apparatus

The materials used in the study included two videotapes of Natural Science lecture, videotape one for training, entitled "The Moon" and videotape two for testing, entitled "Underwater Creatures." The other materials included: lined papers for the control group, strategic notetaking forms for Strategic Notetaking Method, partial Matrix Note for Partial Strategic Notetaking Method, and comprehension tests (with 14 multiple-choice questions). Three sets of television monitors and players were used in the classroom to show videotapes.

The lecture tape contained 115 vocabularies per minute (VPM) in Chinese language. This presentation of 115 VPM is higher when compared with studies that looked at previous college level English-speaking, which contained only 108 VPM (Hughes & Suritsky, 1994) and studies that contained 75 VPM for seventh-grade students (Bretzing et al., 1987). However, the 115 VPM in Chinese language is comparatively lower than 150 VPM used in Peck and Hannafin's (1983) study. Due to different oral speeds between Chinese and English, the Comparison between VPM might not be appropriate. Also, there is paucity of research on how fast the Chinese class lecture should be delivered in the elementary classroom.

The strategic notetaking form contained several written prompts (Boyle, 2001), which guided students to write down main ideas and summaries and indicated their understanding about the topic of the prior lecture. The partial strategic notetaking form contained 50% of the heading and key points of the full lecture information; the other half of the information was intentionally taken off to be filled by students. For example, every even number of headings present in the tape for training and testing were taken off.

Instrument

Four dependent variables were used to assess the effects of the independent variables. They were: cued information units (CIU), non-cued information units (NCIU), comprehension multiple-choice knowledge tests, and long-term free recall (LTFR) on concept measures.

CIU

This is a design to examine students' notes on how many CIU (cued information units) were recorded in their notes among experimental and control groups after all groups of students watched the videotape.

Cued information units (CIU) refer to the number of the information units the teacher writes on the board before watching the tape. All the participants took notes while watching the 11 minute videotape. All the notes were collected from the students and counted for the number of CIU.

The total number of CIU written on the board during test session was 21. Each student gets one point for recording any one item of cued information unit in their notes. An independent rater scored all CIU, a second rater randomly selected one-third of the participants' score sheet and scored each in the same manner as the first rater. Inter-rater reliability was calculated to be 0.96 for the CIU.

NCIU

This is a design to examine students' notes on how many NCIU (non-cued information units) were recorded in their notes among experimental and control groups after all groups of students watched the videotape.

The non-cued information units (NCIU) is referred to as the number of information units orally delivered by the teacher without any emphasis, either verbally or written on the board. All the participants took notes while watching the 11-minute videotape. All the notes were then collected and compared to a sequential list of the non-cued information units identified from the videotaped lecture information.

The NCIU had the same amount (21 non-cued units) of information, which was delivered only once orally without being written on the board and without being emphasized by the teacher. Each student gets one point for recording any one item of non-cued information unit in their notes. An independent rater scored all NCIU measures, a second rater randomly selected one-third of the participants' score sheet and scored each in the same manner as the first rater. Inter-rater reliability was calculated to be 0.95 for the NCIU.

Multiple-Choice Test.

There were a total of 14 items, multiple-choice comprehension questions, for "probing" students' understanding of information presented in the videotape of "Underwater Creatures." The questions were based on factual information presented in the videotaped lecture. According to the elementary curriculum in Taiwan, the information in the videotaped lecture was not taught to students until fourth grade. Therefore, students who participated in this study were assumed not to have knowledge of the test materials before this study was conducted (the sample items were included in Appendix B).

Each item was worth one point if answered correctly, so the highest possible score was 14 points on this test. The internal reliability was conducted after the results were discovered; the Cronbach alpha of .74. The face validity was obtained from two elementary school science teachers to ensure the content of the test were related to the videotaped lecture of the tape: Underwater creatures. Both were satisfied with the relationship between the test and the content of the videotaped lecture. Factor analysis showed that the 14 items loaded on a single factor.

Long-Term Free Recall (LTFR) Measurement.

Students' long-term memorization of the lecture topic was measured by students' performance on a free-recall task on concepts presented in videotape two days after watching the videotape. Students were provided with a blank paper for recording the concept items. They were allowed 5 minutes to recall.

Each concept contained in the videotape that was found in the students' recall list during the long-term recall test was counted as one point. There were a total of 63 concepts identified in the videotape of "Underwater Creatures" to generate a possible score of 63.

Inter-rater reliability of the long-term free recall concept items measure was assessed. Two independent rater scores on 1/3 of students' recall lists were correlated at .95.

Writing Speed

Another method was used to assess the participants writting speed – this method is the words per minute (WPM) method in which little or no mental processing is required. In this study, the researcher used the same method as the standard for probing students' writing speed.

Design

Six experimental conditions were studied. These included two independent variables of notetaking instruction methods (Strategic Notetaking Method training, Partial Strategic Notetaking Method training, and control) and prior knowledge of science (high vs. low). Students were divided into high or low prior knowledge group by mean-split of their performance on the latest Natural Science midterm test.

The four dependent variables of cued information units, non-cued information units, multiple choice test, and long-term free recall on videotaped concept were analyzed using the 2 x 3 MANCOVA with writing speed as the covariate. Once the multivariate results were significant, univariate ANOVAs were used as follow-up to test the main and interaction effects of independent variable on each dependent variable. This method was used because Hummel and Sligo (1971) stated that MANOVA followed by univariate ANOVAs minimizes experiment-related error.

Procedure

In order to deliver different treatment to the three experimental conditions, the researcher followed a prepared, scripted lesson plan which showed students in the experimental groups how to use a strategic notetaking form, and the partial strategic notetaking form. The control group received no treatment.

The two experimental groups experienced six sessions, including four training sessions (40 minutes for each session and 160 minutes in total) and two performance evaluation sessions. Session 5 included a 14 item multiple-choice comprehension test and session 6 included long-term free recall. The control group met with the instructor only twice, that is at the two performance sessions of this study: when the 14-item comprehension test was administered, and when the long-term free recall test was administered, two days after the comprehension test.

Prior to the training session, participants were told to write their first name as many times as they could for one minute. This task was used to measure the writing speed when no cognitive processing is required (Hughes& Suritsky, 1994). The speed at which students are able to write might have an impact on the number of ideas they are able to write in their notes. For this reason, writing speed was used as a covariate in data analysis.

One 11-minute videotaped lecture was administered to the two experimental groups during the first four training sessions. The first videotape, "The Moon," was used as a model for notetaking. Students were requested to take notes when watching the tape, then compare their notes with the instructor's and identify differences between the two.

The fifth session was the evaluation session, which was utilized to test notetaking behavior of all participants. In this session participants watched videotape two, "Underwater Creatures." The notes students took when watching the videotape were collected to generate measures of CIU and NCIU.

For sessions one through four, the instructor designed a training schedule for both experimental groups to help participants familiarize themselves with the strategic notetaking form. The instructor explained the reason for using it, when to use it, where to use it, and how to use it. Students kept practicing their specific notetaking form during the four training sessions.

During the fifth training session, all participants watched the same 11-minute videotape with a notetaking form corresponding to the treatment they received. The notetaking information was collected from the students and analyzed.

After watching the taped lecture, the participants were allowed 11 minutes to review their notes, and then they were requested to take a comprehensive multiple-choice test related to the videotaped lecture. Students were allowed 10 minutes to complete 14-item multiple-choice questions.

Two days later, at the sixth session, each group of students were administered a long-term free recall test in which students were requested to recall the topic-related concept items they could remember from the videotape which they had watched two days ago. They were then asked to write their answers. Students were told to finish this exercise in five minutes. The students' recalled information yielded the measure of the long-term free recall score.

Training Program

While watching the training videotaped lecture information, students were encouraged to take notes, practice word abbreviations, paraphrase sentences, and determine the main points from important information. The importance of the review of individual notes was also emphasized. The comparison of individual notes for the purpose of improvement was also encouraged. The details of notetaking training was included in Appendix B.

CHAPTER IV

RESULTS

A 3 x 2 between-subjects multivariate factorial analysis of variance was designed to perform on four dependent variables: CIU (cued information unit), NCIU (non-cued information unit), LTFR (long-term free recall on concept), and TEST (14 items multiple-choice test). Independent variables were notetaking treatment (a control no-training group, strategic notetaking training, and partial strategic notetaking training) and prior knowledge (high and low). Students' writing speed rate was treated as a covariate.

Data Screening

Before running the MANCOVA, the researcher conducted preliminary analysis to check outlier and missing data, the assumptions of normality, collinearity, multicollinearity, and homogeneity of variance-covariance matrices. Reliability and validity of measurement were also examined for the 14-item multiple-choice comprehension test.

Outlier

In order to identify the outliers, the Mahalanobis distance was used to measure how much a case's values on the various measurements differed from the average of all other cases. Mahalanobis distance identifies a case as having extreme values on one or more of the dependent variables. According to Tabachnick & Fidell (2001), with the df =

6 (because there were 7 variables) and set ά=.01, the critical value is 16.81. Any case with a value greater than the critical value should be treated as outlier and should be deleted because of its impact on the validity of the MANCOVA results

The multiple regression method was run to obtain the Mahalanobis distance value; only one case was found higher than the critical value (16.8119), which is obtained from ID 134 for the value of 53.12. The data ID 134 was then defined as outlier and deleted from further analysis. The residuals statistics of Mahalanobis Distance was shown in Table 4.1.

Table 4.1. The Residuals Statistic including minimum, maximum, and mean and standard deviation of Mahalanobis value of all participants run by Multiple Regression method.

	Minimum	Maximum	Mean	Std. Deviation
Mahal. Distance	1.436	53.118	6.920	5.610

a Dependent Variable: ID

Deletion of Cases

No missing data was found in this research. However, a total of 10 participants were deleted from the sample because: (a) three cases were not present in one or more training sessions; (b) one case of outlier; and (c) six cases of learning disabled students. The consideration for deletion of these 10 cases from the sample was because they would bias the results if they were not deleted.

Normality

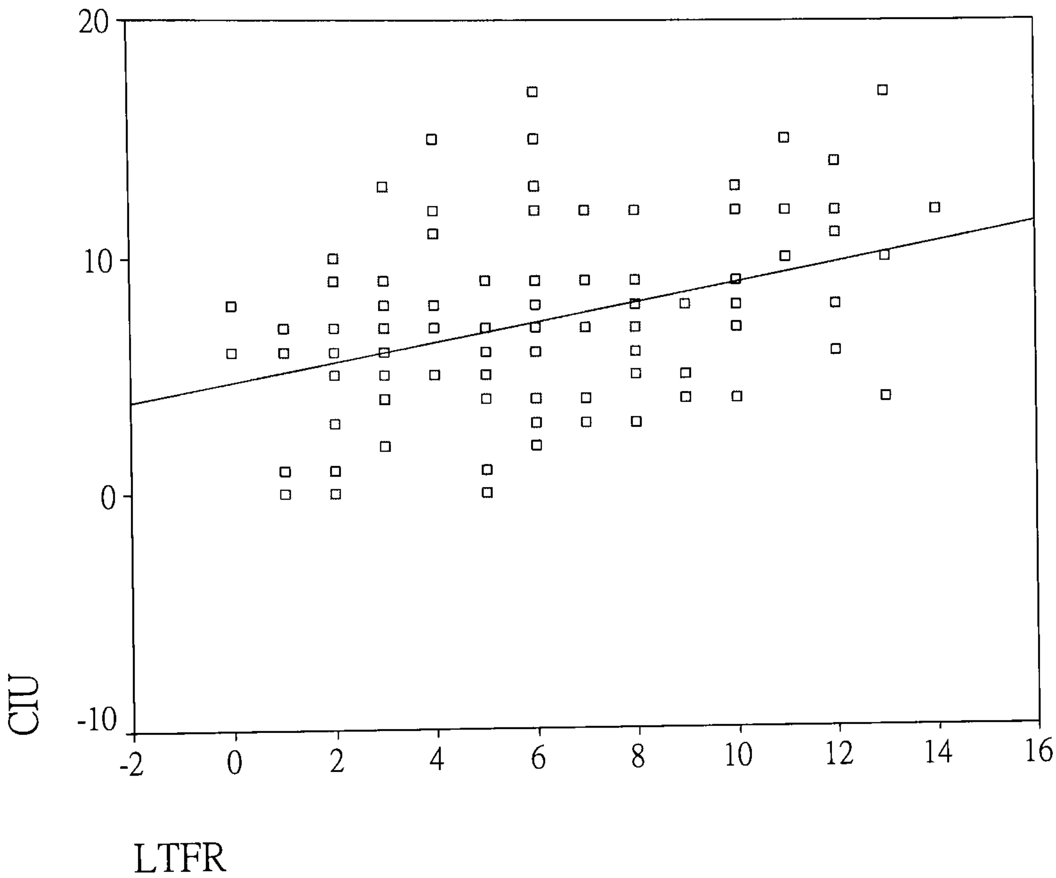
Two components of normality are skewness and kurtosis. In normal distribution, the value of each is equal to 0. The farther the value is away from zero, the more abnormal the distribution. Schwab (2004) suggested using the criteria value of between -1 and +1 for evaluating normality. The strong positive skewness and kurtosis values of 1.66, 2.60 was observed only on NCIU. The logarithmic transformations was performed by enter LG (x +1). The NCIU was renamed LOG_NCIU after this log transformation, and the skewness and kurtosis were largely reduced to .63 and -.68, respectively for the new variable. The skewness and kurtosis of all dependent variables results, before the data transformation, are shown in Table 4.2. The post transformation of NCIU data into NCIU_LOG is also shown in Table 4.2.

Table 4.2. The skewness, standard errors, and kurtosis of the measured variables of CIU, NCIU, TEST, and LTFR, and NCIU_LOG

	CIU	NCIU	TEST	LTFR	NCIU_LOG
Skewness	0.37	1.66	-0.95	0.35	0.63
Std. Error of Skewness	0.25	0.25	0.24	0.25	0.25
Kurtosis	-0.14	2.60	0.76	-0.76	-0.68
Std. Error of Kurtosis	0.50	0.50	0.47	0.50	0.50

Linearity

A further examination of the oval-shaped scatter plots of the four dependent variables did prove the existence of linearity relationship. The bivariate correlation scatter plot between CIU and LTFR (long term free recall) is shown in Figure 4.1.



Figur 4.1. The bivariate correlation of scatter plot on long-term free recall (LTFR) and recorded cued information-CIU.

Multicollinearity

Multicollinearity and singularity are problems that are caused by high correlation between variables, implying they are similar to each other. Variables with multicollinearity actually weaken an analysis because they inflate the size of error terms (Tabachnick & Fidell, 2001). As shown in Table 4.3, the bivariate correlation among all the dependent and independent variables were not high enough thereby indicating non-multicollinearity.

Table 4.3. The Bivariate Correlations Coefficient among all the Variables.

	1	2	3	4	5	6	7
1 Prior Know.	1						
2 Treatment	.10	1					
3 CIU	.26	.08	1				
4 Writing Speed	-.03	-.04	.07	1			
5 LTFR	.36	.17	.38	.12	1		
6 Test	.20	.05	.34	.10	.40	1	
7 NCIU_LOG	.07	.48	.19	-.16	.34	.23	1

Note: CIU refers to Cued Information Units. NCIU_LOG refers to Log of Non-Cued Information Units. LTFR refers to Long-Term Free Recall. WPM refers to students' writing speed per minute.

In order to further confirm non-multicollinearity, the Collinearity diagnostics proposed by Belsely, Kuh, and Welsch (1980) were also performed through the multiple regression method. The criteria for diagnosis of multicollinearity are to look in the

"Condition Index" box for a value that exceeds "30," then, along the row, to observe which two other variables have values exceeding .50 in the "variance proportions" box. Variables with large variance proportions are those with multicollinearity problems (Belsely, Kuh, and Welsch, 1980). The Collinearity diagnostic results showed that no multicollinearity between variables was found. The result was illustrated in Table 4.4.

Table 4.4 The Collinearity Diagnostic for Detecting Outliers

Dimens.	Eigen.	Condition Index	Variance Proportions						
			Prior Know	Treat	CIU	WPM	LTFR	Test	NCIU_L
1	6.90	1.00	.00	.00	.00	.00	.00	.00	.00
2	.48	3.78	.01	.00	.00	.02	.00	.00	.58
3	.20	5.82	.00	.11	.23	.04	.27	.00	.01
4	.14	6.94	.01	.00	.68	.01	.46	.00	.01
5	.10	8.26	.41	.23	.05	.05	.17	.02	.11
6	.09	8.77	.09	.41	.00	.50	.01	.01	.25
7	.06	10.98	.22	.01	.03	.20	.00	.68	.03
8	.02	18.37	.26	.23	.00	.19	.08	.30	.01

Note: CIU refers to Cued Information Units. NCIU_LOG refers to Log of Non-Cued Information Units. LTFR refers to Long-Term Free Recall. WPM refers to students' writing speed per minute.

Reliability and Validity

Before the MANCOVA analysis was employed, psychometric characteristics of the measurement of a 14-item comprehension test was examined.

Validity

The construct validity was derived from factor analysis and used to describe the 14 item multiple-choice comprehension knowledge test.

The validity was first established by factor analysis to examine how many constructs existed in this test. Principal component extraction was first performed on the 14 items from 93 students. Both the factorability of the correlation matrices (Table 4.5) and the Kaiser's (1970, 974) measure of sampling adequacy (Table 4.6) were checked. The bivariate correlation matrices indicated a moderate correlation between items. In addition, Kaiser's (1970, 1974) value of .642 (greater than the criteria of .6) was acceptable for running factor analysis (Tabachnick & Fidell, 2001).

Table 4.5. The Bivariate Correlation of all 14 Multiple-Choice Items Correct Responses by Participants

	1C	3C	7C	9C	2C	4C	6C	13C	8C	12C	5C	10C	11C	14C
1C	1.00	0.19	0.40	0.19	0.31	0.13	0.12	0.31	0.18	0.34	0.03	0.14	0.14	0.08
3C	0.19	1.00	0.16	0.25	0.16	0.53	0.02	0.19	0.28	0.26	0.12	-0.14	0.28	0.08
7C	0.40	0.16	1.00	0.11	0.28	0.17	0.09	0.39	0.05	0.19	0.06	0.21	0.21	0.15
9C	0.19	0.25	0.11	1.00	0.16	0.18	-0.18	0.24	0.34	0.26	0.14	0.18	-0.01	0.11
2C	0.31	0.16	0.28	0.16	1.00	0.14	0.34	0.12	0.15	0.18	0.18	0.18	0.24	0.11
4C	0.13	0.53	0.17	0.18	0.14	1.00	0.07	0.02	0.19	0.27	0.18	0.05	0.26	0.17
6C	0.12	0.02	0.09	-0.18	0.34	0.07	1.00	0.13	0.13	0.19	0.28	0.37	0.06	0.05
13C	0.31	0.19	0.39	0.24	0.12	0.02	0.13	1.00	0.13	0.23	0.19	0.12	0.28	0.24
8C	0.18	0.28	0.05	0.34	0.15	0.19	0.13	0.13	1.00	0.35	0.19	0.19	0.07	0.10
12C	0.34	0.26	0.19	0.26	0.18	0.27	0.19	0.23	0.35	1.00	0.22	0.21	0.26	0.15
5C	0.03	0.12	0.06	0.14	0.18	0.18	0.28	0.19	0.19	0.22	1.00	0.18	0.01	0.17
10C	0.14	-0.14	0.21	0.18	0.18	0.05	0.37	0.12	0.19	0.21	0.18	1.00	0.02	-0.05
11C	0.14	0.28	0.21	-0.01	0.24	0.26	0.06	0.28	0.07	0.26	0.01	0.02	1.00	0.11
14C	0.08	0.08	0.15	0.11	0.11	0.17	0.05	0.24	0.10	0.15	0.17	-0.05	0.11	1.00

Note: C stands for students' correct response.

Table 4.6. The factorability test of Kaiser's measure of sampling adequacy on 14 multiple-choice correct response items.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	Bartlett's Test of Sphericity		
	Approx. Chi-Square	df	Sig.
.64	270.98	91	.000

In scree plot (which is used to determine how many factors should be kept) as shown in Figure 4.2, only one factor was extracted through principal component extraction. Therefore, no rotated method was necessary. The only component matrix obtained was shown in Table 4.7. The component obtained was internally consistent and well defined by the variables. This could be observed from the loading of all items in the factor, as shown in Table 4.7. The smallest value of loading is .332, which is over the criteria of .30 (Tabachnick & Fidel, 2001).

Judged by this result, the construct validity was obtained and the 14 multiple-choice item test was found to be a good single construct for measuring students' knowledge of the videotaped lecture (Underwater Creatures).

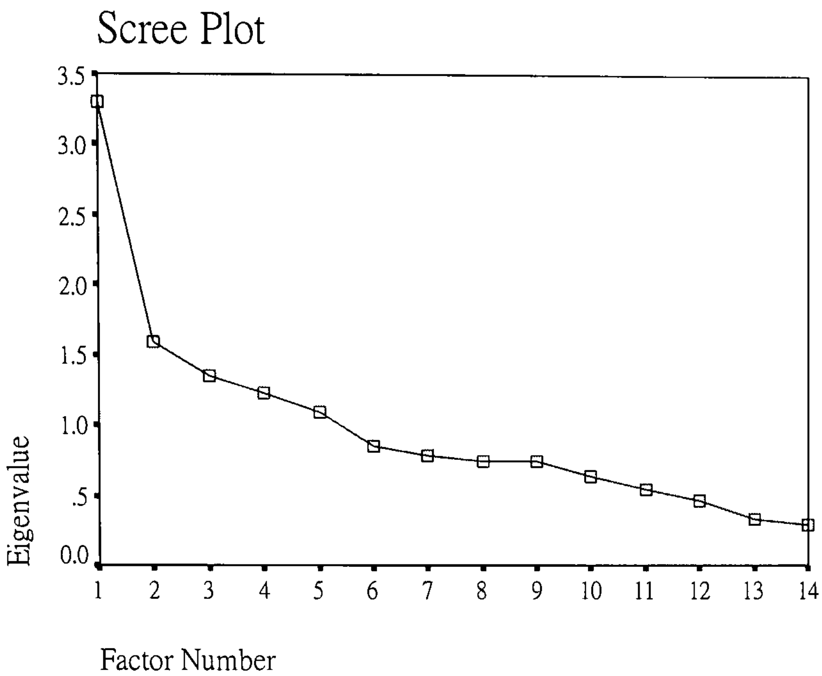


Figure 4.2. Connection of Eigenvalue among all 14 multiple-choice correct response items.

Table 4.7. The Component Matrix Obtained from all 14 Items Answered by all the Participants.

	Component 1
Q1C	.561
Q3C	.532
Q7C	.531
Q9C	.463
Q2C	.521
Q4C	.506
Q6C	.346
Q13C	.538
Q8C	.517
Q12C	.641
Q5C	.400
Q10C	.358
Q11C	.439
Q14C	.332

Extraction Method: Principal Component Analysis.
One components extracted.

Reliability

In order to measure the reliability of the comprehension test, students' answers on the 14 items were transformed to 0 (when they had an incorrect answer) and 1 (when they had a correct answer). After this process, the internal consistency coefficient alpha was used to assess consistency in scores among items. The greater the consistency in responses among items, the higher the coefficient alpha (Green & Salkind, 2003). The results of coefficient $\alpha = .74$ is indicated in Table 4.8. Because deleting items did not improve the α level much, no item was deleted.

Table 4.8.The Reliability Analysis of the 14 Multiple-Choice Items.

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
1C	7.47	8.74	.40	.29	.72
3C	7.77	8.45	.38	.43	.71
7C	7.48	8.74	.38	.30	.71
9C	7.82	8.65	.30	.35	.72
2C	7.70	8.40	.40	.29	.71
4C	7.63	8.53	.38	.37	.71
6C	7.69	8.80	.26	.37	.73
13C	7.62	8.47	.40	.35	.71
8C	7.78	8.46	.37	.24	.71
12C	7.48	8.48	.50	.30	.70
5C	7.63	8.70	.31	.19	.72
10C	7.88	8.82	.25	.31	.73
11C	7.82	8.67	.30	.26	.72
14C	7.95	8.94	.22	.13	.73

Reliability Coefficients 14 items

Alpha = .74 Standardized item alpha = .74

MANCOVA Procedure

The 3 x 2 two-way multivariate analysis of variance with the writing speed as covariate (MANCOVA) was conducted to determine the effect of the treatment (control, strategic notetaking, partial strategic notetaking) and prior knowledge (high vs. low) on the four dependent variables, which were the CIU (cued information unit), NCIU_LOG (non-cued information unit), 14 multiple-choice comprehensive test, and LTFR (long-term free recall). The order of data entry for measurement variables was CIU, NCIU_LOG (a logarithmic transformation of NCIU), TEST, and LTFR.

Distribution of the 93 participants in the six experimental conditions constituted by variables of the treatment and prior knowledge is indicated in Table 4.9.

Table 4.9. The distribution of participants with high versus low prior knowledge across all three groups.

		Treatments			Total
		Control	Strategic	Partial	
Prior Knowledge	1.00	12	20	15	47
	2.00	18	14	14	46
Total		30	34	29	93

Prior knowledge:1 is low, 2 is high.

To examine the equivalence of prior knowledge of the three groups, ANOVA was conducted on prior knowledge with treatment on the independent variable. No significant difference was found between any groups, $F(2, 90)=1.132$, $p=.327$, as shown in Table 4.10.

Table 4.10. ANOVA results of Treatment on the Prior Knowledge.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.57	2	.29	1.13	.33
Within Groups	22.68	90	.25		
Total	23.25	92			

The test for homogeneity of dispersion matrices was not significant, F(40, 10509)=.899, p=.232. The homogeneity assumption was met. It is shown in Table 4.11.

Table 4.11. Box's Test of Equality of Covariance Matrices

Box's M	65.034
F	1.14
df1	50
df2	11433.23
Sig.	.23

The descriptive statistics of the dependent variables (CIU, NCIU, TEST, and CONCEPT) grouped by the independent variables of treatment and prior knowledge, including means, standard deviation, and sample sizes are shown in Table 4.12 through Table 4.15.

Table 4.12. The means, standard deviation, and sample size of the treatments by prior knowledge on the dependent variable of cued information units (CIU).

	Control	Strategic	Partial	Total
Low	5.83/3.76	7.00/3.28	5.73/3.31	6.30/3.39
	(12)	(20)	(15)	(47)
High	6.44/3.78	10.64/4.16	8.21/3.42	8.26/4.11
	(18)	(14)	(14)	(46)
Total	6.20/3.72	8.50/4.04	6.93/3.53	
	(30)	(34)	(29)	

Table 4.13. The means, standard deviation, and sample size of the treatments by prior knowledge on the dependent variable of Non-Cued information units (NCIU_LOG).

	Control	Strategic	Partial	Total
Low	.026/.09	.27/.26	.29/.24	.22/.25
	(12)	(20)	(15)	(47)
High	.06/.14	.35/.19	.39/.27	.25/.25
	(18)	(14)	(14)	(46)
Total	.05/.12	.30/.24	.34/.25	
	(30)	(34)	(29)	

Table 4.14. The means, standard deviation, and sample size of the treatments by prior knowledge on the Comprehension test (represented by percentage).

	Control	Strategic	Partial	Total
Low	60.71/15.38	60.35/19.18	57.14/18.90	59.42/17.88
	(12)	(20)	(15)	(47)
High	62.23/16.94	66.84/16.24	71.43/15.85	66.46/18.65
	(18)	(14)	(14)	(46)
Total	61.67/16.08	63.02/18.06	64.03/18.65	
	(30)	(34)	(29)	

Table 4.15. The means, standard deviation, and sample size of the treatments by prior knowledge on the Long-Term Free Recall (Concept).

	Control	Strategic	Partial	Total
Low	3.66/2.42	4.95/3.20	5.60/3.33	4.83/3.09
	(12)	(20)	(15)	(47)
High	6.44/3.15	7.57/4.47	8.21/2.89	7.33/3.53
	(18)	(14)	(14)	(46)
Total	5.33/3.16	6.03/3.93	6.87/3.35	
	(30)	(34)	(29)	

Medium correlation was observed among the dependent variables and between the dependent variables and the covariate, which justified the use of MANCOVA. (Green & Salkind, 2003). With Wilks's criterion, the MANCOVA showed that the combined DVs were significantly different for Prior Knowledge, Wilks's $\lambda = .825$, $F(4, 84) = 4.46$, $p = .003$; and for Treatment, Wilks's $\lambda = .642$, $F(8,168) = 5.21$, $p = .001$. These results are shown in Table 4.16. No significant interaction results were found: Wilks's $\lambda = .940$, $F(8, 168) = .655$, $p = .730$.

Table 4.16. Multivariate Analysis of Variance results for the scores on the combination of DVs for the treatment and prior knowledge with the covariate of students' writing speed.

Effect	Wilks'	F	df	Error	Sig.	Eta Square	Power
Prior Knowledge	0.83	4.46	4.00	84.00	0.00	0.18	0.93
Treatment	0.64	5.21	8.00	168.00	0.00	0.20	1.00
Knowledge * Treatment	0.94	.66(a)	8.00	168.00	0.73	0.03	0.30

a Exact statistic

Following the significant prior achievement main effect in the multivariate analysis, univariate follow-up analysis on each dependent variables revealed that students with different levels of prior achievement performed differently on CIU, $F(1,87) = 8.75$, $p < .01$, $\eta^2 = .09$; and on long-term free recall, $F(1, 87) = 14.74$, $p = .000$, $\eta^2 = .15$, as indicated in Table 4.17. All differences were in favor of the students with higher prior achievement in sciences. Means of CIU were 6.19 and 8.43 for the low and high prior achievement groups, respectively. Means of LTFR were 4.74 and 7.41 for the two groups, respectively. There were no statistically significant differences for NCIU_LOG, and for TEST.

Referred to in Table 4.12 and Table 4.15, the results of descriptive statistic procedures indicated that high prior knowledge group performed significantly better than lower prior knowledge group on CIU and LTFR. Post hoc was not conducted because there were only two groups.

Univariate analyses, as follow-ups for the significant treatment main effect in the multivariate analysis, showed significant treatment effect on the dependent variables of CIU, $F(2, 87) = 4.52$, $p = .01$, $\eta^2 = .09$, and NCIU_LOG, $F(2,87) = 17.34$, $p < .001$, $\eta^2 = .28$. These results are also shown in Table 4.17.

Table 4.17. The Univariate Tests of Between-Subjects Effects result of Prior Knowledge on CIU, LTFR, TEST and NCIU_LOG.

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Observed Power (a)
Prior Knowledge	CIU	113.85	1.00	113.85	8.75	0.00	0.09	0.83
	LTFR	161.18	1.00	161.18	14.74	0.00	0.15	0.97
	TEST	1254.07	1.00	1254.07	4.17	0.04	0.05	0.52
	NCIU_LOG	0.11	1.00	0.11	2.37	0.13	0.03	0.33
Treatment	CIU	117.58	2.00	58.79	4.52	0.01	0.09	0.76
	LTFR	51.12	2.00	25.56	2.34	0.10	0.05	0.46
	TEST	121.60	2.00	60.80	0.20	0.82	0.01	0.08
	NCIU_LOG	1.58	2.00	0.79	17.36	0.00	0.29	1.00
Prior Know * GROUPS	CIU	35.62	2.00	17.81	1.37	0.26	0.03	0.29
	LTFR	0.13	2.00	0.06	0.01	0.99	0.00	0.05
	TESRATIO	593.57	2.00	296.79	0.99	0.38	0.02	0.22
	NCIU_LOG	0.02	2.00	0.01	0.17	0.85	0.00	0.08
Error	CIU	1132.62	87.0	13.02				
	LTFR	951.45	87.0	10.94				
	TEST	26162.01	87.0	300.71				
	NCIU_LOG	3.96	87.0	0.05				

Note: a Computed using alpha = .01. CIU refers to Cued Information Units. NCIU_LOG refers to Log of Non-Cued Information Units. LTFR refers to Long-Term Free Recall. WPM refers to students' writing speed per minute.

Post hoc pairwise comparisons on CIU showed that the strategic notetaking method group (M = 8.82) outperformed the control group (M = 6.14) on the task, p = .005. Post hoc comparisons on NCIU_LOG showed the two strategy instruction groups, means of .31 and .34 for the strategic and partial strategic method group respectively, performed significantly better than the control group (M = .04), at the significant level of p=.000.

Table 4.18. The Post Hoc pairwise comparison on the CIU and NCIU_LOG among the three treatment groups.

Depend.Variable	Treatments	Treatments	Mean Diff.	Std. Error	Sig.(a)
CIU	group 1	group2	-2.683(*)	.920	.005
		group3	-.835	.949	.382
NCIU_LOG	group 1	group2	-.269(*)	.054	.000
		group3	-.298(*)	.056	.000

Note: The mean difference is significant at the .01 level. CIU refers to Cued Information Units. NCIU_LOG refers to Log of Non-Cued Information Units. LTFR refers to Long-Term Free Recall. WPM refers to students' writing speed per minute.

Students' hand writing speed also played a critical role in the completeness of students' notes. Specifically, it strongly related to students' NCIU_LOG. The Univariate ANOVA results, F (1, 86) = 4.708, p=.033, is illustrated in Table 4.19.

Table 4.19. The MANOVA results of students' hand writing speed on CIU, NCIU_LOG, COMPREHENSION TEST, and CONCEPT.

Source	Dependent Variable	df	F	Sig.
WPM	CIU	1	4.708	.033
	NCIU_LOG	1	.237	.628
	comprehension test	1	1.720	.193
	CONCEPT	1	3.007	.086
Error	CIU	86		
	NCIU_LOG	86		
	comprehension test	86		
	CONCEPT	86		

Note: CIU refers to Cued Information Units. NCIU_LOG refers to Log of Non-Cued Information Units. LTFR refers to Long-Term Free Recall. WPM refers to students' writing speed per minute.

CHAPTER V

DISSCUSSION

The results of this study provide evidence that third grade students can benefit from a notetaking training program that emphasizes notetaking during science classroom lectures. This finding is consistent with other researchers who have found that strategy instruction improves students' strategy development. The study has shown the potential of strategy instruction as an effective means to improve learning because of the positive relationship between the amount of information recorded in notes and academic performance (Baker & Lombardi, 1985, Einstein, Morris, & Smith, 1985; Kiewra & Flecher, 1984). Based on this research finding, favorable results can be anticipated when strategic notetaking or partial strategic notetaking forms are taught to the third grade students.

Indeed, there was a treatment main effect observed from the multivariate analysis on the four dependent variables. The main treatment effect answered the first research question, "Does instruction in a notetaking strategy affect students' notetaking behavior and learning?", and supported the prediction.

One of the researcher's concerns was how much information students in the notetaking training groups are able to record in their notes during teacher's lecture. The study showed that students in both the strategic notetaking technique and the partial strategic notetaking groups were more effective than the control group on writing down cued information (CIU) and non-cued information units (NCIU). However, the notetaking training did not show significant effect on students' learning as measured by comprehension and delayed free recall of information.

The better notetaking behavior manifested by the notetaking training group can be attributed to the scaffolding available in the two conditions. Students in these two groups were trained to follow the prompts listed in the strategic and partial strategic notetaking form to chunk important information during the class lecture (e.g., "naming three to seven new main points with details") and summarize (e.g., "quickly describe how the ideas are related"). The prompts facilitate learning and make the information more meaningful in one's memory (King, 1992; Wittrock & Alesandrini, 1990).

However, the experimental groups did not perform better than the control group on long-term free recall (LTFR) and comprehension test. The lack of difference might be caused by multiple reasons. First, the treatment was brief. The enhancing effects of notetaking on learning might not reflect in learning after the brief training. However, because of the strong relationship between notetaking and learning, it can be expected that the learned strategy of notetaking eventually will lead to improvement of learning. Second, Kiewra (1988) suggested that theoretically notetaking involves, "attending to the lecture, locating targets in long-term memory, holding and manipulating the attended information in working memory, encoding ideas into long-term memory, and transcribing relevant notions" (p.41). The cognitive ability of third graders might not be mature enough to fully benefit from the theoretical framework of notetaking instruction. Another possible reason could be that the multiple-choice questions only required a lower level of rote-learning studying strategy, which limited the expression of the enhancing effects of training (Ormrod, 2004). The lack of expected enhancing effect of strategy instruction on learning suggests possibilities for future research: (a) longer treatment; (b) including age as another independent variable; and (c) use measurement that assesses higher level of learning.

The multivariate significant results also showed that the population's mean score on the combination of the DVs were significantly different between the higher and lower prior-knowledge students. This result did answer the second research question on "Does students' prior knowledge exhibits significant difference in notetaking behavior and learning?"

The higher prior knowledge group tended to perform better than the lower prior knowledge group on both the CIU (cued information units) recorded in their notes, and on LTFR (long-term free recall), but not on NCIU_LOG (log of non-cued information unit) and TEST (multiple-choice test). This finding is not surprising. The reason might be due to students in the higher prior knowledge group having already learned somewhat related information before testing. Therefore, when they learned related information while watching a videotaped lecture throughout the testing; they were able to meaningfully connect to the to-be-learned material with old information. However, they performed no better on NCIU_LOG and TEST. The reason for the lack of significant effects on NCIU_LOG might be due to youth of the participants, who still needed an instructor to signal the importance of information (such as telling them to "write down this important information"). This result indicated that both higher and lower prior knowledge third grade students need scaffolding from a classroom teacher to prompt them in order to keep complete notes, which can eventually lead them to perform better on future learning tasks. This is a practical implication for the third grade teacher in the science classroom. The higher prior knowledge group was also not performing better than the lower prior knowledge group on the TEST (immediate multiple-choice test) score. Again, this result might be due to the multiple-choice test not being as good a measure in differentiating how much students had learned versus not-learned notetaking behavior.

In regard to research question three, in order to find the most suitable format of notetaking instruction, there was no interaction effect between the variables of treatment and prior knowledge. The students with low prior knowledge would benefit more from the partial strategic notetaking method (P-SNM) than from strategic notetaking method (STM) was not supported. Although the prediction was not supported, the researcher believes that the rationale behind the prediction was valid. This rationale seems valid primarily because P-SNM is designed based on Sweller and Chandler's (1991) cognitive load theory. This theory states that students' learning of knowledge and development of strategies can be impeded by the competition for cognitive capacity, more specifically, the capacity of the working memory between the two learning facts. Therefore, the task of learning new information is more demanding for students with lower prior knowledge. The partial strategy notetaking form with 50% of the needed information contained in the form should decrease the cognitive burden on these students when they were working hard to engage in learning new information and taking notes simultaneously. Conversely, students with high prior knowledge may not need the scaffolding provided in the P-SNM form. Working with the SNM and P-SNM should make no difference in notetaking behavior for these students. Future research is warranted to further investigate the question.

Implications

Theoretical Implications

Kiewra (1988) pointed that metacognitive processes play an essential role in the notetaking behavior, which involves "attending to the lecture, locating targets in the long-term memory, holding and manipulating the attended information in working memory, encoding ideas into long-term memory, and transcribing relevant notions". Essentially, the researcher found that notetaking is also related to students' writing speed. Otherwise stated, the students write more complete notes if they use abbreviation methods. For example, the students' writing speed makes a significant difference on the CIU. Therefore, the students' writing speed should be considered as one important variable (especially on cued information units), which could theoretically influence students' notetaking behavior and further play a critical role in the control process during notetaking.

When compared with the control group, the full and partial notetaking strategic groups took better notes as measured by CIU and NCIU. This finding carries significant theoretical implications. Advocates of strategy instruction contend that after a learner successfully learns a skill, he or she will face a variety of other tasks and situations where the skill is demanded. Since it is difficult, if not impossible, for the learners to learn all of these eventualities, teachers should teach students learning strategies so that the learner can generalize the strategies to accommodate potential future demands (Singer, Cauraugh, Lucariello, & Brown, 1985). However, whether the type of general transfer can occur has been the subject of much debate over years. Although research clearly shows that general transfer is much less common than specific transfer, recent studies have also shown effective study methods and habits that can be taught and expected to be generalized from one subject matter to another (Brooks & Dansereau, 1987; Hughes & Schumaker, 1991; Hutchinson, 1993, 1996; Pressley, Snyder, & Cariglia-Bull, 1987). This study provides supportive evidence that when planned well, learning strategies, such as notetaking, can be taught to students as young as 9-years old.

Educational Implication

This study demonstrated potential to improve students' learning by teaching effective studying strategies. As indicated in the variables of CIU and NCIU, the strategy instruction groups had better notetaking behavior than control group. The difference in the performance may be attributed to the fact that the two experimental groups were trained to take notes when practicing. Self-regulated learning researchers have identified many effective learning strategies, among them are "the most widely studied" (Zimmerman, 1998, p. 75) strategies of goal setting, task strategies, imagery, self-instruction, time management, self-monitoring, self-evaluation, self-consequences, environmental structuring, and help seeking. It is encouraging to think how many students will be benefited if the strategies are taught regularly and systematically in classrooms.

Consistent with theoretical implications, students should be taught methods of taking fast notes (enhancing writing speed), using abbreviations or their own short-hand notations (Josel, 1997; 2000; Weishaar & Boyle, 1999). The abbreviation and short-hand method can not only ensure that students keep to the teacher's pace and prevent frustration or hand-ache, but can also help students record complete notes (Josel, 1997; 2000). Practice of these methods is necessary; meanwhile, students need to be encouraged to use these methods whenever possible. For example, teachers should encourage students to use these methods in shopping lists and notes to their friends, in addition to lecture or textbook notes (Josel, 2000).

In the past, students in the third grade were generally considered too young to take notes during class lectures. Pressley (1995) suggested that young students need to be prompted to use good learning strategies. The strategic and partial strategic notetaking forms include written prompts that function to remind students to engage in effective step by step notetaking activities.

In this study, the researcher found that third grade students can be trained to take relatively complete notes by using notetaking forms that include writing prompts, especially the strategic and partial notetaking forms. As previously mentioned, the completeness of students' notes is strongly related to students' academic performance (Baker & Lombardi, 1985; Einstein, Morris, & Smith, 1985; Kiewra & Fletcher, 1984); therefore, one can be confident that these students who received notetaking training will eventually perform better than the non-notetaking group in the future.

However, as previously discussed, that even the higher prior knowledge students experienced difficulty in taking notes on non-cued information units from the lecturer. This reflects that these young children need more oral (teacher emphasizing the importance of information) or physical (writing on the board) prompts in order to take the most important information down in their notebooks. Therefore, it is important for teachers to recognize that young students always need to be reminded to take notes on important lecture information.

Limitations

The experiment that lacks random assignment thus is referred to as a quasi-experimental design. This type of experiment, if carefully designed, yields useful knowledge (Campbell & Stanley, 1963). Since, in many educational institutions, it is not realistically possible to randomly assign students to the experiment and control groups, the researcher, therefore, used the static-group comparison quasi-experimental design (Gale, Gale, & Burg, 2001).

Gale et al. (2001) argued that the goal of experimental research is to create a set of conditions such that any observed changes can be attributed to the intervention (treatment) rather than to extraneous variables, which are more likely to occur in the research participants who were not randomly assigned. Consequently, the extent to which quasi-experimental research may be generalized is an issue.

Those interested in generalization of the results of this notetaking training program should be encouraged to be aware of the environment of the students, such as, the characteristics of participants, the suburban area of school types, and the teachers' classroom instruction. In addition, the readers also should be aware of how to use this information for other content areas.

Future Research

Contrary to the researcher's prediction, there was no interaction effect between the treatments and prior knowledge. The researcher expected that students' with low prior science achievement might need more scaffolding in notetaking than those with higher prior achievement so that the partial notetaking strategy instruction would benefit students with lower achievement more than the full strategy instruction. Based on Sweller & Chandler's (1991) cognitive load theory, lessening students' cognitive load allows them more cognitive space to process lecture information, which in turn enhances students' learning. Therefore, the researcher still believes the rationale behind the prediction and hopes future research will examine the relationship between ability/achievement and method of strategy instruction.

In addition, the lecture speed of the classroom teacher might reasonably be assumed to have some influence on the completeness of students' notes. Therefore, a reasonable classroom teachers' lecture rate for different native language students may also be a topic of interest to researchers.

Overall, children seemed to have great potential in applying the notetaking learning strategy. Future studies, however, might focus on the ways that different content areas might show different results.

Conclusion

Baxter, Bass, and Glaser (2001) claimed that notebook writing has become increasingly popular in elementary science education. This study examined the effectiveness of notetaking training in a natural science class for third graders based on the information processing model. Students who received notetaking training did perform better than the non-notetaking training group on various learning tasks. Also, no interaction was found for high versus low students across all three groups. Even though limitations should be noted for the generalization of this research, the potential of the notetaking learning strategy for young children should not be ignored by the elementary school teachers.

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APPENDIX A

STRATEGIC NOTETAKING FORM

An Abbreviated Strategic Notetaking Form

Strategic Notetaking Form

What is today's topic? Page 1

Describe what you know about the topic.

As the instructor lectures, use these pages to take notes from the lecture.

Today's topic?

Name three to seven main points with details of today's topic as they are being discussed.

Summary:quickly describe how the ideas are related.

New Concept or Terms:

Page 2

Name three to seven new main points with details as they are being discussed.

New concept or Terms:

Summary :quickly describe how the ideas are related.

Page X

Name three to seven new main points with details as they are being discussed.

New Concept or Terms:

Summary : quickly describe how the ideas are related.

Last Page

At End of Lecture

Write five main points of the lecture and describe each point.

1.

↓

5.

Note. From "the effects of strategic notetaking on the recall and comprehension of lecture information for high school students with learning disabilities." By Boyle and Weishaar (2001), Learning Disabilities Research & Practice, 16 (30), 133-141.

APPENDIX B

COMPREHENSION TEST

Sample Items of The Comprehension Test (In Chinese)

學習單元: 水裡生物

1. ( ) 下面哪裡的水含鹽量最高？1. 海洋 2. 溪流 3. 湖泊 4.池塘

2. ( ) 下面哪裡的水的魚形狀像飛彈，可使他們由的更快1. 海洋 2. 溪流 3. 湖泊 4. 池塘

3. ( ) 通常生活在溪流底層的魚嘴巴朝 1. 下 2. 上 3.中間 4. 後面

4. ( ) 並非所有水生動物都有鰓，譬如 1.吳郭魚 2.鯉魚 3.鯨魚 4.大肚魚 就沒有鰓

5. ( ) 迴游性生物常在河口交配產卵，請問河口指的是 1.大海 2.河的上游部分 3. 河的中間段4. 河的下游與海交接的地方

Sample Items of the Comprehension Test (In English)

1. ( ) Which choice below is more salty than the others?
   1. ocean 2. creek 3. lake 4. pond

2. ( ) The fish that is shaped like a missile, so that it can swim faster in a current, lives in which place?
   1. ocean 2. creek 3. lake 4. pond

3. ( ) For fish that lives at the bottom of the creek, the shape of its mouth is more likely to face
   1. down 2. Up 3. strait ahead 4. backward

4. ( ) Not all things that live under the water have a gill. Which of the following doesn't have a gill?
   1. wu-guo fish 2. carp 3. whale 4. da-tu fish

5. ( ) When they migrate, some creatures usually lay their eggs at the outlet of the river. What does "the outlet of the river mean?"
   1. ocean 2. the upper part of the river 3. the middle part of the river 4. the lower part of the river

APPENDIX C

NOTETAKING TRAINNING PROGRAM

The Details of the Notetaking Training Program

First session:

Time & Content

5 min. (minutes): watched the practice videotaped lecture and jotted down notes,

3 min.: examined their own notes to see how many key points they had, compared with a provided copy of the instructor's complete notes

6 min.: The teacher explained the purpose of strategic notetaking and the structure of the strategic notetaking form

10 min.: The researcher turned on the videotape and began modeling notetaking on the strategic notetaking strategic form (stopped and played repeatedly)

3 min.: teacher solicited questions,

5 min.: students practiced recording information in the strategic notetaking form as they watched videotaped lecture;

3 min.: teacher solicited questions

5 min.: the teacher emphasized the importance of notetaking, and also clarified what the teacher had written on the notetaking form (main ideas selection), as well as how the words and phrases were jotted down (abbreviation method).

Note, instructor intends to help students acknowledge that (a) to think about the main ideas that are very important before instructor lectured, (b) the spelling and grammar is not important as long as they were legible, (c) to pay attention to cued information, (d) to use graphic organizer whenever possible, and (e) to encourage generalization.

Second session:

Time & Content

5 min.: Teacher solicited questions about students' difficulties in notetaking, generalization application, and emphasized the main ideas of the previous session.

10 min.: Teacher offered abbreviating training (students learned to invent their own abbreviations in words or symbols), paraphrasing training, marking of important information (used "*" or their own ways), being aware of margins, and leaving room between lines (allows additional notes while review).

5 min.: Teacher repeated the format of strategic notetaking form.

10 min.: Teacher used the same videotape (without pausing) to practice strategic notetaking form .(thinking about the topic and linking it with previous knowledge first)

7 min.: Students checked their own notes with others and added "new" information, teacher selected some students' notes and discussed.

3 min.: Teacher concluded by encouraging generalization, and invention of their own abbreviations.

Third session:

Time & Content

5 min.: Teacher solicited questions.

10 min.: Teacher offered abbreviating training (students could make their own abbreviations or symbols), paraphrasing training, marking of important

information (* or their own ways), being aware of margins, and leaving enough room between lines.

5 min.: Teacher repeated the format of strategic notetaking form and reinforcing students' good notetaking behavior.

10 min.: Students practiced notetaking by watching the videotaped material again, used new strategic notetaking form (with longer stops and repeats). The teacher and students followed these sequential steps: (students) watched tape→ (teacher) stopped tape and (students) took notes→(students continuous) practiced→ (teacher) answered questions from students regarding notetaking → (students) watched tape again→ another cycle...

5 min.: Teacher discussed students' notetaking, and solicited questions.

5 min.: Teacher made conclusion.

Fourth session:

Time & Content

5 min.: Teacher emphasized the importance of abbreviation and paraphrase while taking notes.

10 min.: Students watched tape without pausing and jotted down information on notes.

5 min.: Class formed several groups with 2-4 persons in each group, compared their own notes and discussed the main points within the group.

10 min.: Teacher randomly selected 3 notes from different groups and made a comparison among them.

5 min : Teacher solicited questions.

5 min : Teacher concluded and reminded students there would be an evaluation test the next day.

<u>Fifth session (all students' notes were collected, all students' took test):</u>

11 min.: Class watched Natural Science videotape (tape 2)

11 min. Class reviewed notes

5 min.: Teacher collected students' notes and read the test instruction

10 min.: Teacher administered test.

<u>The sixth (last) session (Long Term Free Recall Evaluation):</u>

2 min.: Teacher read instruction for LFR evaluation.

2 min.: Teacher distributed lined paper.

5 min.: Students wrote down as many concept items as possible that were related to the videotaped lecture.

2 min.: Teacher collected students' recall evaluation.

The above mentioned details of notetaking program was administered based on Pressley & Woloshyn (1995), Kiewra (2002), and Boyle's (2001) research studies, which integrated the following components:

a. Comparison: At the beginning, compared students' conventional notes and the effectiveness of strategic notetaking, so students might be convinced by the huge difference between these two results. (Boyle, 2001; Kiewra, 2002).

b. Selling the strategy: Tell students how effective this strategy is (Kiewra, 2002).

c. Modeling: Model the procedure (Boyle, 2001; Pressley & Woloshyn, 1995).

d. Practicing: Allow students to practice and make improvement (Kiewra, 2002).

e. Self monitoring and evaluation: Encourage students to monitor their own progress throughout their notetaking task, and then evaluate their results (Pressley & Woloshyn, 1995).

f. Generalization: Encourage students to generalize this notetaking training to other content areas (Kiewra, 2002).

g. Cooperative learning: Encourage students to enhance their notetaking ability by comparing their notes with those of other students. Cooperative learning can promote more sophisticated cognitive processing (Ormrod, 1999).

h. Feedback: Always seek feedback from students in order to immediately know their learning pace/speed (Boyle, 2001).

I Attention: Getting students' attention by making the learning strategy more interesting (Robinson-Riegler & Robinson-Riegler, 2003).

j. Advance organizer: Use an advanced organizer to help students by connecting ideas and giving them a mental road map, which will improve students' understanding and motivate students to learn (Paik, 2003).