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行政院國家科學委員會補助專題研究計畫　X 成果報告
□期中進度報告

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成果報告類型(依經費核定清單規定繳交)：x 精簡報告 □完整報告

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中華民國　96 年 7 月 30 日

Help children to take notes on science class

The definition of being success in today's information age is totally different from previous hunting, agriculture, and even industrious societies. Knowledge is the central focus of nowadays' society (Toeffler, 1990): "He who has access to knowledge has the power" (p.20) and has the best chance to be successful (Toffler, 1990; Toffler & Toffler, 1995). Teachers need to teach students the requisite knowledge and skills necessary not only for survival, but for success in today's school (Texas Education Agency, 2007; Huitt, 1999). Researchers also showed that a learner's inadequate 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).

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).

Many studies suggested that students should be taught study skills, because of the enhancing effect of the skills/strategies on learning (Schunk, 2004). 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. 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, & 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.

Learning strategies, such as notetaking, can be taught to middle elementary students when planned well (Lee et al., 2007). Individuals will be more aware of how much they understand about the materials through information process such as notetaking (Peverly, Brobst, Graham, & Shaw, 2003). 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, notetaking, improved students' academic performance in various subject areas (Hartley, 1983; Hughes, C, & Suritsky 1994; Kiewra, 1985; Ornstein, 1994).

Participants

Participants in this study were 117 fifth-grade students in the Natural Science classes offered in a rural elementary school in southern Taiwan. The students' ages ranged from 11 to 12. There were 52 females and 65 males.

Design.

This study utilized a 3 x 3 factorial design, with nine experimental conditions constituted by the variable of note taking strategy instruction (full notetaking strategic, partial notetaking strategic, and control groups) and the variable of prior knowledge (high vs. medium vs. low), based on students' performance on a Natural Science examination. Students' writing speed was used as a covariate.

Measurements

Six dependent variables were used to assess the effects of the independent variables. They are: Board-Cued Information Unit (BCIU), Verbal-Cued Information Unit (VCIU), The Non-Cued Information Unit (NCIU), 15 items of Multiple-Choice Test, three items Essay Question Test, and Long-Term Free Recall (LTFR) Measurement.

1. Board-Cued Information Unit (BCIU) is a design to examine students' quantity of recording critical points which were written on the black board while they watching the video tape lecture.
2. Verbal-Cued Information Unit (VCIU) is a design to examine students' quantity of recording critical points which verbally speak out and emphasis twice in the video tape lecture.
3. The Non-Cued Information Unit (NCIU) is a design to examine students' notes on how many NCIU were recorded in their notes among experimental and control groups after all groups of students watched the videotape.
4. The 15 items of Multiple-Choice Test consisted fact information about "material forces", designed to examine students' understanding of the lecture presented in the tape.
5. The three items Essay Question was used to students for "probing" students understanding of the video tape lecture, by express out their thoughtful comments in the written form.
6. For Long-Term Free Recall (LTFR) Measurement, students' long-term memorization of the lecture topic was measured by their performance on a free-recall task about the concepts presented in the videotape two days after watching the videotape.

The words per minute (WPM) method is used for probing students' hand writing speed with little or no cognitive processing that might possibly interfere students' recording quantity on their note books.

Procedure

In order to deliver different treatment to the three experimental conditions, the researcher followed a prepared, scripted lesson plan training students in the experimental groups how to use a strategic notetaking form, and the partial strategic notetaking form. The control group received no treatment. There were two parts of the study, training and assessment sessions.

Results

The 3 x 3 two-way multivariate analysis of variance with the writing speed as covariate (MANCOVA) was conducted to determine the effect of the treatment (strategic notetaking, partial strategic notetaking, and control,) and prior knowledge (high vs. medium vs. low) on the six dependent variables, which were the BCIU (board cued information unit), VCIU(verbal cued information unit), NCIU (non-cued information

unit), 15 multiple-choice comprehensive test(Test), 3 essay questions (ESSAY), and LTFR (long-term free recall) on concepts. The order of data entry for measurement variables was BCIU, VCIU, NCIU, Test, Essay, and LTFR. The prior knowledge was determined by their performance on the previous midterm examine, with the first one third highest score as high, second one third as medium, the rest was put on the low category.

The descriptive statistics of the dependent variables (BCIU, VCIU, NCIU, Test, Essay, and CONCEPT) grouped by the independent variables of notetaking treatment and prior knowledge, including means, standard deviation, and sample sizes are shown in Table 1. With Wilks's criterion, the MANCOVA showed that the combined DVs were significantly different for treatment, Wilks's $\lambda = .64$, $F(12, 190) = 4.00$, $p = .000$; and for prior knowledge, Wilks's $\lambda = .77$, $F(12,190) = 2.27$, $p = .01$. No significant interaction results were found: Wilks's $\lambda = .81$, $F(24, 332) = .87$, $p = .64$

Univariate analyses, as follow-ups for the significant treatment main effect in the multivariate analysis, showed significant on the dependent variables of BCIU, $F(2, 100) = 18.78$, $p = .00$, $\eta^2 = .27$; VCIU, $F(2,100) = 4.51$, $p = .01$, $\eta^2 = .08$; and NCIU, $F(2, 100) = 3.00$, $p = .05$, $\eta^2 = .06$. Post Hoc paiwise comparisons with Tukey method showed the full notetaking strategy group with means of (M = 5.13, 1.21, 1.52), outperformed the control groups (M = 1.39, .72, 1.03) also on the tasks of BCIU, VCIU, and NCIU, respectively. While, students in the partial strategic notetaking group (M=4.74, 1.26, 1.55) outperformed control goup (M=1.39, 1.26, 1.03) on the tasks of BCIU, VCIU, and NCIU, respectively.

Univariate analyses, as follow-ups for the significant prior knowledge main effect in the multivariate analysis, showed differences on the dependent variables of VCIU, $F(2, 100) = 4.28$, $p = .02$, $\eta^2 = .08$; Test, $F(2,100) = 4.31$, $p = .02$, $\eta^2 = .08$; Essay, $F(2, 100) = 4.00$, $p = .02$, $\eta^2 = .07$; and Concepts, $F(2, 100) = 5.03$, $p = .008$, $\eta^2 = .09$. Post Hoc pair comparisons with Tukey method showed the high prior knowledge group with means of (M = 4.08), outperformed the low groups (M = 3.01) on the tasks of VCIU. While, students in the medium prior knowledge group (M=11.33, 2.55) outperformed low group (M=9.27, 1.54) on the tasks of Test and Concept, at p=.016 and .017 respectively.

Discussion

To extend Lee et al's. (2007) research on notetaking, the present study further examined the possible differences on the outcomes of notetaking behavior during class lecture, by dividing cued information into BCIU and VCIU. The essay question was also added for probing students' higher-order thinking (Criswell, & Criswell, 2004; David, 1993), and the training was extended to five sessions. The results were similar to Lee et al's (2007) studies in that both had significant gains on the dependent variables of cued and non-cued information for strategic and partial strategic groups, but not significant difference on comprehension test and delayed recall (on concept). Meanwhile, the main effect of prior knowledge were not totally agree with Lee et al's study, which claims high prior knowledge group had favorite outcomes on cued information unit and delayed free recall. The present study divided prior knowledge into three groups instead of just two like theirs. We found the high prior knowledge group did better only on cued information unit, while the medium prior knowledge group did better on comprehension test and delayed free recall.

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計畫成果自評部份：

本研究與原計畫大致相符, 顯著項目不及原設想來的多. 六項評量標準有一半達顯著差異. 屬可接受範圍. 本研究成果頗富學術價值, 應可爲教育研究期刊接受. 此研究結果論文已近完成, 即將投國外期刊.