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ABSTRACT

Recent advances in technology have made it easy to provide students an outline or some form of notes prior to lectures and for later review. To test the efficacy of instructor-provided notes, 74 students studied lecture material under one of four conditions, in groups of 4 or 5 students. Some listened and took notes as their normal strategy. Others listened and took notes using an instructor-provided outline with spaces for students to fill in important information. A third group listened with a complete set of notes that included virtually everything the instructor would say, in outline form. A control group studied the complete set of instructor notes without hearing the lecture, which was a 35-minute lecture on the structure and functions of the brain. Experiment 1 tested memory, while the second experiment measured memory and transfer. In both studies, the group taking their own notes and the group with instructor-provided partial notes performed better than the groups with full sets of notes, regardless of whether they heard the lecture or not. While instructor-provided notes have been shown previously to facilitate learning, the straight-forward nature of this lecture and extensive use of Power Point may make providing notes unnecessary. (Contains 1 table and 14 references.) (Author/SLD)

Running head: NOTE-TAKING AND LEARNING

Do Instructor-provided On-line Notes Facilitate Student Learning

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Abstract

Previous research has shown that providing students an outline or some form of notes prior to lectures and for later review facilitates learning. Recent advances in technology make providing these notes practical and inexpensive. To test the efficacy of instructor provided notes, students studied lecture material under one of four conditions. Some students listened and took notes using their normal strategy. Others listened and took notes using an instructor-provided outline with spaces for students in fill in important information. A third group listened with a complete set of notes that includes virtually everything the instructor would say (in outline form). Finally, a control group studied the complete set of instructor notes without hearing the lecture. The lecture was 35 minutes and covered the structure and functions of the brain. Experiment 1 tested memory, while Experiment 2 measured memory and transfer. In both studies, the group taking their own notes and the group with the instructor-provided partial notes performed better than the groups with full set of notes (regardless of whether they heard the lecture or not). While instructor-provided notes have previously been shown to facilitate learning, the straight-forward nature of this lecture and extensive use of power point may make providing notes unnecessary.

Do Instructor-provided On-line Notes Facilitate Student Learning

Note-taking and learning from lectures has been an active, productive area of research for the last 30 years. Lecturing remains the most popular college teaching method (Benjamin, 2002), and taking notes is a common classroom activity (Armbruster, 2000). Recent technological changes should cause us to reconsider note-taking research and how it relates to current classroom environments. For example, instructors can assist students by making outlines and class notes available electronically to students. This paper describes two experimental studies designed to answer three practical questions about learning from lectures. Should instructors provide students with lecture notes? If so, what kind of notes should be provided? And, if instructors provide elaborate notes to students, do students really need to go to class?

DiVesta and Gray (1972) distinguished the encoding and external storage functions of notetaking. The encoding occurs when the act of notetaking alters the learner's cognitive processes. By making attention more selective, forcing the listener to organize ideas, and helping students relate material to existing knowledge, taking notes facilitate learning (Peper & Mayer, 1986). Notes serve an external storage function when students have an artifact for later review. Both functions have been shown to facilitate learning across a wide range of conditions, but the effect size for the external storage function is generally stronger (Kiewra, 1985; Kiewra, DuBois, Christian, McShane, Meyerhoffer, & Roskelley, 1991).

In a recent literature review, Armbruster (2000) emphasizes the important relationship between note quality (completeness and accuracy) and learning. Student notes are often limited (containing 35% of the presented material) and sometimes incorrect (Kiewra, 1985). Knight and McKalvie (1986) found that students reviewing a good set of notes (but never attending the lecture) outperformed a group who attended the lecture, took notes, and then reviewed their own notes. Given these problems with student notetaking, researchers have searched for ways to facilitate better notetaking. Providing students with a skeleton outline of the lecture improved both the quality of notes taken (Kiewra, Benton, Christensen, Kim, & Risch, 1989) and test performance after review (Kiewra, DuBois, Christian, & McShane, 1988).

Lecture outlines and class notes can be made available to students via faculty WebPages or course management systems such as Blackboard and eCollege. Grabe (2002) surveyed students and monitored online "hits" on his notes pages. Students in a large, lecture course frequently downloaded copies of the class notes prior to coming to class, as a guide for review just before tests, and as a substitute when absent from class. Accessing class notes was correlated with course achievement, even when reading ability was controlled.

Three practical questions guided this research. First, should instructors provide notes prior to class? Based upon the studies by Kiewra and colleagues, the answer to this should be yes. Partial notes relieve students from some of the copying down of terms, allowing for more focus on understanding and encoding (Armbruster, 2000; Kiewra et al, 1988; Kiewra et al., 1991). By allowing more focus on relating ideas within the presentation (internal connections), learning and recall should be enhanced. By allowing students to relate lecture ideas to prior knowledge (external connections), understanding and transfer should be enhanced (Mayer, 1984; Peper & Mayer, 1986). Second, if we provide notes, what should be in them? Should notes be in skeleton form (with just the key points) or should a detailed set of notes be provided? If providing notes makes the task of note-taking easier and leaves the student more capacity for meaning making, then why not just provide complete notes so the student can follow along? However, if the activity of note-taking encourages deep processing, skeletal notes should be better. The third and final question is if students can study a good copy of notes, why attend the lecture at all? To test these speculations, four conditions were compared. In one condition, students listened to the lecture without any notes from the instructor but were encouraged to take notes (the take notes group). In a second condition, students were provided a skeleton outline (covering one side of one page) listing key phrases (the skeletal notes group). In the detailed notes condition, students were provided with an elaborate outline (approximately 3 pages, single spaced). In the fourth condition, students were given the detailed outline but did not see the video (the control group).

To insure some level of ecological validity, a videotape of a college lecture was used in the study. This instructor used PowerPoint slides to organize the lecture. Skeleton notes were constructed by combining the key points off the PowerPoint slides onto one page (these notes are normally made available to all students prior to the lecture). The detailed notes were the instructor's own notes, which she uses to keep herself organized (as she teaches multiple sections throughout the school year). These detailed notes are made available for students who have extended, excused absences from class.

Experiment 1

Method

Participants. Seventy-four students from undergraduate Educational Psychology classes at a Midwestern university participated in the study. The mostly female sample were sophomores and juniors, majoring in education, and taking their first psychology class.

Materials. All students watched a 35-minute video on the brain, taken from a 50-minute General Psychology class. The topic was chosen because it would be of interest to the experimental sample, but not typically covered in Educational Psychology. Fifteen minutes were cut from the original tape by omitting class announcements, some questions and responses that were difficult to hear and went off-topic, and an end-of-class summary.

The test consisted of 14 fill-in-the-blank or short answer questions. The questions were factual, covering material explicitly presented in the videotape. Alpha was .74.

Procedures. Volunteers were randomly assigned to one of four experimental conditions. The take notes students were given blank sheets of paper. In the skeletal notes condition, students were given a one-page outline with key terms and main ideas. The full notes group received a three-page outline with literally about 80 terms and ideas. The control group received the 3-page outline, but was not allowed to view the video.

To begin the study, all participants were given a general description of the study. After signing consent forms, students were randomly assigned to groups and moved to one of four rooms, given instructions and materials appropriate to their experimental conditions, and the video began (except for the control, who was instructed to study the outline). At the end of the video, the experimenter removed all materials and distributed the test. Students participated in small groups of 4 or 5, and the entire experiment took just under one hour.

Results

Descriptive statistics are presented in Table 1. There was a significant treatment effect, $F(3, 70) = 3.28, p = .026$. Using the LSD procedure, a series of t-test found that the skeletal notes produced the highest scores, but those scores were not significantly higher than the take notes group. The mean for the skeletal notes group was significantly higher than the full notes and the no lecture control groups. The take notes group did not differ significantly from the skeletal notes or the no lecture control, but they did score significantly higher than the full notes group. The no lecture control group was significantly lower than the skeletal notes group, but not different from the other two. Finally, the full notes group scored significantly lower than the skeletal notes and the take notes groups, but not from the no notes control group.

To examine the quality of notes taken, two simple analyses were undertaken. First, ten sets of notes from the take-notes group were randomly selection. The notes were examined to determine how many of the 16 key ideas in the skeletal notes were recorded. Two individuals, working independently, scored the 10 sets of notes and had 100% agreement. Of the 16 key ideas, seven of the 10 had all 16, two had 15, and one set of notes contained 14 of the 16.

A second analysis compared the notes of the skeletal and the take notes groups. Again, 10 sets were randomly selected from each group. Two individuals scored the notes to determine how many lecture ideas were actually recorded. Student notes were compared to the 60 ideas contained in the instructor's complete notes. Agreement occurred in 95% of the scores, and that one differed by only one idea. The skeletal notes group recorded an average of 45.70 (s = 10.22), while the take notes group had a mean of 52.10 (s = 14.12). This difference was not significant, t (18) = 1.61, p = .26.

In summary, the students in the two note-taking groups were very active, recording much of the lecture content. The number of ideas recorded did not change by giving students skeletal outlines.

Experiment 2

A replication experiment was conducted. The outcome measure was altered by shortening the factual test to 10 items and adding 4 transfer items. The transfer items required students to apply their knowledge about the brain to answer questions not discussed in the lecture.

Method

Forty students from the same population as above participated in this experiment. All details were identical except for the test. The factual test was shortened from 14 to 10 items. By choosing the best questions of the original 14 items, the reliability was virtually unchanged (alpha = .72). The transfer test gave students 4 problems, such as "We know the brain develops with age. Comparing children and adults, which part of the brain probably develops the most? Why?" Other items asked about comparative anatomy, robotics, and evolution. The key was that there was no information presented in the lecture on these topics, but students could speculate intelligently based upon the information presented. Items were scored on a scale of 0, 1, or 2, where 2 represented an appropriate use of lecture information and a 1 was partial credit for being on the right track. All responses were scored by two individually working independently. They agreed on 96% of all scores.

Results

The first analysis compared the performance on memory items across the four groups. There was a significant effect, F (3, 36) = 3.94, p = .016. The descriptive statistics are found in Table 1. Follow-up tests found that the take notes group was significantly higher than the control group and the full notes group, but not the skeletal notes group. The skeletal group was not significantly different from any other groups. The control group was significantly lower than the take notes group, but not different from the two other groups. The pattern for the full notes was the same, in that they were significantly lower than the take notes group, but equal to the other groups.

A second ANOVA tested differences among the groups on the transfer test. Once again, there were significant differences, F(3, 36) = 3.82, p = .018. Follow-up tests revealed the exact same pattern as with the memory tests. The take notes group did not differ significantly from the skeletal notes group, but did significantly outperformed the other two groups.

General Discussion

Having students take their own notes, or providing them with a skeletal copy and allowing them to fill in gaps on their own, produced the best results. The failure to find a significant difference between the take notes and skeletal notes groups is surprising given the general superiority of providing partial notes in previous studies (Armbruster, 2000; Kiewra et al., 1989). One possible explanation is another technology commonly used in classes: PowerPoint. The instructor taped for this study used a series of PowerPoint slides to make the lecture easy to follow and to assist students in taking good notes. The teaching strategy appears to have worked, since the notes taken closely resembled the skeletal notes. A less organized, more difficult to follow lecture might prove a better test of the benefits of skeletal notes.

Providing students with the instructor's detailed notes resulted in poor performance. One possibility is that the notes are just too much to attend to, and that following along with all the notes may be too distracting. It is also possible that these notes make the listener too passive, since they just follow along. It is important to note that this study did not involve an opportunity to review, when a complete set of instructor's notes might prove very helpful. The control group with the notes but no lecture also performed poorly, confirming what instructors have tried to tell students: it is important to get good notes when you miss class, but it is not the same as attending class.

The present studies has several limitations, which can be described by briefly discussing some things that are missing from this paper. One is individual differences. A recent paper by Ryan (2001) presents an interesting analysis of note-taking styles, arguing that students vary in their beliefs about the purpose of note-taking and in their note-taking habits. The notes taken the in the present studies were remarkably homogeneous, closely resembling the instructor's own outline and the PowerPoint slides. There was certainly no evidence of styles in these two studies. This could be due to the highly structured, detail-oriented lecture that was employed. Further, this was a one-shot experience for students. Sustained experience in a course with an instructor might yield more variability in note-taking and study behaviors, as students learned what information was needed for tests or class assignments.

Also missing from this paper is any reference to self-regulated learning. Van Meter and Pressley (Pressley, Van Etten, Yokoi, Freeburn, & Van Meter, 1998; Van Meter, Yokoi, & Pressley, 1994) described student note-taking as flexible and adaptive. They found students alter their note-taking based upon the pace and density of the lecture, the type and difficulty of test expected, and the level of assistance from the instructor. One way to interpret the present studies is that these students quickly recognized the situation and adapted to it: the instructor provides a highly structured lecture with main points on the overhead and lectures on details that elaborate the key points. Studying how students use their notes for exam preparation, and how their note-taking behaviors vary across courses are important topics for further investigation.

Another missing ingredient in this research is that no student actually down-loaded any notes and completed any task on-line. The two experiments presented here were traditional research, controlling variables in experimental fashion. Classroom research, such as that by Grabe (2002), and qualitative work, such as those described in the Van Meter and Pressley papers, are necessary complements to the experimental studies presented here.

Finally, missing from this paper is any reference to the theme of this session, "Cognitive Load and Deeper Processing." Kiewra et al. (1989) are very clear that note-taking is a taxing chore, requiring most of the listener's cognitive capacity to get the information and to record good notes. Armbruster (2000) supports this view, arguing that "taking notes is such a cognitively demanding task, there is limited opportunity for generative processing at the time of encoding" (pp. 179). While no direct measures were taken, and the other papers in this session may have data on this issue, the performance of the students in these studies would seem to contradict this view. There were group differences in performance, even without the opportunity for review, showing a clear encoding effect. The students in these studies appeared to be "expert" notetakers. Many reported receiving direct instruction in how to take notes as far back as the fourth grade, and that their notes were routinely graded for quality back in middle school. Combined with the deliberate pace of this lecture and the instructor's assistance, taking a good set of notes did not appear to be as taxing as it has been described.

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Table 1

Descriptive statistics from Experiments 1 and 2

	Memory (Exp. 1)		Memory (Exp. 2)		Transfer (Exp. 2)	
Condition	M	s	M	s	M	s
Control	5.61	3.63	2.90	1.29	3.10	1.10
Take notes	6.89	2.81	5.60	2.59	5.20	2.04
Skeletal notes	7.61	2.25	4.10	.99	4.30	1.25
Full notes	4.79	3.17	3.50	2.07	2.90	2.28

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