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Notes

1. A specific listing of the references for the 34 textbooks and errors, if committed, is available from the first author.
2. Reprints may be obtained from Dr. Philip Bobko, Department of Psychology, University of Maryland, College Park, MD 20742.

Note Taking and Note Review: Why Students Fail Questions Based on Lecture Material

Robin J. Palkovitz and
Richard K. Lore
Douglass College, Rutgers University

Data collected in this study suggest that deficits in note taking ability are not as critical as deficits in studying from notes.

Students at virtually all educational levels spend the bulk of their classroom time taking notes on information presented orally by teachers. Thus, note-taking skills are assumed to be crucial for academic success and most method-oriented books and courses emphasize the mastery of techniques that will help students accurately organize and record verbally presented information. This emphasis suggests that deficits in test performance are due to poor note-taking skills. There is, of course, an alternate explanation as to why students fail test items based upon lecture material: Students may take adequate notes but fail to review and learn the information in their notes.

Experimental evidence regarding the efficacy of note-taking and subsequent review has not yielded consistent conclusions. Several studies have reported facilitative effects of note-taking on the learning of lecture material (DiVesta & Gray, 1972; Fisher & Harris, 1973) whereas others have failed to demonstrate improved performance associated with note taking (Berliner, 1969; Peters, 1972). Carter and Van Matre (1975) suggest that these conflicting results may be partially explained by the presence or absence of a review and the timing of the review, if any, relative to the test.

Among theoretical models of the function of notes, the "external memory device" position (Miller, Galanter & Pribram, 1960) suggests that the benefits of notes is not in taking them, but rather in having them, in that they provide information necessary for later review and elaboration. Note taking has also been described as an "encoding" process in which the student personalizes information by putting it into his own words (DiVesta & Gray, 1972; Howe, 1970). Although note taking may include transformational and elaborative processes, there is no assurance that this actually occurs (Carter & Van Matre, 1975). According to Anderson (1970), note taking more closely mirrors verbatim transcription than the transformational and elaborative processes involved in efficient learning.

Research by several investigators (e.g., Carter & Van Matre, 1975; Fisher & Harris, 1973) has suggested that the "external memory device" view best characterizes the primary function of notes. In other words, although note taking may be a necessary condition for good test performance, it is not sufficient; good notes must be coupled with intensive review for optimal performance. In the present study, we compared the test performance of students taking a course in introductory psychology with the quality of notes taken during lectures in order to provide more precise information on why students fail test items based upon lecture material.

Method. Ten male and 32 female college students enrolled in an introductory psychology course participated as subjects in the present study. Subjects volunteered for the experiment to partially fulfill course requirements.

Stimulus materials consisted of a series of four 75-minute lectures presented to the entire class as a basis for a portion of an in-class multiple-choice exam. Eight multiple-choice questions from the exam were selected as target questions to be discussed with each of the subjects individually in order to determine the completeness and correctness of their notes in regard to those questions. Criteria for selection of the eight exam questions included: (a) that the question could only be answered by having knowledge of material covered in the lecture (i.e. topic not discussed in the textbook), and (b) that the question was derived directly from the lecture material rather than being a paraphrase of the material or the application of a principle discussed in the lecture.

After the first exam was scored and the results returned to the class, announcements soliciting volunteer subjects for the present study were made. All students who volunteered were individually scheduled for a 30-minute interview and instructed to bring their class notes to the interview. When subjects arrived for their interview, the purpose of the study was explained to them. The subject and the experimenter

then examined the subject's lecture notes for material which the subject had recorded pertaining to each of the eight questions selected from the exam. When the subject's notations relevant to each question were found, the experimenter recorded the notes as being in one of the four following categories: (a) Completely correct, (b) Partially correct or incomplete, (c) Missing, or (d) Incorrect. These categories, coupled with the exam performance for each question (correct or incorrect) created a 2x4 matrix for categorizing each response and the notes corresponding to it.

Results. The reliability of the experimenters' ability to classify the lecture material into the four categories was evaluated by having two independent judges classify the lecture material presented by 10 subjects. For these 80 questions, both judges agreed upon the classification of the students' notes 73 times for a percentage agreement of .913.

The overall performance of the 42 subjects on the 8 exam questions is presented in Table 1. One student insisted that her notes for 2 questions had been misplaced after the exam had been taken and thus the results are based upon a total of 334 questions.

Table 1. Classification of Lecture Material in Notes as a Function of Test Item Performance

	Notes				
Performance	Correct	Incomplete	Missing	Incorrect	Total
Correct	187	17	19	4	227
Incorrect	71	19	16	1	107
Total	258	36	35	5	334

A chi-square analysis of the data in Table 1 indicates that test item performance is influenced by the quality of the students' notes, χ^2 (3) = 12.94, $p<.01$.

A total of 227 questions were correctly answered. For 82 percent of the correctly answered questions, the appropriate lecture material was judged to be complete and correctly recorded in the students' notes. However, for 66 percent of the 107 questions that were answered incorrectly by the students, the appropriate lecture material had also been judged to be complete and correctly recorded in the students' notes. Obviously, performance on exam questions is not simply determined by the ability of students to take accurate or complete notes: 18% of the questions were answered correctly despite faulty or missing notes and two-thirds of the mistakes were made by students with notes judged both complete and correct.

When one focuses on questions missed by the students, a clear pattern emerges. Incorrect notes were quite rare, with only one question possibly missed because the student distorted the lecture material. Higher percentages of the incorrectly answered questions were based upon notes judged to be either incomplete or missing (18% and 15% respectively) but even these combined categories account for no more than one-third of the student mistakes and a chi-square analysis of the classification of the lecture material for incorrect items only (bottom row of Table 1) is highly significant, $\chi^2(3)= 104.5$, $p<.001$. In other words, students incorrectly answered a disproportionate number of questions for which they had accurate notes.

Further analysis of the data split by overall exam performance indicated that high scorers (those who had over 74% of all exam questions correct)and low scorers (subjects correctly answering less than 60% of all exam questions) did not perform differentially based on the quality of their notes, $\chi^2(3)=1.62$, n.s. That is, both high and low scorers tended to incorrectly answer exam questions although both groups had complete, correctly recorded notes.

Discussion. The results of the present study indicate that students do not miss exam questions based upon lecture material primarily because their lecture notes are incomplete or incorrect. Rather, most errors are made by students who accurately record the lecture material but then fail to adequately review and learn the information in their notes.

Students tend to focus on inadequate note-taking skills as the primary source of errors on tests and often express surprise when the correct answers to test questions are found to be clearly stated in their notes. Several strategies developed by the second author during 16 years of teaching introductory psychology courses have proven helpful in emphasizing the importance of note studying as well as note taking.

Students who request an office meeting to discuss their performance in the course are required to bring (a) copies of all course tests, (b) their lecture notes, and (c) the textbook. With practice and a little preparation, it is an easy matter to select five or six questions derived directly from lecture material that were missed by the student and then point out the correct answers *in the student's own notes.* Incidentally, viewing students' notes can also provide the instructor with information on lecture topics that were unclear or boring (doodling frequency goes up!). A comparable analysis of questions derived from the textbook is also profitable for students. Often, questions are missed from sections of the text that the student has obviously not read; clean pages and no underlining offer some evidence that the material has not been studied. This procedure invariably provides remarkably graphic information for students with academic problems and can effectively refute the usual student rationalizations (e.g., "But I read the material four times", "I just don't do well on multiple-choice tests").

Typically students do not review their lecture notes until just prior to a test. But, by this time, much of the content of the lectures has been forgotten and their telegraphically written notes are meaningless. The importance of early and regular review of notes can be vividly demonstrated by requesting students to compare their ability to read and interpret their own notes taken during a recent lecture with those taken three-four weeks earlier. The poor performance of most students on the earlier material will convince even the most skeptical student of the benefits of early review.

We each have a tendency to place undue faith in published material and question the authority of information in our own handwriting. In our view, most instructors draw a high percentage of test questions from lecture material (or material covered both in the text and lectures). In such cases, more information which the instructor views as important is contained in 20 pages of lecture notes than in 20 pages of text material. Students should therefore be encouraged to allocate more study time per page to lecture material than to assigned readings.

The notes we examined were virtually always a verbatim copy of the lecture material. Typical students do not appear to employ "encoding" processes to personalize information from lectures (DiVesta & Gray, 1972; Howe, 1970). Finally the results of our study support the "external memory device" (Miller, Galanter, & Pribram, 1960) function of notes in that they provide information necessary for later review.

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Note

Requests for reprints should be sent to Dr. Richard Lore, Department of Psychology, Douglass College, Rutgers University, New Brunswick, New Jersey 08903.

Learner Characteristics and Performance Effects in Self-Paced Instruction for Community College Students

Marc P. DesLauriers, *Kansas University Medical Center*
Robert L. Hohn, *University of Kansas* and
Gary M. Clark, *Kansas University Medical Center*

No differences in performance were found among a control and two treatment groups, but some interesting attitudinal differences emerged.

Past research has demonstrated that various teaching methodologies have differential effects on college students' performance. In addition, it has been shown that environmental and situational influences such as socioeconomic status, size of classes and program curricula affect college learning. Analysis of this work indicates that simple interactions between method and environment rarely exist. Rather, optimal learning for the individual seems to be a function of several factors.

This study was an attempt to assess the impact of one dimension of instructional method—that of self-paced instruction. Gagné and Briggs (1974) have defined self-paced instruction as the "learner working at his or her own rate, but upon objectives set by the teacher and required of all students" (p. 187). It should not be confused with self-directed study in which objectives may vary for different students. One form of self-paced instruction reduces the number of class meetings, relying on suggested activities outside of class to serve as a useful substitute for class time. Studies by Himmel (1972) and Hohn, DesLauriers and Deaton (1977) have found more positive attitudes toward self-paced courses of this type with superior or similar levels of achievement.

Research has also examined the interaction of personality characteristics of the learner and teaching method, as well as environmental and situational influences. A variety of characteristics have been found to interact with self-pacing in psychology courses taught in four year college programs. Some specific examples are: independence or autonomy (Grasha, 1972); need for affiliation (Beach, 1970); need for achievement (Doty, 1967); and locus of control (Eilersen, 1972; Hohn, DesLauriers, and Deaton, 1977). For example, Hohn et al. found that a combination of low external locus of control, low endurance and high autonomy predicted comprehension for self-paced learners in introductory educational psychology.

Very little research examining interaction between the personality characteristics of students in community college settings and teaching method has been conducted. Because of the lack of investigation and possible misinterpretation of score values on some of the instruments, there remains a great deal of uncertainty as to how specific personality traits and teaching methods interact at this level. However, there is reason to believe that community college learners may be more conventional, less independent, less inclined to reflective thought and less tolerant than their counterparts in four-year institutions (Medsker & Trent, 1965). In a study of high ability students, Tillery (1963) found that the main differences between students selecting community colleges and those choosing the state university were that two-year students were less autonomous and more authoritarian. Community college students also seem to differ in a variety of demographic variables such as age, socioeconomic level, occupational status and amount of time available to devote to college study. Clearly though, more research is needed in this area before definitive statements can be made.

A second major purpose of this study was to determine whether learner characteristics interact in the same manner