Notetaking Research

Implications for the Classroom

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Abstract. The study of student notetaking behaviors has produced useful insights into how students learn from lectures. This article presents five preliminary conclusions about notetaking practices based on findings from the notetaking literature. Each conclusion is followed by a discussion of the implications for classroom instruction. Finally, the author proposes links between various lecturer and student behaviors and the external events of instruction described by Gagne and Briggs (1979).

Notetaking: From Research to the College Classroom

Educational researchers have been accused of trying to prove through experimentation what everybody else has known for a long time. Researchers are most vulnerable to this accusation when their investigative targets are widely accepted practices or beliefs. Everyone can point to certain educational practices which are so familiar and commonplace that they seem automatic. When student or teacher practices become habitual, their effectiveness is rarely challenged. Instructional designers who question such practices on the basis of research findings learn that resistance to change is strong.

In recent years, educational researchers have begun to study one such widely-practiced behavior in the college classroom—student notetaking. Perhaps no study strategy would be more staunchly defended by students and teachers alike than that of recording notes while listening to lectures. Asking students to surrender their notebooks and pens at the beginning of a lecture is likely to incite a minor uprising. Instructors too would be uncomfortable. Most have grown accustomed to viewing a roomful of students busily recording information as a sign that students are actively engaged in learning from the lecture.

From a purely technological perspective, notetaking seems archaic. Inexpensive duplicating procedures make it feasible for instructors to provide students with copies of detailed lecture notes. Students can record a lecture on audiotape and listen to it again and again. But despite these conveniences, notetaking continues to be practiced in most college lecture courses. In a recent survey of one undergraduate sample, Carrier and Newell (Note 1) found that 100% of the respondents strongly agreed with the statement "I almost always take notes in lectures."

How and why do students take notes? Does notetaking contribute to performance? In what ways can lecturers improve the environment for notetaking? Although many dimensions of notetaking remain to be investigated in more depth, sufficient research has been reported to allow us to extract some preliminary conclusions. These can serve as guidelines for instructional designers and other instructional improvement specialists who can help their faculty clients better understand the role of notetaking in college instruction. These faculty can in turn begin to explore how they might structure the classroom environment to help students take and use notes more effectively.

In the following sections of the article, five preliminary conclusions which emerge from the notetaking literature to date are presented. After stating the conclusion, a brief summary of research which supports it and the implications of the conclusion for college instruction are presented. Finally, suggestions are presented for how lecturer behaviors can positively affect notetaking practices within the context of the "events of instruction" proposed by Gagne and Briggs (1979).

Conclusion 1: Students who take notes during a lecture will learn more than those who simply listen.

The foremost question addressed by researchers in the early notetaking literature was to what extent does taking notes during lectures lead to better test performance than simply listening? The guiding hypothesis was that notetakers would learn more than non-notetakers because the former are more actively engaged in manipulating incoming information. Ladas (1980) provides greater clarity to this hypothesis by discussing notetaking in terms of current information processing models. These models propose a set of phases which characteristically take place in the learning of new information.

Initially, the learner must be motivated or aroused to selectively attend to the to-be-learned stimuli. Specific and general behaviors of lecturers designed to focus student attention and increase motivation illustrate this "orienting stimuli" phase of information processing. The lecturer might move to the podium and assume a particular posture which indicates to students that he is ready to begin. Or he might pose a provocative question, or tell a humorous story to lead into the lecture. If the lecturer succeeds in arousing student attention and interest, students will be more likely to display appropriate "orienting responses" such as putting aside the newspaper, taking out a notebook and preparing themselves to record information.

As the lecture is delivered, the serious

notetaker engages in another phase of information processing, one which Ladas calls "search and associate." The information processor searches his memory networks for information related to the incoming stimuli in an attempt to link the new with the old. When notetaking, an individual may attempt to remember points from an earlier lecture which relate to the new information. At the same time, he must make judgments about what to record and what to let go by. When the incoming information is very familiar, the notetaker likely will choose not to record it. If it is a complex concept or idea, he may choose to record it verbatim rather than in a paraphrased form because there isn't time enough to analyze or relate it to stored knowledge. Retrieval of information, another critical element in the information processing task, is facilitated by the availability of cues. For many, notes contain a rich supply of cues for facts, concepts, and principles presented in the lecture. In sum, information processing models which view learners as active agents who are constantly selecting, transforming, and integrating new information into their current networks of knowledge provide one conceptual scheme for interpretation of notetaking behaviors.

Findings from much of the research which compares notetaking with non-notetaking conditions would seem to support the hypothesis that notetaking facilitates information processing activity. In Ladas' review, he reports that of the eleven studies of this nature he located, eight found that taking notes led to better performance and three found no significant differences. Significant main effects favoring notetaking were found, for example, by Crawford (1925) on general quizzes given immediately after a lecture or after a delay of interval of days or weeks. Berliner (1971, 1972) found that notetaking instructions yielded superior performance over instructions to "pay attention" on one form of a short answer criterion test given as an immediate test and after a delayed retention interval. When the task was reading rather than listening to a lecture, Kulhavy, Dyer, & Silver (1975) found that notetaking groups scored significantly higher than either underlining or reading only groups on an objective-style, immediate posttest.

Implications for the Classroom

Studies contrasting listening with notetaking have consistently yielded support for notetaking practices. Some critics have claimed, however, that this research is not ecologically valid because conditions in the studies may be too dissimilar from those in actual lecture courses. To illustrate, some studies have used lectures whose content is unrelated to the course in which the study was run. Artificial constraints to not take notes or to listen only have been imposed on students who would normally take notes. The brevity of the lecture delivered in a study, sometimes lasting less than twenty minutes, is in contrast with the typical college classroom lecture which may run 45 to 50 minutes in length. But while any given study may indeed be weak in one or more of the areas mentioned, taken as a whole, this research represents the only systematic effort to empirically demonstrate the effects of notetaking.

Should college instructors encourage notetaking among their students? On the basis of the research to date, the answer to this question appears to be a definitive "Yes!" Further investigations of notetaking under natural classroom conditions will continue to enrich our understanding of this study strategy. Examining student notetaking behaviors across all lectures given within a single course would indicate if notetaking patterns differ at the beginning, middle, and end of a course. The effects of training students to use specific notetaking formats needs further exploration; some studies have noted a decrement in performance due to notetaking training (Corey, 1955; Palmatier & McNinch, 1972).

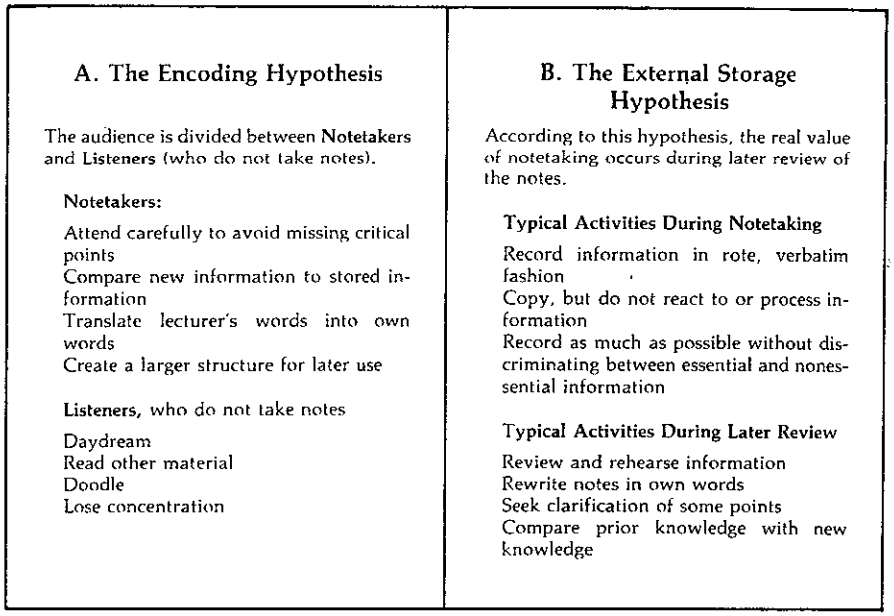

Figure 1. Two hypotheses about notetaking

Conclusion 2: In general, students will learn more from a lecture if they both record and review their own notes.

As noted above, one hypothesis about why notetaking is more helpful than simply listening is that taking notes actively engages the learner's attentional and processing functions during the period of listening. In other words, recording what the lecturer presents helps the student act upon new information at a deeper level. This viewpoint, then, stresses the encoding function of notetaking.

In contrast, others have hypothesized that notetaking is of value primarily because it results in a permanent record of ideas from the lecture and that this quality is more critical than possible encoding activities which take place during the recording of notes. Processing of any depth during notetaking is minimal it is argued, because most students record information in a rote, verbatim fashion, failing to translate it into their own words. From this perspective, the real processing of lecture content occurs not during notetaking, but in later review.

To test which model best explains the effects of notes, studies have compared conditions which allow students to take their own notes with ones in which students are either given lecturer's notes prior to or after the lecture. If a major benefit of notetaking is to facilitate active encoding of information, taking notes for oneself should be more facilitative than simply reviewing notes compiled by someone else. However, if the

utility of notes rests mainly in their external storage capacity, externally provided notes should be as useful as personally encoded notes if the information contained within each is equivalent.

A study by Fisher and Harris (1973) is representative of how this question has been examined. They employed five treatment groups, each of which combined a notetaking strategy (i.e., took notes versus did not take notes) with a review strategy (i.e., reviewed own notes versus reviewed lecturer's notes versus mental review). While review of some type was useful under both notetaking conditions, subjects who were allowed to both generate and review their own notes scored higher on immediate free-recall and short term objective tests than any other group. This finding suggests that both the practice of taking notes and being allowed to review one's own notes are optimal study strategies.

Thomas (1978) offered several nonnotetaking groups a lecture summary to review while others reviewed only their own notes or their own notes in addition to the summary. Even though the lecture summary group members had more information units available at review time than the average member of a notetaking group, they recalled less. This study suggests that while notetakers may not have recorded the quantity of lecture content, some aspect of the coding process, the rehearsal of personally coded material, or both helped students retrieve information at the time of recall.

Implications for the Classroom

Clearly, the acts of taking notes and reviewing notes make individual contributions to the learning process. When students use idiosyncratic coding strategies, shortcuts or mnemonics as they take notes, reviewing their own notes may cue certain types of information or activate retrieval strategies. An instructor might encourage students to become more efficient in their notetaking by explicitly teaching some of these shorthand coding devices. Carrier and Newell (Note 1) found that less than 2% of the undergraduate sample they surveyed had received any instruction on how to take notes and more than half indicated they would like to take a course to improve their skills. It is possible that a small expenditure of time devoted to building notetaking skills could result in big gains in the quality of student notes.

Conclusion 3: Review of notes will lead to improved performance.

Review of notes was discussed above in the context of the encoding versus external store hypotheses. In this section, different types of review activities and their contributions to learning from lectures will be addressed.

The nature of review of notes is determined in part by the motivations of the individual notetaker. When it occurs, as well as the purposes for notes review, varies from student to student. Some students regularly review their notes following each lecture. In doing so, they intend to fill in gaps while the lecture content is fresh in memory, or to elaborate upon hastily noted words or phrases. Points which need further clarification from the lecturer are identified. Other students rewrite their notes after each lecture simply to make them "neater." Three-fourths of the sample in the Carrier and Newell survey, for example, indicated that following a lecture, they routinely add things to their notes and generate questions which they attempt to answer. The effects of specific strategies used during notes review is uncertain. In a study by Norton (1981), rewriting and rereading of notes seemed equally beneficial in promoting test performance, and both were superior to not reviewing notes at all.

A second form of review occurs immediately preceding a quiz, a midterm or final examination. This massed review grows out of the specific motivation to perform well on the impending exam. This activity is often referred to as "cramming" because the student hopes to retrieve as much as possible in a brief period of time for the sole purpose of examination performance. Here the student attempts to reconstruct an abbreviated version of the lecture, to recall the lecturer's perspective on the content and to remember as many critical facts, concepts, principles, and the like. Most hope they can remember enough to "get through" the exam, expecting to forget most of what was crammed for soon afterwards.

No studies were located which directly compared the effects of distributed, postlecture review of notes conditions with a single massed pre-exam review of notes. Instead, most studies have investigated different approaches to massed review. The three review strategies most frequently contrasted are the review of one's own notes, the review of externally provided notes and a "mental review" which occurs when subjects are simply instructed to think about what they have heard. Representative is a study reported by Carter and Van Matre (1975). They paired two notetaking conditions (take notes versus listen only) with three review strategies (review own notes versus mental review versus no review). The conditions tested in their study were: (1) notes; (2) notes/review; (3)notes/mental review; (4)listen/mental review; and (5)listen/no review. In addition, half the subjects received the review period and the test immediately following the lecture, while the other half received the review period and the test one week following the lecture.

The authors found that notes/review was more helpful than a mental review or no review on both the immediate and the delayed tests. These authors suggest that the benefits of notes/review can be attributed to its suppression of recall of irrelevant material, its potency to cue relevant information and the fact that it serves as an additional learning experience by providing more exposure to important lecture information. Only one study (Fisher & Harris, 1973) found that a review period before a delayed test was not facilitative. However, in this study, the review period immediately followed the lecture rather than being closely tied with the delayed test which was given three weeks later.

This finding suggests that both the practice of taking notes and being allowed to review one's own notes are optimal study strategies.

Implications for the Classroom

Instructors are reluctant to encourage cramming behaviors for examinations, perhaps because they fear that students will spend no time thinking about course content until a few hours before the exam. Although their fears may be warranted, massed review of notes before an exam has been shown to produce better recall and recognition of lecture content. These results are found regardless of whether the review period and the test occur a few hours or a few weeks after the lecture. Instructors can take comfort that if students review only before the exam, they will likely perform better than if they did not review at all.

How massed review of notes compares to distributed review cannot be determined from existing research. If findings from other comparisons of massed and distributed practice generalize to notetaking review, we could expect greater gain for review when it occurs consistently following each lecture (Travers, 1967). To insure that distributed review takes place, an instructor might build in a 5 or 10 minute review period at the end of each lecture or at the beginning of the next lecture. Norton (1981) found that despite good intentions, students may not carry though with regular review on their own. In her study, more than 90% of the students indicated on a prelecture questionnaire that they intend to revise their notes in preparation for exams. When queried after the examination given in the study, however, only 14% reported that they actually did revise their notes before the exam.

Conclusion 4: Lectures can facilitate student notetaking by highlighting important information and providing a clear organizational framework.

The quality of student notes and their subsequent worth to the notetaker during review will depend to some extent on the behaviors of the instructor. Students complain that it is difficult to take notes from some instructors, perhaps because they wander from one topic to another, fail to give cues, or speak so rapidly that no one can keep up.

As he listens to a lecture, the notetaker continually must decide what to record. Such decisions are influenced by many factors. Specific behaviors of the lecturer play an important role in this process. It has been found, for example, that items which are written on the blackboard have a high probability of being recorded in student notes (Maddox & Hoole, 1975; Howe & Godfrey, 1977). On the other hand, the use of some forms of visual aids actually reduces notetaking behaviors (Hartley & Cameron, 1967). In part this can be explained because conditions of the lecture situation are changed (e.g., a darkened lecture hall during the presentation of a slide tape).

The pacing and organization of the lecture are also crucial. Even a skilled notetaker is capable of recording only a small proportion of what the lecturer presents. Ladas (1980) discusses a study by Greene (1928) who found that students took notes at the rate of 20 words per minute during a lecture. If a lecture is presented at the slow rate of 100 words per minute, the average notetaker will be able to record only about 20% of what is presented. What students do record, they tend to remember. There is a strong correlation between recording a piece of information in one's notes and getting items relevant to that information correct on the test (Howe, 1970).

Does the organizational structure of the lecture affect notetaking? Logically, a salient lecture organization should be useful because the notetaker has to work less hard to recognize connections among ideas and to differentiate between essential and nonessential information. Research on organization of prose suggests that the importance of organization increases as the difficulty or unfamiliarity of the information increases. Scrambled passages have been shown to reduce recall over their logically ordered counterparts, but usually only if the to-be-learned material is difficult. Apparently most learners are capable of generating organizational frameworks where none are explicit.

Most of the studies investigating organizational variables and notetaking have had students read prose rather than listen to orally presented lectures. DiVesta and Gray (1973) manipulated the organization of prose by varying the degree to which six passage segments were related to a common conceptual superordinate theme and were contiguous with one another. They contended that the thematic relations among these passage segments would affect a subject's selection of strategies for storage and retrieval of the information. The authors reasoned that notetaking should be more helpful in cases where there was little inherent organization in the material (e.g., six "discontinuous, unrelated" passages) than in materials with a salient organizational scheme (e.g., six "continuous, related" passages). They did not find the predicted interactions between notetaking and thematic organization, but found that notetaking led to superior recall under all organizational patterns.

Shimmerlik and Nolan (1976) hypothesized that encouraging subjects to reorganize passage material through notetaking would increase recall since it would strengthen associations or broaden access to that information at retrieval time. This concurs with predictions from the encoding variability hypothesis (Craik & Tulving, 1975) that multiple encoding strategies for the same information will result in greater remembering. Half of the subjects in the study heard the lecture presented using society as the organizing framework while the other half heard it with topics as the organizing framework. Further, half the subjects within each of the two organizations were asked to record their notes following the same sequential order as the passage while the other half were told to take notes using the alternative conceptual framework. In the sequential condition, then, those who heard the society organization took notes by society. In the reorganization treatment, subjects who received the

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society organization were asked to order their notes by topic. The authors found that notetaking which involved reorganization led to greater free recall of information on an immediate test (Experiment 1) and on a delayed retention measure given seven days later (Experiment 2). They conclude that the utilization of a second organizational framework increased availability of cues during retrieval time.

Implications for the Classroom

The instructor who is intent on "covering all the material" in his lecture notes, regardless of how quickly he must speak, will find little encouragement in the notetaking literature. Notetaking is not an efficient process; students are able to record only modest amounts of information even at a comfortable rate of presentation.

An instructor can reduce the number of decisions a notetaker must make and thus increase efficiency by calling attention to important material. Verbally directing students to "remember this point" or "be sure to note the following" are useful highlighting strategies. The judicious use of blackboard and overhead transparencies is also recommended. Because students record most things written on the board, an instructor should use this medium strategically, taking care to avoid writing trivial or nonessential information. Making the organization of the lecture salient should also ease demands on students. The instructor should not hesitate to provide an overview, e.g., "In this session. I'll discuss five factors that contributed to the current economic recession in Brazil. For each, I will provide an example of the ways it operated at both the local and national levels." This strategy helps the notetaker establish a framework for high importance information, a strategy which is especially useful for certain types of students as I will discuss in Conclusion 5.

Conclusion 5: Students with different abilities and levels of prior knowledge may require different notetaking strategies.

Teachers would agree that students differ in their ability to participate in class discussions, to write term papers or to perform well on examinations. Similarly, different students have different notetaking styles and capabilities.

Ganske (1981), after reviewing more than thirty notetaking studies, identified two major categories of notetakers. The first he labels "processors." These students tend to rephrase lecture points, doodle, miss key lecture points if no cues are provided, and often include irrelevant material. In general, the notes of "processors" are often incomplete and would be difficult for someone other than the notetaker to use. The second type of notetaker Ganske labels "transcribers." They characteristically record information verbatim and almost always note the major points in the lecture regardless of whether they have been cued. These notetakers rarely doodle and tend to be more wordy than processors. As a rule, their notes are more complete and have the appearance of being intended for future reference.

Although we can generate classification schemes for the various types of notetakers as Ganske has done, there is little empirical evidence to indicate that one style or approach is superior to another. Judging the quality of notes is complex business because how the notetaker uses his or her notes is unobservable and yet may be as important as the quality of the notes themselves. To an external evaluator, a set of notes may appear as a garbled collection of meaningless abbreviations and sentence fragments, but to the notetaker the notes may represent a web of links or associations to other knowledge or cues which will aid recall at a later time.

There is some evidence that certain students may actually learn less if they record notes during a lecture. Berliner (1971, 1972) examined how memory abilities relate to notetaking. He found that notetaking interfered with ability to recall information for students with poor short term memory abilities. DiVesta and Gray (1973) also found positive correlations between memory ability and performance on both immediate and delayed tests for notetakers. Peters (1972) found that notetaking during a lecture interfered with recall test performance for students with "low efficiency listening" scores as determined by their ability to recall words from a list presented at slow and fast rates.

In a study involving high and low math ability students, Peper and Mayer (1978) found that students who took notes remembered more interpretive-like or "far transfer" types of information while non-notetakers remembered more "near transfer" or generative items. These relationships were especially strong for lower ability subjects, causing the authors to suggest that lower ability students are less capable of assimilating new and unfamiliar information through listening. In a recently completed study, Carrier, Higson, Klimoski and Peterson (Note 2) found that students with high levels of debilitative achievement anxiety took notes of lower quality than students with low debilitative anxiety or those with facilitative anxiety.

That students who are deficient in memory ability may require a different strategy than those with greater memory ability is consistent with other findings from research on individual differences and instructional manipulations. That is, learners with relatively low general ability, those with little prior knowledge of the instructional content to be taught or those with specific cognitive styles (e.g., field independence vs. field dependence) benefit from instructional techniques or methods which reduce processing burdens (Cronbach & Snow, 1977). In other words, to the extent that the instruction reduces the demand for student generated mediators, it will enhance the probability of success for these learners. An example of programmatic research supporting this conclusion can be seen in the work of Tobias (1976, 1981, 1982). Consistently, he has found that students with little prior knowledge of the content to be learned need high levels of instructional support. He defines instructional support as those conditions which, for example, enhance the organizational salience of the material, require overt responses or pro-

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vide explicit feedback about responses. With respect to notetaking, giving explicit instructions to take notes, providing specific cues about what is important, and providing concrete suggestions on the quality of notes could be considered instructional support. Lecturer's notes are another type of instructional support which may be more beneficial than self-generated notes for some students.

Implications for the Classroom

Within most lecture classes, some students may be in need of extraordinary assistance from the instructor if they are to obtain a set of notes which can aid their studies. The research reviewed here suggests that some students will benefit from not taking notes at all!

The problem for the instructor is twofold: to identify, through feasible means, students who need special help, and to determine the most effective types of instructional support or mediating devices. Of course, an alternative to accommodating certain students is to provide everyone with these mediators. For example, detailed lecture notes could be supplied for everyone with the expectation that students who benefit from taking their own notes will continue to do so. Another mediating strategy, that of highlighting critical information, will be especially useful to certain students, but should not interfere with the processing behaviors of students who don't need it.

If an instructor is interested in accommodating the needs of certain subgroups, what steps might he take to do so? One initial action might be to collect and review the students' notes from several lectures. This would help him identify those students who seem to have inadequate notetaking styles. As a next step, he might hold individual conferences with these students to gain a clearer picture of explanations for their notetaking deficiencies. If he finds students with similar problems and needs, he might then plan interventions which would be appropriate. For example, if five students indicate that they find it impossible to follow the lecture because it moves too rapidly, they might be encouraged to listen to an audiotaped version of the lecture. If he finds that a number of students have difficulty discriminating between important and unimportant content, the instructor might provide some practice opportunities with feedback. For students who aren't aware of or skilled at using various shorthand techniques, he might demonstrate how these techniques can increase efficiency. These relatively minor interventions could lead to high payoff for some students in terms of improved notetaking and test performance.

Notetaking and the Events of Instruction

Gagne and Briggs' (1979) scheme for describing crucial "events of instruction" provides a useful framework for considering how lecturer behaviors can aid student processing activities. Table 1 displays this framework. Both research and practice can benefit from conceptualizing the external events of the lecture environment and the internal events which are student responses to this environment.

From an instructional research perspective, notetaking offers an important vehicle for studying student processing behaviors in real instructional settings. Taking notes results in an external, reviewable record of the facts, concepts, relationships, and principles presented in the lecture. If notes mirror some of the cognitive processing activities which take place during listening, it also can be argued that notes provide a methodology to examine how students perceive and organize new information. As a result, the study of notetaking offers unique potential for exposing what is often hidden, that is, how students manipulate incoming information.

From an instructional practice perspective, notetaking is equally important to understand because it is a prevalent student behavior from entry to exit. In a typical lecture class, a large amount of student time is devoted to the recording, reorganizing, and reviewing of lecture notes. Whatever an instructor can do to improve the quality of the listening environment, including the uses of clear and explicit lecture organization, highlighting techniques to emphasize critical information, as well as special accommodations for some students, should lead to more productive use of student time.

Recent research on notetaking has revealed interesting information about student processing activities during the presentation of information. Further work is needed to assess students' perspectives on the value of notes, how notetaking skills relate to different types of learning outcomes and the effects of direct training on the quality of notes and other study strategies.

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Table 1
Notetaking and the Events of Instruction

Instructional Event	A Lecturer Might Operationalize This Event in the Following Ways:	Which Encourages Notetakers to:
1. Gaining attention	*Physical movement*-e.g., Move to podium, Arrange lecture notes, Switch on overhead projector *Verbal interaction*-Good morning. Let's begin.	Prepare to listen Locate place to take notes
2. Informing learner of objective	Overview the lecture content Suggest how the information will be useful	Formulate a rationale why material should be noted
3. Stimulating recall of prerequisite learning	Review terminology Summarize main points from previous lecture Ask questions to determine if students recall key terminology, concepts, principles Provide 5 minutes for students to review notes from an earlier session	Retrieve critical information from long-term memory to working memory Search for past associations Review earlier notes
4. Presenting the stimulus material	Speak at a comfortable pace Provide salient organization of lecture points Pause to allow for questions, clarification	Alternate between own words and lecturer's words
5. Providing "learning guidance"	Use verbal cues such as "Note the following," "This is important to remember," "Record this in your notes" Use blackboard, overhead transparencies judiciously to highlight major points Raise questions to test comprehension of an idea Provide an outline	Discriminate between essential and nonessential information Uses mnemonics
6. Eliciting performance	During lecture, provide sample questions/problems similar to those which will be presented on an examination	Practice performance by overtly or covertly responding to questions/problems Highlight notes material relevant to responses
7. Providing feedback about performance correctness	Request other students to respond to student answers Models responses to questions/responses	Correct inaccuracies Attend to essential information
8. Assessing the performance	Encourage distributed and massed review of lecture content	Rehearse notes content in preparation for examination
9. Enhancing retention and transfer	Present divergent examples, nonexamples, and problem situations during lectures Explicitly link information from previous lecturer with current lecture	Integrate new information into existing notes

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