# SEMI-NOTES CAN HELP

*Improving the Lecture*

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*Despite being attacked as inefficient and outmoded, the lecture continues to be the most commonly used format for teaching. This paper outlines some of the lessons learned in applying a technique for improving the educational value of the lecture by capitalizing upon the student's involvement in note-taking.*

*Semi-notes do not represent a cure-all for educational ills, but if they are used within their limitations they represent a convenient method of increasing lecture effectiveness. Little additional effort on the part of the instructor is required for their implementation.*

THE PAST FEW YEARS have seen a marked increase in the emphasis on effective teaching and in attempts to understand and to regulate the learning process. Amidst the hardware and software of the effective teaching movement, the lecture stands condemned. The cry goes out that "the lecture is dead."

In its original setting, the lecture format made sense. We can see the medieval scholar standing at his lectern, sharing the fruits of his scholarship, as contained in the handwritten manuscript before him, with his students. But with the invention of the printing press and all of the advances in communication which have taken place in the meantime, should the lecture remain unchanged? Materials are now readily available to students. No longer are they dependent upon the physical presence of the scholar. They can read and study for themselves and interpretations of the original documents are readily available. Textbooks and study guides are produced by the carload. "Modern teaching methods" and "modern technology" are here to assist the student. Why then do we have the usual college lecture—often merely a reading of the textbook to the students—persisting?

## WHY IMPROVE THE LECTURE?

If the lecture is indeed dead, why not let it die a peaceful death and then bury it? While this paper does not propose to be a defense of the lecture, I might offer a couple of reasons why the lecture is bound to be around for quite a while yet. If the lecture is to remain with us, then spending time and effort to improve it can be justified.

The lecture will continue to exist because the present educational process is self-perpetuating. The new engineering teachers are the products of the old system and technical competence is still deemed to be adequate preparation for college level teaching. By and large, therefore, college teachers will perpetuate the system under which they were taught, because they know of no other. Add to this the fact that classrooms and university facilities have been planned around the lecture approach. Throw in the fact that the lecture is very efficient in the use of the instructor's time—his involvement with the students in minimized, freeing large amounts of his time for "the more important things" which revolve around technical matters. Stir these attitudes and pressures together, and it becomes evident that the lecture is firmly entrenched and will not die easily.

Another reason for the continued existence of the lecture revolves around the fact that the lecture approach is the one with which the students are familiar and the one with which they feel comfortable. Throughout their school years they have been conditioned to believe that learning is something that occurs in a classroom in the presence of someone called a teacher. If the teacher does not show up one day, then that day is lost. Nothing can be learned. Even at the graduate level, where we are dealing with very capable and highly motivated students, this attitude is readily apparent. Try an experiment. Delay your arrival in the classroom for fifteen or twenty minutes. How often will you enter the room to join a discussion of the topic of the day? More than likely you will find the students (if any have waited

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around) chatting together and waiting for the "show" to begin. The possibility of learning something in the absence of the instructor never occurred to them—that thought is completely foreign to their upbringing. The lecture, then, has two things going for it. The students want it and the teachers want it.

A third reason for not burying the lecture approach is that we know too little of the learning process to completely dismiss the lecture. Modern approaches to teaching are becoming available in the form of programmed instruction, computer-aided instruction, television (closed circuit and tape), audio-tutorial methods, etc., but we have only incomplete evaluations of the ultimate worth of these methods. Certainly many of these methods are more effective than the lecture in the transmission of facts. But a lecture transmits more than facts. Studying a book with a teacher is more satisfying and more rewarding than studying the book alone. Something else comes across along with the factual information. Simply equating education with factual knowledge could be dangerous. Such a comparison ignores the higher levels of the cognitive skills described by Bloom (1)—those of analysis, systhesis and evaluation. The sign which hangs in my office to remind me of my job as a teacher says "Education is what is left over after you have forgotten the facts." Education and learning are more than absorbing facts and storing them away as a computer does—to be retrieved and used mechanically upon demand.

The stimulus-response approaches and even the modern day "systems" approaches tend to treat the student as an automaton or mechanism. The basic premise seems to be that a certain stimulus should produce a very predictable response, and much testing and evaluation of teaching methods is done on just such a basis. However, if we accept the concept (von Karman) that "an engineer creates what never was," then creativity—the unique response to a stimulus—is what we need to develop and not stifle. Engineers trained in the traditional manner have been showing some creativity, and until we know more about how to effectively teach creativity and the higher cognitive skills, we should be careful about condemning the lecture.

Whether we like it or not, good or bad, the lecture is going to be around for some time. The lecture may be dead, but there is no reason for it to be deadly.

### THE SEMI-NOTES APPROACH

THE ATTENTION SPAN of a listening adult is just about two minutes. That is, we can have a person's undivided attention for only about two minutes. If we fail to interest him (show the relevance of the topic to his needs) in that period of time, then his attention will wander. Therefore, a lecture must involve a student (either mentally or physically) at least once every two minutes if we want to maintain his attention. The usual techniques suggested for effective speaking make use of just such planned involvements of the listener, but we can capitalize on something else in a classroom situation.

Working in our favor is the fact that a student in a classroom is involved in one way in which the usual listener is not—the student is busy taking notes. Looking back over some of the notes that I took in college, I find them to be a pretty disorganized mess. Most of them are undecipherable now (and thinking back over my attempts to review for tests, I'm not so sure that they were decipherable even back then.) Glancing at the notebooks kept by students today I find much the same situation. If we stop to consider just what is required of the student in producing

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a coherent set of notes, it is no wonder that the results are what they are. A student must listen to material (much of which is new to him), try to follow the logic of the presentation, make value judgments on this logic, sort out the relevant points and organize them into a legible and coherent style. Certainly a formidable task.

Some years ago Zumwalt (2) presented the concept of semi-notes or incomplete notes as an aid to student learning. In this approach the student is presented with the skeleton of a set of notes, and he completes the picture by the addition of his own notes and comments during the course of the lecture.

I have used semi-notes in several chemical engineering courses over the past couple of years, and I would like to share with you my impressions of the advantages and disadvantages of this approach.

## IMPACT ON THE STUDENT

From the student's point of view, these notes come as a godsend. For once he can concentrate on what is being said rather than spending a good deal of his effort in organizing a set of notes. At the end of the course, regardless of his ability as a note-taker, he has:

1. ACCURATE NOTES. It is sometimes surprising to see how often errors creep into student notes (this in spite of the sterling and crystal clear presentations that we make.) Having a roadmap to follow helps to keep them on the right track, and the distractions from such things as passing trucks, noisy lawnmowers, etc. seem to produce fewer errors when semi-notes are used.
2. ORGANIZED NOTES. The notes are coherent and organized around a logical development. This aspect is important when the time for review comes around.
3. PERSONALIZED NOTES. Although the skeleton or framework is supplied, much of the material in the completed notes is in the student's own handwriting. He has also had the opportunity to make special notes and markings which will help him to interpret the notes later on.
4. SIGNIFICANT NOTES. Not only are the notes coherent, they also contain what the instructor considers important. This is a definite plus value for the student.

## IMPACT ON THE INSTRUCTOR

From the instructor's point of view, the use of semi-notes represents an additional burden. The instructor must cope with:

1. PREPARATION OF NOTES. The notes must be prepared and be ready for distribution to the students before the lecture is given. Fortunately, the work that is involved in preparing these notes is not much more than that required to prepare a fairly complete set of notes for lecturing. I have found that by writing in pencil on a Ditto master, the master is prepared for duplication and a projection transparency can easily be Thermofaxed if one is desired.
2. RIGIDITY OF STYLE. When following the notes, the lecture presentation is not as free-flowing as it could be. The instructor cannot easily deviate from the pre-determined order of presentation. Perhaps the most frustrating thing I have encountered here is a lack of freedom in the choice of words. The words suggested to fill in the blank spaces in the notes must generally be very close to those in mind when the notes were prepared. If a better way to say something occurs to the instructor in the midst of his presentation, not only must it make sense when coupled with what appears on the handout sheet, it must also fit into the space provided. One soon learns to be careful to consider alternate ways of saying things during the initial preparation of the notes.

## IMPACT ON LEARNING

When considered from the pedagogical point of view, semi-notes have strong and weak points. These include:

1. THE LECTURE MUST BE PLANNED. This one aspect probably accounts for one of the largest impacts that the use of the notes can provide on the improvement of the lecture. THE INSTRUCTOR MUST BE PREPARED FOR HIS CLASS. No off-the-cuff lectures can be made. The lectures become organized, not only within themselves, but between lectures also, because that is the way that they must be under this system.
2. THE STUDENTS BECOME INVOLVED. The students must be awake and involved in order to complete the notes. By supplying the connecting thoughts and having the student write in the key thoughts, considerable reinforcement of these key thoughts is provided for the student (he is involved in hearing, seeing and doing—all at the same time.)
3. THE STUDENTS NEGLECT THE TEXTBOOK. Because the semi-notes represent the "distilled essence of knowledge" for the course, students will tend to ignore the textbook and await the next "revelation" unless they are forced to interpret the textbook by some sore of assignment which requires a study of the text.

4. THE STUDENTS MAY ACQUIRE A "PSYCHOLOGICAL SET." By just following the organization and development of a topic rather than being involved in such a formulation, they may get into the habit of saying yes . . . that makes sense . . . of course . . . etc. without really understanding the development. They may say, "Yes, I see," when they don't really "see." This process can lead to a false sense of security in the student—and potential disaster at exam time.

## SUMMARY

Like most things, semi-notes turn out to be a mixed blessing. With careful use and an awareness of their shortcomings they can be a very useful tool in teaching. The main advantages stem from the fact that:

- The instructor must organize his presentation.
- The students must become involved with the presentation.
- The students like the notes and appreciate them.

The major disadvantages of semi-notes seems to lie in presenting to the student a well-organized and seemingly simple explanation. If the student accepts the logic unquestioningly, he may learn little. Learning is an intensely personal experience—the result of a struggle of each individual with himself, and a special effort must be made to get the student involved in that struggle, thereby making the notes as effective as possible.

The role of the teacher is often likened to that of a guide. But what person would pay good money to hire a hunting guide who invariably said, "Come and watch me hunt." A person who hires a guide wants that guide to take him to where the game may be found, to give him some pointers on technique, but not to down the game for him.

Here, then, is the challenge of effective use of semi-notes: to lead the student to and through the subject and not cheat him of the fun of bagging the game himself. Semi-notes will work. They will work well within the framework of the existing lecture format. The challenge is to keep them working for the student and not to let them work against the best interests of his education.

## LITERATURE CITED

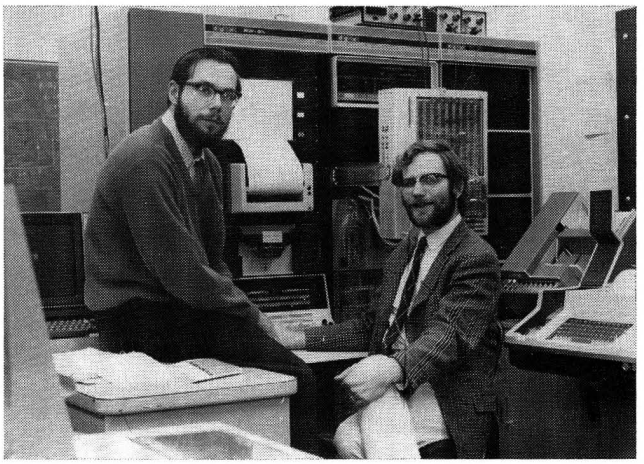

1. Bloom, B. "Taxonomy of Educational Objectives: Cognitive Domain," McKay, New York, 1963.
2. Zumwalt, G. W. "SEMI NOTES: An Aid for the Engineering Lecture," Journal of Engineering Education, 54(5), 182 (1964).


## ADDENDUM—WINTER CEE

*The following picture and biographies, recently received, are of the authors of "A Facility for Education in Real-Time Computing" CEE,* 5, No. 1, p. 30-32 (1971).

James H. Christensen (right) is Assistant Professor of Chemical Engineering, and of Information and Computing Science, at the University of Oklahoma. He received his PhD in Chemical Engineering from the University of Wisconsin in 1967, and was a Ford Foundation Fellow in Engineering Design at Thayer School of Engineering at Dartmouth prior to moving to Oklahoma in July 1968. His main interests are in the application of digital computers to chemical process design, optimization, and control.

Paul M. Vargo (left) received his PhD from Case-Western Reserve University in 1969. During the last 2 years, while a faculty member of the Electrical Engineering School, University of Oklahoma, his activities have included developing a Real-Time Computer System to support education and research activities and initiating a research project exploring Man-Computer Communication.



## LETTERS
(Cont'd from p. 66)

in equation (h) even if it is a variable. One usually sees various authors attempt to write, incorrectly, the identity

$$\frac{d\left[m_t \hat{G}_v(t) T_t\right]}{dt} = \frac{d(m_t \hat{U}_t)}{dt} \qquad (j)$$

using reference temperatures and other gimmicks. The right-hand-side of equation (j) correctly accounts for unsteady-state internal energy changes but the left-hand-side is pure nonsense. To the unitiated, the l.h.s. of equation (j) is, indeed, tempting.

The stirred-tank, energy design equations on page 4-23 of *Perry's Handbook*, 4th Ed. are in error.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