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ABSTRACT

Prompted by the lack of research on learning in large college classes in terms of the cognitive processes and strategies students use, an experimental, preliminary study implemented generative activities in an undergraduate educational psychology class of approximately 70 students. The activities involved such things as stopping in the middle of a lecture to have students either paraphrase a principle or definition or summarize what was just said, or having them compose or analyze metaphors and generate new examples or analogies. Instructors provided feedback by presenting one or more prototypical, appropriate elaborations, or by discussing some common misconception in elaborations. Despite the limitations of the study, several observations were made, among them that (1) generative activities can be developed for most of what is taught; (2) implementing generative activities in large, college classes is logistically possible and worthwhile; (3) the effectiveness of generative activities in large classes reflects student differences; (4) students may not be comfortable when asked to engage in generative activities; (5) students may need training in the use of generative processes; and (6) providing adequate feedback to the students is crucial to the success of generative activities. (HOD)

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Elaborative strategies:

Promises and dilemmas for instruction in large classes

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Recent research has brought great advances in our understanding of the cognitive processes of the reader, the learner, and the problem solver (e.g., Anderson, Spiro, & Montague, 1977; Spiro, Bruce, & Brewer, 1980). Yet, the cognitive processes of the students in large college classes have received relatively little attention. Recent reports have stridently called for major, across-the-board improvements in instruction (e.g., National Commission on Excellence in Education, 1983). Systematic application of knowledge gained from cognitive research might well transform instruction and improve learning. Although some preliminary suggestions have been made (e.g., Bjork, 1979), cognitive theory and research has as yet had little direct impact on research or practice in large college classes. In this paper we will examine research on generative or elaborative strategies. A preliminary investigation of generative strategy use in a large college class will also be described.

Large class research

While studies of the effects of class size have been present in the literature since the 1920's (e.g., Hudelson, 1928), the parameters of what constitutes a large class remain ill-defined. The researcher may operationally define large classes to be those enrolling 40, 100 or perhaps 200 students. However defined, more and more college teaching is being conducted in large group settings (McKeachie, 1980) and there is little reason to believe that the trend will be altered in the near future. Large classes provide institutions of higher learning a means of coping with large enrollments and decreasing funding by reducing the per pupil costs of instruction (Moore, 1977). Further, large classes are especially predominant in lower level, introductory courses that provide prerequisite knowledge and are students' first taste of college instruction.

One consistent finding of large class research is that the larger the class size, the more likely the instructor is to employ a lecture mode. In large classes, the largest percentage of instructional time is spent by teachers lecturing with a minimum amount of time spent by students talking (Lewis, 1982). What this means, in general, is less student-teacher interaction, with fewer students contributing less frequently in large, lecture classes.

Perhaps related to the characteristic of instructional mode is the inding that student achievement generally decreases as class size increases (McKeachie, 1980). When analyzing the relationship between class size and learning outcomes, the determination of effectiveness depends, in large part, on the type of evaluation conducted. If the educational objective is acquisition and recall of factual material as measured by traditional achievement tests, then the lecture format predominant in large classes may be an effective and efficient instructional mode. If the objective is application of acquired knowledge, problem-solving, and attitude differentiation, alternative methods need to be considered (Siegel, Adams, & Macomber, 1960).

Although observational research in large college classes has employed a variety of procedures (unobstrusive observation, videotaping, audiotaping, student ratings, grades, and interviews), the focus of data observation has primarily been on teacher behavior (e.g., Murray, 1983). One explanation for this emphasis on teacher vs. student behaviors may be the predominance of the lecture approach which minimizes student participation.

Similarly, experimental studies have involved manipulation of the means of delivery of instruction, comparing "innovative" formats such as programmed or TV instruction to the standard lecture format (Baker, 1976; Cheatam & Jordan, 1976; Macomber & Siegel, 1957; Siegel, Adams, & Macomber, 1960; Ward, 1956). Although innovative methods typically produce improved student test scores (Lewis, 1982), experimental research, like the observational research, has for the most part ignored the roles of the student in the learning/instruction process.

Student elaborations and generations

Since the research on learning and instruction in college classes has for the most part focused on the mode of instruction and the behavior of the instructor, the question remains, "What can (and should) the students do in order to improve the quality of their learning in large college classes?" One implication of the rapid development of the cognitive/information processing perspective and attendant shift in the view of learning from passive reception of stimuli and formation of associations to active construction of knowledge is that questions of what the student does become paramount. Although there is little relevant research that directly addresses this issue in the context of the large college class, there has been a good deal of research on learning from text that has focused on what the learner does. A review of this literature (Goetz, in press) suggests that students will learn and remember more from text when they:

- study the text in a deep, semantic fashion
- form mental images
- construct an organized, interrelated representation
- bring to bear appropriate, prior knowledge and incorporate new information with what they already know
- process the material initially in a manner consistent with testing conditions
- engage in planning, monitoring, and regulating.

Wittrock (1974, 1983) uses the term "generative processing" to describe the types of processing that lead to improved comprehension and memory for verbal material by the active construction of semantic representations. Ausubel's (1962, 1963, 1968) meaningful verbal learning, Weinstein's (1978, 1982) emphasis on elaborative processing and Mayer's (1975, 1979) assimilation encoding theory stress the same point. Wittrock (1983) has provided a list of the types of activities and aids that promote generative processing.

Insert Table 1 here

Although the research of these and other investigators (e.g., Dansereau, 1978, in press) has focused on the role of generative or elaborative processing in learning from printed text, examination of the activities listed in Table 1 suggests many generative or elaborative activities could be incorporated within a large class setting, if we are willing to stop lecturing long enough to let the students more actively engage in the learning process. Stopping in the middle of a lecture to have students paraphrase a principle or definition or summarize what has just been said, or to have them compose or analyze metaphors or generate new examples or analogies would provide an opportunity for generative processing. To implement such activities in large classes, students must work individually or in pairs or small groups. There simply will not be time to call on each student in turn.

Wittrock (1983) offers several cautions regarding when generative processing will facilitate learning. Two appear particularly germaine to the current discussion. First, generative activities will only promote learning when they induce students to produce elaborations they would not otherwise have produced. Given the research on large college classes, the oft heard laments of college instructors, and our own unsystematic observations, we conclude that for most students, any generative processing induced will exceed their production in the typical passive-receptive mode. Second, generative activities will only promote learning when the elaborations produced are relevant to and consistent with the intended learning. In large classes, the need to monitor and provide feedback in order to ensure appropriate elaborations becomes a logistical problem. Circulating around the class may prove ineffective when the class size exceeds 40. As an alternative, the instructor can provide feedback by presenting one or more prototypical, appropriate elaborations, or, after having examined a sample of written elaborations, discussing some common misconceptions. Another approach would be to have students work in pairs, taking on the roles of elaborator and monitor (e.g., Dansereau, & Larson, 1983).

A final caution that we would add is that the introduction of elaborative activities entails costs in time both in class and out. Stopping in the middle of a lecture to actively engage the students reduces the amount of time available for lecturing. Attempting to inspect written elaborations in order to provide feedback to the students can increase the burdens of large class instruction, but inspection of only a sample can minimize this increase. Although introducing elaborations will cost time, if student learning improves, it will be time well spent.

A preliminary investigation of generative strategy use in large college classes

Recently we attempted to implement generative activities in an undergraduate educational psychology class of approximately 70 students. Whenever possible a generative activity was included in each class session. Although the experience was personally illuminating, it was less than ideal as a test of the effectiveness of generative activities for a variety of reasons. First and foremost, although the class was to be taught by two of the authors, neither the students nor their instructors were aware of the arrangement until after classes had begun. Consequently, the generative activities employed were generated on the spot rather than carefully planned and developed in advance. Further, no appropriate base line data or control group was available. For all its limitations, however, the experience did leave us with several strong impressions that we would like to share.

Generative activities can be developed for most of what we teach

After talking about classical and operant conditioning, students can be asked to compare and contrast the two. After hearing about contingencies of reinforcement students can be asked to generate new examples of contingency statements (e.g., If you mow the yard, I'll give you $5) illustrating positive reinforcement, negative reinforcement, and punishment. Before talking about the Piagetian processes of assimilation and accomodation, students can be engaged in demonstration of the closely related phenomena of learning set.

Implementing generative activities in large, college classes is logistically possible but not trivial

In introducing and instructing students regarding the activities, a balance must be found between leaving the task so open that students lack adequate guidance, and being so directive that the task no longer requires active generation on the student's part. Based on student evaluations of the generative activities employed, there was an apparent relationship between the perceived effectiveness of the strategy and the clarity of presentation. As cautioned earlier, time is a critical concern when introducing generative activities. At first activities were scheduled at the end of class sessions. When students frequently failed to complete the activities, we shifted them to the middle of the class period.

The effectiveness of generative activities in large classes reflect student differences

The data from student evaluations demonstrated a wide range in the perceived effectiveness of generative activities used in the educational psychology class. For example, for the activity that compared and contrasted classical and operant conditioning, 12% of the students felt that the activity interfered with learning, 42% felt the activity had no effect on learning, and 46% felt it facilitated their learning of the material. One explanation for this discrepancy is that certain strategies may prove more or less effective for the individual based on their content knowledge and strategy repertoire.

Students may not be comfortable when asked to engage in generative activities

Although Lewis (1982) concluded that the students welcomed the changes entailed by "innovative" teaching methods, these methods brought changes in the mode of instruction. When changes are made in the role of the student, specifically to require more active involvement in the learning process, a number of students will experience discomfort. It should also be admitted that a number of lecturers are likely to experience unease at the thought of relinquishing the pulpit.

Students may need training in the use of generative processes

The passive, receptive mode of learning may be so well ingrained in some college students that they require training or retraining in generative activities. For example, after lecturing on Piaget's stages of cognitive development, we asked the students to tell us why "Piaget's stages of cognitive development are like the development of an insect." We hoped that insect development would provide a familiar conceptual peg upon which to attach new information about cognitive development, but we provided a brief synopsis of insect development from a youth encyclopedia as an aid to students who might lack familiarity with the topic. We were hoping that students would identify similarities such as that, in each case, development progresses through a fixed number and sequences of stages, and that developmental stages each require a certain period of time and impose constraints on behavior. Students' written analyses of the analogy were classified as appropriate, inappropriate literal, unrelated, or composite (i.e., a mixture of appropriate and inappropriate) according to a system adapted from Vosniadou, Ortony, Reynolds and Wilson (1983). Although Vosniadou et al. have found that ability to comprehend metaphorical language develops relatively early (perhaps between the ages of 6 and 10), of the interpretations generated by our students, 8% are unrelated, 18% inappropriate literal, 47% composite, and only 27% appropriate. It may be that some or all of the 73% of students who failed to generate appropriate interpretations could use training in the use of metaphorical language as a learning technique.

Providing adequate feedback to the students is crucial to the success of the generative activities

If, as we found, students sometimes generate inappropriate elaborations, provision of corrective feedback will be necessary to prevent the detrimental effects of which Wittrock (1983) warned. As we suggested before, cooperative student pairs and instructor provided examples of appropriate elaborations can fill this need.

Conclusion

As noted before, little research which focuses on learning in college classes in terms of the cognitive processes and strategies and students has yet been conducted, and the preliminary study reported here embodied several flaws and limitations. There is, however, ample reason to believe that research and development efforts based on generative or elaborative strategies could improve college instruction. If such improvement is to be forthcoming, research priorities must include the following:

- Investigations (experimental and observational) of college instruction focusing on the learner, rather than on the instructor.
- Systematic experimental evaluations of elaborative strategies in large college classes.
- Investigations of the relationship between characteristics of individual learners and the effectiveness of elaborative strategies.
- Development and evaluation of methods of identifying and training students who need instruction in the use of elaborative strategies.

It does not seem too much to hope that the injection of generative activities into large college classrooms may make a significant contribution to the attainment of educational excellence in our colleges.

Table 1

Elaborations and Generations

Teacher or Test Elaborations		Learner Generations
Headings and subheadings	–	Compose headings and subheadings
Titles	–	Compose title
Familiar stories and words	–	
Underlined, circled, or checked words and sentences	–	Underline, circle, or check words and sentences
Questions	–	Develop questions
Objectives	–	Write objectives
Summaries	–	Give summary
Main ideas, rules, and principles	–	Abstract main ideas, rules, and principles
Relations (between parts of text and experience	–	Relate text to experience
Explanations	–	Write or discuss explanations
Inferences	–	Draw inferences Predict next event, outcome
Interpretations (analysis and synthesis)	–	Analyze or synthesize
Metaphors	–	Compose metaphors
Analogy	–	Give analogy
Examples	–	Provide examples
Pictures and partial pictures	–	Image and draw pictures
Graphs and tables	–	Prepare graph and tables
Maps	–	Draw maps
Blanks	–	Fill in blanks
Paraphrases	–	Say in own words
Applications	–	Solve problems Apply principles Discussion and related group work Discuss story Read story or partial story Act out story Retell story Evaluate story Write story

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