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The Interactive Lecture: Reconciling Group and Active Learning Strategies with Traditional Instructional Formats

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Despite calls for the radical transformation of teaching and learning in higher education to a more constructivist, collaborative learning approach, the lecture remains the dominant mode of instruction for most teachers (Cuseo, 1996). This instructional strategy has been the primary model of teaching presented throughout the academic careers of most faculty. And, as we have noted elsewhere (Matthews, Cooper, Davidson, & Hawkes, 1995), there are many situations in which the lecture is the preferred procedure to accomplish many educational objectives.

This article is an attempt to seek a rapprochement between those who use the lecture as their dominant method of teaching and those who believe that group and other active learning procedures are the only effective instructional strategies.

Specifically, we are calling for increased use of the Interactive Lecture. The Interactive Lecture is one in which active learning, group learning, and classroom assessment strategies are embedded

at frequent intervals in order to foster deeper processing of course content. The Johnson brothers at the University of Minnesota have used the term *Interactive Lecture* for over a decade, referring to procedures in which cooperative learning exercises are placed within the lecture at regular intervals. Donald Bligh (University of Exeter) in his classic text *What's the Use of Lectures?* has been making a case for more interactive lectures since the early 1970s. Dean Osterman and his colleagues at Oregon State University used the term *Feedback Lecture* in referring to comparable procedures (Osterman, 1985). Alan Jenkins and Graham Gibbs in England used the term *Structured Lecturing* to describe a similar strategy in the late '70s and early '80s (Gibbs & Jenkins, 1992). Although differing in detail, each of these approaches suggests breaking lectures into segments and asking students to reflect on problems or issues at regular intervals.

We have examined these approaches and the literature on information processing and have developed our own version of the Interactive Lecture, which focuses on two elements that can make the traditional lecture more interactive. Our version of the Interactive Lecture provides a way of meeting the needs of teachers who feel that they need to lecture much of the time in order to cover course content, to provide models of appropriate academic discourse, to convey enthusiasm for the discipline, and for other reasons. The Interactive Lecture provides active learning opportunities that the research literature documents as essential for deep processing of course content. And it involves less risk for faculty uncomfortable with turning over large amounts of class time to more formal group-learning strategies.

The Interactive Lecture that we have developed focuses on two concepts not used in the interactive procedures identified above: Cognitive Scaffolding and Quick-thinks. Cognitive Scaffolds are

forms of support provided by the teacher (or another student) to help students bridge the gap between their current abilities and the intended instructional goal (Rosenshine & Meister, 1995). As Brown and Palincsar note, "The metaphor of a scaffold captures the idea of an adjustable and temporary support that can be removed when no longer necessary (1989, p. 411). James Cooper and his California State University, Dominguez Hills colleague, Susan Prescott Johnston, have written about scaffolding in other publications (Cooper, 1997; Johnston & Cooper, 1999). Readers are encouraged to review these articles for more detailed information concerning the research and theory that support the use of scaffolding, and for more detailed examples of scaffolding in college settings. In this article we will focus on five types of scaffolds.

Types of Cognitive Scaffolds

1. Anticipate Student Errors. In this procedure, teachers identify common misconceptions and problems that students have had in the past and use this information to draw attention and "precorrect" these problems. For example, students taking research methods and statistics commonly confuse correlation scatter plots and frequency polygons. Both are drawings of statistical relations containing dots. But the type of information presented on the X- and Y-axes is quite different. If the teacher alerts students to this common problem, and emphasizes how the concepts are similar and how they are different, student understanding increases dramatically. In introductory psychology, students commonly confuse the concepts of punishment and negative reinforcement. If the teacher alerts students to this common problem and emphasizes how the concepts are similar and how they are different, increasing student understanding.

2. Partial Solutions. In this strategy, teachers provide the answers to the first few steps of a problem so that students can direct their attention to one or two elements that serve as the focal point for that day's instruction. Freed from the cognitive demands of working through dense material previously covered but not completely mastered, students can focus their cognitive capacities on the most important elements of a problem or issue. For example, when teaching students how to compute a Spearman correlation, the instructor can work the first half of the computation so that students can focus on the essential element of the Spearman formula, the *relative ranking differences* of the X- and Y-variables. Similarly, when first presenting a frequency polygon drawing for a set of data, the instructor can label the X- and Y-axes for the class, and then ask students to complete the graph. These procedures save valuable class time, allowing instructors to spend more time on the critical features of the day's lesson.

3. Think Alouds. In this procedure, the instructor models how an expert practitioner addresses an issue, by verbalizing the thought process used in resolving the issue. For example, in identifying the independent and dependent variables in an experimental study in medicine, the instructor could say, "I know that the independent variable is some sort of treatment given to patients and that the dependent variable is some sort of outcome of that treatment. In this study, the independent variable is the drug that is purported to reduce AIDS symptoms as compared to the placebo treatment. The dependent variable is the frequency of reported symptoms experienced over the next few months." Compare this with

simply reporting the results of the study to students. If students are expected to critique journal articles and to critically analyze research on tests and papers, the former approach is more likely to foster higher-order thinking about research methods than the latter approach.

4. Procedural Guidelines. The technique is particularly useful in laboratory courses and professional- and trade-school settings. A set of guidelines or sequential steps is given to students to be checked off as they complete tasks such as testing blood pressure, conducting a lab experiment, or completing each section of a research report.

5. Comprehension Checks. In this technique, classroom assessments are conducted at frequent intervals in order to ensure that students have mastered content covered in one portion of the class before the instructor moves on to new material. Many of the Classroom Assessment procedures identified by Patricia Cross and Tom Angelo exemplify this strategy. Types of Comprehension Checks will be delineated in more detail in the Quick-thinks section to follow.

Types of Quick-thinks

Quick-thinks are brief, active-learning exercises that can be inserted in lectures or other instructional formats and require students to process information individually and/or collaboratively. Each can be used as a Comprehension Check focusing on a different cognitive outcome, ranging from relatively low-level

knowledge skills to higher-level skills such as analysis and synthesis (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956). The research and theory base for the strategies is substantial, as described in Johnston and Cooper (1997). Following are descriptions of eight Quick-thinks:

1. Select the Best Response. This technique requires students to select the best answer for a multiple-choice test question. Physicist Eric Mazur at Harvard and a group of chemists headed by Art Ellis at the University of Wisconsin-Madison have used a version of this approach that they call ConcepTests in both large and small classes and report significant gains in critical thinking and attitude toward the discipline when they insert these items frequently within lecture and lecture-discussion classes.

2. Correct the Error. As indicated by the name, in this strategy, an instructor poses a test item that contains an error and the student's job is to find the error. In the correlation drawing described earlier, the instructor could mislabel the axes of a scatter plot, and then ask students to find and correct the error, either working individually, in pairs, or both. An instructor could ask a teaching-methods class to find the error in the following statement: "Instructional objectives specify what the teacher will do in the class." (The correct answer is that objectives specify what the *student* will do.)

3. Complete a Sentence Starter. In this Quick-think, a teacher provides a sentence stem for students to complete. For example, in a course in criminal justice, the instructor might offer an item such as: "The three strikes mandatory

sentencing laws might result in_____." In a research methods class, a Sentence Starter might be: "A correlation scatter plot depicts information concerning_____."

4. Compare or Contrast. After a period of lecturing, the instructor poses a comparison or contrast item to the class. For example, "After viewing Joan Miro's painting *Composition* and Jackson Pollock's painting *One*, identify similarities between the paintings." (Responses might include fluidity of design, non-realistic content, or impression of movement.) In an introductory or an experimental psychology class, the instructor might ask how a negative reinforcer is *different* from a punisher. (The answer would be that the former increases the behavior it follows, the latter decreases the behavior.)

5. Reorder the Steps. In this procedure, students are given a set of randomly ordered steps and asked to sequence them. In a psychology class treating Pavlovian or classical conditioning, the class might be given a Conditioned Stimulus, an Unconditioned Stimulus, a Conditioned Response, and an Unconditioned Response and then asked to sequence the elements correctly.

6. Support a Statement. Students are given a statement and, based on their readings, homework assignments, and/or class notes, are asked to provide support for the statement. In a teaching-methods or curriculum class, students might be given the following statement, "Piaget has had a significant impact on teaching and learning. Identify contemporary areas

in education which have been influenced by Piagetian thinking." (Answers could include cooperative/collaborative learning, inquiry-based science techniques, and whole-language approaches to the teaching of reading.)

7. Reach a Conclusion. This procedure requires students to make a logical inference about the implications of facts, concepts or principles they have just learned. For example, in an educational research methods class, students might be presented with the following: "If a researcher used a Posttest Only Control Group (or Experimental) Research Design, what could a researcher say if someone argued that the Experimental Group students had higher test scores than the Control Group students prior to the beginning of the study?" (The answer would be that random assignment should control this selection threat to internal validity.)

8. Paraphrase the Idea. In this Quick-think, students are required to rephrase an idea in their own words. In an educational research methods class, graduate students who are K-12 teachers could be asked to describe, in their own words, what norm-referenced testing is to a parent whose child had just received her Stanford 9 standardized achievement test scores.

Putting It Together--The Interactive Lecture

We advise faculty interested in preparing an Interactive Lecture and, ultimately, a set of lectures for a course, to initially use current

class notes, syllabi, and textbooks for only *one* course, preferably one that they have been teaching for some time. We suggest that they identify which concepts historically have proven to be the most difficult to teach and which are the most important "big ideas" for individual class meetings and for the semester. Then, we suggest that faculty embed one or more of the scaffolds and Quick-thinks at frequent intervals (e.g., every 15-20 minutes, starting at the beginning of a class period).

Sample Interactive Lecture

Dr. John Cooper is beginning his research methods class, a class that meets twice a week for 90 minutes per session. This class has proven difficult to teach in the past because of its dense content and students' perception that it is not relevant to their lives. Attendance has been somewhat disappointing and time on task has been spotty when Dr. Cooper lectured for the entire class period.

Dr. Cooper begins this day's class by reviewing material that students found to be difficult in the previous class period. He knows that this material was perceived as difficult because he gave a Comprehension Check known as a Minute Paper to his students at the end of the last class. He asked students to take a piece of scrap paper and identify one or two concepts they found most unclear from the class period. After class, he briefly scanned the 30 responses and found that the students had the greatest difficulty with drawing and labeling a frequency polygon and understanding what kind of information was conveyed in the drawing. So, for today's review he draws a frequency polygon on the board and, since he knows that students might still be unclear on the concept, he provides a Partial Solution by labeling the X- and Y-axes. He then asks the students to complete the drawing for the data he has provided. Students take a short time to complete this task working

alone and then turn to a partner to check their work on the task. Dr. Cooper either calls on students for their answers or completes the rest of the drawing and briefly reviews the correct answer.

This procedure takes five to seven minutes. Dr. Cooper then begins his lecture for today's class, dealing with correlation. He warns the students that, by the end of class, they will need to know the *difference* between the picture they have just drawn, a frequency polygon, and another statistical drawing that superficially looks similar, a picture called a correlation scatter plot that will be presented in today's class. He is attempting to Anticipate Student Errors in making the distinction between the two drawings. After lecturing for 20 minutes on correlation and drawing two correlation scatter plots on the board, he draws a third picture, which just contains X- and Y-axes. He asks students what information would be used to label these axes *if* he were drawing a frequency polygon. With last period's presentation and tonight's review, students know the correct labeling. If the intent were to draw a correlation scatter plot rather than a frequency polygon, Dr. Cooper asks, "What information would I write on each axes?" He is using a Compare or Contrast technique. He then asks students to work individually to draw and label a correlation scatter plot for a set of data. Then they share their responses with a neighbor and Dr. Cooper either calls on students or he writes the correct answer on the board.

Dr. Cooper then begins a 20-minute presentation of how to compute a Spearman correlation. He computes two examples of a Spearman, then asks students, either working individually or in pairs, to compute a third Spearman for a data set Dr. Cooper presents (another Comprehension Check). After going over the correct answer, Dr. Cooper begins a review and summary of what correlation is, when it is used, how to draw a correlation scatter plot, and how to compute a correlation.

He then breaks his students into four-person cooperative base groups. These learning teams (a) answer questions relating to the kind of information conveyed in a frequency polygon and in a correlation scatter plot, (b) draw and label correlation scatter plots for sets of data presented by the instructor, (c) compute correlation coefficients for sets of data provided by the instructor, and (d) review additional content covered since the last exam.

As students are completing these Comprehension Checks, Dr. Cooper walks around the room. When he notes problems, he either corrects misunderstandings within a team or, if the problem is widespread, conducts a one- to three-minute mini-lecture to head the problem off before the class moves on to other content. After students complete 20-30 minutes of base-group work, Dr. Cooper goes over the answers with the students and addresses any questions they have. In addition to presenting these correction scaffolds, Dr. Cooper asks that students provide Think Alouds to each other within their groups, with the more advanced students modeling appropriate thinking for their teammates. The last 20-30 minute section is not Interactive Lecturing and need not be included if the class period is 50-60 minutes. However, we have found it to be a valuable adjunct to what goes before. As faculty become more comfortable with the Interactive Lecture, they may wish to elaborate on the procedure by adding cooperative base-group activities as we have done at the end of each class meeting. The base groups are particularly important if faculty teach classes of three or more hours, as Pamela and James do.

Conclusion

A person new to the Interactive Lecture may choose not to use a system as elaborate as the one just described. Almost any lecture can be enlivened simply by posing a problem to students every 15-

30 minutes and having them reflect on the issue privately before sharing answers with another person and then with the class. This procedure is known as Think-Pair-Share. As teachers become more experienced with the sort of cognitive outcomes they want to foster in their students (e.g., rote skills, application, synthesis), they may want to infuse into their lectures scaffolds and Quick-thinks that focus on these specific outcomes.

The first two authors have used the Interactive Lectures in such classes as research methods, developmental psychology, multicultural education, critical thinking, and introductory statistics. They have also observed the techniques implemented by other instructors in many other courses, including mathematics and science, behavioral science and the humanities. Readers may want to consult the Johnston and Cooper (1997; 1999) and the Cooper (1997) articles for the principles of effective teaching, learning, and information processing that underlay the techniques incorporated within the Interactive Lecture. However, for James and Pamela, the best evidence is that the techniques have worked in their classes for years.

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