



Instructional Design Memo

Chunking Instruction

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Despite major innovations in teaching and learning, the age old lecture remains the primary mode of instruction in education (Bligh, 2000). Regardless of where they are in the world or what they study, for the most part, students show up to class expecting to receive a steady stream of information from a teacher, with no breaks in between. The teacher, in turn, expects students to attend class and effectively process and retain the information that is presented, so that they can later demonstrate understanding through an examination. But in a traditional classroom, where information is often presented for long periods of time without interruption, is this expectation reasonable? Is this antiquated method of content delivery, which remains so pervasive in the classroom, consistent with what we know about how people learn best?

Lectures and Sustained Attention

It is often easy to spot when a person's attention has wandered from lecture. Glazed eyes, yawning, shifting gaze, restlessness, misplaced nods of acknowledgement, doodling - all point to a student who has checked out. Johnstone & Percival (1976) used such behavioral indicators to determine at what point in a lecture that the attention of the majority of the class had lapsed. Based on the observations of 12 university-level chemistry lectures by two trained independent coders, students' attention appeared to wane after 10-18 minutes of lecture and, by the end of class, every 3-4 minutes. This was more than 35 years ago, before students had smartphones, Facebook, Twitter and other distractors.

In a more recent study, Bunce, Flens, and Neiles (2010) evaluated 186 university student reports of their own attention lapses using classroom response systems. The typical function of these devices, also called "clickers", is to facilitate teacher-students interaction by allowing students to respond to teacher questions by clicking a button corresponding to their answer, which is then fed back to the teacher's computer (Paschal, 2002). In this study, students used clickers to indicate awareness of a short (1 minute or less), medium (2-3 minutes), or long (5 minutes or more) lapse of attention. This was done in the context of both lecture and student-centered pedagogies such as demonstrations and clicker questions.

Like Johnstone and Percival (1976), Bunce et al. (2010) found that lapses of attention occurred in more frequently occurring cycles over the course of the lecture portions of the course. Unlike the previous study, though, the Bunce et al., found that student lapses in attention occurred even before 10-18 minutes into the lecture, though with less frequency. Students were more attentive during student-centered pedagogies compared to lecture. Even more interesting is the finding that lapses of attention occurred with less frequency during a lecture that followed student-centered pedagogy than with lecture portions of equal length that were not preceded by innovative instruction. So, if you are going to lecture, do it *after* a more student-centered instructional activity.

What is chunking?

Chunking is the practice of breaking up steady streams of lecture content. The practice is informed by the concept of working memory, specifically, that our working memory holds a limited amount of space for processing information. Chunking lecture content accommodates the limitations of our working memory by opening up space through breaks or pauses. See Figure 1 for a depiction of one chunked and un-chunked lecture.

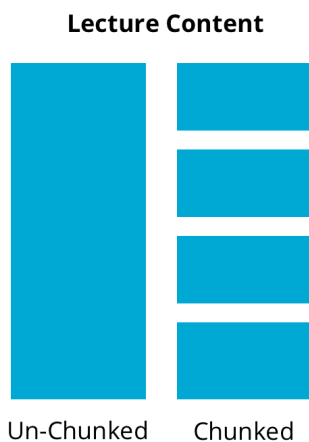


Figure 1

The Pause Procedure

Given limits in students' ability to attend to lecture for prolonged periods of time, recommendations often point to varying instructional approaches and breaking lecture into smaller parts (e.g. Bligh, 2000; Bunce, Flens, & Neiles, 2010; Johnstone & Percival, 1976; Sousa, 2006). A method known as the pause procedure addresses the latter recommendation by inserting three, two-minute pauses at logical stopping points over the course of a lecture (Ruhl, Hughes, & Gajar, 1990). During the pause time, students are encouraged to discuss lecture content with a peer and to update their notes accordingly. By chunking the lecture into three portions rather than presenting all of the information at once, students are better able to sustain attention throughout the lecture.

The efficacy of this procedure has been verified for college students with and without

learning disabilities (Ruhl et al, 1990; Ruhl & Suritsky, 1995). Specifically, students who were instructed using the pause procedure were able to recall more facts, vocabulary, and ideas from the lecture immediately following instruction than were students who were presented with the entire lecture at once. Pause procedure participants also outperformed the other group on an objective exam based on lecture content administered one week following instruction.

Pause + Retrieval Practice with Interpolated Memory Tests

Delivering prolonged lectures results in diminishing returns in student learning. How can pauses between chunks of lecture best be used? A recent study by Szpunar, Khan, and Schacter (2013) explored this question in the context of a 20-minute online lecture broken into four five-minute segments. They suggest that one effective use of pause time is retrieval practice, or the act of remembering something they have previously learned.

The authors compared two groups of undergraduates who received the same lecture material: one group worked on a task unrelated to the material during breaks from the lecture. The other group completed six-item quizzes on the lecture material during the pause time. Both groups were told that they would take a final test covering the entirety of the lecture. Findings indicated that the retrieval practice group took more notes and performed better on the final test than other group. This finding is consistent with evidence indicating that having to recall material improves long-term memory for the material (Agarwal, Bain, & Chamberlain, 2012).

Peer Instruction

Peer instruction provides another method for chunking lectures (Mazur, 1997). Peer instruction is a research-based method that uses mini-lectures punctuated by interpolated assessments called ConcepTests. In this method, a teacher provides a mini-lecture, then poses a ConcepTest to gauge the class's understanding. Students then discuss their choice with their peers, before responding once more to the initial prompt. The sequence is followed by an instructor-facilitated explanation of the correct answer and its rationale. Peer Instruction is supported by 20 years of research demonstrating its effectiveness in improving student success and achievement. It provides an effective way of chunking lectures and maximizing the use of pause time through retrieval practice.

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