

How students learn: improving teaching techniques for business discipline courses

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ABSTRACT

The focus of this paper is to familiarize business discipline faculty with cognitive psychology theories of how students learn together with teaching techniques to assist and improve student learning. Student learning can be defined as the outcome from the retrieval (free recall) of desired information. Student learning occurs in two processes. The first process is the transfer of information from short-term memory (STM) of sensory preceptors into long-term memory (LTM). The second process is the retrieval through free recall of that information. This manuscript identifies both the STM and LTM systems along with retrieval of information from LTM and identifies learning techniques used to enhance these processes. More importantly, this paper outlines various techniques to help instructors overcome the typical student attention span of 10 to 20 minutes, and therefore minimize the negative effect of in-class student attention span on learning.

INTRODUCTION

As students meander through the scope and depth of their chosen academic fields, one often wonders whether the student learnt primarily as a result of the course materials, instructor, fellow students, third parties, or some combination based on the student's propensity and ability to learn. If we limit our discussion to the role of the instructor, it seems that four attributes contribute to student learning: knowledge, communication, interest and respect (Brain, 1998). Therefore, the quality of the teaching and hence student learning experience is managed by the instructor who must determine the learning goals, the tempo of dissemination and which elements of the material to be emphasized. AACSB Assurance of Learning Standards call for the instructor to define learning goals, assess student achievement for these goals, and utilize what is learned through assessment to continually improve his/her course. An effective instructor assesses learning accomplishments of the students to determine if they have achieved knowledge and skills needed to demonstrate competencies taught in his/her course (AACSB, 2009). Even though students may rate the 'best' instructor based on popularity, we must be cognizant of the distinction between in-class entertainment and in-class learning. An effective instructor facilitates student learning and hence education has taken place. Ergo, the primary in-class motivation for any instructor is to help students learn the material at hand. Specifically, what learning techniques might an instructor use to maximally ensure student learning?

The authors start with a review of the relationship between sensory preceptors, short- and long-term memory and recall of data. This is followed with a discussion of various learning enhancement techniques an instructor might use together with a template to put the content into perspective.

STUDENT LEARNING

For faculty to efficiently and effectively engage in student learning, they should understand how students learn. By knowing how students learn, faculty can engage the student learning environment from their tool bag of teaching techniques. We begin this section with a brief background of some basic cognitive psychology theories dealing with sensory preceptors providing data to short-term memory (STM) and then into long-term memory (LTM). Specifically, we present the processes of STM, LTM, and the encoding process (transferring STM data into LTM). Next we deal with the retrieval process – free recall of information. See Appendix 1, Figure 1.

SHORT-TERM MEMORY

Short-term memory is received through our sensory preceptors: visual, auditory, taste, smell, and touch. Code is the term that identifies the form in which raw sensory data is transferred into STM (Best, 1986). The capacity of STM is believed to be 7 ± 2 chunks of information (Miller, 1956). The persistency is 10-20 seconds without rehearsal (Brown, 1958; Peterson & Peterson, 1959). A phone number (7 digits) without area code can be retained actively in our mind from phone book to dialing by (rehearsal) repeating it. Repeating merely maintains the data in our articulatory rehearsal loop and does not lead to effective encoding into LTM.

ENCODING FROM STM TO LTM

Transferring, also known as encoding, STM information into LTM requires four processes: organization, elaboration, association and inference. Organization – Bower (1970) states, “a preferred strategy of the adult human in learning a large body of material is to ‘divide and conquer,’ that is to subdivide the material into smaller groups by some means, and then learn these parts as integrated packets of information.” Elaboration emphasizes the uniqueness of data. Elaborating the material to be learned makes it more memorable, usually by linking it to something that is already known (Baddeley, 1990). Association - all data in LTM is linked with some other data. It is this linkage along the memory paths that allows the retrieval of the learned information. Inference is the process of being able to recall data for which the memory paths have decayed and are too weak for free recall. Through the process of inferring to the data from other cues, one is able to retrieve learned information.

An example of these four processes is a college textbook. The textbook is organized into chapters, sections, and topics. The textbook elaborates by the use of pictures, graphs, charts, diagrams, color, stories, and overlays which make each data of information unique and memorable. Textbooks try to associate the material to the young learner thru current events, stories dealing with young issues (Facebook, LinkedIn, and Twitter), young entrepreneurs, and pictures of young people. Textbooks apply inference by presenting examples which relate current text materials to previous classic examples.

LONG-TERM MEMORY

Long-term memory is based primarily on a semantic code. LTM is meaning-based. Studies show subjects remember the meaning of objects as opposed to the exact wording of sentences or stories (Anderson, 1990). LTM is believed to have unlimited capacity. Information in LTM remains intact until it decays or is disrupted, for example, from a brain trauma. A common misconception is that “poor” LTM results from a lack of retention. However, if a group is asked to recite Lincoln’s Gettysburg Address (which was probably memorized in 7th grade) a very few will attempt this task. When one does recite Lincoln’s Gettysburg Address, then the rest of the group are able to recall it also. The problem is not retention, but *retrieval*. The retrieval process faces a constant decay unless exercised. The final process in student learning is the retrieval or free recall of data from LTM.

RETRIEVAL FROM LTM (FREE RECALL OF INFORMATION)

Free recall is the open association and retrieval of information in LTM. Scanning refers to a process of retrieving data from LTM. Retrieval from LTM is a complex system based on retrieval routes (cognitive memory paths) formed at input (initial encoding). Many factors go into creating these paths which connect associated data. Contextual cues and encoding specificity are currently the main sources of these paths. Student learning is primarily a retrieval response to a recognition or recall cue along associative memory paths in LTM. One example is the “Debits on the window side, Credits on the door side” used by accounting professors in Principles of Accounting. Students need not memorize “Debits left and Credits right.” Instead, their cue is a physical reference to their surroundings. Additionally, as noted earlier, if free recall is not present, inference may result in the retrieval of the desired data. This may be applied by

questioning students as to “What is truly new in this chapter that you have not seen before (even in other courses.) Students may not immediately recall the exact content of previous lessons, but, by posing the question, they may retrieve via inference what they knew before in relation to what is new material in the present.

TEACHING TECHNIQUES

From a business school perspective, the focus of any learning initiative must start at the introductory course level and continue forward. Such an intervention is a catalyst for life-long learning technique awareness and use. For learning to have a chance, not only should the instructor devise learning strategies, but also the student must make an effort to shift from being passive in class to being engaged. The following sections offer the instructor three inter-linked strategies to enhance student learning. First are actions to hold in-class student attention as techniques to counter the influence of short student attention span on learning; second, the lecture template offered as a highly detailed mechanism to promote higher levels of student participation and offer the instructor lecture-specific feedback on student comprehension and learning. Finally, a menu of teaching strategies specifically oriented for compliance with the Accounting Education Change Commission Position Statement One (1990).

MANAGING WAYS TO ENHANCE STUDENT LEARNING AND RETRIEVAL

Within the classroom environment, there are two hurdles compromising a student’s ability to learn efficiently and effectively. First, students have different learning styles (Nelson, 1996). Some are primarily visual; some primarily auditory; and some a combination of touch, taste and smell. The second hurdle to learning is the limited attention span of approximately 10-20 minutes (Bonwell & Eison, 1991). We must vary our routine from lecture to active learning to visuals (overheads, PowerPoint or board work) and back. It is the latter issue of student attention span (an outcome of student attitude to learning) as a key hurdle to student learning that the following sections address.

Once in class, adult learners can initially maintain attention to a lecture for no more than 15 to 20 minutes. Work by Johnstone and Percival (1976) observed students in over 90 lectures, with twelve different instructors. In general, after 3 to 5 minutes of "settling down" at the start of class, the next lapse of attention usually occurs 10 to 18 minutes later, and as the lecture proceeds, the attention span decays to 3 or 4 minutes towards the end of a standard lecture. These findings are consistent with work by Burns (1985). Given that students have an attention span of around 15 to 20 minutes and that university classes are scheduled for around 50 or 75 minutes, instructors must do something to maintain their students' attention. According to Moses (2000) today’s students suffer an even shorter attention span as a result of their high sensory experiences as children (no professor can compete with Captain Kangaroo!). To compensate, students have a broader attention *range* (Rushkoff, 1996) manifest as significant multi-tasking ability which may allow for the use of mobile multi-media learning environments (e.g., iPods) with the caveat that this be limited to students with high working memory capacity (Doolittle & Mariano, 2008).

To overcome attention span decay, Johnstone and Percival (1976) suggest that lectures should be punctuated with periodic and varied activities. These should be deliberately and consistently interspersed in their lectures with illustrative models or experiments, short problem solving sessions, or some other form of deliberate break. This approach usually commands a

better attention span from the class, and these deliberate variations have the effect of postponing or even eliminating the occurrence of an attention break. For example, empirical work by Nouri and Shahid (2005) report that students perceive an instructor's reliance on a single technique such as power point slides as an instructor less receptive to student concerns and a less effective instructor. Finally, according to Middendorf and Kalish (1996), students generally view these interventions as vague and sometimes confusing; a concluding class session debriefing helps students understand what was important and what was not. Table 1 in Appendix 2 offers a menu of actions and their impact on student attention an instructor might consider to maintain the students' attention.

Dealing with different learning styles complements the challenge of students' 10-20 minute attention span. Teaching techniques include lecture (auditory); PowerPoint slides (visual); then active learning activities (touch, taste and smell – TTS). The lecture sets the stage for the topic. The PowerPoint slides help the visual learners see the topic being discussed. In active learning students are completing learning exercises and thinking about what they are doing (Bonwell & Eison, 1991). Using team work to solve a problem both reinforces the topic and gives the TTS learners an opportunity to exercise their learning skills with peers. Additionally, this model of varying delivery methods satisfies the students' 10-20 minute attention span.

THE LECTURE TEMPLATE

One teaching tool that addresses organization, association, and elaboration is the lecture template. The instructor constructs a template (matrix) for a class lecture. This template lists the main topics across the top and vertically organizes the rows into: Characteristics; Strengths; Weaknesses; Formulas; Definitions; etc. The students fill in the "squares" during the class lecture. For example, a class addressing audit evidence would list the main topics as: Audit Assertions, Audit Procedures, Documentation, and Knowledge & Decisions as shown in Appendix 2, Table 2. The vertical list of characteristics would be: Define, Objectives, Inspection, Observation, Inquiry, Confirmation, Recalculation, Computer-Assisted Techniques, Staffing, Supervision, Timing, and Working Papers.

The template can be left with the student or collected at the end of class, reviewed by the instructor for bonus or participation points, and returned next class. The faculty can upon review between classes identify weaknesses in the lecture. The students are actively participating; focused on the ideas of the class; their "forced note taking" is organized; and by seeing the associations – contrasts, similarities, and processes – they create elaboration of the data. Thus the class materials are encoded into LTM for later recall.

Free Recall of Information

Cues used to retrieve data must be associated with that data at encoding. Organization, elaboration, association, and inference are all cues found in textbooks. Textbooks are organized into chapters, sections, topics; while color, diagrams, examples, exhibits, exercises and stories all evoke elaboration (uniqueness); association is found in the student themes throughout the text; and inference in textbooks comes not from the materials to be learned, but the presentation of the materials being made in a logical manner that the desired data can be inferred even if the memory paths are too weak for free recall. All encoding processes provide redundant/alternate memory paths which strengthen the retrieval process of recall.

The two minute paper can be used in a number of ways. Initiated at the beginning of class, it can be used as a recall test of what was learned during the last class meeting. Used at the end of class it can evoke what questions students still have or topics students are unsure how to address. A review between class meetings of these questions can lead the instructor's lecture the next class period by clearing up dilemmas without students having to "ask questions." It also can be used as a "Quick Quiz" in the middle of a lecture, or as a summary of what students have learned so far this class period.

Think-Pair-Share is a student learning team (SLT) type exercise used in class to break-up the lecture and give students an opportunity to reflect on concepts. Using SLTs to solve unassigned homework before going on to the next chapter is an effective quiz of students' ability to progress in the subject. Giving SLTs compare/contrast type questions to complete, challenges them in the subject concepts.

PREPARE STUDENTS FOR LIFELONG LEARNING

The Accounting Education Change Commission Position Statement One (1990) proposes that the real mission of education, especially in accounting where information is growing exponentially, is to prepare students to be lifelong learners. "Self-actualization in learning is known as metacognition. Metacognitive individuals are aware of their own learning processes. They understand what they know and just as importantly, what they do not know. They take responsibility for their own learning. They engage in self-regulatory control strategies to monitor their learning" (Nelson, 1996).

Student sponsored guest speakers help drive home the importance of lifelong learning. SLTs on a first-come-first-served basis may schedule a guest speaker with the instructor on designated class dates. The speaker has 20 minutes including questions to address one of three topics: (1) a business career, (2) resume/interviewing techniques, or (3) a topic of the course. The SLT has to secure the speaker parking, escort the speaker to the classroom, introduce the speaker to the class, collect one business card, and rough draft a thank you letter for the faculty to complete and mail to the speaker. The SLT receives bonus/quiz points while the class is exposed to new ideas and new energy to begin the class. For a summary of these common teaching techniques and their application, see Appendix 2, Table 3.

CONCLUSION

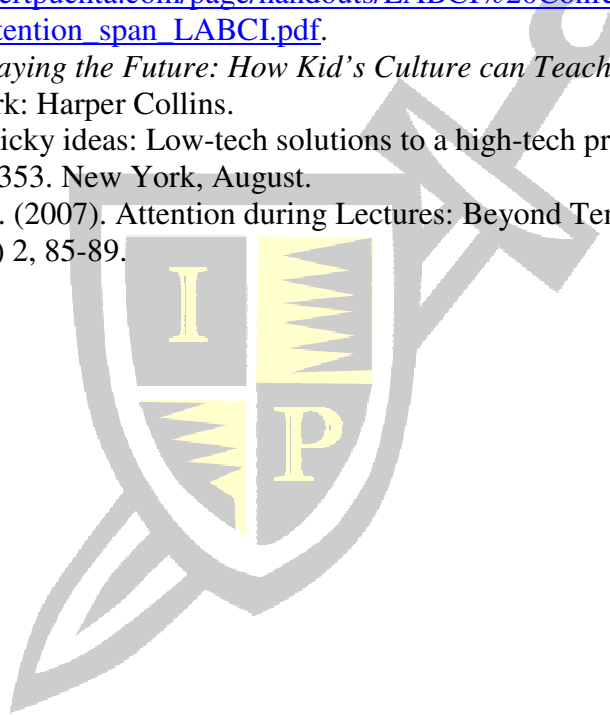
Cognitive Psychology Theories were introduced so faculty could understand the two main systems of how people learn: encoding and free recall. Encoding involves four processes: organization, elaboration, association, and inference. Free recall involves input cues (more inputs cues, stronger retrieval links) and inference (logical reasoning to input cues).

The aim of this paper is to help instructors at business schools (a) understand via cognitive psychology theory how students learn, (b) become aware of the impact of student attention span on learning, and (c) offer instructors a variety of interventions to manage student attention span decay and enhance student learning. Our objective is quite simple, to help us as instructors engage in productive student learning.

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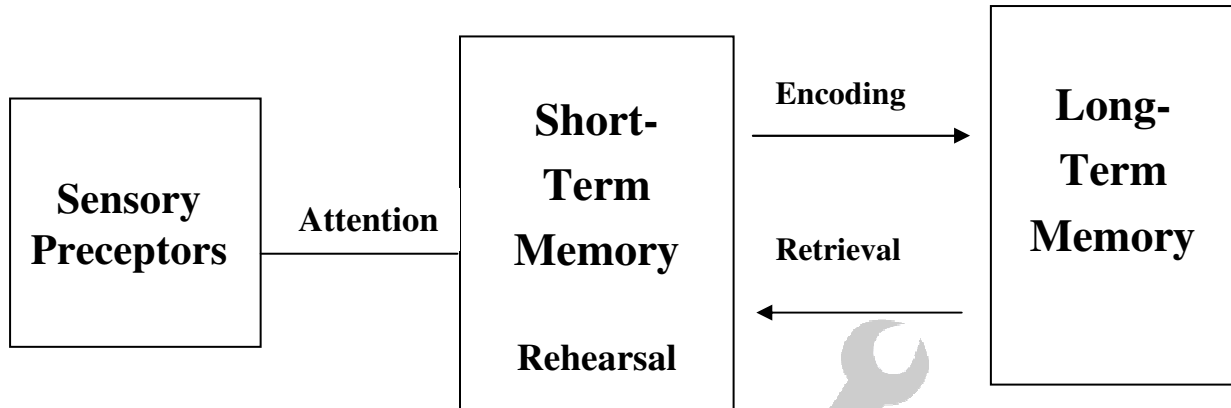
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APPENDIX 1

Figure 1
Information - Processing Model of Memory



	Sensory Preceptors	Short-Term Memory	Long-Term Memory
Capacity	Large	Small	Infinite
Cause of Forgetting	Primarily Decay, also Interference	Primarily Interference, also Decay	Retrieval failures

Adapted from Nelson (1996).

APPENDIX 2

Table 1
In-Class Tips to Hold Student Attention

Action	Impact
Plan carefully and fully.	Lessons which run smoothly keep students' attention and minimize interruptions.
Pre-Brief: Clarify the specific objective(s) for each class.	"What do I want my students to learn from this class?" Let students know what they should get out of this class.
Divide learning tasks into smaller sub-skills.	Sequence your topics to avoid teaching skills for which students have not yet mastered necessary prerequisites.
Use Variety.	Mix lecture with small group or individual work. If the objective is critical thinking, a pure lecture may not meet the objective.
Plan careful Breaks	Short interactive problem solving sessions to break up the lecture format.
Use Technology	Discussion boards, chat rooms, e-mail, YouTube videos in class. Portable digital media players (iPods, Zunes), personal digital assistants.
Make class presentation clear.	Use vocabulary appropriate to the level of your students. Translate statistics into meaningful concepts. E.g., a billion seconds ago it was 1961. To avoid the 'curse of knowledge' (C. Heath & D. Heath, 2007), think and present from the student's knowledge perspective.
Plan for student involvement in the lesson.	Too much passive listening invites distraction. Challenge students to explain their new knowledge to one another. Consider 'clickers' to collect student responses and discussion to a posted question.
Show enthusiasm, be dramatic.	If you appear bored, how can one expect to instill interest among your students?
Move around.	During lectures or large group activities, avoid sitting behind a desk or standing only in one spot.
Relate the topics to the interests and needs of your students.	A shared frame of reference will help students relate to the topic at hand.
Debrief	Review of the lecture spotlights key points.

Adapted from: Allen & Tanner (2005), Beekes, 2006), Bligh (2000), Caldwell (2007), Cebeci & Tekdal (2006), Middendorf & Kalish (1996), Partin (1987), Puchta (2007), Weaver (2007) & Wilson & Korn (2007).

Table 2
The Audit Evidence Lecture Template

	Audit Evidence Topics			
	Audit Assertions	Sufficient Competent	Documentation	Knowledge & Decisions
Define				
Objectives				
Inspection				
Observation, Inquiry				
Confirmation				
Recalculation				
Computer-Assisted Techniques				
Staffing				
Supervision				
Timing				
Working Papers				

Table 3
Application of Common Teaching Techniques

Technique.	Application
SLT active learning: (a) Solve unassigned homework; (b) Solve a concept question	During class give permanent SLTs a homework or concept question to solve. After an appropriate amount of time, select an SLT to present their solution to the class. Collect the solutions for review.
Lecture with visual aids (Board, overhead, power point, etc)	Variety of deliveries to address attention span deficit.
Lecture Template to reinforce note taking, organize, associate and elaborate class materials in support of encoding.	As noted on P. 5.
Two minute paper: Beginning of class (Quick Summary); Middle of class (Quick Quiz); End of class (Quick Summary/Quick Question)	At the beginning, middle, or end of class "Take out a piece of paper." (Bad news); "Do NOT write your name on it." (Good news). Proceed as noted on P. 5.
Think-Pair-Share	As noted on P. 5.
Student sponsored guest speaker.	As noted on P. 5.