Strengthening Undergraduate Learning: Six Research-Based Principles for Teaching and Their Applications

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~ In celebration of the 20th anniversary of the Associated Colleges of the South Summer Teaching and Learning Workshop
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Introduction

In the last decade, many studies have emerged to show how research on learning can impact teaching at the K-12 level. In higher education, however, there are fewer studies that address how research-based principles can enhance our teaching. With this book, we hope to support stronger teaching based on what we know about how students learn. Although there are a lot of "teaching tricks" out there, we are interested in providing evidence-based information about learning and then offer teaching applications based on that evidence. Here, we present a brief guidebook that offers six research-based teaching principles, citations of the research, teaching applications, and an annotated bibliography. We believe it will useful for both veteran and new faculty members who simply do not have time to keep up with the literature in their field and the literature in undergraduate pedagogy.

We also offer teaching applications for each principle based on pedagogical research. These applications span the disciplines and most can be implemented without extensive preparation. We encourage instructors to adapt these strategies according to specific needs, interests, disciplines, and classroom contexts. As an additional resource, this Guidebook includes "Extensions" that elaborate on these principles. Extensions are based on best practices and are not necessarily research-based. In each Extension we share a list of resources with more information on the topic.
Part I: Engaged Learning

Learning is not a spectator sport. Students do not learn by sitting in class listening to teachers, memorizing prepackaged assignments, or spitting out answers. They must talk about what they are learning, write about it, relate it to past experiences, and apply it to their daily lives. They must make what they learn a part of themselves (Chickering & Gamson, 1987, p. 5).

Learning is not necessarily determined by what a teacher "covers" in class, but also by students actively building an understanding of core concepts in their own minds. People learn most effectively when they are engaged in a meaningful and challenging activity. Students need to work, to solve problems so that they can teach themselves and construct a new understanding of the material. By being challenged and actively grappling with ideas, students learn more deeply. Prince's (2004) meta study, "Does Active Learning Work? A Review of the Research" found support for the benefits of all types of active learning (defined as any instructional method that engages students in the learning process), concluding that the "magnitude of improvements resulting from active-engagement methods" (p. 28) is significant.
Notable Studies


The author examined pre- and post-test data for over 6,000 students in introductory physics courses and found that students' performance was better when they had been in classes that made substantial use of interactive-engagement methods. Test scores measuring conceptual understanding were almost twice as high for students in classes that used engaged learning methods than those in traditional classes.


Based on a meta-analysis of hundreds of empirical studies, the authors found active learning approaches provided a significant advantage over passive learning approaches in terms of acquiring subject matter knowledge and academic skills.

Resources


Authors give principles about student-faculty interaction to help motivation, cooperation and active learning. For more information see https://www.msu.edu/user/coddjeos/seven.htm


Active Learning in Higher Education (Retrieved from: http://alh.sagepub.com/)

An international, peer reviewed publication for all those who teach and support learning in higher education and those who undertake or use research into effective learning, teaching and assessment in universities and colleges. [from its website]
1. Learning in Small Groups

Cooperative learning offers a systematic, learning-centered approach to instruction without putting anyone into a pedagogical strait jacket (Millis, 2010, p. 6).

Cooperative learning offers a concrete, coherent way to strengthen classroom and online practices that operationalize the principles of learning (Bransford et al., 2000, p. 13).

Group learning, also referred to as cooperative learning, is an effective way to engage students. Cooperative learning is often defined as a highly structured form of group work that focuses on problem solving. We now have a vast body of literature that leads to the conclusion that involving students in group work, including problem-based learning (PBL), case-based learning, and cooperative learning, leads to deeper understanding (Millis, 2010; Nilson, 2010). Nilson (2010) stated in Teaching at Its Best, that by 1990 over six hundred studies had been conducted comparing group learning to individual learning with overwhelming support for cooperative methods (p. 156).Although the results of these studies vary in strength, achievement was consistently higher for those who participated in cooperative learning methods. In fact, students who were engaged in group work demonstrated higher achievement with difficult assignments and increased student responsibility and motivation (Johnson et al., 1994; Prince, 2004).

Group work does not need to be used all the time in order to be effective. For example, shorter group strategies, such as a challenging problem to solve, can work well within a lecture, or to initiate class discussions. Moreover, students can play a wide variety of roles in group work from simply partnering in a think-pair-share exercise to having specific roles in more complex group assignments.
Instructional Applications

Fishbowl
With this exercise, students respond to a controversial claim made by the instructor, but only students sitting inside the “fishbowl” may talk. Students outside the fishbowl listen to arguments and are prepared to enter. To set up the exercise, place several chairs (two to six depending on the size of the class) in a circle in the middle of a classroom with one to three empty chairs just outside the circle. The rest of the class sits in a larger circle around the fishbowl. When a student wants to talk s/he must go to one of the empty chairs (“on deck” chairs) just outside the circle. Variations: 1) all students are required to get in the circle by the end of the exercise, 2) students prepare for the activity by writing a response before the fishbowl begins, 3) students observing the fishbowl are required to take notes for a post-fishbowl discussion.

Jigsaw
In a jigsaw exercise, students are divided into groups of four to six students. During the first phase of this activity, each group reads or researches a different topic to become experts on that topic. During the second phase, the experts separate and move to new groups comprised of members who have researched other topics and then coach each other on their topics. For example, in a literature class the instructor might divide the class into five groups and each would have a different topic. For example, one group might be assigned symbolism in the reading while another group worked with the imagery. Each group refines and researches one concept or topic, and each group member is expected to become an “expert” on that topic. It is helpful to have the groups devise ways of presenting their content area to others. In phase two, new groups are formed and each group now has an “expert” on one of the assigned topics. Everyone in each group is then responsible for teaching their concept.

Send a Problem
For this exercise, instructors need to divide the class into groups containing four or five students. Each group receives an envelope with a different problem attached. The instructor indicates the amount of time the groups will have to solve their problem. At the end of their allotted time, the students put their solution into the envelope and give it to another group. The next group tries to solve the problem without looking at the solution in the envelope. After time is called,
they pass the problem to the third group. The last group opens the envelope and then analyzes, evaluates, and synthesizes the proposed solutions in order to present their peers with best approaches and answers.

Googledocs
Use a googledocument to have students edit each others’ writing. Googledocs also allow the instructor to track student work.

Process-Oriented Guided-Inquiry Learning (POGIL)
With group practices such as POGIL, students use class time to work in learning teams on specially designed activities. These activities promote mastery of content and the development of skills when problem solving, communicating, and assessing. Students take on greater responsibility for their education; they learn to rely on thinking skills rather than memorization; they improve performance skills while learning subject content; and they develop positive relationships with other students and faculty (Hansen, 2006). For more information see: http://www.pogil.org/post-secondary

Think-Pair-Share
The instructor poses a question requiring reflection and gives students time to think through and possibly write an appropriate response. Each student then turns to a partner and shares responses. Finally, the students share their responses (and/or responses of their partner) with the class. A variation on this strategy is “think-pair-scare,” where students take a short quiz after reviewing with a partner.
Notable Studies
DeHaan, R.L. (2005). The impending revolution in undergraduate science education, *Journal of Science Education and Technology*, 14(2), 253-269. The author writes: “There is substantial evidence that scientific teaching in the sciences, i.e., teaching that employs instructional strategies that encourage undergraduates to become actively engaged in their own learning, can produce levels of understanding, retention and transfer of knowledge that are greater than those resulting from traditional lecture/lab classes.”

Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education*, 93(3), 223 – 231. In this review of literature on active learning, the author notes that students remember more content if brief activities are introduced to the lecture rather than “covering” more material. He found that although the results vary in strength, there is broad support for active, collaborative, cooperative and problem-based learning.


Wood, W.B., & Gentile, J.M. (2003). Education: Teaching in a research context. *Science*, 302, 1510. Physics, chemistry, and biology educators developed and used objective tests to compare student learning gains in traditional courses and in courses that used active engagement methods. The results provided substantial evidence that students acquired and integrated new knowledge more effectively in courses which included active, inquiry-based, and cooperative learning, and courses that incorporated information technology, than in traditional courses.
Resources


A problem-based learning (PBL) model is a type of group-oriented, engaged learning in which students participate in solving complex problems and working together to find a resolution. PBL encourages students to connect disciplinary knowledge to real-world problems—and, in the process, motivates students to learn.

Studies have demonstrated that PBL improves the long-term retention of knowledge and increases library use, textbook reading, class attendance, and promotes better study habits (Major & Palmer, 2001; Strobel & van Barneveld, 2009). PBL also promotes studying for meaning rather than simple recall. Working on problems that are at an appropriate level of difficulty is rewarding. However, instructors should be aware that assigning problems that are too easy or too difficult can frustrate the learner (Kuh et al., 2005, 2008; Major & Palmer, 2001; Strobel & van Barneveld, 2009).

Several meta-analyses have provided a synthesis of the effects of PBL and have compared PBL to traditional forms of instruction (Major & Palmer, 2001; Strobel & van Barneveld, 2009). Strobel and van Barneveld (2009) found that PBL was more effective when it came to long-term retention, skill development as well as teacher and student satisfaction. Traditional approaches, however, were better for short-term retention as measured by standardized board exams.

Steps for Creating Problem-Based Learning Strategies Within Teams. Adapted from Study Guides and Strategies: http://www.studygs.net/pbl.htm

1. Give each team an "ill-structured" problem and ask them to discuss this problem within their teams. (For tips on creating good problem, see http://fhs.mcmaster.ca/pbls/writing/intro.htm.) Having the team reach a consensus about the issues in each of the following steps is an important part of PBL.

2. Create lists of what is known about the problem as well as what strengths and capabilities each team member has.

3. Create a written explanation of the problem based on the group's analysis of what is known and what is needed to solve it.
4. List possible solutions, order them from strongest to weakest.

5. Choose the best solution.

6. List actions to be taken to solve the problem using a timeline.

7. Create a list of what is needed to know to solve the problems as well as possible resources. Determine if you will need to work individually or in teams to solve the problem. If your research supports your solution, and if there is general agreement, go to (8). If not, return to (4).

8. Outside of class, write up the solution with supporting documentation and present it by summarizing the problem, the process, and the solution.


Resources


Resources (cont.)


University of Delaware: Problem-based learning at the University of Delaware. Retrieved from: http://www.udel.edu/pbl/problems/
The more elaborately we encode a memory during its initial moments, the stronger it will be (Medina, 2008, p.133).

A picture is worth a thousand words. – Unknown

Investigators in large meta-studies have concluded that multimodal learning can be more effective than traditional, unimodal learning (Fadel, 2008; Kress et al., 2006; Medina, 2006; Tindall-Ford et al., 1997). Multisensory learning stimulates several senses, which allows the brain to encode a memory more deeply. The more elaborately a memory is developed, the more meaningful the learning will be because the brain has to work harder to process information.

Teaching using multiple modalities is different from teaching to “learning preferences” or “learning styles.” Teaching to learning styles matches instruction to the students’ supposed learning style (e.g., visual, auditory, read/write, or kinesthetic). In recent years a number of studies have shown this practice to be ineffective (Dela-houssaye, 2002; Pashler et al., 2008).

Approaching a concept from multiple angles, however, and asking students to use more than one of their senses strengthen their overall understanding. Our senses evolved to work together so we learn best if we stimulate several senses (Medina, 2006). For example, adding visuals to text and/or auditory learning can lead to considerable improvements in learning (Fadel, 2008; Medina, 2006). Several studies have demonstrated that after three days participants remembered only 10% of information received via auditory input. However, when a picture was added to this input, participants remembered 65% of the information (Kalyuga, 2000; Mayer & Gallinni, 1990; Medina, 2006; Pieters & Wedel, 2004; Stenberg, 2006; Vekiiri, 2002).

Functional magnetic resonance imaging (fMRI) scans demonstrate that our brains process visual, textual and auditory input in separate channels allowing for “simultaneous reinforcement of learning” (Fadel, 2008). Thus, students using combinations of visuals and text learn more than students who use only text (Fadel, 2008).
When engaging students in complex tasks instructors need to be careful to give students time to reflect and process, avoiding cognitive overload (Kalyuga, 2000). In-class writing exercises, group work, or simply turning to write on the board gives students a moment to process. Moreover, the senses do not need to be simultaneously stimulated; they can be sequentially stimulated. For example, an instructor may decide to begin with a lecture then follow with discussion or an activity. In this way students use more than one of their senses to reinforce their learning.

--- Instructional Applications ---

Create opportunities for students to hear, read, write, see, talk, act, think, and touch new material.

Involve as many senses as possible in your teaching and students’ learning. Encourage students to create concept maps or mind maps, work in pairs or groups, free write, take a practice quiz, or solve a problem on the new material (Nilson, 2010, p. 5). Introduce a concept with one modality then reinforce student learning by using a different modality. For example, begin class with a discussion then reinforce student learning by adding a visual or kinesthetic element.

**PowerPoint**

Keep in mind when creating a PowerPoint presentation, a picture really is worth 1,000 words. Instructors are encouraged to use more images and less text to make these presentations more memorable (Mayer & Gallinii, 1990; Medina, 2006; Pieters & Wede, 2004; Stenberg, 2006; Vekiri, 2002).

**Continuum exercise**

After students have read a text or have heard a short lecture, ask them to move their desks out of the way (this exercise will require use of the whole room). Tell students that you will be reading a series of statements and where they stand in the room indicates if they agree or disagree with your statements. For example, if they stand at the far end of the room it indicates that they agree, if they stand closer to the front end of the room they disagree. The students may also stand anywhere in between. Students must defend their position, but they can also move if they are convinced by their peers’ arguments. This exercise requires not only that students have read the text before class, but also that they listen to their peers’ opinions during discussion.
Posters
By creating paper or virtual posters students are encouraged to both synthesize material and use more than one of their senses. Have students examine a number of posters and then select the criteria for making their own. Next, either as individuals or in small groups, they can design their posters. Once students have a basic design, allow time for students to get peer feedback on their work. Students can then present their posters either for the class, or for other students in their discipline (National Council of Teachers of English, 2004).

Reenactments
Encourage students to bring costumes and props to class to reenact scenes from historical or literary texts, ethnographies, etc. When introducing historical influences on the topic at hand, students can arrive in costumes, introduce themselves as that historical figure, and take questions about their contributions. Or as an alternative, students can hold a debate, but they must do so based on the beliefs or writing of their character. This requires that students have a firm grasp of the writings or actions of their character before arriving to class.

PechaKucha
PechaKucha pronounced "pe/chahk/cha" is Japanese for "chit chat." It was created in Tokyo in 2003 by two architects as a new way to deliver PowerPoint presentations. In PechaKucha 20 slides, each shown for 20 seconds for a total of six minutes and 40 seconds, are advanced automatically as the speaker presents. This practice follows the brain-friendly guideline of grouping or chunking information into short learning segments. It also requires the presenter work to distill content to the most important points. To use PechaKucha effectively, use more graphics and very few words on each slide. Then build five to 15 minute discussion periods after each presentation. Encourage students to talk with each other about the information, not just ask the presenter questions. Asking questions helps students to process the new information and connect it to prior knowledge. For more information, see http://www.pecha-kucha.org
Notable Studies


Tindall-Ford, S., Chandler, P., & Sweller, J. (1997). When two sensory modes are better than one. Journal of Experimental Psychology: Applied, 3(4), 257-287. The results of this study indicate that when participants incorporated audio text and visual diagrams into their study they performed better than those who studied only using visual tools.

Pescuric, A., & Byham, W.C. (1996). The new look of behavior modeling. Training & Development, 50(7), 24-30. This short article demonstrates how the five-step training practice of behavior modeling—content overview, positive model demonstration, skill practice, feedback, and a discussion of application—can be adapted for learners who want relevant content and want to use new technologies that engage multiple senses and modalities.
Resources


Extension 2.1: Crafting an Effective Lecture

An effective lecture is an important teaching tool. Silberman (1996) advocates making lectures meaningful by beginning them with interest-building devices, using methods to enhance retention, and reinforcing main points with student involvement.

*Interest building devices*
- A visual, a question, or an anecdote can capture student attention.
- Introduce an intriguing problem around which the lecture will be structured.

*Methods of enhancing retention and understanding*
- Use key words or "headlines" to reinforce major points.
- Use real life examples and analogies that activate students' prior knowledge on a topic.
- Use graphics and handouts to reinforce main points.
- Pause during the lecture and ask students to create examples to illustrate the point being discussed.

*Reinforcing main points with student involvement*
- Solve a problem with information given in the lecture.
- Ask students to assess their own learning by reviewing with each other or in groups.

When switching gears during a lecture, instructors often try to interest students by presenting cues or questions about something they perceive as interesting or unique. However, instructors need to give students information that will activate prior knowledge or will help them better understand the concept. Students need to be able to filter out unnecessary information in order to understand the critical content. For example, to introduce a unit on the solar system, an instructor might ask students what they know about UFOs. While students might find this topic of interest, it does not activate prior knowledge about the solar system. Having students focus on extraneous material will distract them from the primary learning objective.

Medina (2008) suggests a more systematic approach to "reboot" a lecture. Rather than presenting a fifty-minute lecture, he advocates planning the class in five ten-minute chunks. Before and after each chunk, give the meaning and background of the concept, idea, or skill.
Notable Studies
The major finding from this study was that in a traditional lecture, students could recall approximately 70% of the content from the first ten minutes of the lecture, but only 20% from the last ten minutes.

Adult learners were most engaged for the first 10 – 20 minutes of a lecture. The authors observed students in over 90 lectures, with twelve different lecturers, recording lapses of student attention. They noted that students paid attention less after 10 to 18 minutes of class. This window became shorter and shorter as the lecture proceeded and sometimes there would be a lapse after three or four minutes.

Resources


Extension 2.2: The Reverse Lecture or the "Flipped" Classroom

In many traditional classes, students listen during class time then practice or do homework on their own outside of class. A flipped class does the opposite. Reversed, inverted, or "flipped" classes have students listen to a short pre-lecture on their own outside of class, and then engage in discussion or activities during class time. Post a ten-minute mini-lecture or video on your Moodle or Blackboard site to be viewed by students prior to class. Students can watch this screencast or short narrated video, as many times as needed in order to grasp complex concepts. The reverse lecture allows time in class to respond to questions, work in small groups, and discuss misconceptions. It is also an effective way to get students actively engaged in content-rich courses. In addition, absent students can stay on-track with less instructor intervention.

In order for reverse lectures to work, instructors must hold students accountable for watching the videos. Some instructors assign homework related to the video due at the beginning of class. It is also possible to embed quiz questions within a video with technologies such as Camtasia Studio. If students get a question wrong, they need to re-watch that segment of the video. Alternately, students can be asked to take an on-line quiz before class using Moodle or Blackboard, or taking a short quiz using clickers or paper and pencil at the beginning of class. (Free online resources include: Jing (which is limited to five minutes) from Techsmith, Screenr, and Screencast-o-matic. PresentationTube is another good resource for creating reverse lectures. For more information, see: http://www.flip-teaching.com/ and http://mashable.com/2008/02/21/screencasting-video-tutorials/)

The instructor can then give a mini-lecture in class focusing on the most difficult part(s) of the material, making connections, and helping students conceptualize the material where they need guidance. This activity might take 20-30 minutes of lecture time. During the remainder of class students engage in activities that apply the new information. For example, they could be asked to use a think-pair-share activity and then journal about how they reached their answers. During student discussions the instructor can circulate the lecture hall to listen and coach.
Notable Study

“Interactive windows” are activities imbedded in a lecture such as discussions, problem-solving exercises, and “think-pair-share” strategies. Huxham examined the use of these short interactive windows in first year evolution lectures over five years. Evaluations of the teaching involving more than 500 responses identified the interactive nature of the lectures as the single most popular feature of the sessions. The classes that were taught interactively showed strong evidence of their positive influence for recall and learning.

Resources


Part II. Strengthening Learning Based on How the Brain Processes Information

Teaching is the art of creating conditions that lead to change in a learner's brain (Zull, 2002, p. 5).

How can we support students who are novices in our disciplines? How can we help them remember and process information for long term-memory and retrieval rather than for short-term responses on an exam? In this section, we share studies that discuss the importance of repetition as well as the brain’s need to organize information into an established framework to remember and retrieve. We also recognize the critical role that emotion plays in learning.

This section elucidates the implications of recent brain-based research on teaching. Our intention is not to provide a comprehensive study of the neuroscience of learning, which is beyond the scope of this project, but rather to present a brief overview of the more relevant aspects of this field for teaching. For more complete resources about memory and cognition we refer the reader to the following bibliography.

Resources


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3. **Repeat to Remember, Remember to Repeat**

Long-term memories occur from accumulations of synaptic changes in the cortex as a result of multiple reinstatements of the memory (Medina, 2008 p. 141).

Deliberately re-expose yourself to the information if you want to retrieve it later. Deliberately re-expose yourself the information more elaborately if you want the retrieval to be of higher quality. Deliberately re-expose yourself to the information more elaborately, and in fixed, space intervals, if you want the retrieval to be the most vivid it can be (Medina, 2008 p. 133).

Repetition is essential to learning because it is one way that short-term learning is converted into long-term memory (Zull, 2002, p. 129). When a memory is formed, a pathway is created between neurons. Just as a well-worn path becomes a road from continued use, the more we repeat ideas or skills, the more likely it is that we will be able to recall or replicate them (Reiser & Dempsey, 2007).

Learners acquire new information more effectively if it is introduced gradually and repeated in timed intervals (Brown, 2004;
Kornell, 2009; Squire, 2004). By repeating deliberately, wisely, and with a twist to avoid boredom, educators increase the probability that the learner will store information in their long-term memory where it can be retrieved and applied when required.

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### Instructional Applications

**Student-created learning tools**
Encourage students to create their own learning tools such as flash cards, outlines, power point, MP3s or practice sessions. These tools allow the students to re-expose themselves to material outside of class that they will need to recall on a quiz or exam. There are interactive web-based sources for this such as http://www.flashcardmachine.com/

**Breaking down skills into parts**
When a class involves learning a particular skill, such as giving an oral presentation, learning to interview, or performing a piece on a musical instrument, divide the skill into its component parts. This allows the student to know which parts of the skill need his or her attention, and s/he can then design ways to practice the skill. The famous golfer, Tiger Woods practiced hitting golf balls out of sand traps hundreds of times in one session to hone this skill (Medina, 2008).

**Reinforce the goal**
Medina (2008) suggests that during class time it is helpful to refer back to objectives and reinforce goals every ten minutes, but in a varied way through questions, restating the goal verbally, and referring to the goal on the board or in a slide. Concepts can also be presented in a variety of ways (discussion, lecture, visuals) so the learner has to use different parts of the brain to process the information.

**Value remembering**
Make sure students know the value you place on retaining information and encourage them to repeat in order to remember out of class. This can be done by using short quizzes.

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Notable Studies
Craik and Lockhart first proposed the term “elaborative rehearsal” involving deep processing of a to-be-remembered item resulting in the creation of long-term memories. Maintenance rehearsal, on the other hand, is simple rote repetition. An example is when presented with a list of digits for later recall (210452212), grouping the digits to form a phone number transforms the meaningless string of digits into something that has meaning.

In a study with 53 adults, subjects who elaborately encoded or worked to make purposeful connections to assigned reading did significantly better at reading comprehension and working memory tasks than those who simply read the text.

Resources


Extension 3.1: First Things First

Students tend to remember best information or experiences presented first; they remember second best what is presented at the end of class. Their recall of skills and concepts taught just past the middle of class is weakest. These findings are known as primacy and recency in "serial position effect" (Reed, 2004; Terry, 2005).

In a 2005 study, college students viewed lists of 15 commercials and were asked to recall the product brand names (Terry, 2005). When tested they easily remembered the first commercials (a primacy effect) and the last (a recency effect). Their ability to remember the products from commercials viewed in the middle, however, was significantly lower. In a test administered at the end of the term, recall of the first items persisted, while recall of the middle and last items disappeared.

In an additional study, Burns (1985) asked students to write summaries of presentations heard during class. He found that students recalled the most information from the first 5 minutes of class. Recall then declined, but was relatively constant for the next 10-minute segment, and dropped to the lowest level during the 15- to 20-minute interval of class.

**Instructional Applications**

- Instructors can capitalize on the primacy/recency effect by introducing the most important information at the beginning of class when retention tends to be best.

- Mid-class is a good time to give students a chance to reflect. This gives the brain time to assimilate new information. Inserting
pauses, having students interact in groups, or write brief responses allows time to make connections and helps the brain stay engaged.

- It is critical to plan the end of each class. Plan what you want the students to take away whether it is a single point or a summary of the class. End strong with content rather than announcing that time is up.

- Ask students to summarize the key points discussed either as a class or in an exit paper.

- Medina (2008) advocates teaching in ten minute “chunks” to keep students’ attention. (See Extension 2.1 on creating an effective lecture.)

- Highly engaged students will learn regardless of when the activity is presented. While thoughtful instructors are aware of the research cited above, they also know that the quality of the learning activity is more powerful than the timing of the in-class activity.

Resources


4. Learning that is Infused with Emotion is Stronger

Emotion is an on/off switch for learning...the emotional brain, the limbic system, has the power to open or close access to learning, memory, and the ability to make connections (Vail, 2010, p. 3).

Audiences check out after ten minutes, but you can keep grabbing them back by telling narratives or creating events rich in emotion (Medina, 2008, p. 94).

The link between learning and emotion is powerful: emotion gets our attention; our memories retain these charged events for long periods of time. An example of this connection was recently made by Nilson (2011). She asked webinar participants to recall where they were a week ago Tuesday, a year ago on June 21, the evening of their previous birthday, and the day of the 9/11 tragedy. Of course, attendees were much more likely to remember their birthdays and the 9/11 tragedy. When we have learning experiences that involve emotion—whether it is fear, anger, excitement, drama, humor or empathy—those experiences are more likely to be remembered (Medina, 2008).

What is happening in the brain to trigger this memory? When the brain detects emotion, neurons release the chemical, dopamine, which signals other neurons. Positive and successful learning activities stimulate the brain to reward itself through the release of neurotransmitters such as dopamine and serotonin (Medina, 2008; Turk-Browne et al., 2006).

Such chemical activity in the brain is good news for instructors, as we can strategically create learning environments that provoke emotional responses from students. When a student feels safe or affirmed while learning, this will link the new material to those pleasant feelings (Hodges, 2010). “Learning is not simply a cognitive activity—but one tied to our emotional investments, motivations, and senses of ourselves” (Lattuca & Stark, 2009, p.153). People learn better when material evokes emotional and not just intellectual or physical involvement. A learning experience must make enough of an impact to motivate people to want to learn it.
Instructional Applications:

Positive environment
Work toward creating a positive environment in class. Take an interest in your students, learn their names, and explain the purpose of the various teaching strategies to create relevance.

Positive attitude
A positive teacher attitude and passion for the topic go a long way in making learning pleasant and successful. (see Extension 4.1 on the syllabus). We learn more deeply when we are challenged, engaged, and experiencing success.

Reminders
Reminding learners what they already know makes them feel less anxious and gives them a positive feeling about what they are learning.

Bait the hook
“Bait the hook” throughout the class with concise narratives related to your topic. These examples could be humorous, moving, or provocative to (re)capture the students’ attention.

Review games
Create a game that will review the concepts learned and simultaneously allow learners to feel successful. User-friendly templates for Jeopardy and other games can be found at: http://teach.fcps.net/trt10/PowerPoint.htm

Instructor emotion
Nilson (2010) invites educators to be “dramatic, humorous, surprising, maddening” and encourages them to allow students to reflect on and write down their responses to the material. “Any emotion will aid learning by inducing more enduring changes – that is, the generation of new, lasting synapses – in the brain.” (p. 5)

Notable Studies

In this study, where thirty-six students were interviewed about motivation, the authors found that students had less motivation if a course was based
on theory alone. When students understood how the theory could be applied to the discipline or profession, they became more motivated. Guest speakers, field trips, community-based learning, and problem-based learning can all establish relevance and motivate student learning.


The authors note “[M]any faculty members are willing to address students’ intellectual (cognitive) development but uncomfortable with the idea that they are responsible for personal, attitudinal, or career development. Separating intellectual outcomes from others, however, is both artificial and counterproductive because intellectual development is inextricably linked to students’ emotions and attitudes, that is, their affective development.” (p.153)

Resources


Nilson, L. (2011). The mind has a mind of its own: Teaching and learning that’s in sync with the mind. Webinar. Emphasis on Excellence, Inc. (webinar)


Websites with Strategies to Build Classroom Community


**Group Introductions --Get-Acquainted Team Building Activity**, a method for introducing students to one another for group work or for an entire small class; includes reflective questions. Kathryn J. Cox, Ohio State University Extension. Retrieved from: http://www.ohio4h.org/youth/teen.../GroupIntroductionsinpdf_001.pdf

**Not Quite 101 Ways to Learning Students’ Names**, Teaching Resource Center, University of Virginia. Retrieved from: http://trc.virginia.edu/Publications/Teaching_Concerns/Misc_Tips/Learn_Names.htm


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**Extension 4.1: Creating an Effective Syllabus**

Developing a course by backward design when done thoughtfully can help build a more focused course. For example, when Ken Bain, author of What the Best College Teachers Do, is planning a syllabus he asks himself the following questions:

1) What big questions will my course help students answer?
2) What skills, abilities, or qualities will my course help them develop?
3) How will I encourage my students’ interest in these questions and abilities?
4) What reasoning abilities must students have or develop to answer the questions that the course raises?
5) What mental models are students likely to bring with them that I will want them to challenge?
6) What information will my students need to understand in order to answer the important question of the course? How will they best obtain that information?
7) How will I spell out the intellectual and professional standards I will be using in assessing students’ work? Why do I use those standards? How will I help students learn to assess their own work using those standards? (pp. 48-67)
He develops his syllabus from the answers to these questions. Rather than designing a syllabus solely around content topics, the syllabus becomes a means to determine what teaching and learning strategies best achieve the course goals.

Whether or not an instructor chooses to use backward design, it is important to create a thoughtful syllabus. Singham (2007) and Wasley (2008) advocate abandoning the traditional rule-laden syllabus for a less legalistic and more learner-friendly syllabus. Wasley notes that in studies where syllabi have a less punitive tone, such as fewer bolded statements with exclamation points regarding consequences if assignments are late, students are more likely to approach their professor.

Singham (2007) goes so far as to advocate that students build their own syllabus. (For an example, see http://www.aacu.org/liberal-education/le-fa07/le_fa07_myview.cfm) He suggests that professors go to class the first day with a tentative timeline for reading and writing assignments. When students and professors know one another better, they discuss and decide together the criteria for a good paper, define good participation, and create rubrics for assessing student performance. In his experience this collaborative syllabus causes students to be more invested in classes.

Most instructors include the following components in an effective syllabus:

- course information (course number, days, hours, location)
- instructor contact information and office hours
- course requirements, grading scale, and criteria
- required and optional materials
- course purpose and learning outcomes
- policies on attendance and missed or late assignments
- academic integrity policy
- organization of the course with calendar
- statement that the syllabus may be subject to change by mutual agreement

(adapted from Nilson, 2010, p. 33; Lowther, Stark & Martens, 1999)

Syllabi are frequently reviewed in the promotion and tenure process. Instructors are encouraged to check with their institutions on the role the syllabi will play in assessment processes.

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Resources


O’Brien, J.G., Millis, B.J., & Cohen, M.W. (2008). *The course syllabus: A learning centered approach.* 2nd Ed. San Francisco: Jossey-Bass. This book guides readers through the planning stages of developing a learning-centered syllabus. It uses eight principles of designing a course that foster critical thinking and a checklist for the content of a learning-centered syllabus. It also presents how to construct a syllabus that shifts from what material a course will cover to one that reflects what tools and information an instructor can provide students to help them learn. Examples of syllabi are included.


Slattery, J.M., & Carlson, J. (2005). *Preparing an effective syllabus: Current best practices.* College Teaching. 53(4), 156-64. This article suggests that the tone of a syllabus (friendly or punitive) sets the tone for class, citing studies that indicate students perform better in classrooms where a friendly tone is set. The authors also suggest that a syllabus should be the product of a strongly articulated teaching philosophy.

Wasley, P. (2008). Research yields tips on crafting better syllabi. *Chronicle of Higher Education.* 54(27), A11-12. This article cites a study where “The requirements on both (courses) were identical, one syllabus phrased them in negative or punishing terms, and
Resources (cont.)

the other in positive or rewarding terms. One syllabus told students who did not seek advance permission to miss an examination that they would be “graded down 20%.” The other syllabus stated that students who did not seek permission would only be “eligible for 80% of the total points.” While students appraised both classes as having similar level of difficulty, they said they would be significantly less comfortable approaching the author of the punishing syllabus.” The article also describes a study on the use of pronouns in syllabi revealing “you” to account from 55%-82% of pronouns used. The authors suggest instead that that there should be “you and I sections that enumerate specific responsibilities of each party.”

The author interviews professors about the syllabus meant to prevent conflict from the beginning. She also discusses the learner-centered syllabus.

5. The Brain Seeks to Scaffold and Organize Learning

There needs to be a reason for the brain to remember information, and it is better if this reason extends beyond just being able to pass a test (Barkley, 2010, p.101).

Thinking means connecting things, and stops if they cannot be connected. – G.K. Chesterton

Current research tells us that the brain does not retrieve knowledge as a collection of facts, but instead “processes, stores, and retrieves knowledge...as a logically organized whole” (Nilson, p.6). When we engage in a new activity “the raw sensory information comes to us in bits and pieces with little or no meaning. To derive meaning we must integrate the new sensory information into what we already know” (Hodges, 2010). We can help students put new information into a conceptual framework by:

1) helping the learner to analyze their prior knowledge
2) helping the learner understand how new information fits into the discipline
3) correcting inaccurate perceptions
4) making information personally meaningful to the learner.

All students come with prior knowledge; it is the place from which learning begins. However, because students have insufficient or inaccurate prior knowledge and are novices in our disciplines, they frequently do not have the framework or learning strategies to approach the concepts in organized structured ways (Svinicki, 2004). By helping students identify conceptual similarities and differences we give them fewer independent pieces of information to learn. Fewer random pieces of information are easier to process and retain.

Relevant experiences and instruction that builds on prior knowledge enhances comprehension (Braun & Bock, 2007; Caine, 2005). That is, to remember new information it must be relevant, meaningfully organized, and connected to a larger body of knowledge. When students connect what they are learning to information they already know, they are better able to anchor the information into their long-term memory. Having multiple connections between what they are learning and what they already know also make it easier for the students to access new information when they need it (Nilson, 2010; Zull, 2002).
Instructional Applications

Give a short overview of the lesson
Begin by briefly highlighting the organization of the lesson either verbally or visually. This "signaling" helps students prepare for key points to be presented (Mautone & Mayer, 2001).

Connections and patterns
Ask students to make connections and see patterns between new information and knowledge they may already have. These connections allow students to activate prior knowledge, and allow the instructor to assess the level of prior knowledge, and correct inaccurate perceptions (Zull, 2002).

Relevance
Help students connect new information to a broader knowledge base by making it personally or professionally relevant to them. Students are more engaged learners when they make connections between their studies and their lives, their disciplines and their profession (Prince, 2004).

Purpose/Transparency
When sharing the syllabus on the first day of class, explain the purpose behind the assignments to help students learn how to learn in your class. Continue to remind students why you are asking them to do this type of work throughout the semester.

Guest speakers and field trips
Teachers can facilitate learning by connecting new learning challenges to students' interests and skill levels. Zull (2002) suggests that activating relevant experiences of the students may be more important to teaching than presenting students with new information (p. 119). There are a number of ways to achieve this: using the media, showing the students the relevance of their studies to professional, disciplinary, and "real world" concepts via guest speakers and field trips. Community-based learning can also be an excellent tool (see Extension 5.1).

Stories, analogies, and metaphors
Metaphors, stories, and analogies can enhance and enliven descriptions, and express thoughts and ideas more clearly and precisely. Creating analogies is one way of helping students bridge the gap
between the new and the old. Analogies have proven to be effective learning tools for reinforcing thinking skills and conceptual understanding (Alvermann & Phelps, 1998).

**Prior knowledge**

Educators can access students’ prior knowledge by asking students to draw concept maps (see Extension 5.2). This also allows instructors to assess and address inaccurate or incomplete prior knowledge. Early in the term give students free writing assignments where they are asked to think about and organize what they know about the material in the class. When determining students’ prior knowledge, educators should use caution inviting students to guess at answers openly in class or to share inaccurate ideas before a new concept is presented because the students may later recall the incorrect information.

_______________________________________________________

**Notable Study**


The author offers the example of an English teacher asking a class the definition of *onomatopoeia*. Students gave the wrong answers because they didn't know what the word meant. They also gave the same wrong answers in a subsequent test, in part, because they heard them in their initial class.

_______________________________________________________

**Resources**


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**Extension 5.1: Community-Based Learning**

Community-based learning (CBL) can be a powerful means to make the classroom come alive for the students. It is important to remember that CBL differs from both volunteerism (which focuses on community benefit) and internships (which focuses on student benefits). Ideally, CBL should be equally beneficial to the student and the community. CBL works best in the context of a rigorous academic experience. While a valuable community experience is a requisite part of CBL, it must also include a strong academic, classroom-oriented component. Before, during, and after students’ community experience, classroom activities should guide and challenge the students to process, understand, and relate their experiences to other course materials.

Instructors sometimes regard community experiences in the same way they do a traditional text. CBL can function as a primary, supplementary or optional text. In a traditional course, students are not normally graded on having completed the reading; instead, they are graded on how they demonstrate the knowledge via tests, papers and presentations. Community-based learning can work in a similar way-- students are graded, not for the time they spend in the community, but for the academic product they create as a result of that service experience.

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**Instructional Applications**

*Sociology*

Students could partner with a community agency and conduct service hours. The professor could then ask the students to turn in installments of field notes throughout the semester that could be used as
the data source for a final paper. In a theory course, students could apply sociological theory to field note data. In a quantitative methods course, students could identify and critique their data collection efforts, producing a final paper on the use of qualitative research methods.

**Environmental Studies**
Students conclude their semester with a hands-on service to their local environment, cleaning up a park, planting trees, or conducting environmental education programs. After their time in the community, they write a final paper relating their experience to their studies during the semester.

**Spanish**
In a Spanish Conversation Class, students work with children in the local Hispanic community. This could be in the form of an after-school program, tutoring, or as a mentor. For their culminating activity, they reflect on their service and what they learned by producing videos about their experience. They then watch everyone’s videos and have a class discussion as a final reflection.

Resources

*Boyer makes a powerful argument for engaged learning, stating “scholarship has to prove its worth not on its own terms, but in its service to the nation and the world.” Excerpts from this article may help students understand why they are being assigned a service project and its importance to the classroom.*


*Recommended to faculty who are new to service-learning/CBL. This article discusses the importance of reflection and includes guidelines for creating and grading activities related to CBL.*


*The authors discuss the ways in which effective reflection can be taught and offers detailed guidelines for teachers to help their students get the most out of the process.*

Extension 5.2: Concept Maps

Concept maps, which were initially developed to enhance meaningful learning in the sciences, are graphic organizers that represent relationships among ideas, images, or words. Each word or phrase is connected to another and linked back to the original idea. The maps are a way to develop logical thinking and study skills by revealing connections and helping students see how individual ideas form a larger whole.

Uses of concept maps
1. Assess prior knowledge – Ask students to create a visual representation of what they know about an idea or concept.
2. Show how experts organize knowledge – Build a map that shows students how you think – this exercise could also help in your own course design process.
3. Summarize reading – Students represent ideas in an article, the main points of a chapter, or the theme of a novel in order to see relationships.
4. Plan a task – Student groups first visualize a project or lab assignment in order to create an overview of the steps that are involved.
5. Conduct an assessment – At the end of a unit or course, students create a map to show what they have learned.

Instructional Strategies for Creating and Using Concept Maps
Adapted from Clark (2011) and Nilson (2010)

1. Identify the key concepts from the lecture or reading and put each one on a sticky note on a white board. Place the main concept in the center. Then rank order the concepts with the broadest ideas closest to the main topic. Circle concepts that have a relationship to each other. Draw dotted lines to indicate cross-links or connections between concepts. (Maps can also be transferred to paper or software.)
2. Give students a partially constructed map to complete.
3. Create several maps over time allowing students to see how their understanding changes.
4. Construct maps with reference to a “focus question” that specifies the problem or issue as a class.
5. Use software that allows multiple users to work on a map at the
same time.
6. Popular software includes: Cmap Tools, Mindmanager, and Inspiration.

Figure 1: A Concept Map on Concept Maps, by J. Novak created on Cmaps courtesy of IHMC.

Notable Study
Two groups of graduate students were taught to use concept maps as a constructivist learning strategy. They were followed over the course of a year to see the impact concept mapping had on their learning. Results indicated that these students became more aware of their own learning processes as well as their learning strategies significantly more than the control group.

Resources

**Resources (cont.)**


Part III: Assessment

Formative assessment is gathering feedback from your students that helps you know how to better form, or shape your classes and helps them know how to better study. Summative assessments, on the other hand, are usually graded high stakes work that assess a students' competency in the course. This chapter focuses on the research that documents increased student learning when frequent, low stakes formative assessment practices are utilized before the final summative assessment. We also offer examples of assessment strategies that can be incorporated into teaching.

6. Assessing Student Learning in Progress

The best teachers constantly monitor what is happening to students as they set about learning and investigate when things do not proceed as planned or expected. They also enquire their own practice so they might get better at ensuring that their students learn successfully (Demos, 2004, p.8).

Good assessment techniques make “your students review, retrieve, apply, analyze, synthesize or evaluate the material in your lectures, classroom activities, and reading assignments as well as their prior learning experiences” (Nilson, 2010, p.274).

Recent research indicates that formative assessment techniques may be more important than summative in terms of student learning. In two projects, Black et al. (2003, 2004) demonstrated that improving formative assessment raises student achievement. They also observed that: 1) current grading practices are often not effective in promoting good learning, 2) assessment methods tend to emphasize competition rather than personal improvement, and 3) assessment feedback often has a negative impact, particularly on low-achieving students. These students are led to believe that they lack “ability” and so are not able to learn. When improved formative assessment strategies were used, student achievement increased.
Collecting anonymous ungraded work or frequent low-stakes grading is based on the concept that when pressure to perform is minimal, students feel free to explore ideas or admit confusion. Regular low-stakes grading keeps students focused and on track. It can provide regular performance feedback so students and instructors know how they are doing in a course. It also creates a rich learning experience for all students and gives instructors opportunities to clarify materials. Because formative assessment practices are geared toward student learning it is important to respond to the students about the information gathered. Formative assessments are useful for active lecture breaks, priming the pump at the beginning of a class, or as a way to close the day’s class session.

Regularly asking students to work to apply and assess newly presented knowledge also promotes long-term-recall. When students are required to put additional effort into organizing and retrieving information, they are more likely to remember the information over time. Instructors can present skills and concepts in such a way that students must work to process this new information. This “desirable difficulty” makes new materials less forgettable. For example, after explaining a concept, an instructor can ask students to apply this idea to a new situation (Bjork, 1988).

*** Instructional Applications ***

*Minute paper or muddiest point*
In the last ten minutes of class, ask students to share the most important thing learned in class today or one to two important questions about the lecture or reading assignment. Instruct students to write down answers. These responses can be used to start the next class, which can motivate students to be punctual. See: http://www.insidehighered.com/news/2009/02/24/bruff

*Clickers*
Use clickers to ask questions to assess how well students understand the reading at the beginning of class or material discussed at the middle or end of class. See: http://podnetwork.org/publications/teachingexcellence/09-10/V21,%20N3,%20Bruff.pdf

*Scratch off sheets*
The Immediate Feedback Assessment Technique (IF-AT), uses a multiple-choice answer form with a thin opaque film covering the answer options. Students scratch off the coating of the rectangle correspond-
ing with the answer similar to scratching a lottery ticket. If the answer is correct, a star appears within the rectangle immediately reinforcing the learning. If the answer is incorrect, students must re-read the question and scratch off remaining options until the correct answer is determined. Students earn partial credit for multiple attempts and learn the correct response for each question while taking the test. Students can also work in small groups to come to a consensus on the correct answer. See: http://www.epsteineducation.com/home/about/default.aspx

**Higher-level questions produce deeper learning**
Bloom and Krathwohl (1956) created a tiered model of classifying thinking according to levels of complexity. Higher-level questions involve analyzing and creating as opposed to lower level questions that deal with labeling and memorization.

**Waiting for an answer**
Building time to think between asking a question and accepting responses from students increases the depth of answers. Students are more likely to participate in classroom discussions when they are given adequate time to formulate their responses.

**Questions are effective even before a lesson begins**
Research shows that using questions before a learning experience can serve to activate and access prior knowledge rather than asking questions after the learning (Hill & Flynn, 2006).

**Student-created flashcards**
Ask students to create their own flashcards to test themselves and others when working in small groups.

**Note-sharing**
Periodically, pause for a few moments and allow groups of two to three students to compare notes—filling in the gaps that they have and highlighting important information.

**Background knowledge probe**
Evaluating background knowledge can be used on the first day of class, or before introducing a new topic. Prepare two to three open-ended, five to six short answer, or 10-20 multiple-choice questions that assess the students’ existing knowledge. At the next class meeting, let students know the results and how this knowledge affects them as learners.
Knowledge survey
A knowledge survey is a variation of “background knowledge probe”. Instead of providing answers to multiple-choice questions, have students disclose how confident they are in answering each question accurately. For more information on knowledge surveys, see: http://www.isu.edu/ctl/facultydev/KnowS_files/KnowS.htm

Misconception/preconception check
Checking student misconceptions or preconceptions is particularly useful in classes with controversial/sensitive issues. Select a handful of troublesome beliefs that are common and most likely to interfere with student learning to create a simple questionnaire. Explain the purpose of this activity and when they should expect to receive feedback on their responses.

Pick your poison
Ask students to write test questions from material that was recently covered. Tell them that you will include the best questions on the next exam.

Pre and post assessment
Devise several questions for students to answer at the beginning of the semester (or class) that will let you know their knowledge and skill level and that will get at their underlying assumptions about the material. Ask the same questions at the end of the semester to determine whether they have learned what you hoped. You might also ask these questions part-way through the course.

Mid-course evaluation
After four or five weeks of classes ask students anonymously what is working and what improvements you might make to help them learn more effectively. Discuss the results with students so they know you are using the feedback seriously. It is often helpful to discuss the feedback with another colleague to get another perspective.

Focus/advisory groups
In a large class, pick six to ten people at random, or one from each section, to meet with you every few weeks to talk about how the course is going. Do more listening than talking in these meetings.

Frequent short assignments with feedback
If assignments/questions are suitably framed, instructors are able to gather valuable information about how students are understanding
the material. Some professors ask students to answer the questions before class, so that they can assess student knowledge before the class begins and can focus the class accordingly.

**Group instructional feedback**

Invite an outsider to ask students in groups of four or five the following questions: What works? What is not working? What suggestions can be offered to improve the class? The outsider then polls the group as a whole for their answers and reports on the conversation to the professor. Thus, students can speak anonymously (the outsider does not know who they are) and the focus is on solutions rather than concerns.

**Peer- and self-assessment**

For group assignments, ask students to complete and submit a confidential form used to assess how well they and other members of their group met particular expectations (that are clearly noted in the assignment). Examples might include meeting deadlines, providing feedback, dividing the workload, etc. Even when the information provided is not part of the students’ grades, the fact that they were given these forms at the start of the project helps pre-empt the common problems that can arise during group work such as division of labor.

**Think-pair-share**

See Principle 1. This strategy can also serve as an excellent assessment technique. Think-Pair-Share can alternately be presented as Think-Pair-Scare with the “scare” as a quiz. Variations on this strategy include asking students to reach a consensus. They can either write down their collective response to be turned in or to share it in a large class discussion.

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**Notable Studies**


This study involving 200 college students found that taking a practice test before an exam better prepared students than other methods of studying including repetition and concept mapping. Students were divided into four groups and asked to read several paragraphs about a scientific topic. Each group performed one of the following learning strategies: 1) reading the text for five minutes, 2) reading the text in four consecutive five-minute sessions, 3) drawing diagrams about information from the excerpt they were reading, and 4) reading the passage once and taking a “retrieval practice test,” requiring them to write down what they recalled. A week later, all four groups took a quiz asking them to recall facts from the passage they had read and draw conclusions based on those facts. The
Notable Studies (cont.)

students in the 4th group who took the practice test recalled 50% more of
the material than in the other three groups. The investigators concluded
that by organizing and creating meaningful connections and struggling
to remember information to identify areas of weakness that students were
able to better recall information.

Reconsidering the role of assessment feedback in student learning. Studies
in Higher Education, 27(1), 53-64.
This article reports the findings of a three-year research project investigat-
ing the meaning and impact of assessment feedback for students in higher
education. Formative assessment feedback was found to be
essential to encourage ‘deep’ learning.

Resources
Grunenberg, M., Morris, P., & Sykes, R., (Eds.) Practical aspects of memory:
Current research and issues, 1, pp. 396-401, New York: Wiley.

Press.

the black box: Assessment for learning in the classroom. Phi Delta Kappan,
86, 1-8.

Bloom, B., & Krathwohl, D. (1956). Taxonomy of educational objectives: The
classification of educational goals, by a committee of college and university

Brookfield, S.D., & Preskill, S. (2005). Discussion as a way of teaching: Tools and

stephenbrookfield.com/Dr_Stephen_D_Brookfield/Critical Incident _
Questionnaire.html

Bruff, D. (2009). Multiple-choice questions you wouldn’t put on a test: Promoting
podnetwork.org/publications/teachingexcellence/09-10/V21,%20N3%20
Bruff.pdf

Cornell University Center for Teaching Excellence. (n.d.). Course-level assessment
methods. Retrieved from: http://www.cte.cornell.edu/faculty/cl _
assessment_methods.html

Cornell University Center for Teaching Excellence. (n.d.). Using Rubrics to Assess
rubrics.html


Extension 6.1: Summative assessment techniques

Summative assessment is a recorded judgment about student performance. Some techniques for summative assessment include papers, exams, portfolios, projects, laboratory notebooks, artistic performances, demonstrations, journals, homework, problem sets, reports, clinical experience, research projects, case studies, posters, and exhibits.

Nilson (2010) summarizes research on test-construction based on Walvoord and Anderson (1998) and Suskie (2004): Test early and often to give students more feedback. Myers and Myers (2007) confirmed these findings. In their research they compared two sections of statistics with the same content and instructor. The control group had only a mid-term and final while the experimental section had bi-weekly exams and the same final. At the end of the semester, the experimental section that received regular feedback throughout the semester scored 15% higher on the final exam, had significantly fewer withdrawals, and ranked the course and instructor significantly higher than the control group.

For advice on constructing exams, see the following websites:


Tips for Grading

Grade in a pleasant place, free from distraction.
If you make grading a semi-pleasant activity, it will not be quite as painful.

Read five or ten papers before making any marks at all.
Assign preliminary grades on post-in notes. Place these notes in
order from best to worst, and determine your grading scheme from there. Create or revise your rubric. (See examples of rubrics below.)

Set a time limit for each paper.
Set a timer for each paper. Use your time limit as an average because some papers take longer than others.

Avoid grading marathons.
Grade no more than 20 pieces of student work at a time to avoid burnout and lack of attention to detail, then move on to something else.

Put potentially plagiarized papers in a pile, and check them all at once.
Checking for plagiarism can be time consuming. Put suspicious papers in a pile to be examined later. When you get to them, your first line of defense is Google or Google scholar. Take the oddest phrase you can find and put it in quotes.

Do not correct grammar/spelling on each page.
Trying to fix mistakes or highlight the errors on each page can take forever. Consider circling the offending words without comment. If a paper is “really” bad, take one paragraph and fix it. Then write in the margin that the rest of the paper should be similarly structured. Students do not tend to learn from comments made on written work after they have completed the paper and have received a grade (Semke, 1984).

Electronic markings.
Singham (2007) gives feedback on written work electronically and suggests the following as guides to revise papers:
Underline means awkward phrasing or the meaning is unclear.
Bold means unfamiliar material or words that require an explanatory statement.
Italics mean incorrect grammar, a typo, or the use of language that is too colloquial.
[ ] contains text that has been added by me or questions or comments.
Red means the statement is not commonly known and requires evidence or sourcing or a citation to back up the assertion.
Video feedback

ScreenChomp is a free iPad app that allows instructors to provide personalized feedback through a video. Instructors can take digital picture of a student paper, convert it to a pdf, write comments on it using 12 different “pens”, and then record a video edits. Before you meet with students, ask them to view the video of you giving them personalized feedback. All you will need is an iPad2, the free app, and a free Dropbox account. The videos can be downloaded as MP4 files, making them easy to share on ScreenChomp.com, Facebook, YouTube, iTunes, and Blackboard. All activity on ScreenChomp can be easily recorded and then edited through platforms such as Camtasia. A short explanatory video is available at: http://www.youtube.com/watch?v=igp7rHZRg4M&feature=youtu.be

How Students Regard Marked Assignments

Adapted from Composition Chronicle, M. Dossin (1992)

What students appreciate most is the opportunity to rewrite their assignments after they have been marked or discussed (Dossin, 1992). Students respond well when the standards are clear and they see in the feedback that the instructor has made a real effort to understand the student’s point and message. Students are particularly frustrated when assignments are returned with a grade as the only feedback, with only negative or sarcastic comments, or obscure jargon. Finally, students like to receive their papers back as quickly as possible, certainly before the next writing assignment is due.

Developing a rubric

1. Determine learning outcomes. Take time to describe the work before you judge it.
2. Keep it short and simple (Include 4 - 15 items; use brief statements or phrases.)
3. Each rubric item should focus on a different skill.
4. Focus on how students develop and express their learning.
5. Evaluate only measurable criteria.
6. Ideally, the entire rubric should fit on one sheet of paper.
7. Reevaluate the rubric (Did it work? Was it sufficiently detailed?)

A Rubric Assessing In-class Presentations

<table>
<thead>
<tr>
<th></th>
<th>Excellent</th>
<th>Good</th>
<th>Uncertain</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization of Presentation</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Knowledge of Concepts</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Communication of Concepts</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Enthusiasm</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
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<tr>
<td>Ability to Handle Questions</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Overall Evaluation of Presentation</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Comments:</td>
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<tr>
<td>BEGINNING</td>
<td>DEVELOPING</td>
<td>ADVANCED</td>
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<td></td>
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</tr>
<tr>
<td>ACCESS</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Does not show evidence of library use (physically or online).</td>
<td>Shows evidence of library use (physically or online).</td>
<td>Uses sources that are available from the library (physically or online).</td>
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<tr>
<td>Selects sources that suggest the use of elementary search strategies.</td>
<td>Selects sources that demonstrate basic searching principles.</td>
<td>Explores the searching mechanics of information resources (advanced search options, limits, controlled vocabulary).</td>
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<tr>
<td>UNDERSTAND</td>
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</tr>
<tr>
<td>Confuses primary, secondary, and tertiary sources.</td>
<td>May understand the difference between primary, secondary, and tertiary sources, but uses one type of source when another is available or more appropriate.</td>
<td>Understands the difference between primary, secondary, and tertiary sources and uses each appropriately.</td>
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<tr>
<td>Uses minimal variety of sources and no experts.</td>
<td>Uses some variety of sources in types.</td>
<td>Uses a variety of sources—primary, secondary, tertiary sources.</td>
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<tr>
<td>EVALUATE</td>
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<tr>
<td>Does not incorporate credible or authoritative sources.</td>
<td>Includes mix of credible/authoritative and questionable sources.</td>
<td>Includes only credible and authoritative sources.</td>
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<tr>
<td>Uses sources not relevant to topic.</td>
<td>Uses mix of relevant and irrelevant sources.</td>
<td>Uses only sources relevant to topic.</td>
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</tr>
<tr>
<td>Fails to recognize bias.</td>
<td>Partially recognizes and/or deals with bias.</td>
<td>Recognizes and deals with bias appropriately.</td>
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<tr>
<td>USE ETHICALLY</td>
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<tr>
<td>Fails to properly identify sources of information and ideas according to the standards of ethical use of intellectual property.</td>
<td>Properly identifies all sources of information and ideas according to the standards of ethical use—may be minor mistakes.</td>
<td>Properly identifies all sources of information and ideas according to the standards of ethical use and intellectual property. There are no noticeable mistakes.</td>
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<tr>
<td>Does not include a functional bibliography and/or in-text citations.</td>
<td>Includes a bibliography or in-text citations which may contain minor formatting errors or omissions.</td>
<td>Bibliography and in-text citations are consistent with each other and in proper formatting for the subject area.</td>
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<tr>
<td>USE ETHICALLY</td>
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<tr>
<td>Uses source material as indirect quote without adequate paraphrasing.</td>
<td>Attempts to paraphrase or summarize cited material but poorly worded/repurposed.</td>
<td>Effectively paraphrases or summarizes ideas/information from the cited source materials using original language.</td>
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<tr>
<td>CREATE</td>
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<tr>
<td>Does not develop insight, or does not include a range of sources and perspectives.</td>
<td>Develops some insights based on some sources and perspectives.</td>
<td>Develops meaningful insights based upon variety of sources and perspectives.</td>
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<tr>
<td>Demonstrates little or no synthesis of arguments/ideas, unable to integrate sources with each other or with one's own argument.</td>
<td>Demonstrates some engagement with sources tending toward summation, rather than higher-level synthesis.</td>
<td>Demonstrates sophisticated level of creative, critical synthesis.</td>
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<tr>
<td>Misrepresents other positions on the topic, or fails to identify or acknowledge other views.</td>
<td>Represents some other positions, with varying degrees of accuracy—may fail to acknowledge some major perspectives.</td>
<td>Accurately represents major/leading positions on the topic.</td>
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</tbody>
</table>

Table 1. Rubric for Assessing Information Literacy. This rubric was developed by Trinity University faculty members during a series of workshops in 2009-2010 with consultant, Dr. Megan Oakleaf of Syracuse University. This rubric was designed to assess information literacy of first-year students, but can be customized by faculty members to meet different needs.

Resources


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Notes: