Improving Classroom Performance by Challenging Student Misconceptions About Learning

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In an overview of the preparedness of high school seniors for college level work, Kuh (2007) comes to conclusions familiar to many teachers. Most entering students are not adequately prepared either academically or in terms of study skills for college level work. This preparation is predictive of college success. The result is that many students founder in college, despite the potential to succeed. As psychologists, we see this phenomenon in introductory psychology, among the most popular college courses and often taken in the first year. But, as psychologists, we can help to address this situation by sharing our knowledge of how people learn with students. This article describes several demonstrations that faculty can use either for teaching psychological concepts related to learning or for instructing students how to study more effectively.

For the past several years, I have addressed the entire entering class at my university on how to study effectively, in a presentation entitled *How to Study Long and Hard and Still Fail… Or How to Get the Most Out of Your Studying.* The presentation grew out of workshops that I have given for teachers at community and four-year colleges. I realized that the same information about how people learn that is useful for teachers to improve their teaching is also helpful to students for improving their learning. I generally give the presentation about five weeks into the fall semester so that most students have experienced their first exams. Students rate the presentation as highly useful to them.

The basic thesis for the presentation is the following. Students base their study practices on their beliefs about how people (specifically themselves) learn best. These beliefs determine choices such as whether or not they need to go to class and how they study. The more accurate these beliefs, which are often implicit, the more effectively the students learn. The more flawed the beliefs, the less effectively the students will learn. Unfortunately, the beliefs most students possess about learning are based on biases, untested intuitions, and erroneous assumptions.

It obviously is not possible to cover all the relevant concepts in a single 45 minute presentation. I focus on issues where I perceive students have the most counterproductive misconceptions. Specifically, I address mistaken student beliefs that are related to poor classroom performance, metacognition, and the levels of processing framework.

In the presentation, I start with the following list of “Beliefs about Learning that Make You Stupid:”

1. Being good at a subject is a matter of inborn talent rather than hard work.
2. Learning is fast.
3. Knowledge is composed of independent facts.
4. I’m really good at multi-tasking, especially during class or studying.

Dweck (2002) demonstrated that students who believe ability is inborn tend not to work hard or persevere; they seek to avoid failure rather than work for success. I see this attitude most often when I teach statistics, when students tell me “I’m bad at math.” The more constructive belief is, “I have to work especially hard at math.” Schommer-Aikins and Easter (2006) have linked beliefs that learning is fast and that knowledge is composed of isolated facts to poorer student performance. Most students, particularly weaker ones, grossly underestimate the time required to complete assignments and often feel that one good reading is enough to master material. Learning is slow and effortful, and students learn more during review than they do during initial reading. Weaker students also try to memorize isolated facts rather than trying to comprehend interrelated concepts. Bolded definitions in textbooks and the practice of rote memorization of those definitions on flashcards promote isolated learning. Finally, the research literature clearly shows that divided attention, a result of multi-tasking, is significantly less effective for learning compared to focusing on one task at a time (e.g., Fernandes & Moscovitch, 2000). Many students do not realize that distractions such as checking text messages or Facebook degrade their studying.

A key difference between strong and weak students is the quality of their metacognition. Metacognition refers to a student’s awareness of his or her level of understanding of a topic. Good students know when they have mastered material, but weaker students tend to be grossly overconfident (Dunning, Heath, & Suls, 2004). Students with poor metacognition are the ones who are confident they have done well on an exam and are then shocked by their poor score. They are the ones who tell their teachers, “I thought I really knew the material,” and “I studied so hard for this exam, I can’t believe I failed.”

Here is an activity that can help students to gauge their level of metacognition. As a final question on the first exam, ask students to write down an honest estimate of the percentage of questions they believe they got right, from 0 to 100%. When discussing exam results, prepare a scatterplot of their estimated scores against their actual scores. Students with good metacognition should fall close to the diagonal, but virtually the entire class will show an overestimate of their performance, and this overestimate will be larger for students with lower scores. In my presentation, I always show a graph of typical results. The point is not to embarrass weaker students, but to make them aware of the problem so they can make appropriate adjustments.

When students do poorly on an exam, they typically assume that they need to spend more time studying for the next exam. Students with poor metacognition, however, usually need to make changes beyond simply studying more (although that often helps). They likely have poor study strategies, which increase false confidence that they know the material without increasing actual learning (Roediger & Karpicke, 2006). Students need to change the way they study as well as the amount. Many students arrive at college with highly overlearned study skills developed in high school that are now ineffective. They possess a metacognitive sense that may have accurately informed them when they had studied sufficiently for high school, but is now no longer accurate. One of the major challenges students face in the transition to college is changing their entrenched but counterproductive study skills and metacognitive sense developed over many years of secondary education. The transition to college is not just about learning new study strategies, but also about overcoming old ones.

Simply telling students that they have misconceptions about learning is unlikely to change such entrenched beliefs (Chew, 2005). In my presentation to students, I use the following activity to persuade them. I pose the following question to the students:

Which of the following is the MOST important ingredient for successful learning?

1. The intention and desire to learn
2. Paying close attention to the material as you study
3. Learning in a way that matches your personal learning style
4. The time you spend studying
5. What you think about while studying

Everyone thinks of their answer. Then I tell them that when I give the signal, they should raise their hands with the number of fingers signaling their answer (one finger raised for alternative one, etc…). I then give the signal, and everyone can see the responses. Usually most of the group is split among alternatives one through four, with relatively few people choosing five.

Instead of telling the group the correct answer, I let them discover it through a demonstration of levels of processing and learning. In the Levels of Processing framework, memory is conceptualized as a continuum of levels going from shallow to deep (Craik, 2002). Depth of processing depends on how a learner encodes or rehearses information. Shallow levels involve encoding of meaningless physical characteristics such as spelling or font. Intermediate levels involve acoustic information such as rhymes. Deep levels involve distinctive semantic analysis. The deeper information is processed, the more likely it is to be recalled later. Although the Levels of Processing framework is no longer considered a viable model of memory, it still serves as a powerful heuristic for helping students to improve their study effectiveness.

In this demonstration, I manipulate level of processing using orienting tasks. An orienting task induces a person to encode information at a certain depth. I use orienting tasks devised by Jenkins and associates (e.g., Hyde & Jenkins, 1973). Students listen to a list of words. For each word, they carry out an orienting task that creates either deep or shallow processing. One group rates the pleasantness of each word (“Is the word pleasant?”), an orienting task that leads to deep semantic processing, Another group checks each word for the presence of an E or G (“Does the word contain an E or G?”), an orienting task that causes shallow processing. After completing the list, the students are asked to recall all the words. The group that did pleasantness ratings, the deeper processing orienting task, virtually always remembers strikingly more words.

For large groups, say over 40, I use a 2 × 2 between groups factorial design with levels of processing (deep or shallow) as one variable and intent to learn (intentional or incidental) as the other. In the intentional learning condition, students are forewarned they will be asked to recall the words at the end of the orienting task. In the incidental condition, students are not forewarned, and the recall test comes as a surprise. I prepare four different handouts, each with the instructions appropriate for one of the conditions: deep/intentional, deep/incidental, shallow/intentional, or shallow/incidental. Before the presentation, I divide the room into quadrants and assign conditions to each one. Everyone in a quadrant gets the handout for the assigned condition. In addition to instructions, each handout has a grid with 24 rows of two columns, one column is headed “Yes” and the other “No.” I then read the list of 24 words shown in Figure 1. For each word, everyone carries out their assigned orienting task by checking the “Yes” or “No” box after each word. The list consists of 12 related word pairs (e.g., “Hot” and “Cold”) that are randomly ordered. After I present all the words, I ask everyone to recall as many words as they can, which always elicits groans from the incidental learning groups not forewarned about the recall test. Lastly, I have students count the total number of words they recalled; I do not check for accuracy of scoring.

Next, I explain levels of processing, orienting tasks, and the four conditions. I then describe three hypotheses about how the results might turn out. First, if intent to learn is critical, then those who were forewarned about the recall test (the two Intentional groups) should do better than those who were not (the incidental groups), regardless of level of processing. Second, if depth of processing is important, then those who rated the pleasantness of words (the two deep groups) should recall more than those who did E/G checking (the shallow groups), regardless of whether they knew about the recall test. Third, if both level of processing and intent to learn are important, then the group that did pleasantness ratings and was warned about the recall test (the deep/intentional group) should do better than the other three conditions. I survey the students to see which hypothesis they believe will be supported. Usually the vote is split, with a preference toward the joint effects of deep processing and intentional learning.

Everyone is now eager to see the results. For large groups, I have everyone stand. I instruct people to remain standing if they recalled at least three words and sit down if they did not. I then ask about six words and proceed upward by threes. People will start sitting down starting at nine, and it becomes obvious at about 12 to 15 that the shallow processing groups recalled very few words, regardless of whether they were warned or not. The majority of people standing did deep processing, and there should be equal numbers of people who were warned or not warned about the recall task. The results show that level of processing is much more important than intent to learn. The intent to learn with shallow processing leads to poor performance, whereas deep processing without the intent to learn still leads to good recall. I ask if people noticed the words were in pairs. The deep processing groups invariably notice it and use it in recall. People in the shallow processing groups often do not notice it at all.

Many of you have no doubt noticed that this demonstration can be done with “clicker” technology. Although true, clickers are not required and I prefer not to use them. I believe the public commitment to one’s beliefs, as opposed to the anonymity of clickers, increases both student engagement and the impact on learning of the demonstration.

After the demonstration, we return to the question regarding the most important ingredient for successful learning. The levels of processing demonstration showed that the desire to learn, paying close attention, and the time spent studying may be necessary, but they are not sufficient for learning. The shallow and deep processing groups were matched on time and attention. The third alternative addresses learning styles because many students believe in them, such as being a visual or kinesthetic learner, but current formulations of learning styles have weak if any research support (Coffield, Moseley, Hall, & Ecclestone, 2004). That leaves alternative five, what a student thinks about while studying, as the correct answer. Time studying and intent to learn are only effective if they cause students to use deep processing during study. Students may spend a huge amount of time studying and be highly motivated, but if they use shallow study strategies, they will not learn. Many entering students have ineffective, shallow study strategies, such as rote memorization of isolated facts.

Word list for the levels of processing demonstration

(1) Evening	(13) Cold
(2) Country	(14) Love
(3) Salt	(15) Bargain
(4) Easy	(16) War
(5) Peace	(17) Hate
(6) Morning	(18) Wet
(7) Pretty	(19) Rich
(8) Expensive	(20) Nurse
(9) Poor	(21) Pepper
(10) Doctor	(22) Hard
(11) City	(23) Ugly
(12) Dry	(24) Hot

It is not enough to tell students to process information deeply; students need concrete steps for deep processing as they study. Here are four research-based study tips. First, as they study, students should elaborate on the material for connected learning. For example, they should ask themselves, “How does this concept relate to other concepts?” Second, they should think about the distinctiveness of the concepts; that is, what distinguishes one concept from another. Students should ask themselves, “What are the key differences between this concept and other concepts?” Third, if possible, they should try to make the information personal by relating it to themselves. Students should ask themselves, “How does this concept relate to my own experience, or what personal example can I think of that illustrates this concept?” Fourth, they should study with retrieval and application in mind. Instead of reading over material repeatedly, students should close their books and practice recalling and applying the information in the ways the teacher expects them to on exams. For example, say a student is learning about the Piagetian concept of assimilation. The student can elaborate on the concept by linking it to accommodation as one of the two key processes for cognitive growth. The student should also understand the distinction between assimilation and accommodation, and personal examples of assimilation and accommodation are helpful to do so. Finally, the student should be able to recall and use the concept of assimilation in a way that is expected by the teacher. Obviously, trying to do all these steps while studying is difficult. The allure of shallow, ineffective study strategies is that they are easier to do than more effective study strategies. The more students employ these deeper study strategies, however, the easier they will become; and these study habits will serve them well even beyond college.

Students should approach all their study habits in terms of orienting tasks and levels of processing. Students often consider note taking to be stenography, where they passively record facts for later memorization. Students should approach note taking as a deep orienting task that helps them think meaningfully about a presentation. Effective note taking is an active process of closely listening and comprehending the presentation and then recording enough key information that the concepts can be recalled later. When reading a textbook, most students highlight key points, but they often do so in a way that promotes memorization of isolated facts. Students should approach highlighting as a deep orienting task, where they selectively highlight those parts of the text that represent the core meaning.

There are many other psychological concepts that could be included in this presentation, such as schema development or cognitive load, but this about as much information as a group can handle in one presentation.

Although the presentation I have described is aimed at students, teachers can also benefit from the same information. Teachers can design their presentations and activities to promote deep processing. The term “active learning” is popular right now, but active learning that does not lead to deep processing will not be effective. Teachers can use formative assessment (Angelo & Cross, 1993; Chew, 2005) both to improve metacognition and to give students practice in recalling and using information appropriately. For struggling students, teachers can provide concrete steps such as those outlined above or other research-based strategies to increase their learning effectiveness (Berry & Chew, 2008).

Psychologists know more about learning and other key elements of student success than professionals in any other field. That knowledge encumbers us with two responsibilities. First, our own teaching should be informed by psychological knowledge related to student learning. Unfortunately, teachers of psychology often fail to use psychological concepts to improve their teaching (Chew, 2005, 2007). Second, we should share what we know about learning with students to improve their performance. What students believe about learning has a powerful influence on their success in college.

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