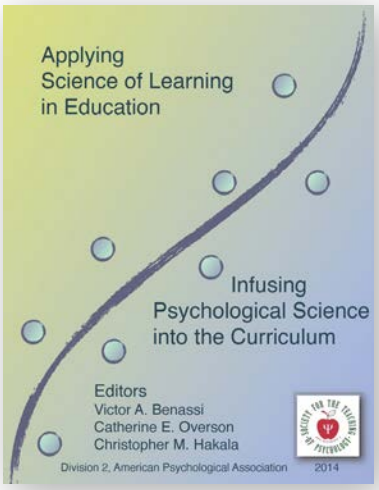

Helping Students to Get the Most Out of Studying

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This chapter explores how teachers can help students become more effective learners. I first outline the obstacles and challenges that students encounter to developing a deep understanding of concepts, such as misconceptions, multi-tasking, and ineffective study strategies. Then I discuss the research on how to help students overcome those obstacles, such as deep processing and formative assessments. Teachers can have a major impact on how well their students learn both in terms of course content and in terms of study skills. I argue that effective teachers address both issues.

For students to be critical thinkers, they must first be critical learners. They must have the study skills to learn information efficiently and effectively. Learning efficiently means students must be able to get the optimal amount of learning from their time studying. Learning effectively means several things. First, they must be able to discern the critical concepts from the less important and tangential information. Second, they must develop a schematic understanding of the subject. That means students must not only learn the concepts, but, in addition, they need to develop a framework of connections among the concepts; they need to know how ideas are linked together and what makes them similar or distinct. Third, they must be able to retrieve and apply the information appropriately. They must recognize when the information is relevant to a novel situation, and be able to use the information to reason, make decisions, or solve problems in that situation. Finally, their schematic understanding must be generative; it must lay the foundation for further, more sophisticated learning.

Should teachers be concerned with their students' ability to learn? The answer to that question depends on a teacher's belief about the primary goal of teaching. If one believes that the primary goal of teaching is to present information and that it is the sole responsibility of the students to learn the information, then whether or not students learn is not relevant to the teacher. For these teachers, their primary responsibility is to present accurate information in a clear, interesting, and well-organized manner. If however, a teacher believes that the goal of teaching is to develop student understanding, then whether and how students learn is a major concern. Teaching success is measured by student learning, not by the content of the teaching presentation. For these teachers, learning is a shared responsibility between teacher and student. No matter how brilliant the presentation, if students fail to learn, then the teaching is not successful.

Educational research clearly shows that teachers can have a huge impact on the efficiency and effectiveness of student learning through the design of the pedagogy, learning activities, and assessment methods (Hattie, 2008; Ambrose, Bridges, DiPietro, Lovett, Norman, 2010). The research also indicates that learning is a complex interaction of many factors (Chew, et al., 2009). A problem with any one of the factors can create potential obstacles to student learning and understanding. Thus, the teacher has a role in helping students to diagnose and correct student learning difficulties. Below are some the potential problem areas that can undermine learning.

Student Mental Mindset

Efficient and effective learning starts with a proper student mindset. Several lines of research indicate that student beliefs about learning can have positive or negative consequences on learning (e.g. Dweck, 2002). Teachers must be aware of student misconceptions that undermine learning and try to correct them. They include:

- Learning is fast
- Knowledge is composed of isolated facts
- Being good at a subject is a matter of inborn talent rather than hard work
- I'm really good at multi-tasking, especially during class or studying

Schommer-Aikins (e.g. Schommer-Aikins & Easter, 2006) has identified several beliefs related to poor student performance. First, students believe that learning occurs much more quickly than it really does. They may not understand the difference between skimming a chapter and closely reading a chapter for comprehension. They may believe that a single reading is sufficient for comprehension. Thus, they may plan their study schedule to finish reading all the material for the first time right before the exam, leaving no time for review. Because of their flawed judgment, students start work on assignments or preparing for exams too late to do an adequate job. They rush to finish papers at the last minute and "cram" before exams. Students must learn that there are no shortcuts to reading for comprehension. They must realize that they learn more as they review material that they have already read than they do the first time they read it. They must learn to set study goals with realistic deadlines that include time to spare in case the work takes longer than they estimate. The teacher can help by providing a desired timeline for certain steps of an assignment to be completed. For example, students should complete a draft of a paper three days before the final draft is due, or they should finish reading all the chapters on an exam a week before they take the exam so they can spend the last week in review. Ideally, providing the structure will be sufficient for students to benefit, and the teacher need not monitor or grade students for achieving these intermediate steps.

A second student belief that undermines learning is that knowledge is composed of isolated facts (Schommer-Aikins & Easter, 2006). Students with this belief memorize key definitions in isolation of other concepts. The use of note cards lends itself to this generally poor study strategy because the easiest way to use note cards is to write down and then memorize definitions. Students never develop a connected understanding or how to reason with and apply concepts. Students can use note cards to accomplish deep understanding if they try to connect information on one card to other concepts, but there are other methods of study that reinforce the connectedness of knowledge, such as concept maps. (Berry & Chew, 2008).

Dweck and colleagues (e.g. Dweck, 2002; Blackwell, Trzesniewski, & Dweck, 2007) have demonstrated how student views on the nature of intelligence can have a strong influence on how they study and how they deal with setbacks. Dweck distinguishes between a belief that intelligence is fixed and inborn versus the belief that it is malleable and grows with practice and study. Those who believe intelligence is inborn believe that people are naturally good or bad at a subject. Statements such as "I'm bad at science," or "I'm good at math" illustrate this mindset. A subject either comes easily or with difficulty to a person and no amount of practice can change that. A growth mindset is reflected in a statement like, "I have to work hard at science," and "I've spent a lot of time on math so it comes easily to me." Students with a fixed mindset tend to avoid challenges because failure would be threatening to their self-concept. They put forth less effort in subjects that they feel should be easy for them and they give up easily if a task becomes too difficult. They cope poorly with failure. Students with a growth mindset work towards mastery, are more open to criticism, and are more likely to persevere through challenges and setbacks. We promote a growth or fixed mindset by the feedback we give. Teachers must be aware of these beliefs and encourage a growth mindset through their instruction and feedback.

Multitasking is the curse of the connected, digital world. We are surrounded by the siren song of technology ready to distract us. Students may not understand how harmful multitasking is to the efficiency and effectiveness of their study. Attention, the ability to focus and concentrate, is a major constraint on the cognitive system. The evidence is clear: trying to perform multiple tasks at once is virtually never as effective as performing the tasks one at a time focusing completely on each one (Sanbonmatsu, Strayer, & Medeiros-Ward, Watson, 2013). There are several reasons for this. Divided attention occurs when attention is split between tasks. Divided attention diminishes performance even when people try to ignore the distraction. When students who are supposed to be taking notes on their laptops or tablets choose to distract themselves by shopping or checking social media, they distract not only themselves, but also those around them, diminishing learning for everyone (Sana, Weston, & Cepeda, 2013).

The second problem with multi-tasking is inattentional blindness (Beanland, & Pammer, 2012; Bredemeier & Simons, 2012). Attending to one object in a scene diminishes the ability to perceive other objects in the scene. In other words, we are incapable of detecting all objects in our environment. Attention allows us to select what we will perceive, but it also often prevents us from perceiving much else. As Simmons and his colleagues have shown, observers miss large, salient objects in a scene when attention is directed elsewhere, but they have the sense that they have seen the entire scene (e.g. Bredemeier & Simons, 2012). The problem of not knowing what we missed is that we believe we haven't missed anything. Inattentional blindness is relevant to students when they allow themselves to be distracted. They necessarily miss objects they are not attending to and are unaware that they missed them.

The third problem with multitasking is the attentional blink (Beanland, & Pammer, 2012). Attentional blink refers to the fact that switching attention is time consuming and effortful. When we allow ourselves to be distracted from what we are supposed to be studying, it takes several minutes to refocus on the material and fully concentrate on it. There is no such thing as a momentary distraction.

Cognitive Load and Mental Effort

Attention allows us to select relevant information from irrelevant information, but it also has a second, equally important function. It allows us to concentrate on the relevant information. Concentration, or mental effort, can be another obstacle to student learning, according to Cognitive Load Theory (e.g. van

Gog, Paas, & Sweller, 2010). Cognitive load refers to the amount of concentration required by a task. Some tasks, like doodling, have low cognitive load; other tasks, like taking a final exam, require a great deal of mental effort and have a large cognitive load. Mental effort is the amount of concentration that people have available to them. Mental effort is always a limited resource; a person only has a finite amount of concentration that he or she can use to perform tasks. The key is that the total cognitive load of all the tasks that a person is trying to do cannot exceed the available mental effort. If it does, performance on all tasks will suffer. Tasks with a high cognitive load, like studying conceptually difficult material, require all available mental effort. Any distraction will carry some amount of cognitive load, will take away from the mental effort dedicated to studying, and cause a decrement in learning. Furthermore, if students are presented with difficult concepts or required to complete complex activities that exceed their available mental effort, then they will be overwhelmed and they will not be able to learn. Teachers must be aware of the cognitive load of different concepts and different learning activities. Learning is hard work, but not all hard work leads to learning.

Metacognition and Self-Regulation

Two related concepts that are relevant to student learning are metacognition and self-regulation. Metacognition, also referred to as self-awareness, refers to a person's awareness of his or her own thought processes. In the case of learning, it refers to a student's awareness of his or her own level of understanding of a concept. Students with good metacognition know when they have mastered material sufficiently to perform well on an exam. Students with poor metacognition tend to be overconfident (Dunning, Heath, & Suls, 2004; Askell-Williams, Lawson, & Skrzypiec, 2012, see also Ehrlinger & Shain, this volume). They believe they have a good understanding when their knowledge is superficial and full of gaps. They stop studying before they have truly mastered material. On exams, they do not realize they are missing items because their knowledge is too superficial to realize they are missing nuances and fine distinctions. Thus they often leave exams confident they have done well but are then stunned when they do poorly.

Self-regulated learning is a model developed by Pintrich (e.g. Pintrich, 2004) in which students plan for learning, implement study strategies and monitor their progress, and finally evaluate what they have learned in relation to their goals. Effective learning requires regulation of learning strategy, motivation, and affect. Good self-regulation means that students have multiple strategies that they can bring to bear for learning in a particular context. Self-regulated learning is strongly associated with student learning (Clark, 2012).

Ineffective Study Strategies

Students are often most enamored with study strategies that are the least effective (Rohrer & Pashler, 2010; Arnott & Dust, 2012). For example, Arnott and Dust (2012) found that a massed review activity just before an exam was significantly less effective for student exam performance than spaced review activities after each chapter, but the massed review was overwhelmingly preferred by students. Students often prefer study strategies that are intuitive or easy to do, regardless of whether or not they are effective. For example, the notion of "learning styles," which states that each person learns optimally in one modality, such as visual or acoustic, remain popular despite the lack of any evidence for the validity of such extreme positions (Pashler, McDaniel, Rohrer, & Bjork, 2008).

Cognitive and educational psychologists have established the effectiveness of many study strategies (e.g. Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013), at least in short-term, controlled studies;

but these strategies are often difficult and counterintuitive. Hyde and Jenkins (1969) established that deep, meaningful rehearsal leads to better recall of word lists compared to shallow, meaningless rehearsal, regardless of whether students intend to learn or not. They also established the idea of an orienting task, which is a task that induces participants to rehearse information at a shallow (e.g. checking for a certain letter in the spelling) or deep (e.g. rating the pleasantness of a word) level. Deep level orienting tasks lead to better recall than shallow tasks. This work paved the way for the levels of processing framework (Craik, 2002), which posited that the method of encoding or rehearsal was the critical element for later recall. The lesson from levels research is clear: bad study strategies trump good intentions.

Misconceptions

Students are not blank slates, but possess intuitive or popular beliefs about psychology, many if not most of which are simplistic or incomplete, or completely wrong (e.g. Lilienfeld, Lynn, Ruscio, & Beyerstein, 2009). These beliefs turn out to be highly resistant to change through pedagogy (e.g. Chew, 2005). Some are popular misconceptions promulgated by the media, such as developing total retrograde amnesia through a knock on the head and the existence of paranormal powers such as ESP. Many are intuitive, such as the idea that blind people develop extraordinary hearing to compensate for the loss of vision. Others are just highly confusable or difficult to understand, such as the difference between negative reinforcement and punishment. Such misconceptions are widespread and difficult to correct.

Student Fear and Mistrust

Cox (2011) documents how student fear and misunderstanding can undermine learning. The goals of students often differ from the goals of teachers, and conflict and miscommunication can result, even when both the student and teacher are well intentioned. Students may fail to perceive the goals of an assignment and see it as “busy work” or a hoop to jump through in order to get a passing grade. They may see the teacher as an obstacle to their goal of obtaining a degree rather than a facilitator of learning. They may see critical feedback not as an opportunity to reflect and improve, but a personal attack on their competence. Students shift easily from a learning mindset to one in which they simply want to do whatever is necessary to pass the course, to give the teacher what he or she wants. Learning becomes irrelevant. For optimal learning, the students must have trust in the teacher; they must believe that the teacher wants them to learn and all the assignments and activities are designed to help them learn. Students will work harder and persevere longer for teachers they trust.

Transfer of Learning

The goal of pedagogy is to have students transfer their learning appropriately. Traditionally, this means that students will appropriately generalize their learning from courses to relevant situations and apply the information correctly to help them understand or reason through the situation. While the goal is virtually universal in education, the evidence suggests that it is seldom achieved (e.g. Bransford & Schwartz, 1999; Bransford, Brown, & Cocking, 2000). New learning is highly context dependent. Students learn concepts within a specific context, both in terms of subject matter and in a class, and they think of it within that context (e.g. Thomas & McDaniel, 2007). They do not automatically generalize information to other contexts. Thus, learning may easily become inert, in that students fail to generalize it to applicable situations (Bransford, et al., 2000). Information must be taught and learned in a way that promotes appropriate transfer to relevant situations.

How to Help Students Become Better Learners

Effective teaching that supports student learning is a complex process (Chew, et al. 2009), yet there is much that teachers can do to help students learn more effectively. I've already discussed how to try to correct some of the misconceptions in student mindset. The importance of undivided attention during class and study cannot be overemphasized. Faculty can set policies about inappropriate use of electronic devices during class. Students can be encouraged to turn devices off or put them out of reach during study.

Teachers can develop activities and assignments that promote deep processing and thus enhance learning. Assignments and activities are basically orienting tasks that make students think about the material in certain ways. If the assignments require reflection and meaningful analysis, then the assignment will facilitate learning. If the assignment allows students to complete it with only shallow processing, then it may actually undermine learning and understanding. Although deep processing is desirable for learning, it is also highly effortful. Teachers must be aware of cognitive load in designing pedagogy, activities, and assignments to prevent overwhelming students (Clark, Nguyen, & Sweller, 2006).

Teachers who have developed expertise over many years can easily underestimate the cognitive load required for understanding certain concepts or completing certain activities. It is easy to forget how challenging learning a concept for the first time can be. Teachers must take care to not overwhelm students; they can adjust the amount of information presented, the time allowed for certain activities, or provide scaffolding for certain assignments. Furthermore, teachers must be careful to design their presentations, especially multimedia presentations, to minimize distraction and reduce irrelevant cognitive load. Mayer (2009) has articulated a theory of effective multimedia learning (see also Mayer, this volume). He has demonstrated how the design of multimedia presentations can help or hinder student learning.

Researchers have approached the problem of developing activities that lead to deep processing in two ways. Learning scientists have documented cognitive principles that can guide development of effective pedagogy (e.g. Ambrose, et al. 2011; Dunlosky, et al., 2013; McDaniel & Wooldridge, 2012). These include spacing learning out versus massed learning, interleaving topics, and testing effects (see also Carpenter, this volume; Pyc, Agarwal, & Roediger, III, this volume). The second approach is the scholarship of teaching and learning, which documents and assesses effective pedagogical practices. This can include effective study strategies (e.g. Berry & Chew, 2008) or effective teacher practices (e.g. Bain, 2004; Cox, 2011). Both approaches are useful to teachers interested in improving their effectiveness.

Another method to help students is to instruct them explicitly in effective study strategies (Chew, 2010). When students are explicitly taught a conceptual framework of the cognitive basis of effective learning that includes concepts such as metacognition, self-regulation, and deep study strategies, their learning improves. (Arnott & Dust, 2012; Askell-Williams, Lawson, & Skrzypiec, 2012). I have created a set five brief videos that help teach students the cognitive basis of effective study. They are available at http://www.samford.edu/how-to-study/.

Formative assessments are a powerful means of promoting desirable study habits and learning. A formative assessment can be any low stakes assessment activity that gives both the teacher and the student feedback about the level of student understanding (Clark, 2012). They come in many forms,

such as think-pair-share items, conceptests (e.g. Chew, 2005), or classroom assessment activities (e.g. Angelo & Cross, 1993), but their goal is the same, to provide feedback that both teacher and student can use to improve student learning and understanding. When implemented properly, they are a highly effective means of improving student learning (Clark, 2012). Formative assessments can be used to promote improved metacognition, deep learning, and appropriate retrieval and application. They can be used to detect and correct student misconceptions (Chew, 2005). They force students to practice recall, which promotes learning. They can demonstrate appropriate transfer of concepts to novel domains. Furthermore, they can promote student trust and rapport with the teacher. They show that the teacher wants to help students learn. They model the kind of thinking and understanding that the teacher expects before high stakes exams occur. There are a wide variety of formative assessments that can be adapted to virtually any situation (e.g. Hammer & Giordano, 2012).

Teaching effectiveness should be measured in terms of student learning because teachers have a huge impact on it, for better or worse. Poor teaching can actually hinder learning. Truly effective teaching makes student learning almost unavoidable. There is an important distinction between teaching that makes it easy for students to learn and teaching that makes it easy for students to get good grades. Good teachers focus on the former. They do so both by designing effective pedagogy and teaching students to be effective learners.

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