The Intent to Learn:

The Impact of Focused Attention

Cora Dzubak, Ph. D.

Penn State University

Distractions are a near constant intrusion in our lives and they have become more and more difficult for students to ignore. Cell phones are always within reach, there is continuous access to social media, and at the same time the overall speed of our society continues to increase. Adding to environmental distractions are the changes in education that include a stronger focus on standardized testing, "teaching to the test", and more frequent of learning strategies for which memorization will suffice. It is one challenge to attempt to minimize classroom distractions, another to apply effective teaching strategies, but perhaps the most significant issue related to effective teaching and learning is student "intent to learn". Without a desire and intent to learn, the likelihood of better prepared and successful college students is discouragingly dismal. This article examines how the cognitive consequences of distraction, and a lack of student driven initiative involving the conscious intention to learn, negatively impact student learning and the acquisition of knowledge.

Cora M. Dzubak, Ph. D., is the director of the Nittany Success Center at Penn State University at York, PA. Phone: 717.771.4013 Email: cmd14@psu.edu

Introduction - The Intent to Learn

For many students it is an ongoing challenge to maintain focus on lecture while also limiting the brain's exposure to distracting or irrelevant classroom stimulation. The activity in a typical college classroom, when combined with the internal distractions of one's own mind, provides a constant alternative to effective focus on a lecture. Despite this, there is the need to sustain attention in order for information to be processed, relayed, and stored in long term memory. The circuitry leading to long term storage is a complex one, but the general process is quite well understood. One critical step in the memory process is effective use of working memory, whose role is a constant one as it directs information to long term memory. One might be easily distracted by irrelevant sensory input, but there is no need to process and store it. Part of the function of working memory is to *prevent* the encoding of information that is not intended for further processing.

In his discussion of neuroplasticity, Helmstetter (2013) noted that it is "one's conscious *intention* to do something that increases the brain's ability to wire in new ideas" (p. 3). One needs to consciously focus on thinking before any action is effective in terms of controlling our own learning. Helmstetter wrote that "*mindfulness* follows the process of active thinking, of metacognition, and helps to regulate and manage one's thoughts. It has to do with consciously thinking about your thinking" (p. 83). It might be an especially worthwhile classroom strategy to encourage students to practice eliminating all distractions, and focus on only their own mind and their thoughts. Once students can effectively do that, they can begin to retrain, direct, and regulate the mental energy allocated to their thinking and to their learning.

There are many reasons to be optimistic about student learning and student ability to control attention, concentration, and the activity in their brains. Once students understand and can appreciate their potential to access and regulate their own thoughts, they can then undertake the task of learning most efficiently and effectively. The process of learning is enhanced by making material personally meaningful, associating it with what is already in the brain, and making connections between what has been learned and what is being learned. The *intent* to learn is the key to maximizing the effectiveness of this process; that is, the student must want to comprehend and retain information.

Distractions and multitasking interfere with our ability to focus and to learn. In their research on encoding, Naveh-Benjamin, Craik, Peretta, and Toney (2000) recorded “marked differences between encoding and retrieval activities involved in processing information created via multitasking” (p. 610). They found that the encoding processes require considerably more attention than retrieval processes and are more vulnerable to the effects of distractions and the competing demands associated with multitasking. In order to most effectively encode our attention must be focused on a single task. When attempting to engage in just two tasks simultaneously, partial engagement in one task will interfere with focus, and therefore encoding, of the second. Distractions and multitasking also interfere with the process of information moving into short-term memory. Information that does not make it into short term memory cannot be transferred into working and long term memory. In that case, it cannot be later recalled or retrieved.

Hembrooke and Gay (2003) found a performance decrement under divided attention conditions related to the limited capacity model of attention. They noted that there is a “fixed amount of cognitive resources upon which we can draw” (pg. 5). Konig, Buhner, and Murling (2005) found that when we try to engage in simultaneous processing, the tasks necessarily interfere with one another. This interference is a matter of resource allocation. We have a neurologically limited capacity for effective cognitive processing. Any variables that mentally distract us will interfere with our ability to effectively encode new information. When we think with the intent to learn, we need to be aware of both internal and external distractions, the depth of our thinking, and whether we are maintaining focus. These will increase the likelihood that information will be processed and learning will occur.

The Need for Sustained Attention

Distractions can be filtered out by the intentional application of focused attention, encouraging the brain into processing one source of sensory input at the expense of another (Schwartz and Begley, 2002). Students are able to select what to focus on, but it is to be emphasized that they must willfully direct and control their attention in order to filter out competing unwanted sensory input. Over a decade ago Restak (2003) wrote that the brain is designed to work best on a single task. If students intend to learn, they need to consciously avoid activities that compete with and interrupt their focus. Multitasking between and among several activities requires cognitive switching and results in time lost while changing from one cognitive task to another (Meyer & Kieras 1997a). Allotting only partial attention to activities, as occurs when multitasking, also interferes with the encoding process, which results in an increased delay in task completion and consequent weak memory due to the lack of sufficient focus to store information. Information to be encoded needs to be intentionally attended to. This is why trying to multitask is particularly problematic to learning, as the parallel distracting task interferes with encoding sensory input. This in turn limits what is further processed, stored, and available for later retrieval.

Many students are quite confident that they can memorize almost all of what they want to learn, especially for exams. That is highly improbable unless they are told exactly what they need to remember. Describing the ineffectiveness of memorization, Brown, Roediger, and McDaniel (2014) noted, "students work hard to capture the precise wording of phrases they hear in class lectures, laboring under the misapprehension that the essence of the subject lies in the syntax in which it is described. Mastering the lecture or the text is not the same as mastering the ideas behind them" (p. 15). Brown, et al (2014) explained that repeated reading, frequent review, and memorization result in the "illusion of mastery" (p.16). The authors continue, "Even the most diligent students are often hobbled by two liabilities: "…a failure to know the areas where their learning is weak, and a preference for study methods that create a false sense of mastery" (p, 17). Without establishing intent to learn there will be no mastery of content.

As noted by Ormrod (2011), "Attention's limited capacity means that we must be quite selective about the information we focus on, and we must ignore (and so lose) a lot of the information we receive" (p. 55). Shallow processing of information might be accomplished during multitasking, but shallow processing more readily fades from memory. Deep processing, as needed during intentional thought, reflection, problem solving, and learning, is less likely to fade or be lost because it requires sustained activity in more parts of the brain. That sustained activity is dependent on focused and sustained attention.

Selective and intentional focusing of attention can override the effect of distractions and effectively filter them out (Schwartz and Begley, 2002). Intentional use of selective attention prepares the brain for processing one signal instead of another. As difficult as it sometimes is, individuals are indeed able to select what to focus on, despite the neurologic temptations of environmental distractions. The key is that one must *willfully* direct attention, but when accomplished, it can and does filter out distractions and unwanted information.

It is necessary for students to avoid distractions that interrupt a focus on a primary activity when in fact that activity is to be remembered. Continuous partial attention and multitasking share some similarities; they both involve "cognitive switching"; ie, alternating between and among tasks. There are active as well as passive distractions that divide attention and result in reaction time "switching costs", the time lost as we switch mental gears while changing from one activity to another (Stone, 2007). Partial attention and multitasking both interfere with the encoding process, causing task delay and quite possibly memory problems due to a sustained lack of focus.

Learning and the Frontal Lobe

The effective processing and storage of information involves a multistep neurologic pathway. *The prefrontal cortex* is generally recognized for its role in executive functioning. Most important, it plays the lead role when students deliberately focus and intend to learn. It is very adaptive, responds to a variety of cognitive demands, and absorbs an immense amount of information. Located near the prefrontal cortex is the *frontal cortex,* often referred to as the seat of working memory and information processing (Rock, 2009). It is the role of working memory that might be most problematic when one just looks up answers, and later does not recall the information; that is, there was inadequate use of the frontal cortex (Dzubak, 2014). In general, the frontal regions of the brain are most responsible for executive functioning and higher order thinking. However, the prefrontal cortex has limitations. Not only is there a limit to how much the prefrontal cortex can hold and process at one time, but there is also a limit on what one can then do with the information. If one tries to do too much, there will be a loss of accuracy and/or quality of processing. Distractions and partial attention interfere with higher order thinking skills (Rock, 2009).

Both the prefrontal cortex and the frontal cortex deal primarily with thought, planning, and general information processing. To some degree they compete with the *cingulate gyrus*, a specialized part of the limbic system that actively detects novelty; that is, it is looking for distractions! The *basal ganglia* plays an active role in the embedding of patterns, so once a pattern is learned and stored, it can be performed with little or no thought. Although this function helps to gather information about new objects and activities, it is the prefrontal cortex that puts the pieces together and categorizes them. There has been in increased research interest in the role of the *hippocampus,* central to memory functions and often considered to be the “first stop” in memory production. It might be speculated that part of the problem of forgetting the information is due to insufficient use of the memory function of the hippocampus. On the other hand, the *striatum* is believed to take a more predominant role during multitasking and performance of repetitive tasks, but it is known to be inefficient when it comes to transfer and generalization (Poldrack, 2011). A question that has often been raised is whether when using technology the information that should be processed via the hippocampus is actually being directed through the striatum. It is the striatum that becomes especially active both with distraction and during interrupted conditions; these are not conducive to memory storage.

The Critical Role of the Hippocampus

Although the prefrontal and the frontal cortex play significant roles in learning, the hippocampus is considered to play a particularly pivotal role in memory. It is known that the hippocampus is most active when there are uninterrupted conditions for effective processing (Poldrack, 2011). This is important to recognize when one considers how often students do not provide the brain with the opportunity to function under uninterrupted conditions. Sustained distractions interrupt processing. The frontal lobe holds new data or information for less than thirty seconds. It is filtered, redirected, or dismissed, but it is not stored.

The hippocampus is involved in two neurologic activities that are of special significance at this point in processing. The first is that attention must be sustained long enough to allow memory related neurologic processing to occur and second, the hippocampus is given the opportunity to function under uninterrupted conditions (Sousa 2006). These two activities are jeopardized when students are multitasking, dividing their attention, or otherwise distracted, as often occurs in a setting in which they are "looking up answers" or simply reviewing, rather than engaging in active retrieval from memory. The role of the hippocampus is to integrate information, which is necessary for the formation of long term memory. From here, the information is returned to the prefrontal cortex, where connections are established as previously stored memories are reactivated. Following this, the information is sent back to the hippocampus, where solidification of memory occurs, and storable patterns are established.

When information is processed in the hippocampus, we can recall and apply it later in places different from where it was learned. The hippocampus regulates working memory, which is active when new learning takes place as well as when past memories are retrieved from long term memory. It also plays a prominent role in "consolidating learning and converting information from working memory to long term memory" (Sousa, 2006, pg. 19). Zull (2002) described this process as resulting in the integration of new information which creates new synapses and neural connections. As a result, it is believed that new neurons are acquired throughout our lives in this region of the brain.

Why Multitasking Interferes with Learning

Delbridge (2001) referred to the switching among sequential tasks while multitasking as "attention switching", because to effectively switch tasks requires a change of focus and attention. Changing attention and focus allows one to switch between tasks, but different neurology, and different parts of the brain, are involved in the actual execution of the tasks. Stone (2007) coined the term "continuous partial attention" and distinguished it from multitasking. She wrote that multitasking is driven by a desire to be more productive whereas "continuous partial attention" means, literally, to pay partial attention – continuously. It has less to do with being productive or efficient and more to do with being neurologically stimulated by multiple activities.

Sousa (2006) noted that from the study of brain scans it can be determined that different parts of the brain are also involved in various aspects of problem solving activities. As the task becomes more difficult, more of the brain is activated. The brain is in a constant state of reorganization, which helps to facilitate more complex, higher order thinking and problem solving. Higher order thinking requires an increased amount of sustained thought and attention.

Rubinstein et al (2001) found that task priorities and environmental cues are assessed via our supervisory attentional system which helps us to determine which cues will be responded to. Hembrooke and Gay (2003) found that both our conscious and unconscious cognitive mechanisms and resources determine what we select for encoding and further processing. "Sustained distraction" is what causes problems. If information is important or interesting to us, we pay attention to it longer than when we determine it to be unimportant or uninteresting. As we focus and sustain our attention, the information is transferred into working memory where the hippocampus will begin to integrate it with information that is already stored in long term memory. When our attention is fractured or interrupted, the process of integration is also disrupted. Rock (2009) noted, "Multitasking blocks the flow of information into short-term memory" (p.15). Information that does not make it into short term memory cannot be manipulate, cannot be connected, and cannot be transferred into long term memory. Therefore, it cannot be stored, retrieved, or recalled later. That is, it has not been learned. Multitasking simply creates too much interference when deep learning needs to occur.

Reflection and Retrieval Disrupt Forgetting

What is the best strategy students can use in order to learn and to strengthen remembering? It is to regularly retrieve information from memory. From Brown et al (2014), "…the act of retrieving learning from memory has two profound benefits: 1) it tells you what you know and don't know, and therefore where to focus future study, and 2) recalling what you have learned causes your brain to reconsolidate the memory, which strengthens its connections to what your already know and makes it easier for you to recall in the future" (p.20).

When included as a part of intentional learning, reflection and retrieval require integration of information already in memory. Reflection facilitates and strengthens the formation of additional memory, thereby strengthening the connecting and integration of learning and experience. Newly connected information is processed, stored, and can later be generalized, transferred, and applied to other settings and situations. Each time a student pauses to reflect, information is retrieved from memory and re-manipulated in working memory. This process not only results in a strengthening of what is stored but also supplements it as more connections are formed (Dzubak, 2012). Dalrymple (2010) cautions that it is not what we remember, but what we *focus* on that is the most critical variable in learning. He observes that it is filtering, not remembering that is the important skill. He suggests focus might be more important than actual knowledge base.

Students sometimes complain that the process of retrieval from memory is difficult and tiring. It should be. Compare the more basic strategies of repetition and review with the process of retrieval. Repetition and review can be done with minimal cognitive effort, but they do not require searching for information in memory, making connections, or reconsolidation, all of which strengthen memory. Reflection and retrieval require the student to access what is stored in memory. Learning occurs via repeated retrieval and memory is strengthened each time retrieval of the information takes place. Does retrieval take more time than simple repetition and review? Initially it does. Brown, et al (2014) wrote that "recalling what you have learned causes your brain to reconsolidate the memory, which strengthens its connections to what you already know, and makes it easier for you to recall in the future" (p. 26), adding that "if you have to put some effort into getting the answer you remember it better" calling this the "generation effect" (p. 32).

As students study, active retrieval from memory will increase learning far more effectively than repeated review of the same notes, PowerPoint, etc. If students have to put some effort into retrieving the answer they will remember it better, because the greater effort required by delayed recall solidifies memory. Brown et al noted, that "retrieval practice should be spaced, so that some forgetting does occur, leading to stronger long term retention (pg. 32). That point is important for students who not only intend to learn, but also intend to remember! That is due in large part to knowing that delayed retrieval requires more cognitive effort (p.43) and that "Retrieval practice that's easy does little to strengthen learning…the more difficult the practice, the greater the benefit" (p.100). Rock (2009) advocates "effortful learning that changes your brain, making new connections, and building mental models" (p. 201). Use of reflection and combining a process of elaboration of what has been retrieved is encouraged, noting that it is via elaboration that new meaning is added to what is in memory. These strategies are not dependent on memorization or just repetition and review, but rather require a purposeful intention to learn.

Conclusion

Have we raised a generation of "memorizers" who can effectively Google most of what they need to know without the need for critical thinking and learning? Let us hope not. "Intent to learn" can certainly be taught, but it requires a change in the way many schools are approaching teaching and how students approach learning. Neuroscience has provided a significant amount of research about how the brain functions and how information is processed and stored. There is sufficient research to convince us that distractions and multitasking take a significant toll on learning. It is known that one's desire to learn and the intent to remember are very much under our control. Young people are as bright and talented as ever. Allow educators to take on the challenge of teaching effectively, raising expectations for learning, teaching students how learning neurotically occurs, and reinforcing learning when it happens. Educators can teach students to become independent and creative thinkers who can integrate information, synthesize it, and apply what has been learned to an ever changing array of unique problems and settings.

References

Brown, P., Roediger, H., & McDaniel, M. (2014). *Make it stick: The science of successful learning.* Cambridge, MA: Harvard University Press.

Dalrymple, D. (2010). *Knowledge is out, focus is in, and people are everywhere*. *Researcher, MIT Mind Machine Project. Retrieved from* https://ffbsccn.wordpress.com/2010/01/18/“knowledge-is-out-focus-is-on”

Delbridge, K. A. (2001). *Individual differences in multi-tasking ability: Exploring a nomological network.* Unpublished Doctoral Dissertation, University of Michigan.

Dzubak, C. (2013). A purposeful pause: The role of active reflection in learning. *Synergy, v 6.* Retrieved from http://www.myatp.org/synergy-volume-6

Dzubak, C. (May, 2014). *Why looking up answers is not learning”.* PA Association of Developmental Educators Annual Conference Proceedings (PADE), p. 18–25.

Helmstetter, S. (2013). *The power of neuroplasticity.* Gulf Breeze, FL: Park Avenue Press.

Hembrooke, H., & Gay, G. (Fall 2003).The laptop and the lecture: The effects of multitasking in learning environments. *Journal of Computing in Higher Education.* Retrieved from http://www.ugr.es/~victorhs/recinfo/docs/10.1.1.9.9018.pdf

Konig, C. J., Buhner, M., & Murling, F. (2005). Working memory, fluid intelligence, and attention are predictors of multitasking performance, but polychronicity and extraversion are not. *Human Performance,18*, pp. 243-266.

Meyer, D. E. & Kieras, D. E. (1997a). A computational theory of executive cognitive processes and multiple-task performance: Part 1. Basic mechanisms. *Psychological Review, 104*, 3-65.

Naveh-Benjamin, M., Craik, F. I. M., Perretta, J. G., & Tonev, S. T. (2000). The effects of divided attention on encoding and retrieval processes: The resiliency of retrieval processes*. The Quarterly Journal of Experimental Psychology. 53A*, pp. 609-625.

Ormrod, J. (2011). *Our minds, our memories*. Boston: Pearson Education.

Poldrack, R. (2011). *May I have your attention? The brain, multitasking, and information overload . Project Information Literacy*. Retrieved from http://projectinfolit.org/smart-talks/item/109-russell-poldrack

Restak, R. (2003). *The new brain; How the modern age is rewiring your mind*. NY: Rodale Inc.

Ratey, J. (2001) *A User's Guide to the Brain.* NY: Pantheon.

Rock, D. (2009). *Your brain at work.* NY: HarperCollins Publishers.

Rubinstein, J. S., Meyer, D. E., & Evans, J. E. (August, 2001). Executive control of cognitive processes in task switching. *Journal of Experimental Psychology, v27,* (4), pp. 763-797.

Schwartz, J. and Begley, S. (2002). *The mind and the brain.* NY: Harper Collins.

Sousa, D. (2006). *How the brain learns*. Thousand Oaks, CA: Corwin Press.

Stone, L. (2007). Continuous partial attention. *P2P Foundation*. Retrieved from continuouspartialattention.jot.com

Wylie, G., & Allport, A. (2000, August). *Task switching and the measurement of "switch costs"*. Psychological Research, 63 (3-4L) pp. 212 - 233.

Zull, J. (2002). *The art of changing the brain*. Sterling, VA: Stylus Publishing, LLC.