What Research Reveals About

Promoting Student Planning, Organization, and Time-Management Skills

MEDIA MULTI TASKING AND THE STUDENT BRAIN

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School Specialty

"We cannot solve our current problems by engaging in the same kind of thinking we used when we created them."
— Albert Einstein

Life in the twenty-first century is complex for all of us. For our students who are immersed in a 24-hour-a-day multimedia environment, balancing the dizzying number of areas vying for their attention can seem overwhelming. Requirements for academics are often at odds with social pressures, and both can be at the mercy of compelling forms of technologically driven entertainment. Clearly, as educators we face problems whose solutions will require innovative thinking involving all stakeholders. Consider, for a moment, the following statistics about our technology-driven world:

- Our interaction with media is fast-paced. Wikipedia, for example, is now the number one source for basic information (Rainie 2007).
- Google is the top choice worldwide for accessing news (Schonfeld 2009).
- Jon Stewart of The Daily Show is the most trusted source for news on television (Kaktuani 2008).
- According to measures compiled in September 2009 and reported by the Radicati Group, Inc. (Storage Newsletter, May 8, 2009), 247 billion e-mail messages are sent every day throughout the world and 81% of these are spam.
- Communication has progressed from live phone conversations to voice mail to e-mail to text-messaging. Further, all of these forms co-exist within an environment of Twitter, Skype, and Ning.

What then does contemporary research—especially neuroscience—tell us about how educators can help our electronically multitasking students succeed in education today? In particular, what can we do to help them develop "executive function skills" needed for a change-dominated, technology-driven, globally interdependent world? These skills include:

- goal-directed behavior;
- organizational abilities;
- time-management competencies; and
- strategic, purposeful, analytical and critical thinking.

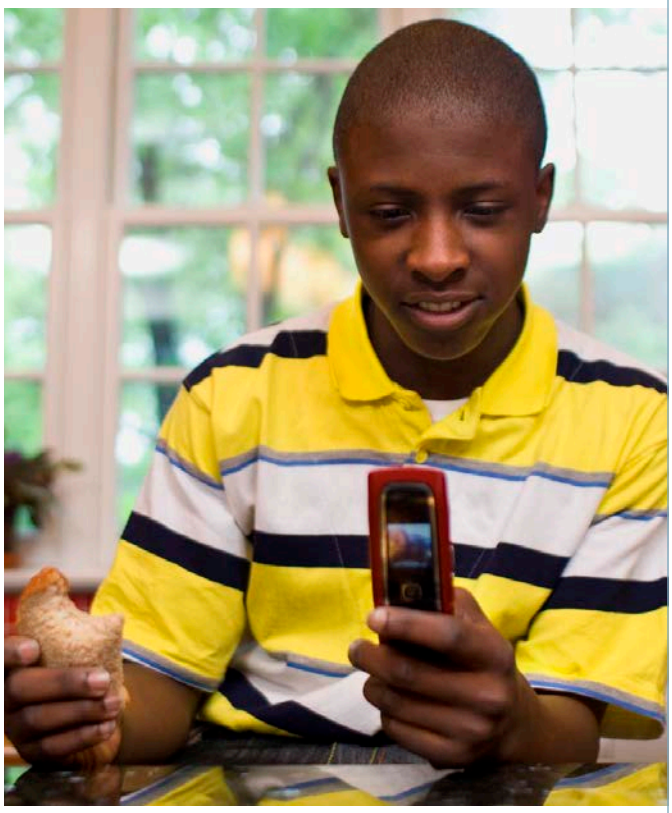
An emerging body of neuroscience research suggests that providing students with specific, effective, and systematic instruction in executive function skills—with an emphasis on planning, time management, and strategic thinking—is critical to their success in a multitasking twenty-first century world.

The Impact of Media Multitasking Upon Students' Academic Performance

Let's begin with issues surrounding the possible negative effects this level of media engagement is having upon our students, particularly younger students sometimes referred to as "Generation M":

- Karpinski (Science Daily, April 14, 2009) found that college students who use Facebook spend less time studying and have lower grade-point averages despite their firm conviction that the time they spend on Facebook doesn't impact their studies.
- Greenfield's study (Science Daily, Jan. 29, 2009) indicates that students who spend more time using different types of technology (social networking, Internet, video games, etc.) become more proficient visual thinkers but are less able to engage in critical thinking and other forms of abstract analysis.
- Greenfield also speculates that the type of attention and learning associated with media-related activities may not promote reflection, analytical thinking, or imagination—abstract activities that are associated with reading and discussion of complex ideas based on text.
- Additionally, studies focusing on students who multitask using various forms of media (called media multitasking) experience much more difficulty sustaining concentration and perform significantly less proficiently in tasks requiring complex problem-solving (Kenner & Poldrack 2009).

Kenner and Poldrack also reported that students who engage in regular media multitasking (e.g., listening to music while monitoring a sports game on TV, while



e-mailing, while texting, or while completing homework) had difficulties primarily in four areas:

a. selectively ignoring background stimulation in the environment or stimulation the student recently engaged in;
b. switching between two different tasks (a surprise finding for researchers and students alike);
c. focusing on important information and filter distracting information; and
d. engaging in "depth-based" thinking requiring longer periods of concentration, preferring instead a "breadth-based" approach using shorter time periods.

As reported in other studies examining students' relationship to media and the impact upon academic performance, students reported believing that media multitasking enables them to accomplish more because they can participate in several different activities at once. They also reported that they could work at greater than 100% productivity, achieved by adding the percentages of completion from several different areas. However, Functional Magnetic Resonance Imaging (fMRI) allows us to see a live brain in action.

Poldrack (ScienceDaily, July 26, 2006) reported that students who participated in consistent media multitasking did not engage the higher-order areas of the brain (prefrontal cortex) or the hippocampus for storing information, but instead relied on an area called the striatum, a part of the brain underlying our ability to learn new skills, but not involved in problem-solving activities or in committing learning to memory.

Additionally, Small from UCLA (Rushkoff 2009), utilizing fMRI, reported that although media-multitasking students employed many different areas of the brain, students who engaged in greater amounts of multitasking—when compared to lesser media-multitasking individuals—were significantly less able to focus on the individual activities in which they were multitasking.

The researchers noted that these students could not filter distracting, irrelevant information when required to focus on one topic. At the same time, brandishing an unrealistic sense of accomplishment, these multitasking students believed they were even more focused and productive because they were multitasking.

Nass (Rushkoff 2008) speculates that media multitasking may, in fact, stimulate the pleasure centers in the brain, thus motivating students to continue engaging in this behavior despite diminishing outcomes.

Whether the result of gaming, iPods, surfing the net, instant messaging, or just plain watching television for extended periods, clearly our students experience large quantities of media exposure. Johnson's study (JAMA May 2007) indicates that the average middle school student engages in three or more hours of television and/or video game-playing each day.

This high level of media involvement is associated with elevated risk for subsequent attention difficulties, failure to complete homework, boredom at school, poor grades, and a higher dropout rate at both the high school and college levels.

Especially at risk are students labeled "heavy media users" (Kaiser 2010), or those averaging 16 hours per day of media use. Light media users consumed 3 hours or fewer per day. Academically, heavy media users received significantly lower grades (47% Cs or lower) compared to the light media users (23% Cs or lower). In the 2010 study, 40% of students in grades 7-12 (up from 15% in 2006) reported using another medium most of the time while studying.

Educational Implications from Neuroscience

As we move through the twenty-first century, educators and scientists are joining forces to form a more comprehensive understanding of how the brain learns. Some have termed this early part of the century the "age of the brain-mind" (Caine 2008). For educators, this era is both a golden age—a time when our profession could not play a more central and essential role in determining the future of humankind—and a time of great insight into contradictions between what we and our students practice, and what both of us should be doing to promote brain-related, higher-order reasoning and self-regulation skills.

One of the most significant breakthroughs in neuroresearch occurred during the last decade of the previous century. With the development of brain-imaging and scanning mechanisms, neuroscientists can now study living, working brains, providing educators with a more complete understanding of how the brain promotes—and sometimes works against—the learning process. In effect, the use of fMRI and other recent technologies—including diffusion imaging—are yielding more sophisticated, in-depth opportunities to study how the brain works.

Current research regards the prefrontal cortex area of the brain—i.e., the frontal lobe area—as the chief coordinator of many higher-order procedures. Researchers often compare the frontal lobe area with a conductor of a grand and complex orchestra. Like the conductor who monitors and interweaves the sounds of various instruments, the frontal lobe area receives information from different parts of the brain and factors this information into actions and decisions.

Specifically, researchers have confirmed the important role of the frontal lobe in processing information and decision-making. Studies using fMRI demonstrate that students who participate in consistent media multitasking do not engage higher-order areas of the brain for storing information. Additionally, these students are less able to focus on individual activities while multitasking. As a result of what some have labeled "multimedia saturation," today's "digital natives" spend several hours per day with various forms of technology, often using these various forms of media together or while engaged in other activities. A recent Kaiser study stated that contemporary youth combine, on average, 7.5 hours per day of media entertainment with academic pursuits.

While media-multitasking students may become more proficient visual thinkers, studies show they are less capable of reflection, concentration, analytical thinking and imagination.

Mixing multiple media stimuli causes the student brain to shut down neural connections in order to switch attention. Reactivating these pathways involves rebuilding these connections, which in effect cuts down a student's productivity. While media-multitasking students may become more proficient visual thinkers, studies show they are less capable of reflection, concentration, analytical thinking and imagination.

Research in Executive Function Skills

Several recent studies recognize a group of higher-order skill sets, termed "executive functions," which provide students with competencies essential for success in both academic pursuits and processes beyond the educational setting.

These skills include:

- goal-directed behaviors
- organizational skills
- time management
- self-regulation, including monitoring
- self-awareness
- strategic thinking
- problem-solving and cognitive flexibility

Thanks to the developments and insights generated through neuro-scientific research, we now understand that the development and maturation of these competencies seem to follow a spiraling sequence, resulting from family and cultural experiences within the child's environment. Accordingly, the following developmental patterns are being identified:

- Executive function skills start developing early in infancy.
- The maturation of executive function skills proceeds slowly in the case of frontal lobe maturation, continuing at least into early adulthood.
- Both biological and environmental factors contribute to their maturation.
- There is great variability in the maturation of executive function competencies related to context, motivation, and cultural concerns (Ylvisaker 2002).

From an educator's perspective, compelling research supports the value of allocating time to teach executive function skills—including time management—within the regular classroom environment.

According to a recent study of U.S. middle school students, evidence of behavior indicates self-discipline was twice as reliable in predicting academic performance as IQ (Duckworth et al, 2005). Duckworth (as cited in Mathews 2006) concluded from this study: "Underachievement among American youth is often blamed on inadequate teachers, boring textbooks, and large class sizes. We suggest another reason for students falling short of their intellectual potential: their failure to exercise self-discipline" (p. 1).

For too long, educators have assumed that students will develop executive function skills by osmosis, based on modeling in the home or just naturally from everyday experiences. While studies within the field of special education have demonstrated strong success of specific instruction in planning, as well as the other executive function skills (Ylvisaker, M. & Feeney, T. 2002), only recently has research affirmed the benefits of teaching such skills in the regular classroom.

> Results from recent studies (Carlson 2005, Duncan 2007) consistently show the relationship between proficiency in executive function skills and successful school performance. These studies support an adjustment within the educational setting.

An extensive body of research confirms the value and impact of educational resources and learning experiences in helping to close the achievement gap. Ferguson (Flaxman 2003), for example, confirms that a student's family background, including socio-economic conditions, powerfully influences his or her academic performance. He distinguishes between "well-resourced vs. under-resourced populations," and asserts that schools serving under-resourced students must provide extensive educational resources and experiences to those students to ensure their academic progress. As described previously, these students must also receive direct and ongoing coaching and mentoring to develop executive function skills, including the capacity for self-regulation, self-assessment, planning, and organizational competency.

Research suggests there should be certain key, non-negotiable elements in educational settings that reinforce students' development of executive function skills. Student productivity can be greatly enhanced when students are directly taught planning and problem-solving processes that reinforce long-term connections with in-depth reasoning and comprehension. Research has consistently shown a statistically significant relationship between self-discipline skills and academic performance.

What Can We Conclude About Educational Settings That Reinforce Students' Ability to Plan, Manage Time, and Apply Executive Functions?

An education that promotes students' use of these competencies must center on the neuroscientific perspective that the frontal lobes hold the primary responsibility for the executive functions of working memory, maintaining attention, self-regulation (initiation and inhibition), planning and time management, and flexibility. A spiraling curriculum, assessment, and instructional delivery process must represent a true system for promoting students' executive function development. Such a system must directly emphasize students' capacity for:

- self-regulation to efficiently manage time and materials;
- self-awareness;
- goal-directed behavior;
- self-monitoring and evaluating performance; and
- the flexibility to solve problems and revise plans.

Within such an educational system, foundational executive function skills should be essential parts of educational programs at all grade levels. Such foundational skills should be taught first to enable students to have the organizational structures in place to start the school year. For example, students should be given experiences in modeling, shaping, and internalizing such essentials as: (1) structuring their learning environment; (2) managing materials; and (3) managing time.

Students also require direct instruction and coaching related to study strategies and academic support, including: (1) following directions; (2) mnemonic devices and memorization strategies; (3) note-taking and information organizational skills; and (4) test preparation and reflection. Finally, students require advanced work in key areas related to personal growth, which has been called the executive function of self-awareness. Such competencies include: (1) discovering and capitalizing upon learning strengths; (2) goal-setting and achievement; and (3) complex decision-making.

It is important to teach executive function skills in a specific and direct manner within the classroom. Vygotsky (1934) wrote of the importance of parents and teachers to "scaffold" instruction in organizing and problem-solving processes in order to provide playful and specific instruction when the child is younger, then lead the child/student into increasingly independent application of executive function competencies (Ylvisaker & Feeney 2002). An effective educational program that emphasizes executive function skills should have a spiraling design, revisiting key competencies in more complex and challenging lessons at ascending grade levels.

Classrooms that emphasize executive function skills—and provide a system for students to expand and enhance their use of such skills—should emphasize several key recurrent elements:

1. Student goal-directed behavior: As a group, the teacher and students should construct a system/rubric to measure progress on identified goal(s) and determine how the class will celebrate when the goal is met. Monitoring and progress reporting should occur at regular intervals.
2. Self-monitoring with feedback: The teacher must facilitate students' writing individual SMART (i.e., specific, measurable, appropriate, relevant, and time-centric) goals, including the specific methods that will be used to provide feedback and measure progress. Again, the class should establish a way to celebrate when the goal is met.
3. Self-regulation, including efficiently managing time and materials: The classroom should be

designed to assist students in setting up systems to help them manage their materials and time. Students must anticipate possible challenges as they work to maintain these systems, including revising them as needed.

4. Self-awareness: Teachers must provide students with ways to learn about their own learning strengths. Once determined, help students select methods for studying and designing projects that best fit their unique learning-strength profiles. For example, a visual/spatial learner might create a movie or tell a story via a storyboard, based on an assigned reading selection.
5. Flexibility, solving problems and revising plans: Teachers should discuss situations that might require flexibility in order to adjust and move forward, providing examples from their own life, including ways they learned from unsuccessful attempts.
6. Discussions must be aimed at understanding the different problem-solving models, addressing both quickly made choices and those that take longer to decide. Through role play, students should explore the difference between approaching a problem emotionally vs. using more logical strategies, such as those represented by the problem-solving model.

We can conclude that when students receive this kind of spiraling instruction in the use of executive function skills, they can overcome negative effects of media multitasking. The development of consistent planning and time-management skills can enable students to overcome pressure from distractions that lead to procrastination. They can become increasingly self-aware and self-regulating, using a range of complex reasoning processes to solve problems, make decisions, and achieve goals. Self-regulation skills that have been recognized as important to student behavior are equally essential for academic achievement. Perhaps most significantly, an education that incorporates this emphasis will ensure that students are truly prepared for the rigors of the information age and the challenges—and opportunities—it presents to all of us.

References

Britton, B.K., Tesser, A. (1991). Effects of time-management practices on college grades. *Journal of Educational Psychology.* 83(3), 405-410.

Caine, R. N., Caine, G., Klimek, K.J., & McClintic, C. L. (2008). *Brain/Mind learning principals in action*. Thousand Oaks, California: Corwin Press.

Carlson, S.M. (2005). Developmentally sensitive measures of executive function in preschool children. *Developmental Neuropsychology,* 28, 595-616.

Das, J.P. & Naglieri, J.A. (1997). *Naglieri-Das cognitive assessment system*. Chicago: Riverside.

Das, J.P. (2002). A better look at intelligence. *Current Directions in Psychological Science*, 11 (1), 28-33.

Dawson, P. & Guare, R. (2009). *Smart but scattered: The revolutionary "executive skills" approach to helping kids reach their potential*. New York: The Guilford Press.

Dickinson, D.J., & O'Connell, D.Q. (1990). Effect of quality and quantity of study on students grades. *Journal of Educational Research*, 83 (4), 227-231.

Direct evidence of role of sleep in memory formation is uncovered. (Online newsletter). *ScienceDaily* (2009, September 16). Retrieved January 11, 2010 from *http://www.sciencedaily.com/releases/2009/09/090915174506.htm*

Duckworth, A.L., & Seligman, E.P. (2005). Self-Discipline outdoes IQ in predicting academic performance of adolescents. *American Psychological Society*, 16 (12), 939-944.

Duckworth, A.L., & Seligman, E.P. (2006). Self-discipline gives girls the edge: Gender in self-discipline, grades, and achievement test scores. *Journal of Educational Psychology*, 98 (1), 198-208.

Duncan, G.J., Dowsett, C.J., Classessens, A., Magnuson, K., Huston, A.C., Klebanov, P., et al. (2007). School readiness and later achievement. *Developmental Psychology*, 43, 1428-1446.

Durlak, J.A., Weissberg, R.P., Dymnicki, A.B., Taylor, R.D., & Schellinger, K.B. (2009, In press). The impact of enhancing students' social emotional learning: A meta-analysis of school based universal interventions. *Child Development.*

Flaxman, Erwin. (2003). Closing the achievement gap: Two views from current research. *ERIC Digest*: ED482919 2003-12-00. Retrieved January 18, 2010, from *http://www.ericdigests.org/2004-3/gap.html*

Greenberg, MT. & Rhoades, B.L. (2008). *Self-regulation and executive function: What can teachers and schools do?* Foresight Mental Capital and Wellbeing Project. The Government Office for Science. United Kingdom. *http://www.Foresight.gov.uk*

Greenfield, P. (2009). Is technology producing a decline in critical thinking and analysis? (Online newsletter). *ScienceDaily* (2009, January 29). Retrieved February 12, 2010, from *http://www.sciencedaily.com/releases/2009/01/090128092341.htm*

Hamilton, J. *Multitasking teens may be muddling their brains.* (online NPR transcript). *National Public Radio*, October 9, 2008, from *http://www.npr.org/templates/story/story.php?storyId=95524385*

Henry J Kaiser Family Foundation (2006, December) *Media multitasking among American youth: Prevalence, predictors and pairings*. Menlo Park, California: Ulla G. Foehr.

Henry J Kaiser Family Foundation. (2010, January). *Generation m squared: Media in the lives of 8- to 18-year-olds*. Menlo Park, California. Roberts, D.F., Foehr, U.G., & Rideout, V.J.

Johnson, J. G. (2007). Frequent TV viewing during adolescence linked with risk of attention and learning difficulties. (JAMA) *Archives of Pediatric Adolescent Medicine*: 2007; 16(5), 480-486.

Kakutani, M. (2008). Is Jon Stewart the most trusted man in America? *The New York Times*: August 17, 2008.

Karpinski, A. (2009). Facebook use linked to lower grades in college. (Online newsletter). *ScienceDaily* (2009, April 14). Retrieved October 7, 2009, from *http://www.sciencedaily.com/releases/2009/04/090413180538.htm*

Kenner, N. & Poldrack, R. (2009). Portrait of a multitasking mind: What happens when you try to do three things at once? *Scientific American*: December 15, 2009.

Latzer, Y. & Shochat, T. (2008). Children with TVs or computers in their room sleep less. (Online newsletter). *ScienceDaily* (2009, September 5, 2008), Retrieved January 5, 2010, from *http://www.sciencedaily.com/releases/2008/09/080902102536.htm*

Lehrer, J. (2009). DON'T! The secret of self-control. *The New Yorker*: May 18, 2009.

Leon, S. (2008). Rush NeuroBehavioral Center Executive Functioning Curriculum: 2007-2008 Evaluation. Unpublished manuscript.

Luria, A. (1982). *Language and cognition*. New York & Chicester: John Wiley Press.

Macon, T.H., Shahani, C., Dipboye, R. L., & Phillips, A. P. (1994). College students' time management: Correlations with academic performance and stress. *Journal of Educational Psychology*, 82(4), 760-768.

McCloskey, G., Perkins, L.A. & Divner, B.V. (2008). *Assessment and intervention for executive function difficulties: School-based practice in action*. New York: Routledge.

Mathews, J. (2006). Self-discipline may beat smarts as key to success. *The Washington Post*: January 17, 2006.

Meltzer, L. (2007). *Executive function in education: From theory to practice*. New York: The Guilford Press.

Poldrack, R.(2006). *Multitasking adversely affects brain's learning*, UCLA psychologists report. (Online newsletter). *ScienceDaily* (2006, July 26). Retrieved February 12, 2010, from *http://www.sciencedaily.com/releases/2H06/07/060726083302.htm*

Prensky, M. (2001a, September/October). Digital natives, digital immigrants. *On the Horizon*, 9 (5), 1-6.

Radicati Group. (2009). (Online newsletter). *Traffic will total 247 billion messages per day in 2009*. StorageNewsletter.com. (2009, May 8). Retrieved February 12, 2010, from *www.storagenewsletter.com*

Rainie, L. (2007). Wikipedia: When in doubt, multitudes see it out (Online newsletter). Pew Research Center Publications, April 24, 2007.

Rushkoff, D. (2009). *The decade Google made you stupid*. (Online blog). *The Daily Beast*, (2009, December 13). Retrieved December 15, 2009, from *http://www.thedailybeast.com/blogs-and-stories/2009-12-13/the-decade-google-made-you-stupid/full/*

School Specialty, Planning and Student Development. (2010). *Premier Planners*. Bellingham, Washington.

Schonfeld, E. (2009). More people worldwide get their news online from Google news than NYT or CNN (Online newsletter). *Seeking Alpha*, December 23, 2009.

Sleep strengthens memories and makes them resistant to interfering information. (2006). (online newsletter). *ScienceDaily*, (2006, July 11). Retrieved January 11, 2010 from *http://www.sciencedaily.com/releases/2006/07/060726083302.htm*

Stickgold, R. & Walker, M.P. (2005). Memory consolidation and reconsolidation: What is the role of sleep?. *TRENDS in Neurosciences*, 28 (8), 408-415.

Tierney, J. (2009). Why Sarah can't focus (and other questions about paying attention). *The New York Times*: May 8, 2009.

Tough, P. (2009). Can the right kinds of play teach self-control? *The New York Times*: September 27, 2009.

Vygotsky, L.S. (1934). *Thought and language*. Cambridge, Massachusetts: MIT Press.

Ylvisaker, M. & Feeney, T. (2002). Executive functions, self-regulation, and learned optimism in pediatric rehabilitation: A review and implications for intervention. *Pediatric Rehabilitation*, 5 (2), 51-70.

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