Why Internet-based Education?

Morton Ann Gernsbacher[1]

[1]Department of Psychology, University of Wisconsin–Madison, USA

* **Correspondence:** Morton Ann Gernsbacher, Vilas Research Professor and Sir Frederic Bartlett Professor, University of Wisconsin–Madison, Madison WI 53706
email: MAGernsb@wisc.edu

ABSTRACT

This essay illustrates five ways that Internet-based higher education can capitalize on fundamental principles of learning. Internet-based education can enable better mastery through distributed (shorter, more frequent) practice rather than massed (longer, less frequent) practice; it can optimize performance because it allows students to learn at their peak time of their day; it can deepen memory because it requires cheat-proof assignments and tests; it can promote critical thinking because it necessitates intellectual winnowing and sifting; and it can enhance writing skills by requiring students to write frequently and for a broad audience.

WHY INTERNET-BASED COURSES?

Over 7 million post-secondary students in the United States – a third of all U.S. college and university students – were enrolled in an Internet-based course last year. Enrollment in Internet-based courses increased a whopping 440% during the past decade (Allen & Seaman, 2014). For the coming decade, most college and university presidents predict that all their students will take an Internet-based course (Parker, Lenhart, & Moore, 2011). Internet-based higher education has moved "from a fad to a fixture" (Selingo, 2013, p. 97).

A decade ago, I volitionally moved all my University of Wisconsin–Madison courses onto the Internet. I wanted to harness the power of the Internet. I also wanted to harness fundamental principles of learning. In this essay, I will illustrate five reasons why Internet-based higher education can capitalize on principles of learning and, therefore, why Internet-based education can be effective pedagogy.

INTERNET-BASED HIGHER EDUCATION CAN LEAD TO BETTER MASTERY

A core principle of learning is that shorter, more-frequent episodes of practice lead to better mastery than longer, less-frequent episodes (Oseas & Underwood, 1952; Ruch, 1928; Underwood, 1961). Acquiring skills through more frequent practice is considered distributed

learning, whereas acquiring skills through less frequent practice is considered massed learning. Distributed learning almost always trumps massed learning (Benjamin, & Tullis, 2010).

Distributed learning's advantage over massed learning has been demonstrated for students of all ages (e.g., Seabrook, Brown, & Solity, 2005), acquiring mastery in a wide range of courses (e.g., college composition, Kellogg & Raulerson, 2007; college biology, Reynolds & Glaser, 1964; and college statistics, Budé, Imbos, van de Wiel, & Berger, 2010). Harness the pedagogical power of distributed learning has been one of the most common battle cries for improving higher education (e.g., Roediger & Pyc, 2012; Willingham, 2002).

Internet-based higher education enables more frequent engagement with the material than traditional face-to-face higher education (Holzinger, Kickmeier-Rust, & Ebner, 2009). For example, at my university most face-to-face undergraduate classes meet only twice a week. Many seminar-style courses, including graduate-level courses, meet only once a week. While we professors would like to believe that our students continue to practice their skills when they are not in class, many students wait until the night before class meets to engage with the material. The students then attend class, but several days if not a week pass before the students engage with the material again.

In contrast, Internet-based courses can and should be constructed to require students to engage with the material every day (Elvers, Polzella, & Graetz, 2003; Newlin & Wang, 2002). For example, in my Internet-based courses, students are required to log in almost daily and to complete multiple, small assignments each week (e.g., Foertsch & Gernsbacher, 2008; Gernsbacher, 2013). Furthermore, the assignments are constructed so that it is not in the students' best interest to mass their practice and attempt to do a week's worth of assignments in one sitting. Doing so would be akin to trying to do a week's worth of athletic workouts in one trip to the gym; trying to eat a week's worth of food in one sitting; trying to visit five European cities in one day. It simply would not be feasible.

Thus, Internet-based higher education enables students to distribute their learning over time, to engage with the material in short, frequent episodes, and to master the material in increments, rather than in once- or twice-a-week doses. These short, frequent, and distributed episodes of practice can lead to better mastery.

INTERNET-BASED HIGHER EDUCATION CAN OPTIMIZE PERFORMANCE

Psychological science, as well as personal observation, identifies differences among us in our optimal time of the day. Our cognitive processes peak at our optimal times and flounder at our non-optimal times (May, 1999; May & Hasher, 1998). Empirical research documents that every cognitive process – memory (West, Murphy, Armilio, Craik, & Stuss, 2002), attention (May, 1999), language comprehension (Natale & Lorenzetti, 1997), even intelligence testing (Goldstein, Hahn, Hasher, Wiprzycka, & Zelazo, 2007), and attitude change (Martin & Marrington, 2005) – operates at a peak during our optimal time of the day.

The older we get, the earlier in the day we find our peak time for performance (May, Hasher, & Stoltzfus, 1993), which might explain why, at least at my university, many professors like to teach at 8:00 AM. However, at 8:00 AM most traditional-age undergraduate students have barely gone through two full stages of REM sleep (Randall, 2012). Even if students have tried to get a good night of sleep, their biology dictates against morning hours bringing their optimal performance (American Academy of Pediatrics, 2014). Indeed, by puberty, students' optimal time of the day has already shifted beyond the traditional school day to evening (Kim, Dueker, Hasher, & Goldstein, 2002).

The beauty of Internet-based higher education is that learners can engage with the material – and the course – at whatever time of the day or night works best for them. For example, in my Internet-based courses, all assignments are due at 11:59 PM, but students can complete the assignments hours or days before they are due. Students can also engage with the material around the clock (i.e., 24/7). Thus, Internet-based higher education can optimize performance by allowing students to capitalize on their own optimal time of the day.

INTERNET-BASED HIGHER EDUCATION CAN DEEPEN MEMORY

Psychological science documents the value of deeper levels of processing (Craik, 2010). Information that is processed to a deeper level is remembered better; more deeply processed information is also more tightly connected to previously learned and subsequently learned concepts. Internet-based learning can deepen levels of processing for one simple reason: To allay concerns about cheating, assignments and exams must assess deeper levels of processing.

One of the primary concerns that faculty have about Internet-based teaching is the worry that students will cheat (Parker et al., 2011). By cheat, instructors usually mean look up the answers. But if the answer to a question, or the solution to a problem, is just a click away – be the assignment Internet-based or in-person – that assignment is not assessing a very deep level of processing. We should probably not assess such superficial knowledge in our higher education courses.

Therefore, in my Internet-based courses, I expect students to take advantage of all the material the world wide web has to offer. I encourage students to click and scroll and open as many browser windows as they want when they are completing assignments, solving problems, and taking exams. If the answer to one of my test questions is just one click away, it is not a very good test question.

Similarly, if instructors hesitant-to-embrace Internet-based instruction are worried about their students enlisting a ringer to complete their assignments or take their tests, my response is the same: Do not design assessments that anyone can simply parachute into – regardless of whether you are designing assessments that are Internet-based or in person. Valid assessments should assay mastery of the course material, for which active members of the course should be advantaged.

INTERNET-BASED HIGHER EDUCATION CAN PROMOTE CRITICAL THINKING

A few years ago, a group of psychology students at the University of Cincinnati refused to spend $168 to purchase the textbook for their course. Instead they gathered all the information they needed for their course using only the Internet. How did these students fare? Top of the class (Massis, 2013).

How could that be? Isn't the Internet is full of cat videos? Yes, it is (Clark, 2012). But the Internet is also full of thousands of videos that explain how to compute a t-test, which is a basic statistical tool for students and scholars. The videos available on YouTube and other Internet-based video sharing sites provide a vibrant component of many curricula, including health education (Akagia, 2008; Burke & Snyder, 2008), African American studies (White, 2009), anatomy (Jaffar, 2012), Shakespeare (Desmet, 2009), music instruction (Kruse & Veblen, 2012), American history (Rees, 2008), and nursing (Clifton & Mann, 2011).

Moreover, as research published in *Nature* demonstrated, information available on the Internet-based Wikipedia is just as accurate as information available in the print-based *Encyclopedia Britannica* (Giles, 2005). That is not to say that either Wikipedia or *Encyclopedia Britannica* is 100% accurate, but Wikipedia is no less accurate than a traditional print-based encyclopedia.

The accuracy of information on the Internet, although commonly underestimated, is one factor that led to the University of Cincinnati students' success with substituting Internet-based information for a standard textbook. The other factor was that the process of gathering information from the Internet evokes more critical thinking than simply reading a textbook. Active learning – winnowing and sifting intellectual wheat from chaff – facilitates learning (Chi, 2009; Freeman, Eddy, McDonough, Smith, Okoroafor, Jordt, & Wenderoth, 2014; Prince, 2004; Tsui, 1999). The Internet magnifies the opportunities for winnowing and sifting (Newlin & Wang, 2002; Weiler, 2004).

INTERNET-BASED HIGHER EDUCATION CAN ENHANCE WRITING SKILLS

After critical thinking skills, writing skills are what employees consistently rank as necessary in college graduates (AAC&U, 2013; Sternberg, 2013). However, many college-level instructors rate their students' writing skills as only fair (Purcell, Buchanan, & Friedrich, 2013). Internet-based higher education can enhance students' writing skills by capitalizing on the Internet's inherently text-based mode of communication (Gernsbacher, 2014) and the Internet's inherently broad-based audience (Ellison & Wu, 2008).

For example, across one term of my Internet-based courses, each student composes approximately 85 posts, with each post comprising two to three paragraphs. In essence, each student writes the equivalent of a five-page double-spaced paper each of 15 weeks. Text-based communication on the Internet is a feature, not a bug (Gernsbacher, 2014).

Who reads the equivalent of 50 students' five-page papers each week? I read a sample of them, but the primary readers are the other students in the class. Across the semester, each student

reads and comments on over 700 posts written by their peers. Requiring this quantity of reading and writing in a face-to-face college course would consume all the class meeting time. That is not a concern with Internet-based courses.

Moreover, as the Stanford Study of Writing attests (ssw.stanford.edu), today's Internet-native students are vastly more experienced writing for the public than we professors were at their age (Fishman, Lunsford, McGregor, & Otuteye, 2005). Many of today's college students have written blogs since they were 12 years old and posted Facebook statuses since they were 14; they might have commented on more Internet sites than most professors have read (Keller, 2009).

Therefore, today's students are "almost always less enthusiastic about their in-class writing because it ha[s] no audience but the professor" and it fails to "serve any purpose other than to get them a grade" (Thompson, 2009). Writing to an audience that comprises only the professor is not a concern with Internet-based courses. Posting on a discussion board is de rigueur in most all Internet-based courses, and attaching a document to a common discussion board for all class members to read is just as easy as emailing it to the professor.

Writing to a broad audience (an entire class or an entire Internet) rather than only the professor empirically improves technical aspects of composition (Day, Raven, & Newman,1998); encourages students to write longer and more often (Kaplan, Rupley, Sparks, & Holcomb, 2007); and increases students' mastery of logical, ethical, and emotional appeal, as well as increasing their treatment of opposing views (Gaddis, Napierkowski, Guzman, & Muth, 2000).

The Stanford Study of Writing also points to the fact that text-speak rarely if ever enters into students' course-based writing, an observation I, too, have made. In fact, writing for the Internet increases, rather than decreases, students' grammatical and syntactic skills (Gaddis et al., 2000).

IN SUM

This essay illustrates five reasons why Internet-based higher education can capitalize on principles of learning and, therefore, why Internet-based education can lead to effective pedagogy. Internet-based education can lead to better mastery by providing short, frequent episodes of practice rather than less frequent bouts of practice. Internet-based education can optimize performance by allowing students to engage with the material – and the course – at whatever time of the day works best for them.

Internet-based education can deepen memory by necessitating cheat-proof assignments and exams that engage deeper levels of processing. Internet-based education can promote critical thinking by empowering students to gather multiple sources of information and distinguish wheat from chaff. Lastly, Internet-based education can enhance writing skills by multiplying the writing opportunities with a built-in audience beyond the professor.

A recent meta-analysis by the U.S. Department of Education (2010) evaluated 50 high quality contrasts of Internet-based versus face-to-face courses. The results showed a consistent advantage in student learning from Internet-based higher education courses. However, the report cautioned that the "positive effects [of Internet-based learning] should not be attributed to the

media, per se" (p. ix). Indeed, it is likely that any medium will lead to more successful pedagogy if it capitalizes on fundamental principles of learning.

REFERENCES

Akagia, C. (2008). YouTube? For health education? *American Journal of Health Education, 39,* 58-60.

Allen, I. E., & Seaman, J. (2014). *Grade change: Tracking online education in the United States.* Wellesley, MA: Babson Survey Research Group and Quahog Research Group.

American Academy of Pediatrics (2014). School start times for adolescents. *Pediatrics.* doi: 10.1542/peds.2014-1697

Association of American Colleges and Universities and Hart Research Associates (2013). *It takes more than a major: Employer priorities for college learning and student success.* Washington, DC: Association of American Colleges and Universities.

Benjamin, A. S., & Tullis, J. (2010). What makes distributed practice effective? *Cognitive Psychology, 61,* 228-247.

Budé, L., Imbos, T., van de Wiel, M. W., & Berger, M. P. (2010). The effect of distributed practice on students' conceptual understanding of statistics. *The International Journal of Higher Education Research.* doi: 10.1007/s10734-010-9366-y

Burke, S. C., & Snyder, S. L. (2008). YouTube: An innovative learning resource for college health education courses. *International Electronic Journal of Health Education, 11,* 39-46.

Chi, M. T. H. (2009). Active-constructive-interactive: A conceptual framework for differentiating learning activities. *Topics in Cognitive Science, 1,* 73-105.

Clark, L. (2012, June 26). Google's artificial brain learns to find cat videos. *Wired Magazine.* Retrieved from http://www.wired.com/2012/06/google-x-neural-network/.

Clifton, A., & Mann, C. (2011). Can YouTube enhance student nurse learning? *Nurse Education Today, 31,* 311–313.

Craik, F. I. M. (2010). Levels of processing in human memory. In M. A. Gernsbacher, R. W. Pew, L. M., Hough, & J. R. Pomerantz (Eds.), *Psychology and the real world: Essays illustrating fundamental contributions to society (pp. 76-82).* New York: Worth Publishers.

Day, T. M., Raven, M. R., & Newman, M. E. (1998). The effects of world wide web instruction and traditional instruction and learning styles on achievement and changes in student attitudes in a technical writing in an agricommunication course. *Journal of Agricultural Education, 39,* 65-75.

Desmet, C. (2009). Teaching Shakespeare with YouTube. *English Journal, 99,* 65-70.

Ellison, N. B., & Wu, Y. (2005). Blogging in the classroom: A preliminary exploration of student attitudes and impact on comprehension. *Journal of Educational Multimedia and Hypermedia, 17,* 99-122.

Elvers, C., Polzella, D. J., & Graetz, K. (2003). Procrastination in online courses: Performance and attitudinal differences. *Teaching of Psychology, 30,* 159-162.

Fishman, J., Lunsford, L., McGregor, B., & Otuteye, M. (2005). Performing writing, performing literacy. *College Composition and Communication, 57,* 224-252.

Foertsch, J., & Gernsbacher, M. A. (2008). When the medium illuminates the content: Exploiting the unique features of online communication in an undergraduate psychology course. *Innovate: Journal of Online Education, 4,* 3.

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Science USA, 111,* 8410-8415.

Gaddis, B., Napierkowski, H., Guzman, N., & Muth. R. (2000). A comparison of collaborative learning and audience awareness in two computer-mediated writing environments. *ERIC Document Number: ED455771.* Retrieved from http://eric.ed.gov/?id=ED455771.

Gernsbacher, M. A. (2013). Improving scholarly communication: An online course. *University of Wisconsin-Madison.* Retrieved from http://www.gernsbacherlab.org/research/online-communication-research/online-courses/.

Gernsbacher, M. A. (2014). Internet-based communication. *Discourse Processes, 51,* 359-373.

Giles, J. (2005). Internet encyclopaedias go head to head. *Nature, 438,* 900-901.

Goldstein, D., Hahn, C. S., Hasher, L., Wiprzycka, U. J., & Zelazo, P. D. (2007). Time of day, intellectual performance, and behavioral problems in morning versus evening type adolescents: Is there a synchrony effect? *Personality and Individual Differences, 42,* 431-440.

Holzinger, A., Kickmeier-Rust, M. D., & Ebner, M. (2009). Interactive technology for enhancing distributed learning: A study on weblogs. *HCI 2009: People and Computers, 23,* 309-312.

Jaffar, A. A. (2012). YouTube: An emerging tool in anatomy education. *Anatomical Sciences Education, 5,* 158-164.

Kaplan, D. S., Rupley, W. H., Sparks, J., & Holcomb, A. (2007). Comparing traditional journal writing with journal writing shared over e-mail list serves as tools for facilitating reflective thinking: A study of preservice teachers. *Journal of Literacy Research, 39,* 357-387.

Keller, J. (2009, June 11). Studies explore whether the Internet makes students better writers. *The Chronicle of Higher Education.* Retrieved from http://chronicle.com/article/Studies-Explore-Whether-the/44476/.

Kellogg, R. T., & Raulerson, B. A. III (2007). Improving the writing skills of college students. *Psychonomic Bulletin & Review, 14,* 237-242.

Kim, S., Dueker, G. L., Hasher, L., & Goldstein, D. (2002). Children's time of day preference: Age, gender and ethnic differences. *Personality and Individual Differences, 33,* 1083-1090.

Kruse, N. B., & Veblen, K. K. (2012). Music teaching and learning online: Considering YouTube instructional videos. *Journal of Music, Technology & Education, 5,* 77-87/

Martin, P. Y., & Marrington, S. (2005). Morningness–eveningness orientation, optimal time-of-day and attitude change: Evidence for the systematic processing of a persuasive communication. *Personality and Individual Differences, 39,* 367-377.

Massis, B. E. (2013). Textbook affordability: The library's role. *New Library World, 114,* 179-183.

May, C. P. (1999). Synchrony effects in cognition: The costs and a benefit. *Psychonomic Bulletin & Review, 6,* 142-147.

May, C. P., & Hasher, L. (1998). Synchrony effects in inhibitory control over thought and action. *Journal of Experimental Psychology: Human Perception and Performance, 24,* 363-379.

May, C. P., Hasher, L., & Stoltzfus, E. R. (1993). Optimal time of day and the magnitude of age differences in memory. *Psychological Science, 4,* 326-330.

Natale, V., & Lorenzetti, R. (1997). Influences of morningness-eveningness and time of day on narrative comprehension. *Personality and Individual Differences, 23,* 685-690.

Newlin, M. H., & Wang, A. Y. (2002). Integrating technology and pedagogy: Web instruction and seven principles of undergraduate education. *Teaching of Psychology, 29,* 325-330.

Oseas, L., & Underwood, B. J. (1952). Studies of distributed practice: V. Learning and retention of concepts. *Journal of Experimental Psychology, 43,* 143-148.

Parker, K., Lenhart, A., & Moore, K. (2011). The digital revolution and higher education. *Pew Internet.* Retrieved from http://www.pewinternet.org/2011/08/28/the-digital-revolution-and-higher-education/.

Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education, 93,* 223-231.

Purcell, K., Buchanan, J., & Friedrich, L. (2013). The impact of digital tools on student writing and how writing is taught in schools. *PewResearch Internet Project.* Retrieved from www.pewinternet.org/2013/07/16/the-impact-of-digital-tools-on-student-writing-and-how-writing-is-taught-in-schools/.

Randall, D. K. (2012). *Dreamland: Adventures in the strange science of sleep.* New York: W. W. Norton & Company.

Rees, J. (2008, May). Teaching history with YouTube (and other primary-source video sites on the internet). *Perspectives on History.* Retrieved from http://www.historians.org/publications-and-directories/perspectives-on-history/may-2008/teaching-history-with-youtube.

Reynolds, J. H., & Glaser, R. (1964). Effects of repetition and spaced review upon retention of a complex learning task. *Journal of Educational Psychology, 55,* 297-308.

Roediger, H. L. III, & Pyc, M. A. (2012). Inexpensive techniques to improve education: Applying cognitive psychology to enhance educational practice. *Journal of Applied Research in Memory and Cognition, 1,* 242–248.

Ruch, T. C. (1928). Factors influencing the relative economy of massed and distributed practice in learning. *Psychological Review, 35,* 19-45.

Seabrook, R., Brown, G. D. A., & Solity, J. E. (2005). Distributed and massed practice: From laboratory to classroom. *Applied Cognitive Psychology, 19,* 107–122.

Selingo, J. (2013). *College unbound: The future of higher education and what it means for students.* New York: New Harvest.

Sternberg, R. J. (2013, June 17). Giving employers what they don't really want. *The Chronicle of Higher Education.* Retrieved from http://chronicle.com/article/Giving-Employers-What-They/139877.

Thompson, C. (2009, August 24). Clive Thompson on the New Literacy. *Wired Magazine.* Retrieved from http://archive.wired.com/techbiz/people/magazine/17-09/st_thompson.

Tsui, L. (1999). Courses and instruction affecting critical thinking. *Research in Higher Education, 40,* 185-200.

U.S. Department of Education (2010). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies.* Washington, DC: Office of Planning, Evaluation, and Policy Development.

Underwood, B. J. (1961). Ten years of massed practice on distributed practice. *Psychological Review, 68,* 229–247.

Weiler, A. (2004). Information-seeking behavior in Generation Y students: Motivation, critical thinking, and learning theory. *The Journal of Academic Librarianship, 31,* 46-53.

West, R., Murphy, K. J., Armilio, M. L., Craik, F. I. M., & Stuss, D. T. (2002). Effects of time of day on age differences in working memory. *Journal of Gerontology, 57B,* 3-10.

White, E. J. (2009). Coffy, YouTube, and Uncle Ben: The use of film and new media in the teaching of African American Studies at the University of Hawai'i. *New Media in Higher Education, 42,* 47-53.

Willingham, D. T. (2002). Ask the Cognitive Scientist. Allocating student study time: "Massed" versus "Distributed" practice. *American Educator, 26,* 37-39.