

2007

## Using Internet Technology to Apply and Extend Research from the Past: Reviving Work on Instructor Notes and Review Questions

Mark Grabe  
*University of North Dakota*

Follow this and additional works at: <https://scholarworks.bgsu.edu/mwer>

[How does access to this work benefit you? Let us know!](#)

---

### Recommended Citation

Grabe, Mark (2007) "Using Internet Technology to Apply and Extend Research from the Past: Reviving Work on Instructor Notes and Review Questions," *Mid-Western Educational Researcher*. Vol. 20: Iss. 1, Article 9.

Available at: <https://scholarworks.bgsu.edu/mwer/vol20/iss1/9>

This Featured Article is brought to you for free and open access by the Journals at ScholarWorks@BGSU. It has been accepted for inclusion in Mid-Western Educational Researcher by an authorized editor of ScholarWorks@BGSU.

---

# *Using Internet Technology to Apply and Extend Research from the Past: Reviving Work on Instructor Notes and Review Questions*

Mark Grabe  
University of North Dakota

## **Abstract**

*The theme of the 2006 MWERA conference, Teaching and Learning in an Electronic Era, offered an opportunity to reflect on opportunities and challenges created by new technologies. This paper focuses on applied educational research and identifies a set of interrelated research opportunities enabled because of the Internet. While these opportunities are explored using two specific examples (Instructor Notes and Review Questions), it seems reasonable that similar opportunities exist with other topics.*

While some may be interested in taking advantage of the power of the Internet and other digital technologies to drastically reform educational practice and may interpret what I am proposing as more of the same old thing, I see value both in exploring new opportunities and in carefully evaluating how the Internet may allow old ideas to be applied in powerful new ways. Part of the argument I will advance here contends that, in fact, many old ideas studied so carefully in research labs were never actually implemented and new technologies may now allow such ideas to be attempted and evaluated in settings where they may benefit students.

The potential opportunities I see for researchers can be described as an implementation model consisting of interrelated stages that unfold sequentially but generates multiple feedback loops prompting renewed activity at previous stages. The stages can be described as follows:

*Stage 0 – Stage of Inactivity.* Some research topics generate a great deal of activity and then seem to go dormant. Before the period of dormancy begins, a body of literature resulting mainly from laboratory studies periodically integrated into reviews is accumulated. A dormant topic might be differentiated from a dead topic by the inability of those involved to generate useful applications based on what seem to be insightful principles.

*Stage 1 – Stage of Revival.* A research topic can be revived when some new insight or technology allows the advancement of theory or productive application. The Internet and related technologies offer opportunities for applying and field testing ideas largely derived from laboratory research.

*Stage 2 – Field Based Validation.* In education, laboratory research is often limited by some predictable validity problems. Laboratory studies tend to be short in duration, use artificial content, and lack the consequences to participants that influence the motivation of students in applied settings. Even the careful control over circumstances that is so valued in theory building can cloud predictions made regarding application. Learners in applied settings have considerable freedom and frequently do not use opportunities or resources as intended. Because

the Internet and related technologies allow anytime and anywhere access, learning opportunities offered through the Internet can be embedded as part of the natural learning environment within which students function. The data collection and communication capabilities of these same technologies provide a window allowing the collection of data and the study of learning behaviors in a natural context.

*Stage 3 – Stage of Unintended Consequences.* Technologies that become part of daily life have a way of generating unintended consequences. Students will appropriate powerful tools to their own needs. As some of these adaptations are identified, understanding the new behaviors will become the focus of new research activity.

The comments that follow are intended to outline two research areas in which this model applies. I acknowledge many limitations; the areas were selected based on my personal involvement, the historical overviews are not intended to be complete, the recent Internet-enabled research is mostly my own, and many of the questions I raise I do not claim my research or the research of others can presently answer. My intent is to use these examples to encourage consideration of a general perspective that others may find helpful in thinking about ways in which the Internet and related technologies may advance both classroom applications of existing research and research within the context of applied settings.

## Example One—Supplemental Lecture Resources

Research on student note-taking was quite prevalent before 1990. Kiewra (1989) estimated that more than 100 studies had investigated issues associated with student note-taking. A descriptive model proposed by DiVesta and Gray (1972) organized the early research and continues to be referenced by present investigators. This model has encouraged an examination of the benefits, difficulties, and potential interventions associated with the cognitive processes involved in *encoding* (taking notes) and then making use of the *external storage* generated in the note taking process (study of notes). Taking notes potentially offers an active way of processing

---

new information and provides a tangible record for later study. Students who struggle in the process of taking notes, perhaps because of poor content area knowledge or processing capacity overload (Kiewra and Benton, 1988) may learn less from the immediate experience and then encounter a secondary obstacle because they must attempt to study from an incomplete record of the original presentation. In one study, Kiewra (1985) found that student notes contain less than 50% of the idea units presented. Providing students access to what are often described as “instructor notes” has been evaluated as a solution to both the problems of encoding and external storage (for a recent review see Armbruster, 2000). Instructor notes can eliminate the cognitive demands of note taking or can provide a structure within which personal notes can be embedded. Instructor notes also assure that essential information is available for review.

*Revival.* The Internet and commonly available course management software offer instructors the practical opportunity to offer notes and other lecture supplements to students. In a study involving 700 University of Wisconsin System faculty members who used a course management system (CMS), Morgan (2003) determined that 70% of instructors made lecture supplements available to students. While the meaning of lecture supplements is somewhat ambiguous, lecture outlines (e.g., PowerPoint presentations) and lecture summaries would certainly fit and are likely to be the type of resource many instructors make available. When the original research on providing lecture notes to students was conducted, providing students instructor notes would have been a significant logistical challenge. Instructors would have to work far enough ahead to prepare materials in a format appropriate for distribution, have a large number of copies printed and then distribute these resources before class. Now, the same resource used to support a lecture during class can be conveniently shared with students using a CMS.

*Field Based Validation.* An Internet based delivery system (a CMS or other server-based system requiring students to identify themselves to gain access) offers researchers the opportunity to collect data on student use of lecture resources. These data can then be related to student characteristics, examination performance, and student descriptions of study strategies. There are some very basic, but important questions that should be answered. For example, how frequently do students use online lecture resources and are lecture resources used in ways that are consistent with what laboratory research suggests would be advantageous. More specifically, are lecture outlines downloaded before class so the outline can be used to increase the efficiency of processing lecture content?

A second research topic might involve field based investigations of if and how students are willing to use various “representations” of lecture content. The primary focus of existing laboratory research has been on outlines and complete notes, although other methods for representing lecture content have been investigated such as matrix notes (Kiewra, Dubois, Christian & McShane, 1988). Recent interest in “podcasting”

lecture content represents a largely unevaluated addition to this list of alternatives (Campbell, 2005).

*Unintended consequences.* While a substantial body of literature evaluating online lecture resources has yet to accumulate, educators and a few researchers have started speculating about at least one unintended consequence. If complete representations of lecture content such as lecture summaries or audio recordings are available online, perhaps students will be inadvertently encouraged to skip class (Potts, 1993). I have commonly encountered this concern among colleagues, but I have found little published data on this topic. The issue might be addressed through two questions: First, do students skip class more frequently when provided access to online resources? Second, does the performance of students suffer when they use online resources as an alternative to attendance?

*Sample from the new literature.* Several recent studies have examined relationships among the student use of online lecture resources, examination performance, and student attendance (Christopherson & Grabe, 2006; Grabe, 2005; Grabe & Christopherson, 2005; Grabe, Christopherson & Douglas, 2004-2005; Herson, Sosabowski, & Loyd, 1999; Vandehey, Marsh & Diekhoff, 2005).

Because of the time, effort, and expense in generating and posting online resources, a fundamental question is whether students will use the resources. Grabe and Christopherson (2005) report that across a semester students viewed 61% of outline notes and 56% of complete notes. Vandehey, et al, (2005) reported that approximately 70% of students viewed notes. Christopherson and Grabe (2006) report findings from a study comparing student use of multiple lecture resources that may contradict popular sentiment. They determined that students accessed 61% of outline notes, 19% of complete notes, and less than 3% of audio “notes.” These authors argue that despite the interest in audio representations of lectures, students may prefer a text summary of the lecture. Complete notes may be faster to review, easier to scan to locate topics that were misunderstood, and potentially of greater value because the notes had been “preprocessed” by a more experienced student such as a graduate student note taker.

The question many instructors probably want answered is whether the use of “instructor” notes benefits students. This may not be the best question to ask of this collection of studies. Vandehey, et al. (2005) offers the one example of an attempt to control access to notes, such as outline notes, complete notes, or no notes, across groups of students. This study found no differences in achievement or attendance across groups. However, the study also offers an insight into the interpretive complexity researchers encounter when using manipulative procedures to investigate voluntary behaviors. A survey of students in the outline note group found that less than 70% of students downloaded the notes and “most” did not look at notes before the corresponding lectures were given. Interpreting the results of group comparisons when members of the groups may avoid the treatment experience that defines the group or alter the intended use of the treatment

---

is problematic. In contrast, the Grabe studies demonstrate consistent positive relationships between voluntary note use and achievement and between note use and attendance. These results suffer from a different interpretive problem. Note use is likely confounded with motivation.

Grabe (2005) attempted to contrast the examination performance of outline note users differentiated on the basis of when the notes were first accessed. It was hypothesized based on the assumed advantage of outline notes in supporting the encoding process that students who downloaded the outline notes before lectures would perform better than the students who first accessed the notes within two days of the examination. No performance differences were evident.

All of the studies cited here included some consideration of the relationship between online note use and absenteeism. It seems possible that popular interest in this issue and the attempt to offer some information influenced the decision to publish these studies. Grabe and Christopherson (2005) contrasted the online note use of students grouped as seldom absent and frequently absent. Students who were seldom absent made significantly greater use of online notes. There was a group by viewing time interaction. Those who were seldom absent made greater use of notes during the period when the content covered in the notes was being discussed in class. The groups first accessed notes at a similar rate at a later time when notes might have been used uniquely to review for an upcoming examination. Grabe, Christopherson and Douglas (2004-2005) noted that students miss class for a variety of reasons and instructors may feel differently about the use of notes as a substitute for attendance depending on the reason. Students were asked to estimate the number of lectures they had missed and to estimate the proportion of these absences that fell into five categories; illness or personal emergency, nonacademic University conflict such as athletic events, competing academic commitments, work, or voluntary skipping. Voluntary absences made up 44% of all absences and probably represent the category that most concerns instructors. Students were then asked to indicate how important access to notes was in the decision to miss class for each reason. Access to notes was indicated to play the most important role for voluntary absences, but the rated importance was similar for competing academic demands and surprisingly for illness or personal emergency. Christopherson and Grabe (2006) examined the relationship among attendance, performance, and note access. Performance data were based on five examination questions associated with two lectures for which class attendance was known. This study indicated that using online notes was more beneficial to those students who were not in class than to those who were.

### Example Two—Adjunct Questions

Like note taking, research considering the consequences of providing learners study questions, sometimes describes as interspersed questions or adjunct questions, was quite common before 1990 (e.g., Anderson & Biddle, 1975; Hamaker,

1986). Originally, the focus assumed benefits from focusing student attention or engaging students in the active processing of question-related information. A wide variety of subtopics were considered such as:

- did a factual or applied question influence learning?
- should questions precede or follow exposure to the content to be learned?, and
- does the number of questions associated with a learning goal influence performance.

More recently, engaging learners with questions has also proven to be a method for improving metacognition (Pressley, Snyder, Levin, Murray & Ghatala, 1987). Questions represent a “test like event” offering feedback that provides insight into what is understood and what is not. The benefit in this case is not derived directly from the experience of answering the question, but from taking action when feedback indicates more study is required. For example, Alessi, Anderson and Goetz (1979) provide an early example of using feedback from individual questions to guide targeted review. While questions commonly appear at the end of college textbook chapters and sometimes at the beginning of chapters to establish learning goals, the cost of inserting questions and the related concern that many students ignore inserted material has limited extensive use of questions in hard copy learning materials.

*Revival.* Online quizzes represent an early effort to move student learning experiences in online or hybrid courses beyond the review of pages of static course information. Quizzes provide students valuable feedback regarding their level of preparation for future examinations. While early quiz systems were developed by technologically savvy faculty members, dedicated commercial quizzing systems soon became available (Maki & Maki, 2001). The course management systems now available on most campuses include tools for preparing questions, presenting the questions to students, and storing student performance data for the purpose of identifying topics that should receive more attention or evaluating the understanding of students as part of the process of awarding a grade.

*Field Based Validation.* Some involved in using quizzes or study questions in hybrid courses collected data to determine whether access to questions improved performance on more significant course examinations (e.g., Brothen & Wambach, 20010; Maki & Maki, 2001) and whether access to questions improved metacognition (Maki, 1998; Pressley, Snyder, Levin, Murray & Ghatala, 1987). The opportunity to collect data on how students used online questions also indicated deficiencies in how students used such systems. Maki and Maki (2000) concluded that when students were allowed to control when they used online quizzes they frequently delayed taking the quizzes until the last couple of days before major examinations. Maki and Maki concluded that such procrastination reduced the effectiveness of quizzes in guiding study behavior. Grimstad and Grabe (2004) reached a similar conclusion regarding student use of the feedback from online

---

study questions in guiding review behavior. They provided students voluntary access to a system that presented study questions and presented feedback. Following each incorrect response students received feedback that included the book page number associated with the question. The intent was for students to reread passages from the textbook when learning they had answered specific questions incorrectly. The online system allowed the determination of the delays between the presentation of this feedback page and the request from the student for the next question. Grimstad and Grabe determined that the average delay was too brief to allow a lookup of book related material. Most students appeared to use the system to move quickly through the number of questions they chose to review.

*Unintended consequences.* Online quizzes in the studies cited here were not intended to play a major role in determining student grades, but rather to provide students feedback that will be helpful in preparation for major examinations. The points associated with quizzes appear necessary to establish a contingency assuring widespread participation (Maki and Maki, 2001). Unfortunately, it appears that associating quiz performance with required points may encourage students to look up answers for the questions provided in an online setting. Such behavior appears to reduce the value of quiz performance in estimating later examination performance (Brothen & Wambach, 2001). Brothen and Wambach (2004) evaluated an online quiz system that imposed a 15-minute time limit on 10 item multiple-choice quizzes and found that the predictive power of quiz performance was improved.

*A new direction.* Research on the role question feedback plays in computer-based instruction has enjoyed continuous attention (e.g., Mory, 2004). Interpreting the impact of feedback in influencing metacognition offers a somewhat different perspective. Using the accuracy of examination score predictions as a measure of metacognitive awareness, it appears that students who have made voluntary use of online study questions may not necessarily improve the accuracy of their predictions when contrasted with students not using study questions. This occurs despite the value of the data collected by the computer in predicting future examination performance (Grabe, Bordages & Petros, 1990). Some have begun to question whether poor predictions are a function of flawed metacognition (e.g., Bol, O'Shea, Hacker & Allen, 2003, Dembo & Jakubowski, 2003; Hacker, Bol, Horgan & Rakow, 2000). Participants may be unwilling to indicate they expect poor performance as a defensive measure or may make predictions on the basis of such factors as the score they would like to achieve.

Chrisopherson (2004) attempted to determine if students exposed to practice questions had information that would allow them to make improved predictions of examination performance. Before examinations, she asked those who had answered online study questions to estimate the proportion of the questions they had answered correctly and to estimate the score they would earn on the examination. On some of

the examinations in a semester long course, regression procedures predicting earned examination score demonstrated that the recalled performance on practice questions accounted for significantly more variability than the predicted score. This outcome both indicates that use of the discrepancy between predicted and actual performance in applied settings may not represent a valid variable for assessing metacognitive skill and demonstrates the potential value of the data available when students respond to online questions. Developing and evaluating procedures for more effectively feeding this information back to students or even using this information to direct students toward poorly understood material during study sessions may represent productive opportunities for new research.

## Summary

The Internet and related technologies can serve to revitalize research topics that have languished and provide insights into how students utilize applied opportunities based on this research. This paper identifies two examples, online lecture resources and adjunct questions, in support of this proposal. Applied research focused on these topics is clearly more primitive than the original body of research on which these studies are based. However, the field based research may not need to demonstrate causal relationships to be useful. An issue may be whether students respond in applied settings in ways that are consistent with the proposed advantages identified in more controlled and contrived settings. Documenting how students respond to online learning opportunities set in learner-regulated environments is a unique and important contribution and the data collection capabilities of server-based experiences provide a way to monitor what happens in such authentic settings. Contrasting the characteristics and performance of those students who use online learning opportunities in ways that seem appropriate and inappropriate may be a way to begin.

## References

- Alessi, S. M., Anderson, T. H., & Goetz, E. T. (1979). An investigation of lookbacks during studying. *Discourse Processes, 2*, 197-212.
- Anderson, R. C., & Biddle, W. B. (1975). On asking people questions about what they are reading. In G. H. Bower (Ed.), *Psychology of learning and motivation* (pp. 89-132). New York: Academic Press.
- Armbruster, B. B. (2000). Taking notes from lectures. In R. F. Flippo and D. C. (Eds.), *Handbook of college reading and study strategy research* (pp. 175-199). Mahwah, NJ: Lawrence Erlbaum.
- Bol, L., O'Shea, P., Hacker, D., & Allen, D. (2003). *The influence of practice, achievement level, and explanatory style on calibration accuracy*. Presented at the Annual Meeting of the American Educational Research Association, Chicago.

- Brothen, T., & Wambach, C. (2001). Effective student use of computerized quizzes. *Teaching of Psychology, 28*, 292-294
- Brothen, T., & Wambach, C. (2004). The value of time limits on Internet quizzes. *Teaching of Psychology, 31*, 62-64.
- Campbell, G. (2005). There's something in the air: Podcasting in education. *Educause Review, 40*, 33-46.
- Christopherson, K. (2004). *The role of voluntary use of an online study system on calibration of comprehension: Student perspectives of study habits and explanations for test predictions*. Unpublished masters thesis, Grand Forks, ND: University of North Dakota.
- Christopherson, K., & Grabe, M. (2006). *Voluntary student use of lecture resources, achievement, and course attendance*. Paper presented at the Beyond Boundaries: Integrating Technology Into Teaching and Learning Conference. Grand Forks, ND.
- Dembo, M. H., & Jakubowski, T. G. (2003). *The influence of self-protective perceptions on the accuracy of test prediction*. Presented at the Annual Meeting of the American Educational Research Association, Chicago.
- DiVesta, F. J., & Gray, G. S. (1972). Listening and taking notes. *Journal of Educational Psychology, 63*, 8-14.
- Grabe, M. (2005). Voluntary use of online lecture notes: Correlates of note use and not use as an alternative to class attendance. *Computers and Education, 44*, 409-421.
- Grabe, M., Bordages, W., & Petros, T. (1990). The impact of computer supported study on student awareness of examination preparation and on examination performance. *Journal of Computer Based Instruction, 17*, 113-119.
- Grabe, M., & Christopherson, K. (2005). Evaluating the advantages and disadvantages of providing lecture notes: The role of internet technology as both a delivery system and research tool. *Internet and Higher Education, 8*, 291-298.
- Grabe, M., Christopherson, K., & Douglas, J. (2004-2005). Providing introductory psychology students access to online lecture notes: The relationship of note use to performance and class attendance. *Journal of Educational Technology Systems, 33*, 295-308.
- Grimstad, K., & Grabe, M. (2004). Are online study questions beneficial? *Teaching of Psychology, 31*, 143-146.
- Hacker, D. J., Bol, L., Horgan, D. D., & Rakow, E. A. (2000). Test prediction and performance in a classroom context. *Journal of Educational Psychology, 92*, 160-170.
- Hamaker, C. (1986). The effects of adjunct questions on prose learning. *Review of Educational Research, 56*, 212-242.
- Herson, K., Sosabowski, M. H., & Loyd, A. W. (1999). Intranet-based learning: A one-year study of student utilization. *Journal of Computer Assisted Learning, 15*, 269-278.
- Kiewra, K. (1985). Investigating note taking and review: A depth of processing alternative. *Educational Psychologist, 20*, 23-32.
- Kiewra, K. (1989). A review of note-taking: The encoding-storage paradigm and beyond. *Educational Psychology Review, 1*, 147-172.
- Kiewra, K., & Benton, S. (1988). The relationship between information-processing ability and note taking. *Contemporary Educational Psychology, 13*, 33-44.
- Kiewra, K., Dubois, N. F., Christian, D., & McShane, A. (1988). Providing study notes: Comparison of three types of notes on review. *Journal of Educational Psychology, 80*, 595-597.
- Maki, R. H. (1998). Test predictions over text material. In D. J. Hacker, J. Dunlosky & A. C. Graesser (Eds.), *Metacognition in educational theory and practice* (pp. 1117-1440). Mahwah, NJ: Lawrence Erlbaum.
- Maki, W. S., & Maki, R. H. (2000). Evaluation of a web-based introduction to psychology course: II. Contingency management to increase use of study aids. *Behavior Research Methods, Instruments and Computers, 32*, 240-245.
- Maki, W. S., & Maki, R. H. (2001). Mastery quizzes on the web: Results from a web-based introductory psychology course. *Behavior Research Methods, Instruments and Computers, 33*, 212-216.
- Morgan, G. (2003) Faculty use of course management systems in the University of Wisconsin system. *Educause Center For Applied Research Report*. Retrieved from [http://www.educause.edu/LibraryDetailPage/666?ID\\_ERS0302](http://www.educause.edu/LibraryDetailPage/666?ID_ERS0302)
- Mory, E. H. (2004). Feedback research revisited. In D. H. Jonassen (Ed.) *Handbook of research on educational communications and technology* (2<sup>nd</sup> ed., pp. 745-783). Mahwah, NJ: Lawrence Erlbaum.
- Potts, B. (1993). Improving the quality of student notes. *Practical Assessment, Research and Evaluation, 3*. Retrieved March 24, 2006, from <http://PAREonline.net/getvn.asp?v+3&n-8>
- Pressley, M., Snyder, B. L., Levin, J. R., Murray, H. G., & Ghatala, E. S. (1987). Perceived readiness for examination performance (PREP) produced by initial reading of text and text containing adjunct questions. *Reading Research Quarterly, 22*, 219-235.
- Vandehey, M. A., Marsh, C. S., & Diekhoff, G. M. (2005). Providing students with instructors' notes: Problems with reading, studying, and attendance. *Teaching of Psychology, 32*, 49-52.