TECHNOLOGY AND TEACHING

They Hear, But Do Not Listen: Retention for Podcasted Material in a Classroom Context

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This study examined the retention of students who listened to podcasts of a primary source to the retention of students who read the source as text. We also assessed students' preferences and study habits. Quiz scores revealed that the podcast group performed more poorly than did students who read the text. Although students initially preferred podcasts, their preferences changed immediately after the quiz. Podcasts might be a useful tool to supplement or enrich course-related material, but they are not as effective as text for delivering primary content.

The popularity of portable MP3 players as tools for students to conveniently listen to or view course lectures and content has been increasing in higher education. Audio-podcasting, akin to creating files to allow a student to listen to a lecture or reading on a tape-recorder, has become very popular, with several publishers offering content in this format. Although a number of papers report provocative uses and student enthusiasm for podcasted material (e.g., Campbell, 2005; Evans, 2008; Rosell-Aguilar, 2007) scant evidence exists with regard to actual, rather than perceived, learning impact.

Similar to many other instances of technology, podcasts have been lauded for the student enthusiasm they generate and for the convenience; students can listen to them anywhere and anytime. In an often-cited report, Duke University distributed iPods to first-year students and evaluated student use and satisfaction via surveys and focus groups (Duke University, Office of Information Technology, 2005). Findings included significant student enthusiasm for the concept and perceptions of positive learning impacts. Scholars have reasoned that students' enjoyment will correlate with positive learning outcomes, as students might engage in an activity more often and more thoroughly if they enjoy it. These findings are in line with large student surveys regarding perceived benefits of technology. In a survey of students at member institutions, Educause, a group that advocates and documents technological innovation in higher education, found that students rated convenience, not learning, as the number one benefit of instructional technology (Kravik, Caruso, & Morgan, 2004). In fact, students rated convenience and time savings more than five times higher than learning benefits. It is possible that student enthusiasm for podcasts might be based on the convenience, enjoyment, or perceived learning rather than actual learning impact.

Despite students' beliefs that podcasts are effective learning tools, how well should instructors expect students to learn material presented only in an audio format? During the 1980s, cognitive psychologists studied participants' recall after reading or listening to text. Across several studies, reading text led to better recall than listening to text (Dixon, Simon, Nowak, & Hultsch, 1982; Green, 1981; Hildyard & Olson, 1982). Scholars have reported contrary findings (e.g.,

Sannomiya, 1982, 1984), but other researchers have raised methodology questions regarding these equivocal results (see Rickheit, Strohner, Müsseler, & Nattkemper, 1987). This body of basic research raises applied questions about the use of podcasts to present primary course content, but other advantages, such as convenience, accessibility, and enjoyment, might offset these concerns.

Previous research argued that students are not very good judges of their own learning (see Dunning, Johnson, Ehrlinger, & Kruger, 2003, for a review). In a study of students' perceived learning, use of pedagogical aids, and actual performance, Gurung and Daniel (2005) summarized reports of negligible to negative correlations between student use of such aids and student exam scores, despite positive student perceptions of the learning impact of these tools (see also Gurung, 2003, 2004). Clearly, initial student preference and self-report of learning are not the best indicators of student learning.

Students like the idea of podcasts, but do they learn primary content as well from listening to it as they do from reading it? This issue becomes more important as higher education begins to explore the possibility of audio text supplements to deliver a course's primary content and vocabulary. This study investigated student preference and performance on podcasted versus text-based primary content to begin to provide instructors as well as publishers with guidelines and challenges for audio-podcast use. Additionally, the students who heard podcasts participated in a focus group in which they provided feedback about their learning experiences with the podcasts.

Method

Participants

Participants were 48 students (12 men, 36 women) in a developmental psychology course at a medium-sized regional university who participated as part of a course requirement. We treated all participants in accordance with American Psychological Association (APA) ethical guidelines (APA, 2002).

Materials and Procedure

We randomly assigned students to either read the 3,330-word article or listen to a 21 min, 42 sec podcast of "Mindful of Symbols" by DeLoache (2005) in preparation for a quiz. After 2 days of time to read or listen to the article, all students used a 9-point Likert scale (1 = *not at all*, 9 = *extremely*) to complete prequiz measures of their perceived knowledge and understanding of the material for the quiz, the difficulty of the material, how much they learned, and how much they enjoyed the reading or podcast. Participants also reported the amount of time they spent studying, their activities concurrent with studying (e.g., walking while listening to the podcast), the location of studying, and competing activities they performed (e.g., talking on the phone). Finally, they used the 9-point Likert scale to report the degree to which they would prefer a podcast over reading to learn important material.

All participants then completed a 10-question multiple-choice quiz about the article (e.g., "According to the author, what is the first type of symbolism that infants and young children master?"). After completion of the quiz, participants answered the last Likert scale question again.

In addition to the quantitative data collection previously described, the 23 students who heard the podcast participated in a focus group discussion immediately following the quiz and provided feedback regarding their perceptions of positive and negative aspects of podcasts as primary learning tools.

Results and Discussion

Experimental Data

Data included quiz scores, responses on the prequiz measure, and responses to the postquiz question. The 25 participants who read the article scored higher on the quiz ($M = 8.16$, $SD = 1.11$) than the 23 participants who heard the podcast ($M = 5.91$, $SD = 1.56$), $t(46) = 5.78$, $p < .001$, $d = 1.70$. Despite claims from many, these results reflect the basic research from the 1980s (e.g., Dixon et al., 1982; Green, 1981; Hildyard & Olson, 1982) and suggest that podcasts do not deliver primary content as well as textbooks. Students remember primary content better when they read instead of listen to it.

To explore students' perceptions of their learning, we used a MANOVA with condition as a between-participants independent variable and students' self-reports of their knowledge, their comprehension, the difficulty of the material, and the amount they learned from the text or podcast as dependent variables. There was a multivariate main effect for condition, Wilks's

Table 1. Means, Standard Deviations, and Univariate Statistics for Participants' Perceptions of Learning as a Function of Condition

Measure	Text		Podcast		Univariate Results
	M	*SD*	*M*	*SD*	
Knew (remembered) material	6.56	0.96	5.52	1.73	$F(1, 46) = 6.76$, $p < .05$, partial $\eta^2 = .13$
Understood (comprehended) material	7.08	0.91	6.04	1.94	$F(1, 46) = 5.76$, $p < .05$, partial $\eta^2 = .11$
Difficulty level of material	4.00	1.29	5.04	1.40	$F(1, 46) = 7.23$, $p < .05$, partial $\eta^2 = .14$
Learn from text/podcast	6.40	0.96	5.78	1.51	$F(1, 46) = 2.92$, $p < .10$, partial $\eta^2 = .06$

Lambda, $F(4, 43) = 3.40$, $p < .05$, $\eta^2_p = .24$. As shown in Table 1, univariate results revealed that students who read the article reported that they knew more, understood more, had less difficulty, and, marginally, learned more than did students who heard the podcast. Despite these differences, students did not report spending different amounts of time reading the text ($M = 25$ min, 2.40 sec, $SD = 13$ min, 15.70 sec) and listening to the podcast ($M = 24$ min, 20.87 sec, $SD = 7$ min, 4.88 sec), $t(46) = .22$, $p = .83$, $d = .06$, and students similarly enjoyed reading the text ($M = 5.60$, $SD = 1.47$) and listening to the podcast ($M = 5.48$, $SD = 2.04$). The difference in enjoyment was not significant, $t(46) = .24$, $p = .81$, $d = .07$. Despite claims of greater flexibility for podcasts and student preference for them when asked, students did not spend different amounts of time interacting with podcasts and text, and they did not rate them as differentially enjoyable when asked after actually interacting with the material in both media. Even with these similarities in time and enjoyment, the quiz performance difference remained.

Students reported other activities they did while they were reading and the locations for reading. The choices of activities included walking, sitting, working out, driving, doing chores, and other. Although students did not differ across all categories of reported activities for reading or listening locations as a function of condition, $\chi^2(4, N = 48) = 6.38$, *ns*, 88% of participants who read the text reported sitting, and 60.9% participants who listened to the podcast reported sitting, $\chi^2(1, N = 48) = 4.70$, $p < .05$, $\varphi = .31$. Students listening to podcasts were less likely to sit and study than were students who read the material. There were no significant differences in the locations in which students read or listened to the material. Students who listened to podcasts were not more likely to take advantage of the potential for flexibility for study locations and activities provided by podcasts.

Table 2 shows the number and percentage of participants who reported doing each of the other competing activities (e.g., talking on the phone, doing other computer activities) while they were reading or listening to the article. Students who read the article reported engaging in a mean total of 3.36 ($SD = 2.78$) competing activities, and students who listened to the podcast reported engaging in a mean total of 2.48 ($SD = 2.21$) competing activities; this difference was not significant, $t(46) = 1.20$, $p = .23$, $d = .35$. As shown in Table 2, students in the podcast condition were more likely than students in the text condition to report doing other computer activities, $\chi^2(1, N = 48) = 4.17$, $p < .05$, $\varphi = .30$. Although students in the text condition reported a greater total of noncomputer activities such as talking on the phone, watching television, or having people present ($M = 3.12$, $SD = 2.59$) than

Table 2. Number and Percentage of Participants Who Self-Reported Competing Activities as a Function of Condition

Activity	Text		Podcast	
	n	%	*n*	%
Television	5	20.0	1	4.3
Music	9	36.0	3	13
Roommates/friends present	13	52.0	8	34.8
Unknown people present	6	24.0	3	13
Both friends and unknown people present	6	24.0	2	8.7
Respond to instant messaging/e-mail via the Internet	8	32.0	5	21.7
Facebook/MySpace	6	24.0	6	26.1
Other computer activities	5	20.0	11	47.8*
Text message	10	40.0	5	21.7
Answer phone	7	28.0	5	21.7
Talk on phone	5	20.0	3	13.0
Other	4	16.0	8	34.8
Total	84		61	

Note. "Other" responses included "get ready," "distracted," "interrupted," "other reading," "sat with significant other," "cleaned room," and "showered."
*$p < .05$, $\varphi = .30$.

students in the podcast condition reported ($M = 2.04$, $SD = 1.89$), this difference was not significant, $t(46) = 1.63$, $p = .11$, $d = .47$. Students who listen to podcasts on computers do more computer activities, perhaps due to the distractions inherent in the wide variety of easily accessible computer activities. Any technological device that plays podcasts (e.g., computers, iPods, or cellular phones) might have other features that could be more interesting and distracting than the class material in the podcast.

Both before and after the quiz, participants reported the degree to which they would prefer a podcast over reading to learn important material. To evaluate responses, we used a repeated measures ANOVA with condition as a between-participants independent variable and the timing of the quiz (pre and post) as a within-participants variable. There was a main effect for condition; students preferred text ($M = 6.02$, $SD = 1.25$) over podcasts ($M = 4.41$, $SD = 1.88$), $F(1, 46) = 12.31$, $p < .01$, $\eta_p^2 = .21$. There was also a main effect for time; scores decreased between the pretest ($M = 5.73$, $SD = 2.09$) and the posttest ($M = 4.77$, $SD = 1.87$), Wilks's Lambda, $F(1, 46) = 19.98$, $p < .001$, $\eta_p^2 = .30$. More importantly, however, a significant interaction existed between condition and time, Wilks's Lambda, $F(1, 46) = 18.41$, $p < .001$, $\eta_p^2 = .29$. We performed simple contrasts to investigate the interaction. The difference between the pretest scores ($M = 6.04$, $SD = 1.46$) and posttest scores ($M = 6.00$, $SD = 1.38$) for the text group was not significant, $t(46) = .15$, $p = .88$, $d = .04$. The difference between pretest ($M = 5.39$, $SD = 2.61$) and posttest ($M = 3.43$, $SD = 1.34$) for the podcast group was significant, $t(46) = 5.38$, $p < .001$, $d = 1.55$. Although students who listened to podcasts preferred podcasts before the quiz, after the quiz the preference for podcasts decreased. Although students did not immediately learn about their performance on the quiz (i.e., their grades), merely taking the test alerted them to the limits in their comprehension after listening, and the significant change in the preferences for the podcast group reflected this realization.

Student Focus Group Outcomes

In a focus group following the quiz, we asked the 23 students in the podcast group how the podcasts could be made more valuable. Several issues emerged that might be helpful for future investigation as well as podcast development. Students reached a near unanimous consensus on five points: (a) The lack of signaling de-

vices (e.g., bold words, italics) in the podcasts made it difficult to prioritize the reading and focus on the important points; (2) podcasts lack visuals such as charts and graphs that reinforce the reading; (3) the students were much less likely to review sections of the podcast than they would have been when reading it; (4) the more the voiceover in the podcast sounded like a professional reader (e.g., not casual and conversational), the less enjoyable the podcast; and (5) it was easier to listen to the podcast on the computer than to go through the trouble of downloading it to an MP3 player. Although the last suggestion might explain the results that the podcast and text groups did not differ much in where they interacted with the material, the suggestion that the podcasts might be more effective if the learners were also supplied visual support (e,g., signaled text and supporting graphs) was not tested in this study.

Conclusions

The results argue for caution when relying on audio podcasts to deliver primary course content. Students in the podcast group performed relatively poorly on the quiz and reported that they knew less, understood less, experienced more difficulty with the material, and, marginally, learned less than did students in the text condition. Despite the popular claims that podcasts allow for more flexibility of use, efficiency, and enjoyment (e.g., Campbell, 2005; Duke University, Office of Information Technology, 2005) and despite a lower likelihood of sitting to study, the students in this sample did not differ in where they interacted with the material, how long they studied, or how much they enjoyed the content.

As expected, students who listened to podcasts initially preferred podcasts as learning tools in this study. This finding joins an ever growing list of student preferences for pedagogy and techniques that do not positively affect their actual, as opposed to perceived, learning (e.g., Gurung & Daniel, 2005; Wesp & Miele, 2008). Student perception of learning is seldom a reliable basis for performance-based measures (e.g., Dunning et al., 2003). Interestingly, directly after taking the quiz, even without formal feedback regarding their performance, students in the podcast group realized that the podcasts were not effective tools for their learning and performance. It is possible that students are more likely to gauge the effectiveness of very poor strategies if they have experience using them and reflecting on them in an evaluated context.

The findings reported here suggest that audio podcasts are not effective learning tools for the mastery of primary course content, such as vocabulary and core concepts. The use of audio podcasts remains untested for delivering secondary content that reinforces, extends, and contextualizes the primary concepts of a course or concept. Indeed, enriching primary content in this manner might be the ideal use for audio podcasts.

References

American Psychological Association. (2002). Ethical principles of psychologists and code of conduct. *American Psychologist, 57,* 1060–1074.

Campbell, G. (2005). There's something in the air: Podcasting in education. *Educause Review, 40,* 32–47.

DeLoache, J. S. (2006). Mindful of symbols. *Scientific American Mind, 17*(1), 71–75.

Dixon, R. A., Simon, E. W., Nowak, C. A., & Hultsch, D. F. (1982). Text recall in adulthood as a function of level of information, input modality, and delay interval. *Journal of Gerontology, 37,* 358–364.

Duke University, Office of Information Technology. (2005). *Duke University iPod first year experience* (Final Evaluation Rep.). Retrieved November 9, 2008, from http://cit.duke.edu/pdf/reports/ipod_initiative_04_05.pdf

Dunning, D., Johnson, K., Ehrlinger, J., & Kruger, J. (2003). Why people fail to recognize their own incompetence. *Current Directions in Psychological Science, 12,* 83–87.

Evans, C. (2008). The effectiveness of m-learning in the form of podcast revision lectures in higher education. *Computers & Education, 50,* 491–498.

Green, R. (1981). Remembering ideas from text: The effect of modality of presentation. *British Journal of Educational Psychology, 51,* 83–89.

Gurung, R. A. R. (2003). Pedagogical aids and student performance. *Teaching of Psychology, 30,* 92–95.

Gurung, R. A. R. (2004). Pedagogical aids: Learning enhancers or dangerous detours? *Teaching of Psychology, 31,* 164–166.

Gurung, R. A. R., & Daniel, D. B. (2005). Do text-based pedagogical features enhance student learning? In D. S. Dunn & S. L. Chew (Eds.), *Best practices for teaching introduction to psychology* (pp. 41–55). Mahwah, NJ: Lawrence Erlbaum Associates.

Hildyard, A., & Olson, D. R. (1982). On the comprehension and memory of oral v. written discourse. In D. Tannen (Ed.), *Spoken and written language: Exploring orality and literacy* (pp. 19–33). Norwood, NJ: Ablex.

Kravik, R. B., Caruso, J. B., & Morgan, G. (2004). *ECAR study of students and information technology, 2004: Convenience, connection, and control roadmap.* Retrieved November 9, 2008, from http://www.educause.edu/ECAR/ECARStudyofStudentsandInformat/155030

Rickheit, G., Strohner, H., Müsseler, J., & Nattkemper, D. (1987). Recalling oral and written discourse. *Journal of Educational Psychology, 79,* 438–444.

Rosell-Aguilar, F. (2007). Top of the pods—In search of a podcasting "pedagogy" for language learning. *Computer Assisted Language Learning, 20,* 471–492.

Sannomiya, M. (1982). The effect of presentation modality on text memory as a function of difficulty level. *Japanese Journal of Psychonomic Science, 1,* 85–90.

Sannomiya, M. (1984). The modality effect on text processing as a function of presentation rate. *Japanese Journal of Psychonomic Science, 3,* 17–20.

Wesp, R., & Miele, J. (2008). Student opinion of the quality of teaching activities poorly predicts pedagogical effectiveness. *Teaching of Psychology, 35,* 360–362.

Notes

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