Enhanced Instructional Feedback Using Digital Pen Technologies: A Proposal for a Peabody College Instructional Improvement Grant
Andy Van Schaack, Ph.D.

Overview

Classroom-based research has consistently shown that “the most powerful single moderator that enhances achievement is feedback” (Hattie, 2003, p. 8). Feedback is most commonly provided through in-class activities, examinations, and homework assignments. Professors understand that the more opportunities they provide their students to perform with feedback, the greater the likelihood that their students will acquire and retain the targeted knowledge and skills. Unfortunately, professors also realize that increasing the number of assignments dramatically increases the number of papers they must grade—exacerbating what Stern and Solomon (2006) describe as “…the most stressful, most time consuming, and least rewarding activity in which professors engage” (p. 22).

The proposed solution to this problem is a low-cost, easy-to-use digital pen that enables professors to provide handwritten and spoken feedback to their students on their homework assignments.

As shown in Figure 2 below, a student would submit their assignment electronically to their professor via email or through a network dropbox. The professor would print the assignment onto paper. The professor would then use the Livescribe smartpen to provide handwritten and spoken feedback. (The pen digitizes the handwritten and the spoken comments and embeds the information into the electronic version of the student’s paper.) The professor would return the assignment to the student in PDF format, again via email or network dropbox, and the student would read and listen to their professor’s comments on their computer using the (free) Acrobat Reader application. An example of this type of document can be downloaded from this web address: http://goo.gl/fu0sG. It can be viewed and listened to using Adobe Reader version 10 or greater.

Figure 1. The Livescribe smartpen with embedded audio and digital ink capture technology.

Figure 2: Document workflow beginning with the student at the top and continuing clockwise.
The idea of providing feedback to students through recorded speech is not new. Although the technology used to provide spoken feedback has advanced from audiocassettes (Clark, 1981) to iPods (Ribchester, France, & Wheeler, 2007), the effects seen are relatively consistent. Students feel that spoken feedback produces a more comfortable, less-formal learning environment (Ice, Curtis, Phillips, & Wells, 2007) where the instructor “shifts from being an impersonal grader to a writing coach” (Johnson, 1999, p. 33). Audio feedback allows for the expression of nuance, tone, emphasis, and emotions, making the feedback feel more personal (McCormack & Taylor, 2006). While written feedback is most useful for mechanical corrections such as APA formatting, syntax, grammar, and document structure, where students find highlighting and circling to be useful (Ice et al., 2007), audio feedback allows instructors to convey complex thoughts (Merry & Orsmond, 2008). The mixture of increased detail and the presence of nuance allowed students to obtain a clearer direction and understanding of what they need to improve (Still, 2007; Wilson, 2009).

The outcomes of Ice et al.’s (2007) experiment provide the best indication of the results that are expected from the proposed study. Ice et al. found that professors provided two and a half times more information (by word count) when they spoke their feedback compared with when they typed it. Furthermore, it only took them one-quarter of the time to provide the spoken feedback. (This represents a ten-fold increase in efficiency.) Students were three times more likely to incorporate spoken feedback in subsequent drafts. Finally, students who received spoken feedback rated their professors as liking them more.

Based on the review of the literature, with an emphasis on Ice et al.’s work, it is hypothesized that in the proposed study, professors will:

1) provide more feedback to their students through speech and writing than writing alone,
2) require less time to provide feedback through speech and writing than writing alone,
3) provide more higher-level conceptual comments through speech than writing than writing alone,
4) provide more positive feedback through speech and writing than writing alone, and
5) both students and professors will prefer the spoken and written feedback using the proposed technology compared to the conventional form of handwritten feedback.

**Goals and Objectives**

The purpose of the proposed study is to develop, evaluate, and deliver a new instructional technology that will:

1) enable professors to increase the quality and quantity of feedback they provide, while
2) significantly decreasing the time it takes for them to do it, and perhaps most importantly,
3) allow them and their students to perform their work according to their established (and preferred) habits.

**Use of Funding**

IIG funding will be used to:

- purchase 12 Livescribe smartpens and accompanying 3D recording headsets,
- pay two graduate research assistants for the 80 (total) hours they will support the principal investigator collecting and coding data, and
- pay for travel and conference fees for the PI to present the results of the study at a 2013 conference (AERA or ISTE).
Integration with Curriculum

Curriculum Integration
The technology developed through this research program is curriculum-independent. That is, it may be used with any assignment that can be printed onto paper. This includes papers written in Microsoft Word, presentations created using Microsoft PowerPoint, and spreadsheets developed in Microsoft Excel. These types of documents are produced by undergraduates and graduate students in every department at Vanderbilt University. Even homework assignments that are handwritten—for example, those produced in a calculus class—can be graded using this technology if they are first digitally-scanned.

Potential Impact
The potential impact would extend far beyond Vanderbilt University. If the proposed technology can produce the anticipated benefits for teachers and students, the impact would be significant for educators worldwide. With a modest investment on the part of the school, secondary and higher education teachers could significantly reduce the time they take to provide instructional feedback to their students, while at the same time improving both the quality and quantity of their feedback.

Activities and Timeline

Fall Semester, 2011
- November: Conduct a pilot study of the technology in the PI’s HOD1700 course using his graduate teaching assistants and undergraduate students. Each TA will grade ten 10-page lit reviews using the proposed approach. The pilot is intended to demonstrate the feasibility of the smartpen technology for this application, to develop and refine the instruments used to code the feedback data, and to understand the range of issues that should be addressed through the qualitative component of the full-scale study. Caroline Tricoli, a Vanderbilt undergraduate, is assisting with this pilot study as partial fulfillment of the requirements of the HOD Honors Program.
- November: Recruit one faculty member from each of the following colleges: the College of Arts and Science, the Blair School of Music, the School of Medicine or Nursing, the School of Engineering, the Owen Graduate School of Management, and the Peabody College of Education and Human Development. (Note: Cooperating faculty members and their teaching assistants will be allowed to keep their Livescribe smartpens following the completion of the research study.)
- December: Identify the target assignment for each course and provide familiarization training on the technology to the respective faculty member and their teaching assistant.
- December: Submit the Behavioral/Social Sciences application (Form #1124) to Vanderbilt HRPP.

Spring Semester, 2012
- January: Once the spring semester begins, check back in with each faculty member and firm-up dates for data collection, observations, and interviews.
- January: Train graduate research assistants.
- February through April: Data collection.

Summer, 2012
- Analyze and write up the results.
- Submit paper to one of the following journals (# in parentheses is JCR 5-Year Impact Factor):
  - Journal of Educational Psychology (4.917)
  - Journal of the Learning Sciences (3.644)
  - Learning and Instruction (3.294)
• Submit paper to one of the following conference organizations:
  – AERA (due July, 2012)
  – ISTE (due October, 2012)
• Evaluate the potential for submitting a proposal to the National Science Foundation’s *Innovative Technology Experience for Students and Teachers (ITEST)* program.
  – Letter of Intent due March, 2012
  – Full Proposal due May, 2012

Fall, 2012
• Present results broadly to Peabody College faculty via a Peabody Research Office (PRO) brown bag presentation or other College-wide event.
• Coordinate with Vanderbilt News Service on dissemination opportunities with media outlets.
• Submit final report to PRO.

2013
• Present at either AERA or ISTE conference.

**Budget**

A total of $4,560 is requested for hardware, research assistant support, and conference-related expenses.

*Hardware*
• 12 2GB Echo Smartpen Starter Pack ($99.95 apiece) $1,200
• 12 3D Echo 3-D Recording Premium Headset ($29.95 apiece) $360

*Research Assistants*
• 80 hours of graduate research assistant support @ $25/hr. = $2,000

*Conference-Related Expenses*
• Registration $250
• Airfare $250
• Hotel and Meals (3 days) $500

**Principal Investigator Biography**

Andy Van Schaack is an Assistant Professor of the Practice in the department of Human and Organizational Development where he teaches HOD1700: Systematic Inquiry (see attached vita). He has also taught ENGM275: Technology Forecasting and Assessment in the school of engineering. In the fall of 2012, he will be teaching a graduate-level instructional design course in the school of medicine. His scholarly research focuses on the development and delivery of instructional technologies that maximize the effectiveness, efficiency, and accessibility of teaching and learning. Andy also serves as the Senior Science Advisor to Livescribe, the California-based corporation whose technology is being used for this study. He has a management plan in place with the University Conflicts Committee covering this potential conflict of interest. Andy has not previously received financial support through the Instructional Improvement Grant program.
References


