"A Lot of Work Keeping Everything Controlled": A Class Research Project

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Students who are pursuing master’s degrees in speech-language pathology face a rigorous program of course work and clinical practicum during the years they devote to graduate study. Few of these students, unless they are research assistants and/or complete a thesis, engage in research at the master’s level. This lack of experience, combined with intense course and clinic demands, more often than not results in graduating students with little or no interest in research (e.g., Maxwell & Satake, 1997). Most of these students will go on to graduate and enter the field as practicing clinicians (Council for Academic Programs in Communication Sciences and Disorders, 1999).

As members of a dynamic profession, it is critical for clinicians to seek out, evaluate, and apply research (e.g., Silverman, 1998). An essential part of this is to be careful and critical consumers of research and to expect that continuing education training be supported by current research. Related to skill in critically evaluating research is the need for clinicians to view themselves as researchers and to use research methods in their practice to increase clinician accountability and contribute to the growth of the research base in speech-language pathology.

Yet many practicing clinicians may feel removed from research in the field, even with efforts to disseminate clinically based research, such as the inception of the American Journal of Speech-Language Pathology in 1991. As described by Hegde (1987) on reviewing the history of our profession, there is a considerable time lag between research findings and incorporation into clinical practice. An advocate of clinician-driven online research, Hegde (1987) suggests that this approach begin at the pre-service level. “Unless clinicians are educated within an integrated model of research and clinical service, time spent on training clinicians in research will not be productive” (p. 14). Indeed, students are often heard complaining about being required to enroll in a research class, read and interpret research, and take examinations about independent variables, data analysis, and other aspects of the scientific method when they are “never going to use it” in their careers.

A continuing challenge in the field of speech-language pathology, then, is to promote a more positive attitude toward and involvement in research and to maintain the attitude and involvement after graduation. One means of meeting this challenge would be to assure that all future clinicians engage in clinically relevant research while they are still in school.

This paper describes an effort to provide speech-language pathology students with active participation in a group research project in conjunction with their enrollment in a graduate-level course in augmentative and alternative communication (AAC). The process of presenting the project to the class, enlisting student investigators, preparing materials, recruiting participants, and collecting and analyzing data is recounted. A summary of written student investigator feedback regarding their participation is also provided.

Background

This project was directed by the first author, a faculty member in the Department of Speech Pathology and Audiology at Ball State University in Muncie, Indiana. Ball State is a mid-sized university that evolved from a private teacher training school. The department does not have a doctoral program in speech-language pathology and, as is typical of most master’s training programs, few students complete a master’s thesis (Council for Academic Programs in Communication Sciences and Disorders, 1999) or become actively involved in research. Most students’ learning about research occurs in the classroom, a relatively passive experience that is removed from the actual process.

Students in the first author’s AAC course were required to read, critique, and present to the class a published research article regarding a particular area of AAC (e.g., manual signing, graphic symbols, intervention techniques). However, the first author had begun to view this assignment as an important but too passive way to learn about research. A creative teaching method to engage students in relevant...
research and to contribute to their overall understanding of research in speech-language pathology was needed. Thus began the process of designing and implementing a teaching method that would engage students in relevant research and contribute to their overall understanding of research in speech-language pathology.

As the first author began designing a study using synthetic speech in face-to-face communication interactions, the opportunity for student participation became apparent. In reviewing past research, it was found that a number of studies investigated intelligibility of synthetic speech at the word (e.g., Mitchell & Atkin, 1989), sentence (Mirenda & Beukelman, 1990), and discourse levels (e.g., Higinbotham, Scally, Lundy, & Kowarsky, 1995). Intelligibility of high quality synthetic speech (e.g., DEConsultant1) approaches that of natural speech, even for unfamiliar listeners. Most studies were conducted in relatively quiet conditions where the synthetic speech was presented via tape recording. However, Scherz and Beer (1995) investigated intelligibility of synthetic speech produced in a “live” presentation (i.e., directly from the voice output communication aid [VOCA]). Results indicated that intelligibility of synthetic speech in the “live” condition was actually better than synthetic speech presented in the recorded format. The reliability of these results could be tested through a replication that could be carried out as a group research project by students in the graduate AAC class.

The gathering of qualitative information regarding student investigators’ perspectives during the research process was also considered (Denzin & Lincoln, 1994). Such information has the potential to provide important insights into how best to promote and involve students in research. In discussions with the university’s Institutional Review Board (IRB), it was agreed that as long as students were enrolled in the course they could not be participants in such a qualitative study. Instead, after student investigators had completed the course and received their grades, a questionnaire about their perspectives on the research process was distributed to each (see Appendix A).

Importance of Replication

The issue of replication is worthy of brief discussion in its own right, particularly in the field of speech-language pathology. Replication of published studies is important in all fields of scientific inquiry but tends to receive insufficient attention in many of the applied disciplines. As stated by Maxwell and Satake (1997):

Unfortunately, in the communication disorders and other behavioral fields, replication is not yet given sufficient emphasis as a part of the scientific method as it is in many of the physical sciences. Although replication experiments in several fields, including our own, do not appear to be highly esteemed, the ability to substantiate research findings through experimental replication ought to be an integral goal of all scientific studies irrespective of the nature of the problem. (pp. 10–11)

Although established researchers may prefer to pursue novel research questions, replication of a well-designed study with timely questions was considered to be a vehicle appropriate for student research. With replication, the research questions, stimuli, and procedures are previously determined, allowing student investigators to focus on other aspects of the research process.

For the purposes of the class project, only a portion of the Scherz and Beer (1995) study was considered for replication. Those investigators manipulated presentation of three types of synthetic speech, in both recorded and live conditions, as well as response mode (spoken vs. written). In the present study, only sentence intelligibility during live presentation of synthetic speech with written responses was replicated. Four factors drove the decision to conduct a partial replication: (1) it was considered important to select a project that would make a meaningful contribution to the clinical knowledge base in the field and have the potential for presentation/publication, rather than conduct the class project as an academic experience only; (2) many previous studies have replicated measures of intelligibility of synthetic speech under laboratory conditions; (3) “live” presentation with written responses were the critical elements of the future study; and (4) restricting the replication allowed for a more manageable class project, given time and facility constraints.

Implementation

Student Investigators

The first author presented the research project to 23 speech-language pathology students in a graduate AAC course during the third week of a 10-week summer session.

First, discussion of the role of research in clinical practice was initiated, followed by

1DEConsultant1 is manufactured by Digital Equipment Corporation, Maynard, MA.

2Details of experimental procedures and results are listed in Appendix B.
discussion of synthetic speech research and the importance of replication. The Scherz and Beer (1995) study was then presented to the class. Students contributed ideas regarding implementation of the present study, including: issues of internal and external validity, recruiting participants, randomization, presentation of stimuli, and data analysis. It was also decided to add measures of procedural reliability (presentation of experimental stimuli) and interrater reliability (scoring participant responses) that were not reported by Scherz and Beer (1995). This process resulted in a detailed sequence of tasks for conducting the study. A sign-up sheet was circulated to allow students to volunteer to be responsible for a particular task. It was explicitly stated by the lead investigator that participation was voluntary. Initially, 16 students volunteered; 4 were unable to participate due to scheduling conflicts. Tasks and the number of student investigators for each task are listed in Table 1.

Procedures

Undergraduate students in speech-language pathology and related fields were recruited to participate in the study by posting sign-up sheets in the building that housed the department of Speech-Language Pathology and Audiology. Those who signed up were then contacted by a student investigator for scheduling.

Fifteen sentences presented by Scherz and Beer (1995) in the live condition were programmed into three VOCAs by the first author and a student investigator. Spelling adjustments were made, as needed, to produce correct pronunciation.

Another student investigator contacted an audiology faculty member for assistance in arranging the physical environment for presentation of synthetic speech. A sound-treated booth in the speech and hearing clinic was set up with two chairs facing each other across a small table. Sound-level readings were taken so that output from each VOCA corresponded to that of the Scherz and Beer (1995) study. To ensure proper VOCA and participant placement for each data collection session, a photograph of the setup was taken and tape was used to mark VOCA placement and volume.

Before seeing the first participant, demonstration of procedures was conducted during an AAC class session by two student investigators. Through class input, a detailed sequence of experimental procedures was finalized. This included room setup, spoken instructions to participants, VOCA operation, coding of data collection sheets with VOCA type and participant number, and participant debriefing. Data collection sheets were also scrutinized during the in-class practice session and edited as needed. During this practice session, other student investigators involved in conducting the study collected data for procedural integrity. All procedural and data collection sheets were then filed in the clinic room so that they were accessible to all student investigators.

A team of two or three investigators (students with or without first author) was present at each session during the data collection phase of the study. When participants arrived, they first completed a brief questionnaire containing biographical data and questions regarding recent experience with synthetic speech. After receiving a hearing screening, participants were seated in the sound-treated booth. They were instructed both orally and in writing to write each of the 15 synthetic speech sentences presented.

Procedural Integrity

Data for procedural integrity were collected by a student investigator and the first author. Here, adherence to experimental procedures such as room and VOCA setup, providing instructions, delivery of synthetic speech stimuli, and participant debriefing were marked on a check sheet.

Reliability

Participant responses were tallied by the first author according to number of correct words per sentence and number of correct sentences. Then, following a training session with the first author, a student investigator independently tallied 13 randomly selected response sheets (30%) to obtain an adequate sample for determining reliability of the original tally.
**Student Investigator Feedback**

Progress through the stages of the study and student investigator comments continued to be discussed routinely in class. After data collection had been completed, a graduate assistant, using an informal questionnaire, obtained students' impressions of the research experience. Those written or oral impressions were then prepared in typewritten anonymous form and given to the first author after course grades had been assigned.

**Discussion**

The purpose of this study was to directly involve students in a research experience by obtaining their voluntary participation in a research project as part of a graduate course in AAC. Replication of a published study of comprehension of synthetic speech was conducted by 12 graduate students in speech-language pathology. Students' reports of their positive perception of the experience and successful replication of the previous study support this teaching method as a viable one for preparing future clinicians for conducting clinical research.

**Replication**

Results of the present study were consistent with those of Scherz and Beer (1995). A comparison of the two studies is located in Appendix B. Having obtained these results was gratifying for several reasons. First, this successful replication, along with strong reliability measures, indicated that experimental integrity did not break down by “too many cooks spoiling the broth.” Second, areas of potential breakdown, such as scheduling, running the study, and manipulating equipment, were all minimal, so that the study was successfully completed in a timely manner (less than 6 weeks). Third, student investigators appeared to enjoy and benefit from the experience. Last, successful replication of “live” synthetic speech intelligibility supports conducting future research with a greater degree of confidence in the integrity of the synthetic speech signal, permitting manipulation of other variables.

**Student Investigator Feedback**

Nine of the 12 student investigators provided feedback regarding their participation in this project. Overall, responses were quite positive. Student investigators indicated that they volunteered because they found the topic interesting and wanted to be involved in research. All expressed that their expectations had been met and that they had learned something new (e.g., the amount of time and effort involved in conducting research; broad variation in synthetic speech intelligibility). Several mentioned their surprise at how difficult it is “keeping everything controlled” and the tension inherent in hoping that participants would arrive on time and that equipment would work consistently. In regard to how this experience might affect the future, several student investigators expressed that they now felt more confident in their ability to conduct research. One comment was particularly fitting: “If I do research in clinical practice—I’ll draw from this as ‘real world’ experience.” All student investigators agreed that they would participate in another research project and that they would encourage others to do so.

Involving numbers of student investigators in such a research project presents many challenges. Among those are: maximizing student investigator participation in clinically relevant research while maintaining experimental control; allowing for variable time commitments; and ensuring that even though student investigators are involved in a specific phase of the study, they gain an appreciation of the entire process. The intent of this project was to provide an opportunity for students with varying levels of interest in research to participate actively in the research process. The study appears to have achieved its purpose.

**The Role of Science in Clinical Practice**

By involving an entire class in designing and/or conducting this study, students were given the opportunity to gain experience with the scientific method, the cornerstone of conducting controlled, replicable research. The need for an understanding and application of science must be a vital part of clinical practice in order to ensure that treatment methods are “theoretically sound” and “empirically based” with measurable, cost-effective outcomes (Lubinski, 1998, p. ix).

One particularly illustrative example of clinical practice gone wrong is the extreme and unfortunate phenomenon of facilitated communication (FC). FC, a treatment approach purported to unleash literacy abilities in individuals with autism and related disabilities, originated in Australia and took the United States by storm in the early 1990s. Briefly, FC involves a facilitator supporting an individual’s shoulder, arm, or hand as he or she points to or types letters on a keyboard. As discussed by Shane (1994), despite a profound lack of evidence to support its reliability and validity, and strong evidence to the contrary, use of FC...
reliability, randomization, etc.), expectations, and attitudes

- selecting original research questions for investigation, particularly those that arise out of clinical experience
- providing students with the opportunity to be involved across all phases of a research project by conducting several projects during the semester. One means to achieve this might be to conduct a series of studies that involve manipulation of one variable at a time.

As more and more students and clinicians become involved in research, we may well reach our ultimate goal, as proposed by Hegde (1987): "The ideal to strive for is a solid scientific discipline and a clinical profession with a single identity" (p. 5).

Author Note

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**Appendix A**

Follow-Up Questionnaire to Student Investigators

1. Why did you volunteer to participate in this research?
2. Did the experience meet your expectations? Please answer yes or no and elaborate if you wish.
3. Did you learn anything new during this experience? Please answer yes or no and elaborate if you wish.
4. How do you expect to use this experience in the future?
5. Has your participation changed your attitude toward conducting research? Would you participate in another research project? Would you encourage others to do so?

**Appendix B**

**Replication Procedures and Results**

**Replication Procedures**

Participants: 44 female students 19–40 years of age; native speakers of English; passed a pure-tone hearing screening; no extensive experience with synthetic speech.

**VOCAs:** LightTalker* with Echo Ilb,* TouchTalker* with SmoothTalker* (version 1.5; male voice), and TouchTalker* with DECTalk* (version 1.3; Perfect Paul voice).

**VOCA Sound Level:** Using a Radio Shack* sound-level meter (#33-2050) set at slow dB SPL (sound-pressure level), volume for each VOCA was adjusted: Echo Ilb 74–78; SmoothTalker 75.6–77; DECTalk 74.8–77.

**Stimuli:** 15 sentences from the Scherz and Beer (1995) "live" condition.

**Stimulus Presentation:** Sentences were presented in random order. VOCA order was counterbalanced across sessions.

**Procedural Integrity:** Procedural integrity data was collected for 21 (47%) of 45 conducted sessions. One instance of an incorrect procedure was noted, where a participant was presented with only 14 of the 15 sentences. Data from this participant were excluded from analysis. Procedures were determined to be 100% correct for the remaining 20 participants.

**Reliability:** Intrarater reliability was determined using the following formula: [number of agreements + (number of agreements + disagreements)] × 100. Reliability was 86%.

**Results**

Intelligibility: Word intelligibility was determined by the same formula as that used by Scherz and Beer (1995, p. 75): number of whole words reported correctly + total number of words × 100 (see Table B1). Because Scherz and Beer had divided the total number of sentences presented live into five sentences per VOCA, percent intelligibility for each of these five sentences was also tallied. Present results are generally consistent with those of Scherz and Beer (1995).

The following formula was used to calculate sentence intelligibility: number of whole sentences reported correctly + total number of sentences × 100 (see Table B2).

*LightTalker™ and TouchTalker™ are manufactured by Prentke Romich Company, Wooster, OH.

*Echo Ilb™ is manufactured by Street Electronics, Carpinteria, CA.

*SmoothTalker™ is a trademark of First Byte, Long Beach, CA.

*Radio Shack™ is a division of Tandy Corporation, Fort Worth, TX.

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