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Using Single-Subject Designs in Speech-Language Pathology Practicum

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There are reportedly some 42 million individuals in the United States who exhibit deficits in speech, language, voice, or hearing (American Speech-Language-Hearing Association [ASHA], 2002). Clearly, a significant percentage of the individuals who experience these difficulties receives services from certified speech-language pathologists, clinical fellows, and/or graduate students studying to become speech-language pathologists.

Speech-language pathologists in a variety of settings are required to develop and implement treatment plans for the clients who are under their care. These treatment plans typically must document (a) the treatment to be provided, (b) a set of functional goals, (c) an estimation of rehabilitation potential, and (d) specific objectives to be achieved in treatment, as well as (e) the frequency and (f) the estimated duration of the treatment planned (e.g., ASHA, 2001).

In order to develop effective and efficient treatment plans, speech-language pathologists are required to engage in significant clinical problem solving and decision making. Unfortunately, this decision-making process may be somewhat distorted by biases, even for the experienced clinician. Moran and Tai (2001), for example, suggested that when a clinician relies on clinical impression to guide treatment, it may become distorted by the clinician's

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ABSTRACT: Clinical problem solving may be enhanced through more direct application of research principles in the therapeutic process. The use of single-subject designs during the speech-language pathology clinical practicum experience, with subsequent transition into routine clinical practice, would allow for development of a "clinician as researcher" role early in the careers of future speech-language pathologists. This would likely enhance the objectivity of the clinical decision-making process and teach clinicians in training to rely less on potentially biased clinical impressions.

To facilitate the use of research principles in clinical practice, 78 graduate students completed single-subject projects as a component of their graduate practicum experiences between June 1999 and December 2002. A survey of the first 25 students completing projects revealed increased reported understanding of research principles, enhanced understanding of the connection between research and clinical practice, and high degree of willingness to use single-subject designs in eventual professional settings.

An overall review of student projects revealed more frequent completion of projects during the school practicum experience and more frequent study of treatment approaches involving articulation/phonologic disorders and child language disorders, as well as very heavy reliance on the withdrawal (or ABAB) design. The review indicated a need for further student exposure to alternative designs for use in the study of speech-language pathology treatment, as well as further development of strategies for establishing effective baselines of behavior.

KEY WORDS: graduate training, evidence-based practice, clinician–researcher, student practicum

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tendency to look for pathology, or a "pathology bias." In addition, further bias can be observed when the clinician seeks specific information to support a given diagnosis ("confirmatory bias"). Moran and Tai also noted that clinicians may have a tendency to overestimate treatment effects as well as to underestimate the potential covariance or interaction of events in the therapeutic process that lead to changes in a client's behavior.

Rather than relying on clinical impressions and being subject to unknown treatment interactions, clinicians may enhance problem solving or decision making through more direct application of forms of research methods in the therapeutic process (e.g., Robey, Schultz, Crawford, & Sinner, 1999). If clinicians can isolate variables contributing to changes in behavior, they may gain more direct evidence of treatment effects. In fact, current trends in health care suggest a need for "evidence-based practice," which Sackett and Richardson (1996) defined as "the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients" (p. 71).

ASHA described speech-language pathology as a "science-based" profession and suggested that researchers who "bridge the gap" between basic research and clinical practice are important for the development of diagnostic and therapeutic clinical methods (ASHA, 1994). Evidence-based practice similarly demands that clinicians rely on both research and clinical expertise to make sound clinical decisions. An alternative to having researchers bridge the research/clinical gap is having speech-language clinicians themselves bridge this gap. Ringel (1972), for example, suggested that clinicians who approach clinical problems in a scientific manner are, in fact, involved in research with the intent to deliver optimum clinical practice.

Given the need to monitor and demonstrate appropriate treatment regularly (which results in targeted treatment outcomes), more specific involvement of speech-language pathologists, clinical fellows, and graduate students in "applied" or "clinical" research would be beneficial for furthering the development of guidelines for clinical practice in speech-language pathology (e.g., Apel, 2001; Frattali, 1998; Golper et al., 2001; Olswang, 1990; Robey, 2001a). The speech-language pathologist (or clinical fellow or graduate student) may be viewed as a "scientist practitioner" (Hayes, Barlow, & Nelson-Gray, 1999). The often-mentioned clinician/researcher dichotomy may not be as polarized as it is sometimes described (Ringel, 1972). For example, Logemann (2000) indicated that both clinicians and researchers are involved in selecting the optimum tools for data collection. Both also collect data systematically and in a valid manner. In addition, both are involved with data analysis and the development of follow-up plans, and they also generally summarize their outcomes and recommendations.

DEVELOPMENT OF THE CLINICIAN–RESEARCHER

If speech-language pathologists are to serve as both providers of services and evaluators of the effectiveness of the interventions they provide (e.g., Hayes et al., 1999), students must be sufficiently prepared to master this role. One possible strategy for developing the role of clinician–researcher (or scientist–practitioner) is to begin when students are learning about treatment principles and their application to clinical practice. It may be feasible during students' practicum experiences to foster this "clinician as a researcher" role both with students and with their clinical supervisors.

Recently published standards for the certificate of clinical competence in speech-language pathology (ASHA, 2000) require that "the applicant [i.e., student] must demonstrate knowledge of processes used in research and the integration of research principles into evidence-based practice" (Standard III-G, p. 6). As a result of this regulation, academic programs in speech-language pathology are required to incorporate this standard in their curricula, and must provide assurance that students have attained it. A prime opportunity for teaching students about the principles of "applied" research can occur during student practicum.

Optimally, it would be beneficial for students to approach treatment in a scientifically rigorous manner and also to experience the connection between research and therapy. Hegde (1994) suggested that single-subject designs are well suited for clinical practice and for integrating research into treatment. Similarly, Robey et al. (1999) recommended that "quasi-experiments" involving single-subject designs (i.e., experiments that do not involve random assignment to control and treatment conditions) may be beneficial in clinical practice for developing standard evidence regarding the effectiveness of treatment for individual clients.

SINGLE-SUBJECT DESIGN AS A STRATEGY FOR EXAMINING TREATMENT OUTCOME

Single-subject studies have been incorporated previously in the speech-language pathology literature (see reviews by Connell & Thompson, 1986; Kearns, 1986; McReynolds & Thompson, 1986; and Robey et al., 1999). Although these studies cannot be used to establish treatment efficacy (e.g., Robey, 2001b; Wertz, 2002), they can be beneficial for examining treatment outcomes. Wertz recently described a five-phase outcome model developed by Robey and Schultz. In this model, single-subject designs are frequently involved in the early phases (Phase I and II) when clinicians are developing hypotheses, establishing safety, defining treatment activities, and selecting treatment populations. Although the optimum efficacy studies do involve randomized controlled clinical trials, these investigators indicated that early-phase research involving single-subject designs may provide outcome information that can further facilitate the experimental study of treatment efficacy.

Single-subject designs are well suited to answer the following questions:

- Does a given treatment work for a given client?
- Of two or more treatments, which works better for a given client?

- What components of a treatment package are responsible for treatment effects?
- Does changing the criterion for success lead to changes or improvement in performance? (Kearns, 1986).

In addition, with well-designed studies, acquisition of adequate baseline information, and sufficient raw data for review, methods of analysis can be applied that yield information regarding both clinical and statistical significance of treatments (Robey et al., 1999).

Although recent attempts to link research and clinical practice have involved collaborative efforts between academic researchers and practicing clinicians (e.g., Apel & Brown, 2002; Calvert, Paul, & Throneburg, 2002; Goldstein & Swasey Washington, 2002; Hodson & Porter, 2002), we were not able to find reports of any systematic attempts to involve students in learning to bridge the research–practice divide. Thus, the purpose of this study was to introduce the use of single-subject designs in clinical practice to speech-language pathology graduate students.

These projects were perceived to be beneficial to students as they would (a) allow participation in activities that link research and clinical practice, (b) teach systematic evaluation of clinical effectiveness, (c) encourage exploration of current treatment methods, (d) motivate exploration of current literature regarding treatment approaches, and (e) encourage development of creative treatment methods.

These projects were also anticipated to be beneficial to graduate programs as they would (a) allow faculty to serve as mentors to students in scientific and research methods, (b) encourage faculty to update their knowledge of current treatment approaches/practices regularly, (c) allow faculty and students to discuss standards of practice and treatment approaches routinely, and (d) help programs meet accreditation requirements. The profession was also anticipated to derive benefit from these projects as they would (a) serve to reduce the often perceived clinician/researcher dichotomy, (b) allow measurable gains toward functional goals, (c) facilitate estimation of recommended treatment durations, and (d) improve "best" practices in treatment and facilitate reimbursement. Finally, clients were expected to benefit from these projects as well. Such projects would potentially (a) allow clients to receive more efficient and timely treatment, (b) further reduce health care costs, and (c) enhance the long-term benefits of treatment.

METHOD

Participants

The participants in the study were 78 students who were enrolled in the accredited master's degree program in speech-language pathology at Governors State University, a small suburban state university. All had completed their full sequence of didactic coursework, including "Scientific and Professional Foundations of Communication Disorders," in which they learned about single-subject research. In addition, the students had passed a set of qualifying examinations prerequisite to practicum placement. Given the nature of this commuter institution, all students completed their practicum experiences in off-campus practicum placements; the university program does not have an on-site clinic and fully integrates students into actual clinical environments in the surrounding community. Each student was required to complete the single-subject project during any one of three speech-language pathology practicums, or during an aural rehabilitation practicum. Both the university supervisor and the on-site clinical supervisor were actively involved in the development and completion of each student project.

Procedures

We first proposed the concept that all graduate students complete single-subject projects in their clinical practicum placements to the communication disorders faculty at Governors State. The faculty agreed that students should be actively involved with the development of the single-subject project as a component of the practicum experience, and we held an open meeting with students in April 1999. Students were enthusiastic and gave several recommendations for incorporating the project in practicum. They showed particular interest in studying treatment methods that were being implemented in their practicum placements. Both students and their on-site clinical supervisors were encouraged that they would be studying or examining treatment strategies that were already being employed, as our aim was not to have them develop or implement "new" techniques, but to begin to explore those techniques they were already practicing.

In order to implement the requirement for the single-subject study, the faculty modified practicum course syllabi to reflect the requirement and to indicate that each student needed to complete the single-subject study during one of the practicum experiences. Before engaging in data collection, each student submitted a formal proposal for his or her project to his or her university supervisor for review. In addition, all proposals were reviewed by a doctoral-level member of the faculty with knowledge of single-subject designs. Project proposals were developed in collaboration with the on-site clinical supervisor, who was the primary clinician responsible for the clients being treated by the student.

Proposals included information regarding a rationale for the therapy, client characteristics, a therapeutic question, the dependent and independent variables to be studied, and a complete description of the method to be implemented. The description of the method needed to include details such as the nature of the design (e.g., withdrawal, changing criterion, alternating treatments, multiple baseline), the criterion for establishing a stable baseline before the initiation of treatment, the criterion for withdrawal of treatment if appropriate, a randomization sequence for alternating treatment if needed, and a specific description of the treatment techniques and materials to be employed. Care was taken to maintain client confidentiality and anonymity in all instances. In addition, only clients who were already engaged in treatment that was predetermined

by the on-site clinical supervisor were involved in the student projects.

Following written faculty approval of the single-subject projects, students began collecting data during their scheduled treatment sessions. During data collection and the provision of treatment, students regularly conferred with both their on-site and their university practicum supervisors. Other members of the faculty, with expertise in single-subject design, were also available for consultation. After completing data collection, students presented their findings at a practicum seminar with all other practicum students and all faculty in attendance. When possible, on-site clinical supervisors also attended this seminar and provided feedback regarding students' presentations.

Each student's oral presentation was accompanied by a written summary. The summary followed the format of a research paper and began with the rationale and statement of the problem. Students were encouraged to incorporate a brief discussion of the literature supporting the treatment they used when available. This was followed by a description of method. Students were asked to be specific in their descriptions of both the single-subject design used as well as the treatment approach incorporated in their sessions. The summary was concluded with a presentation and discussion of results. The written summary was circulated among faculty for comment and approval and the project was required to be completed before graduation. The Communication Disorders program maintained all written summaries in an archive and sent each student a copy of the written summary, along with faculty comments.

The Governors State program continues to implement the practicum project requirement in the manner described above. The following results are based on student projects that were completed by December 2002.

RESULTS AND DISCUSSION

Student Practicum Experiences: Fall 1999 to Spring/Summer 2000

Given the potential application of these studies to clinical practice, Brobeck et al. (2000) reported on single-subject projects in the clinical practicum experiences of a preliminary group of speech-language pathology graduate students. Students completed their projects in a variety of settings, including mental health facilities, community rehabilitation centers, hospitals, and schools.

As presented by Brobeck et al. (2000), 25 students completed single-subject projects in the first year of this practicum research experience. Studies incorporated a variety of designs available, including withdrawal (e.g., student examined the use of a mirror in articulation therapy), alternating treatment (e.g., student examined the effects of positive reinforcement and verbal punishment on sustained attention in a client with a right hemisphere disorder), multiple baseline across behaviors (e.g., student examined the use of three phases of the Picture Exchange Communication System [Frost & Bondy, 1994], with two autistic adolescents), and changing criterion (e.g., student examined the use of rebus symbols in the treatment of consonant cluster reduction).

Survey of First 25 Students

A survey of students following completion of projects in the first year revealed highly positive attitudes regarding the practicum projects. Eighteen of 25 (72%) of the students surveyed responded. Of these, all 18 were working as speech-language pathologists at the time they were surveyed. Ninety-four percent of the respondents indicated that the completion of projects enhanced their understanding of single-subject designs; 56% indicated that the projects enhanced their understanding of the therapy process (most others indicated that they already had a good understanding of the therapy process). Fifty percent of the respondents indicated that they perceived research and clinical practice as very different endeavors before the completion of their projects, whereas 22% reported that they did not perceive them as significantly different. A particular shift in the students' perception of the research/clinical practice relationship was noted after they completed their projects. No respondents indicated that they perceived research and clinical practice as very different endeavors after project completion, whereas 78% stated that they did not perceive them as significantly different. Clearly, the students had come to see the compatibility of research and clinical practice. Seventy-eight percent also indicated that they anticipated they would use single-subject designs in future clinical practice.

Students also made several comments on the surveys. The three negative comments were about the logistics of the project, but all comments about actually completing the project were positive. Some examples included: "It reinforced the importance of collecting baselines for all therapy goals," "The project helped me tie everything in together, clinically and the research aspect," and "I realize that every therapy session is essentially assessing/researching if that specific therapy is working."

Student Practicum Experiences: Fall 1999 to Winter 2002

As a result of the positive feedback obtained from both students and their on-site clinical supervisors, the faculty at Governors State opted to continue to use single-subject projects as a component of the graduate practicum experience. An additional 53 students completed projects in their external practicum placements by December 2002.

A total of 78 single-subject practicum projects were completed by graduate students between October 1999 and December 2002. Of these, the largest number (46) were completed in school settings. In addition, 4 were completed in aural rehabilitation practicum settings, 12 were completed in hospital practicum settings, 14 were completed in facilities for mental health/developmental disability, and 2 were completed in skilled nursing facilities.

Overall, the withdrawal (or ABAB) design was the most popular design used by students. The withdrawal design answers the question of whether a given treatment is the actual therapeutic agent (Kearns, 1986). Sixty students opted to use this form of experimental design in their single-subject practicum projects in a variety of practicum placements. In addition, 4 students used alternating treatment designs, 11 used multiple baseline designs (e.g., across subjects, across behaviors, across settings), and 3 used changing criterion designs.

Students explored the effects of treatments for a variety of disorders, including aphasia (5), apraxia (2), articulation/phonology (18), autism (11), cognitive deficits (3), bilingual speakers with speech or language impairments (2), hearing impairments (3), dysarthria (6), dysfluency (2), dysphagia (4), dysphonia (3), child language disorders (18), and pervasive developmental delay (1).

The tendency of students to attempt completion of their projects during their school practicum experiences may have been due to several factors. First, students often completed the school practicum after having completed at least one other clinical placement (i.e., they had some clinical experience in another setting before their school practicum). This likely allowed them to achieve a level of comfort in their basic clinical skills that would facilitate more direct examination of particular treatment approaches. In addition, the client population in the school setting may be one that is inherently more "stable" than the client population found in an acute care hospital setting. As a result, establishment of baselines of behaviors, as well as application of treatment for specific deficits, might have been more feasible. Similarly, the client population in the school setting may be more amenable to direct treatment intervention than more chronically impaired individuals found in some other settings.

In general, students exhibited some typical difficulties while completing their projects. For example, although students were evaluating treatment methods that were consistent with standard clinical practice, some had difficulties establishing adequate baselines of behavior. This problem is reportedly not uncommon in the single-subject literature in the field of speech-language pathology (e.g., see Robey et al., 1999) and may be worth addressing more closely in the future. For example, there may be strategies for establishing a baseline that differ depending on the client's level of care or recovery (e.g., acute, rehab, outpatient).

In addition, in some instances, the withdrawal of treatment did not result in a return of the treated behavior to baseline levels or even toward baseline. That is, client target behavior reached and stabilized at desired levels after very little treatment. Thus, students could not definitively ascertain the therapeutic effectiveness of their treatment. Although students used withdrawal (or ABAB) designs more frequently than any other design (77%), given the desired/potential benefits of treatment, withdrawal designs may not always be the best choice for use in speech-language pathology settings. Other designs such as multiple baseline designs, alternating treatment designs, and changing criterion designs may be more optimal for real-world clinical practice.

SUGGESTIONS FOR FURTHER STUDY

A number of possibilities exist for future study. In particular, the effect of these projects on graduate student training could be examined in several ways. For example, it would be beneficial to contact former students who have completed projects as a result of their graduate training to determine if they are now using single-subject designs in their day-to-day clinical practice. This would be a logical extension to the survey results that 78% of respondents indicated that they anticipated using single-subject designs in clinical practice. In addition, it may be beneficial to contact on-site clinical supervisors to determine if their exposure to student projects has prompted them to use single-subject designs in their own clinical work. If these projects are to prove truly beneficial to the profession in facilitating the link between research and clinical practice, then carryover into clinical practice beyond the student practicum experience will be important.

In order to make these projects more useful at the graduate level, it may also be beneficial to examine some specific aspects of implementing them in the practicum process. For example, students may find project completion more feasible with certain disorder types as a result of the nature of treatment that is provided. They may also find that the establishment of baselines and completion of projects are more feasible in certain clinical settings as a result of the nature of the client population, stability of the clients' behaviors, and amenability of these behaviors to direct therapeutic intervention. Finally, students may find that they are most capable of completing projects at particular points in their practicum sequence (e.g., after they have acquired some basic clinical skills).

SUMMARY

When large sample sizes, control groups, and rigid selection criteria are not feasible, single-subject designs appear ideal for use in speech-language pathology clinical practice. These methods are diverse and flexible, allow for control of extraneous variables that may affect client performance, may be designed to focus on clinically relevant changes, allow changes between baseline and treatment conditions to be examined better, allow increased flexibility in choosing options for intervention, eliminate the logistics of group designs, and eliminate the tendency of group designs to obscure the benefits of a given treatment for a given client.

The continued use of single-subject designs beginning in student practicum with subsequent transition into daily clinical practice would be beneficial. Students would develop more rigorous decision-making skills such that potential bias from reliance on "clinical impressions" would be minimized. In addition, the establishment and application of research skills early in the career of the speech-language pathologist would only facilitate the development of standards of practice in the field. If the field of speech-language pathology is, in fact, moving toward evidence-based practice, it is important for us to better determine

what clinicians' preferences and practices are, and to determine which treatment approaches provide the most beneficial outcomes.

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