Can You Hear Me Now? : Evaluation of an Online Wireless Technology to Provide Real-Time Feedback to Special Education Teachers-In-Training

By: Marcia L. Rock, Madeleine Gregg, Beth K. Thead, Sarah E. Acker, Robert A. Gable, Naomi P. Zigmond

Rock, M. L., Gregg, M., Thead, B. K., Acker, S. E., Gable, R. A , Zigmond, N, (2009). Can you hear me now? Evaluation of an online wireless technology to provide real-time feedback to special education teachers-in-training. Teacher Education and Special Education, 32 (1), 64-82.

Abstract:
In this study, the authors examine whether an advanced online technology can be used to give teacher trainees real-time feedback on their use of research-based classroom practices. Participants include 15 teachers enrolled in a field-based graduate special education teacher preparation program. Data include video-recorded teacher observations and written reflections by teachers about their experiences. Quantitative results indicate that the advanced online bug-in-ear technology is a practical and efficient way to provide immediate feedback to increase teachers' rate of praise statements and their use of proven effective instructional practices and that these improvements are accompanied by increases in students' on-task behavior. Overall, trainees view the advanced online technology as a powerful tool for improving the teaching and learning process but report the need for patience and perseverance in both the teachers and the supervisor, as well as teachers' need for constant reassurance.
Keywords: advanced online bug-in-ear; technology; special teachers/education; learning; psychology of/feedback learning; student teaching/supervision; wireless communication systems

Article:
By all accounts, teacher effectiveness is one of the most important factors affecting student academic achievement (Sanders & Horn, 1998; Wright, Horn, & Sanders, 1997). It is not surprising that in an era of high-stakes testing in which all students are expected to perform well, there is tremendous pressure to significantly improve the quality of classroom instruction (Imig & Imig, 2006). Although a burgeoning number of students with disabilities receive at least some of their instruction in the regular classroom (U.S. Department of Education, 2007), only about 30% perform at the proficient level on state-mandated reading and math assessments (Thurlow, Moen, & Altman, 2006). Thus, there is a mounting demand for colleges and universities to prepare ever more qualified special educators who possess the ability to engage in evidence-based practices.

Across the country, teacher preparation programs look essentially the same, and not all programs produce competent classroom personnel (Billingsley & McLeskey, 2004; Gable, 2004; Gunter & Reed, 1996; Polsgrove, 2003). If we are going to improve classroom instruction, we must make some fundamental changes in both the content and delivery of teacher preparation training (Darling-Hammond & Youngs, 2002). The combination of university coursework and field-based experiences is endemic to most teacher preparation programs. However, in their present form, neither is the solution to the myriad challenges to improving the quality of special education teachers (e.g., Brownwell, Ross, Colon, & McCallum, 2005; Darling-Hammond, 2005, 2006; Wilson, Floden, & Ferrine-Mundy, 2002).

Performance-based feedback is one evidence-based strategy with which to increase the likelihood that preservice and in-service level teachers will make use of empirically supported classroom practices (Scheeler, Ruhl, & McAfee, 2004). Scheeler and her colleagues critically reviewed 10 studies on effective performance feedback and, from that review, drew several definitive conclusions. First, the only empirically validated

characteristic of effective feedback was immediacy. Second, three additional attributes were essential to effective performance feedback— namely, that it must also be (a) positive, (b) corrective, and (c) specific.

In the past decade, the body of research on what constitutes effective classroom practice has grown tremendously (Cook, Landrum, Tankersley, & Kauffman, 2003). It is unfortunately that there still is a huge gap between research and practice (Rock, Thead, Gable, Hardman, & Van Acker, 2006). Furthermore, once teachers enter the workplace, many lack the level of confidence necessary to resist abandoning evidence-based practices in favor of a mishmash of ineffective practices popular in their schools (Gable, 2004). Researchers have demonstrated that consistent delivery of immediate, positive, corrective, and specific feedback can influence both teacher attitudes and teacher behavior (Bentler & Speckart, 198 1; Charng, Piliavin, & Callero, 1988; Fredricks & Dossert, 1983). Accordingly, implementation of a field-based feedback system on the use of effective classroom strategies may be one way to strengthen the quality of special education teacher preparation.

Perspectives on Performance Feedback

Historically, university personnel have used two primary approaches to offer performance feedback to practicing preprofessionals: traditional clinical supervision and real-time supervision. Wiedmer (1995) identified five stages of traditional clinical supervision and distilled them into three overlapping practices: preobservation conferencing, observation, and postobservation conferencing. This approach allows teacher educators to provide students with performance feedback—albeit delayed. In contrast, in the alternative approach—often referred to as live supervision, university personnel rely on various types of technology to deliver in situ performance feedback (Gallant & Thyer, 1989). The latter approach differs from the former in that students receive immediate, on-the-spot feedback while actually engaging in classroom instruction. Although researchers have used various forms of technology to provide immediate feedback, the Bug-In-Ear (BIE) is the most widely used device. Researchers have variously referred to this technology as a "wireless earphone," a "mechanical third ear device," or an "electronic audio-cueing system."

The Evolution of BIE Technology

One of the first published studies on the use of a BIE was conducted with trainees in clinical psychology. Korner and Brown (1952) reported that trainees viewed the mechanical third ear device very positively. Once their initial apprehension decreased (usually by the fourth trial), trainees actively sought and took advantage of supervisory feedback to change their behavior. Korner and Brown concluded that the BIE device represented a promising approach to better prepare clinical psychologists. By the late 1980s, enough studies of BIE technology had been conducted to warrant a review in The Clinical Supervisor (Gallant & Thyer, 1989). The 13 BIE studies reviewed were conducted across a variety of disciplines and provided further evidence of the efficiency of real-time performance feedback. The Gallant and Thyer review showed that the available technology was remarkably trouble free: The earpiece was easily adopted by both university faculty and students, and students experienced minimal difficulty in obtaining feedback from their supervisors and adjusting their behavior to reflect that feedback. Furthermore, use of the earpiece to provide immediate feedback strengthened the relationship between faculty and students and facilitated more creative supervision and support. Another advantage was that students were able to receive live supervision in settings in which they were able to respond immediately. The length of the cue or feedback did not seem to matter—students did not view it as even mildly disruptive. In addition, the feedback helped students decrease their level of anxiety over addressing potentially difficult situations. According to Whiffen and Byung-Hall (1982), BIEs are especially useful in the supervision of inexperienced professionals facing new challenges who need immediate feedback on different ways to resolve a particular situation.

In 1971, BIE first appeared in the education literature in an article published in *Educational Technology* (see Herold, Ramirez, & Newkirk, 1971). Based on the results of their investigation, Herold et al. concluded that BIE technology was far superior to more traditional forms of supervision that relied on delayed conferencing to provide teachers with corrective feedback.

Since then, nine more studies were located, in which researchers relied on some form of BIE technology (see

Bowles & Nelson, 1976; Giebelhaus & Cruz, 1992, 1994, 1995; Kahan, 2002; Scheeler & Lee, 2002; Scheeler, McAfee, Ruhl, & Lee, 2006; Thomson, Holmberg, Baer, Hodges, & Moore, 1978; van der Mars, 1988). These studies were conducted in elementary education, special education, early childhood education, and physical education settings. The results of these studies mirrored those reported by researchers in other disciplines; BIE can be an effective instrument for delivering live feedback to trainees, including classroom teachers. Teachers-in-training overwhelmingly gave the technology favorable reviews and stated that they could easily attend simultaneously to two sets of verbal stimuli (i.e., classroom students and a university supervisor).

Notwithstanding the benefits associated with BIE technology, a fundamental question must be explored: Why has the BIE technology not been more widely used in teacher education? We looked at the accumulated literature for some answers to this question, preparatory to initiating our investigation.

Shortcomings of Traditional BIE Technology

In examining critically various aspects of the traditional BIE, we identified several likely impediments to its widespread use in teacher education. First, traditional BIE relies on FM radio frequency technology that has limited transmission capability—ranging from 150 to 300 feet (Herold et al., 1971; Scheeler et al., 2006). For that reason, a university supervisor must travel to the classroom site to observe a teacher. If the supervisor is already on site, he or she may find it inefficient to set up the BIE technology and deal with the mechanical issues that are bound to arise. Second, in other disciplines, such as clinical psychology or counseling, most supervisors can remain unobtrusive, by observing through a one-way window (Gallant & Thyer, 1989); in education, the majority of supervisory observations occur in the classroom with the supervisor recording his or her observation by speaking in a low voice into a microphone or taking copious notes. The presence of the researcher or supervisor in the classroom may serve as a confounding factor in the teacher's behavior (see Phillips & Halle, 2004, on the issue of observer reactivity). Furthermore, if the observer is also talking during the teacher's lesson, the confound may be even greater. Limited transmission capability and problems surrounding the obtrusive nature of supervision have discouraged special education teacher educators from using BIE devices.

Integration of Mobile Technology into Teacher Education

Despite the rapid infusion of mobile technology into our personal and professional lives, we have made limited use of this technology in teacher education programs. For more than a decade, mobile devices such as Bluetooth headsets and interactive videoconferencing have been used in colleges of business, law, and medicine for conferencing; capturing data; decision making; and documenting of assessment, interventions, and outcomes (Franklin, Sexton, Lu, & Ma, 2007). Given that relatively inexpensive forms of mobile technology are readily available, it seems shortsighted to not incorporate them into special education teacher preparation.

Recognizing the value as well as the short-comings of traditional BIE technology, along with the need to integrate improved mobile technology into teacher education, we developed an advanced form of online BIE technology using four components (patent pending): a Creative WebCam Live! Ultra-Wide Angle Web Camera™ (Model No. VF0060), a Plantronics P1-Voyager 510 Windsmart Bluetooth Headset™ (Model No. 72270-61), an IOGEAR Bluetooth 2.0 USB Adapter, Class 2™ (Model No. GBU221), and Skype™ (Version 3.0.0 .217). (We discuss each of these in detail later in this article.) Then we conducted research on this newly improved BIE device with several questions in mind:

1 . Can recent advances in technology be incorporated to enhance the capacity of traditional BIE?

2. How long does the device need to be used to overcome mechanical or technological issues?

3. Are there any differential effects on the behavior of experienced versus novice teachers?

4. How does use of BIE technology affect student learning?

To answer these questions, we determined the possibility and the feasibility of using the advanced online wireless BIE technology to provide real-time feedback to increase teacher use of high-access classroom practices. We investigated whether that feedback influenced teacher use of praise, redirects, and reprimands, and its impact on student behavior. Finally, we monitored the acceptability and usefulness of the advanced online wireless BIE technology from the perspective of graduate-level special education teacher trainees.

Method

Participants and Setting

We initially invited each of the 17 teachers enrolled in the program during the Spring 2007 semester to take part in the study—all agreed and provided informed consent to do so. One teacher was unable to use the BIE technology because the firewalls of her school district's technology system prevented her from doing so, while the visual distortion and lack of audio recording in another teacher's archived video records precluded our analysis of her BIE observation data. So participants in the present study were 15 of the 17 teachers enrolled in a federally funded graduate personnel preparation program.

Table 1
Participant Demographics

	Frequency	Percentage
Gender		
Male	2	13.3
Female	13	86.7
Age		
18-24	5	33.3
25-35	3	20.0
36-45	6	40.0
46+	1	6.7
Years teaching		
0-5	9	60.0
6-10	3	20.0
11-20	3	20.0
Assigned grade		
K	3	20.0
1st	1	6.7
2nd	1	6.7
3rd	3	20.0
4th	2	13.3
5th	1	6.7
6th	1	6.7
7th-12th	1	6.7
K-5th	1	6.7
K-12th	1	6.7
Ethnicity		
Caucasian	11	73.3
African American	4	26.7
Formal training		
Bachelor's in education	11	73.3
Master's in education	2	13.3
Bachelor's in a noneducation field	2	13.3
Certification		
Elementary education	12	80.0
Elementary and special education (dual)	1	6.7
Uncertified (emergency)	2	13.3

The authors applied for and received local school district and university Institutional Review Board approval. Also, we requested and were granted waivers of informed consent for the PreK- 12 students in the teachers' classrooms, which allowed us to record the BIE observations. The number of years of professional experience varied among teachers with a mean of 5.4 years and a range of 1 to 20 years. The teachers taught in 12 different

schools in six school districts across five counties in the southeastern United States. The school districts varied in type and size: five were rural, three were midsize central city, three were on the urban fringe of a mid-size city, and one was on the urban fringe of a large city. The majority of the participants taught the BIE lessons in their assigned elementary general or special education classrooms during the regularly scheduled instructional time. Only two teachers taught lessons in a colleague's classroom instead. During the course of our investigation, there was some variance in both the grade level and number of students in the participants' classrooms. Table 1 provides a detailed summary of the characteristics of the teachers who were part of this investigation.

Intervention

During the first semester of coursework and field experience, the first author used the advanced online BIE technology to provide immediate feedback to increase participants' use of research-based teaching practices (Scheeler & Lee, 2002; Scheeler et al., 2006). The system we developed (provisional patent protection pending) made use of mobile devices and Internet technology and included the four components mentioned previously: webcam ($61.00), Bluetooth USB adapter ($34.00), Bluetooth headset ($41.36), and Skype (no cost). Skype is a free Internet-based telephone (Voice-over-IP or VoIP) system that allowed the participating teachers to use the mobile device (a Bluetooth headset) to receive coaching while delivering classroom instruction. The webcam permitted the first author to observe the teacher and his or her students in the classroom and vice versa. The Bluetooth adapter connected the computer with the Bluetooth headset so that we could transmit audio feedback to teachers in a wireless manner. Together, these four technology components comprised a wireless BIE technology system that allowed the first author to remain in her university office and provide teachers in the field with immediate, positive, corrective, and specific feedback in situ. The total cost of the advanced online BIE system for each participant was $136.36. Because the advanced online BIE technology was based in part on interactive videoconferencing, it did not allow for surprise (unplanned) virtual classroom visits.

After 3 months of fine tuning and pilot testing a single unit, we ordered the advanced online BIE technology for each participant and distributed the hardware and software components to him or her, along with three pages of detailed instructions for installing it. The participants varied in the length of time they took to install and pilot-test their advanced online BIE technology. Overall, about 4 to 6 weeks passed before most of the participants were prepared for a BIE observation. To establish participants' baseline, the first author "visited" each classroom and conducted virtual observations without feedback during a three 30-minute whole class reading lessons. Then the participants received training in the use of high-access instructional practices. Specifically, the first author required the participants to read a journal article about high-access instructional practices (see Feldman & Denti, 2004). Then she taught and modeled the use of choral and nonverbal response, partner strategies, and cloze reading. Finally, participants scheduled a fourth online BIE observation in which the first author offered immediate feedback while they were teaching a 30-min. whole class reading lesson. Although the participants were enrolled in a master's-level special education class with the first author throughout the study, they were not evaluated on their use of the advanced online BIE technology, nor were they graded on their use of low-access or high-access instructional practices, teacher praise, redirects, reprimands, or their students' level of engagement.

Design

We used a mixed methods sequential explanatory strategy (Creswell, 2003; Tashakkori & Teddlie, 2003) to answer our research questions. In the quantitative analyses, we coded two of each of the participants' video-recorded BIE observations—one of the three without feedback and the fourth with feedback. Technical quality determined which of the three prefeedback observations was coded. For example, more than once, a teacher's archived video file turned out to have been automatically saved by the computer as an audio file rather than a video file, or the audio did not record but the video did. In the end, 8 of the 15 preobservations coded were the first of the three teacher's BIE observations, 4 were the second of the observations, and 3 were the third of the observations. We used one-tailed matched pairs *t* tests to determine the statistical significance between the frequency of codes in participants' preintervention (i.e., baseline) and intervention BIE observation videotapes (McMillan & Schumacher, 1984; Vockell & Asher, 1995). For the qualitative analyses, we used methods

proposed by Lincoln and Guba (1985) to code participants' written reflections about their BIE experiences.

Quantitative measurement. The participants' BIE observations were recorded using Pamela for Skype Business version 3.5 and stored on the first author's office computer in video archives. The cost of Pamela Business version was $36.95 and allowed for 1 year of unlimited video recording through Skype. When the participants placed the Skype videoconference call to the first author, they were directed by screen and speech prompts to accept or decline the video recording of the BIE observation. The participants had the option of terminating the BIE observation at any time by ending the Skype conference call.

The three dependent measures included in this study were as follows: (a) changes in teaching behavior—defined as the teachers' use of low-access and high-access instructional practices; (b) changes in classroom climate, defined as the teachers' use of redirects, reprimands, and praise, as well as the percentage of students' engaged during whole class reading instruction; and (c) level of disruption and benefit associated with the advanced online BIE technology and feedback. Low-access instructional practices were coded as (a1) the frequency of hand raising, defined as the practice of "asking questions and waiting for students to raise their hands with a response" (Feldman & Denti, 2004, p. 4); (a2) the frequency of blurt outs—defined as students blurting out answers as soon as the teacher poses a question (Feldman & Denti, 2004, p.4); and (a3) the frequency of round-robin or teacher led reading, defined as "passage reading, where students [or the teacher] take turns reading aloud while the rest of the class or group follow along" (Feldman & Denti, 2004, p. 4). High-access instructional practices were coded as (a4) the frequency of choral and nonverbal group response, defined as practices in which "students are able to think first and then, upon a signal such as lowering both hands, respond as a group" out loud or with thumbs up (Feldman & Denti, 2004, p. 5); (a5) frequency of partner strategies, defined as practices in which "a teacher matches each student to an appropriate partner . . . and provides the partners with specific roles for the activity" (Feldman & Denti, 2004, p. 5); and (a6) the frequency of cloze or popcorn reading, defined as practices in which "a teacher reads aloud while the students follow along in their books" . . . intermittently, "the teacher leaves out selected words, and the whole class reads those words together chorally" (Feldman & Denti, 2004, p. 7).

To evaluate the second dependent variable, these same preintervention and intervention BIE observational videotapes were coded for (b1) the frequency of teacher redirects, defined as verbal or physical behaviors intended to guide the student toward more acceptable academic responses or social behaviors (Steele, 1995); (b2) the frequency of teacher reprimands, defined as verbal statements expressing disapproval of students' academic or social behavior (Sutherland & Wehby, 2001); and (b3) the frequency of teacher praise, defined as verbal or physical behaviors expressing the positive quality of a behavior beyond evaluation of accuracy (i.e., "good job," "excellent work"; Gunter & Reed, 1996).

Student engagement was analyzed from the videotapes to determine whether changes in instructional climate and teacher behavior were accompanied by changes in PreK-12 student behavior. Academic engagement (time on task) was defined as a student participating in the whole class reading lesson (e.g., student in seat; eyes on teacher, book, paper, or peer; working quietly on assigned tasks; raising hand to answer questions) at the time of the coding. Academic disengagement was defined as a student out of seat and/or talking to classmates about subjects other than the task at hand, and/or making vocalizations, and/or staring off into the distance, and/or laying his or her head on the table, and/or insulting peers, and/ or drawing, and/or hitting peers, and/or spitting, and/or playing with objects. Momentary time-sampling methods at 5-minute intervals were used to code the students' engagement during the 30-minute whole-class reading lessons (Cooper, Heron, & Heward, 2007). To do this, the coders watched the pre-intervention and intervention video tapes, looked at each student that could be seen in the video at the 5-minute mark of the observation period, determined whether each student was engaged and the total number of students who could be seen. The fraction, number of student engaged per total number of students seen, was marked on a recording form. This procedure was repeated six times (i.e., at 5-minute intervals) until the end of the 30-minute observation period.

To measure the third dependent variable, coders examined the supervisor's feedback and the participants'

responses to it in the intervention videotapes to determine the frequency of the following supervisory behaviors: supervisor provides (c 1) encouraging feedback, defined as "praise contingent on demonstration of a specific teaching behavior is provided" (Scheeler, et al., 2004, p. 399); (c2) questioning feedback, defined as a sentence posed in interrogative form to get information or to clarify specific teaching behaviors (Random House Unabridged Dictionary, 2006); and (c3) instructional feedback, defined as "objective information related to predetermined specific teaching behaviors is offered" (Scheeler, et al., 2004, p. 399). In addition, coders recorded when the supervisor delivered the feedback: (c4) during teacher silence, defined as a comment delivered when the teacher was silent because the class was engaged in an assigned task; (c5) after the teacher speaks, defined as a comment delivered within 5 seconds of the teacher speaking or instructing; (c6) during [while] the teacher speaks, defined as a comment delivered during or while the teacher spoke or instructed; (c7) before the lesson, defined as a comment delivered before the planned lesson; and (c8) after the lesson, defined as a comment delivered after the planned lesson. Then to further evaluate the disruptiveness of the supervisor comments, coders analyzed the intervention videotapes for the frequency of a (c9) teacher stop, defined as a 5-second or greater delay in teacher talk after or while the teacher received feedback; (c 10) teacher hesitation–nonverbal, defined as the teacher physically drawing back or showing a facial expression of surprise, panic, puzzlement, or thoughtfulness; and (c11) teacher hesitation– verbal, defined as teacher talk characterized by "stalling for time language" such as "um," "so," or "what."

Interobserver agreement. Two researchers coded teaching behavior frequency (i.e., frequency of low-access and high-access instructional practices) on one of the pre-BIE observational videotapes and on the intervention videotape. A trained doctoral student served as the primary coder for all observations; a university faculty member served as the secondary coder.

Interobserver agreement data were collected on 14 of the 30 (46.7%) of the video recorded observations. Agreement percentages, deter-mined based on a comparison of the two coders' records, were calculated by dividing the total number of agreements by the total number of agreements plus disagreements, multiplied by 100 (Cooper, Heron, & Heward, 2007). The mean percentage agreement across the 14 tapes was 95.4% (range = 79.8% to 100%) for the preintervention condition and 91.7% (range = 52.4% to 100%) for the intervention condition.

Qualitative measurement. We analyzed participants' written self-report data using qualitative methods to better understand trainees' BIE experiences. Specifically, the participants responded to an open prompt to reflect on their BIE experiences. Then three of the researchers read the participants' written reflections, developed codes, and independently examined teacher self-report data three times in an attempt to ensure careful, recursive analysis (Lincoln & Guba, 1985).

Results

Using the coded summaries of the trainees' preintervention and intervention BIE video-recorded observations, we applied descriptive statistics to determine the frequency of coded teacher and student behavior during 30-minute whole-class reading lessons. What resulted were broad numeric trends regarding participants' use of low-access and high-access instructional practices, praise, redirects, and reprimands; their students' level of engagement; the type and timing of the supervisor's feedback; and the amount of BIE disruption. Then we used inferential statistics (matched pairs t tests) to examine whether teacher and student behaviors differed significantly under the two conditions (without and with BIE feedback). Finally, we used qualitative methods to summarize participants' thoughts and feelings about their BIE experiences. We have organized the presentation of the quantitative and qualitative results according to our three primary research purposes and questions.

Successful BIE Use

A review of records confirmed that within a 5-week period, the first author completed 64 30-minute BIE observations using the improved online mobile technology. All but one of the trainees was able to complete four classroom observations (although the recordings for another one of the trainees were distorted and could not be analyzed). Participants noted several types of technology-related glitches encountered during the observations,

forcing some to reschedule or redo a lesson. Forty-seven percent of the participants reported audio difficulties, 40% experienced problems with setup, 13.3% mentioned disruptions because of their school districts' Internet service, and 6.7% experienced frustration when trying to make the initial contact with the supervisor. High levels of anxiety at the start of the study were reported by 73% of the trainees, although 90% of these trainees (66.7% of the total group) felt that their anxiety was eliminated through reassurance from the online supervisor. In the end, 73.3% of the participants reflected that their BIE observation experiences were positive. These broad numeric trends are reflected in the written responses of the trainees:

> I am familiar with people entering and exiting our classroom all the time, but the idea of a voice in my head made me nervous and uneasy . . . Even though this technology was nerve-wrecking at first, I enjoyed using it . . . I learned through this technology that I have a long way to go before I become the teacher that I want to be.

> I thought that the BIE technology was wonderful. I still do not understand how it all works, but that is not important.

I was very anxious about the live classroom observations using Skype, and I was curious about how all this was going to be done . . . after I got all of my technology problems solved and it was time for my first observation I was terrified . . . by the end of the third lesson, I was shining like a light bulb. I was relieved when I got my feed-back during the fourth lesson; I had a sense of closure and satisfaction. Overall, the BIE experience has boosted my confidence as a teacher and my students have grown.

Wow! The BIE technology is absolutely amazing! Using the technology while I was teaching really helped me learn a few things about myself as a teacher . . . . Having the BIE really makes me think before I speak during my lessons because someone is listening . . . . I must admit that it is difficult trying to start new strategies when I have been used to teaching in a certain way for a couple of years, but I am really enjoying the change it has made in my students now and my students to come.

Improved Teacher Practices

Matched-pairs t tests revealed a statistically reliable reduction in the number of hand raisings among trainees from a mean of 29.8 (s = 18.51) during the pre-BIE observation to a mean of 11.5 ($\underline{s}$ = 8.41) during the intervention observation, $t(14) = 4.58$, $p = .0005$, $\alpha_{\text{one-tailed}} < .016$, $\Delta = .99$. There were also statistically reliable reductions between the mean number of round robin and teacher reading-aloud practices and blurt-outs that the participants used in the two observation conditions (see Table 2). By contrast, we found a statistically reliable increase in the number of verbal and nonverbal choral response practices that the participants used during the pre-BIE observation (M = 8.9, s = 14.44) compared to the intervention observation, M = 24.6, s = 17.74, $t(14) = -2.509$, $p = .0\ 125$, $\alpha_{\text{one-tailed}} \leq .0\ 16$, $\Delta = 1.09$. A matched-pairs t test also revealed a statistically reliable difference between the mean number of partner strategies that the participants used during the pre-BIE observation without feedback (M = 0.0, s = 0.00) when compared with those they used during the post-BIE observation with feedback, M = 1.9, s = 2.53, $t(14) = -2.856$, $p = .0065$, $\alpha_{\text{one-tailed}} < .016$, $\Delta = .75$. Last, a matched-pairs t test revealed a statistically reliable difference between the mean number of cloze reading practices the participants used during the pre-BIE observation without feedback (M = 0.0, s = 0.00) when compared with those they used during the post-BIE observation with feedback, M = 4.5, s = 4.52, $t(14) = -3.829$, $p = .001$, $\alpha_{\text{one-tailed}} < .016$, $\Delta = 1.00$. To control for a Type I error, in this study, the Dunn-Bonferroni correction (Hancock & Klockars, 1996) procedure divided the traditional alpha of .05 by the three types of comparisons, for an alpha per comparison of .016.

Changes in Instructional Climate and Student Behavior

Not only were we interested in the by teachers-in-training successful use of the BIE technology and their incorporation of high-access instructional practices into their classrooms, but we were also curious about whether increased use of high-access instructional practices would result in decreases in teacher reprimands and redirects and increases in teacher praise as well as improvements in student engagement. Matched-pairs t tests

revealed a statistically reliable increase in the use of praise statements by participants during the intervention BIE observation, but no significant changes in the use of redirects or reprimands (see Table 2). A matched-pairs *t* test also revealed a statistically reliable increase in the percentage of students who were on task or academically engaged during the intervention observations (M = 92.8, s = 13.6), compared to the pre-BIE observation without feedback, M = 73.8, s = 20.0, t(14) = –3.996, p = .001, $\alpha_{\text{one-tailed}} < .0\ 16$, $\Delta = 1.40$.

Table 2
One-Tailed Matched-Pairs t Test Data

	M		*SD*			
Dependent Variable	Preobservation	Postobservation	Preobservation	Postobservation	*t* Value	*p* Value
High-access versus low-access instruction						
Hand raising	29.80	11.50	18.51	8.42	4.5777	.0005
Round robin and teacher read-aloud	4.80	.4000	5.99	.73	2.841	.0065
Blurt-outs	18.20	14.07	11.75	9.01	2.142	.025
Verbal and nonverbal choral response	8.93	24.60	14.44	17.74	-2.509	.0125
Partner strategies	0.00	1.87	0.00	2.53	–2.856	.0065
Cloze reading	0.00	4.47	0.00	4.52	–3.829	.001
Positive versus negative classroom climate						
Redirects	8.07	12.60	9.71	8.52	–1.839	.0435
Reprimands	1.60	2.40	2.16	2.35	–0.945	.1805
Praise	26.07	54.13	22.33	30.61	–3.616	.0015
Engagement versus disengagement						
Engagement	73.84	92.79	20.01	13.59	–3.996	.001
Disengagement	26.16	7.21	20.01	13.59	3.996	.001

Qualitative analysis of the participants' written reflections mirrored the quantitative findings. Many of the teachers noted how much improvement they observed in student engagement and academic performance during the BIE-with-feedback observation. Apparently, the improvements in student engagement led 80% of the participants to state that they believed the BIE is a helpful, powerful tool for improving teacher and student performance in the classroom. Sixty percent of the participants wrote about the improvements they observed in student engagement, with 40% commenting specifically on their students' increased academic performance:

> It was as if someone had turned the light on for me watching the students actively engage in learning, as a group, was very gratifying for me . . . I feel that they received so much more from that lesson because of the high-access instructional strategies that I used.

> I used two strategies . . . and it was amazing to see almost all of the students participate in the lesson and stay focused.

> The BIE was great in that it involved my students; they loved the BIE observations . . .

> The observations helped me to help them be accountable for their behavior . . . Also, I learned that the students are very interested in the new technology . . . The experience has been so good for the students.

> My kids were more focused engaged and interested in the lesson . . . I saw some of my students who usually do not say much sharing, correcting, and participating.

> The strategies were not only fun to teach, but motivating and invigorating to my students; I saw light bulbs go off and struggling readers as well as fluent readers energized by the new ideas. These strategies

will not be shelved; they work and will be used this year next year and on and on.

Over the course of the BIE sessions, I noticed that my students had been affected by it as well. Of course at the start, they were more interested in the camera. However, as time moved on, they did not focus on the camera at all. An interesting detail was that the students were actually asking me when they could do reading as opposed to trying to get out of it.

Table 3
Frequency Count of Timing and Type of Professor Feedback

Type	Timing of Feedback	Teacher Silence	After the Teacher Speaks	During [While] the Teacher Speaks	Before the Lesson	After the Lesson
Encouragement	783	9	101	178	71	152
Question	82	1	2	1	58	20
Instruction	158	10	15	90	9	34
Total	1,023	20	118	269	138	206

Disruption and Benefit

In considering the feasibility of more widespread use of the advanced online BIE technology in teacher education, we looked at the extent to which teachers perceived it to be disruptive and the degree to which trainees felt they benefited professionally from the feedback they received. We analyzed the participants' preintervention and intervention BIE observation videotapes for the type of feedback that was given, and we also looked systematically for evidence of BIE disruption. We found that the supervisor (i.e., the first author) used encouraging or instructive feedback most frequently and used questioning feedback less often. Feedback was most often delivered while the teacher was speaking, as well as before or after the lessons; it was offered less frequently during teacher silence. Table 3 summarizes these data. In addition, there was little evidence of disruption in teacher behavior; there were no instances of a teacher stopping or hesitating nonverbally in any of the intervention observations and only one instance of a teacher hesitating nonverbally when instructional feedback was given to her.

Qualitatively, teachers reported that the BIE device and feedback did not negatively affect instruction; if fact, trainees asserted that the feedback was extremely useful in bridging the gap between research and practice. About 30% of the participants commented before using it that they had thought the BIE technology would be distracting. Once used, 13% confirmed that the BIE technology was minimally distracting (occasional echo in headset), and 33% stated specifically the BIE was not obtrusive or interfering. On the other hand, 53% of the participants implied in their written reflections that the BIE technology was not obtrusive or interfering. Participants were effusive in their praise of real-time feedback, stating that it was empowering (53.3%), helpful (73.3%), and positive (60.0%). Not only were trainees able to use the BIE successfully without major disruptions, but 73% of them also reported that it helped them to engage in a cycle of reflection that resulted in important professional insights (80%) for improving existing approaches to academic instruction and class-room management. Written statements of several the participants illustrate this:

> While being observed, I really did not pay much attention to the BIE technology . . . The technology allowed for immediate feedback without interruption of the lesson and the feedback was helpful . . . I did not feel as if I was stumbling around trying to figure it out on my own when trying some-thing new. I found myself wanting to try new ideas with my students because I knew I had immediate help.

> In preparing for the observation, I worried that the feedback would be distracting and would result in gaps in my instruction that would be distracting to the students. That did not happen—the feedback was offered spontaneously and quickly at a point that I could easily fit the suggested strategy into what I was saying. I was amazed at how well it turned out for me and for the students.

> When an evaluator or peer watches you teach in person, there is no immediate feedback, which a teacher really needs. With the BIE, there is immediate feedback even while teaching. Throughout all of my lessons Dr. X was telling me how I was doing and what I needed to do, which gave me confidence in my ability to get the job done.
>
> In my past experience, a professor would come out to the classroom and observe a lesson and then provide feedback after the lesson. While this was helpful when planning future lessons, it did nothing for the lesson I had completed. The idea that I could receive coaching to implement strategies in the moment was encouraging. I can take the strategies and tips the professor has given me and apply them right then as if I had planned it . . . As with sports, coaching is crucial to become better and more efficient at what you do—this immediately play-by-play coaching is awesome.

Discussion

In the present study, we sought to determine whether traditional BIE technology could be improved by mobile devices and the Internet as well as to investigate what effect real-time feedback had on the teachers-in-training and their students. In addition, we were interested in learning about the participants' perceptions of their BIE experiences. The mixed research methods allowed us to develop a better understanding, to generate more detailed insights, and to triangulate the data (Tashakkori & Teddlie, 2003). It is interesting that with regard to the latter, most of what we observed in the trainees' BIE video-recorded observations was echoed in their written reflections about their BIE experiences.

Convergent Findings

Our findings support those of previous BIE researchers in education. As with traditional BIE technology, the improved online BIE technology can be used successfully for a reasonable cost and can be set up within a reasonable time period. Whereas traditional BIE technology has a limited transmitting range (Herold et al., 1971; Scheeler et al., 2006), the improved online BIE technology, assembled easily by relatively unsophisticated users, had unlimited transmitting capability. In fact, the geographic location of the participants' 12 schools varied from 2.69 miles to 65.63 miles from the university, with a mean distance of 28.5 miles. This unlimited transmitting capability allowed the first author to conduct seven or eight advanced online BIE observations in a single day. Given the differing geographic locations of the participants' schools, it would have been impossible to do so using more traditional BIE technology.

By combining mobile technology and the Internet, we were able to improve on traditional BIE technology, but for it to make its way into widespread use, the technology had to be economical. Previous BIE researchers reported that the cost of traditional BIE technology (consisting of an FM radio frequency based transmitter and portable receiver) ranged from $50.00 to $60.00 per unit (Giebelhaus & Cruz, 1994; van der Mars, 1988). The improved BIE technology (using a webcam, a Bluetooth headset, a Bluetooth adapter, and Skype) was more expensive, costing just under $140.00 per unit. However, considering the price of gasoline and the time it takes to drive from one school to another, it seems reasonable to assert that our advanced online BIE technology is a highly cost-effective approach to direct teacher observation.

Not only was our improved online BIE technology efficient and cost-effective, it was also effective. Like other BIE researchers (see Bowles & Nelson, 1976; Giebelhaus & Cruz, 1992, 1994, 1995; Herold et al., 1971; Kahan, 2002; Scheeler & Lee, 2002; Scheeler et al., 2006; Thomson et al., 1978; van der Mars, 1988), we found that the immediate feedback had a positive impact on teacher behavior. In our study, the positive impact on teacher behavior was seen in statistically significant increases in participants' use of high-access instructional practices (i.e., choral and nonverbal choral response, partner strategies, and cloze reading) and teacher praise, as well as in the trainees' statistically significant decreased use of low-access instructional practices, such as hand raising and round-robin and teacher read-alouds.

In this study, as was noted previously by a few BIE researchers (Giebelhaus & Cruz, 1995; Herold et al., 1971), technology issues did interfere occasionally with successful advanced online BIE use. According to our

participants, the technology problems that arose most often stemmed from difficulty installing the BIE system, occasional Internet server issues, audio troubles with the Blue-tooth headset, and problems establishing initial virtual contact with the professor. Of those, the audio issue (i.e., the teacher could not hear the supervisor talking through the Bluetooth headset, heard an echo, or received the delayed feedback) was the most frequently encountered obstacle. Changing audio settings and asking, "Can you hear me now?" (the familiar phrase from the cellular telephone commercial) became a humorous and almost regular exchange between the supervisor and the trainees. Thus, we learned that when using this technology, both the trainee and the supervisor have to be patient, willing to engage in on-the-spot troubleshooting, and have access to some type of ongoing technology support. The amount of support our trainees needed ranged from only a few minutes, to 3 to 4 hours, to several days, depending on their school districts' equipment and firewalls, the availability of their technology specialists, and their own level of technical competence.

Our interest extended beyond the feasibility and practicality of using an improved online BIE technology to examining the effect that the feedback had on the participants and their students' behavior. As we mentioned previously, coaching and feedback have been used successfully by BIE and non-BIE researchers to improve teachers' classroom practices (see Gersten, Morvant, & Brengelman, 1995; Scheeler, , et al, 2004). In the present study, the feedback that teachers received through the advanced online BIE resulted in a statistically significant increase in the mean number of praise statements and use high-access instructional practices, as well as a statistically significant reduction in the mean number of low-access instructional practices used. Also, there was a statistically significant increase in the teachers' use of redirects and a statistically significant decrease in the mean number of blurt-outs. However, there were no statistically significant findings with regard to participants' use of reprimands. One plausible explanation is that the supervisor's feedback focused primarily on the use of teachers praise and high-access instructional practices. She did not offer corrective or instructive feedback regarding participants' use of reprimands. Like Gersten and his colleagues, we found that participants experienced heightened levels of anxiety around the observation and feedback process. Therefore, to reduce participants' anxieties, we sought to promote a sense of trust. To do so, we used two strategies. First, we required the participants to complete three advanced online BIE observations before the feedback condition was introduced; previous BIE researchers have reported that it takes about four trials for participants to become comfortable with the use of the technology (Korner & Brown, 1952). Second, during the final advanced online BIE observation, the first author offered high rates of encouragement for best practices and limited her instructive feedback to two research-based classroom practices—teacher praise and high-access instruction. Another possible explanation for the lack of affect on teacher reprimands is that the participants were enrolled in their first semester of a 2-year master's-level training program in special education; thus, they had not yet had a course in behavior management.

As in previous studies of traditional BIE technology, the advanced online BIE technology was not disruptive to the teacher, students, or the classroom routines (see Bowles & Nelson, 1976; Giebelhaus & Cruz, 1992, 1994, 1995; Herold et al., 197 1; Kahan, 2002; Scheeler & Lee, 2002; Scheeler et al., 2006; Thomson et al., 1978; van der Mars, 1988). The majority of participants reported that they could easily attend to two sets of verbal stimuli. On only one occasion did a participant hesitate for a split second while delivering instruction. Her explanation was that there was an echo in the audio coming through the headset. Thus, we concur with Scheeler et al. (2006) that university supervisors should not delay feedback and that teachers should not be averse to receiving it because of the commonly held fear that it will disrupt the flow of classroom instruction.

We think that one of our most important findings relates to the statistically significant improvement in the percentage of students engaged. Scheeler and her colleagues (2006) measured the impact of changes in teacher behavior on their students' percentage of correct responses. Finding that the percentage of student correct responses improved from 76% to 8 1 %, they concluded that the feedback participants received had a positive impact on their teaching behavior and also on their students' responses. The results of the present study are consistent with Scheeler and her colleagues' findings in that we also found that use of the advanced online BIE technology had a positive impact on both teacher and student behavior. Although we did not look at student achievement, we did measure student engagement. We used momentary time sampling procedures to confirm

that the mean level of student engagement across the participants' classrooms during the baseline BIE video recording was 73.8%. In the intervention observations, participants increased their use of praise and high-access instructional practices, and the level of student engagement rose to 92.7%. Given the documented relationship between academic engagement and school achievement, we feel that this is a very noteworthy finding. In a seminal investigation of students' academic engagement in secondary classrooms, Frederick (1977) concluded that high-achieving students were academically engaged 75% of the time. Using this criterion, it seems reasonable to conclude that during the advanced online BIE observation with feedback, the level of academic engagement was consistent with that of high-achieving students.

The present study supports and amplifies previous BIE research in several ways. First, we demonstrated that it is possible to augment traditional BIE technology by using mobile technology and the Internet to provide teachers-in-training real-time feedback. Second, we expanded the participant population to include master's-level teachers and substantiated that BIE can positively influence the classroom behavior of both experienced and beginning teachers. Third, by collecting data on changes in teacher performance and data on the changes that occurred in student engagement, we further validated that what teachers do in the classroom really does matter.

Limitations

Readers should be cognizant of several limitations that necessitate cautious interpretation of our findings. First, the professor who provided student feedback through the advanced online BIE technology was a study author. Several of the authors examined the video-recorded BIE observations and written reflection data. Thus, as coders, they were not naive to the purposes of the study. Future investigations should control for these potential sources of bias. Second, we conducted a limited number of advanced online BIE observations and included no follow-up observations to document practitioners' continued use of high-access instructional strategies and praise as well as ongoing improvements in students' academic engagement. As a result, we do not know whether the improvements were maintained over time when feedback was no longer provided. Also, the use of self-report data (i.e., the participants' written reflections) in this study raises the issue of socially desirable responses. Including follow-up BIE observations and conducting in-depth interviews represent potential solutions to these problems. Another important consideration relates to our participants. When selecting participants, we included a convenience sample—an intact cohort of graduate students. Finally, we did not randomly assign the participants to BIE observation groups with and without feedback; nor did we manipulate the feedback they received (i.e., immediate vs. delayed). More sophisticated research designs using a broader population of participants should help to control for these potential confounds.

Implications for Teacher Education Research

Notwithstanding these limitations, our results confirm prior findings regarding the benefits of using BIE technology to produce instructionally meaningful changes in teacher behavior. Furthermore, we think that our findings regarding the use of advanced online BIE technology have several important implications for teacher education research and practice. First, as we noted previously, mobile technology has been used effectively in a number of disciplines to improve practices in the field (Franklin et al., 2007). In the present study, we demonstrated that this level of technology can realistically be applied to teacher education. We think this is especially important, because of the role that feedback plays in effective personnel preparation (Scheeler, et al., 2004). Even so, Buck, Morsink, Griffin, Hines, and Lenk (1992) reported that many teachers did not feel they received adequate supervision during their field experiences. More widespread use of the advanced online BIE technology may be one way to reverse this troubling finding. Second, we would encourage future BIE investigators (ourselves included) to enhance the rigor and sophistication of the research designs they use. Given that teacher effectiveness is one of the most important factors affecting pupil performance, it is essential that researchers collect outcome data that document those changes in teacher behavior that result in changes in student behavior (Sanders & Horn, 1998; Wright et al., 1997). Third, given the rapid growth of distance education (Bullock, Gable, & Mohr, in press), an advanced online BIE technology may be one solution to the challenges surrounding long-distance supervision. This technology could become an integral part of distance learning and permit direct observation and active promotion of positive changes in teacher behavior.

Concluding Thoughts

The conduct of the present study was guided by the determination to use the most up-to-date technology to promote scientifically supported best practices in special education teacher preparation. The quantitative outcomes testify to the assertions of previous investigators that an online wireless BIE system is both a cost-effective and efficient means to provide teachers with real-time feedback on instruction. Moreover, the qualitative outcomes underscore the fact that BIE technology is a practical tool with which to strengthen the teaching and learning process. Indeed, one participant suggested the use of online BIE technology as a tool for professional collaboration, stating:

> Given my prior experiences, personality, and demeanor, much of my educational history has been carried out in a solitary fashion. The BIE has instilled in me the need to work collaboratively with others. This will be accomplished as I move out of my comfort zone and commit to creating these partnerships. The BIE is an excellent way to launch out and connect with others, which will in turn lift our children to higher levels.

We could not have said it any better.

References

Bentler, P. M., & Speckart, G. (1981). Attitudes 'cause' behaviors: A structural equation analysis. Journal of Personality and Social Psychology, 40(2), 226-238.

Billingsley, B. S., & McLeskey, J. (2004). Critical issues in special education teacher supply and demand: Overview. Journal of Special Education, 38(1), 2-4.

Bowles, E. P., & Nelson, R. O. (1976). Training teachers as mediators: Efficacy of a workshop versus the bug-in-ear technique. Journal of School Psychology, 14(1), 15-25.

Brownell, M. T., Ross, D. D., Colon, E. P., & McCallum, C. L. (2005). Critical features of special education preparation: A comparison with exemplary practices in general teacher education. Journal of Special Education, 38(4), 242-252.

Buck, G., Morsink, C., Griffin, C., Hines, T., & Lenk, L. (1992). Preservice training: The role of field-based experiences in the preparation of effective special educators. Teacher Education and Special Education, 15(2), 1008-1123.

Bullock, L. M., Gable, R. A., & Mohr, J. D. (2008). Technology-mediated instruction in distance education and teacher preparation in special education. Teacher Education and Special Education. 31(4): 225-300.

Charng, H. W., Piliavin, J. A., & Callero, P. L. (1988). Role identity and research action in the prediction of repeated behavior. Social Psychology Quarterly, 51(4), 303-317.

Cook, B. C., Landrum, T. J., Tankersley, M. T., & Kauffman, J. M. (2003). Bringing research to bear on practice: Effective evidence-based practices for students with emotional and behavioral disorders. Education and Treatment of Children, 26, 345-361.

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). Applied behavior analysis (2nd ed.). Upper Saddle River, NJ: Prentice Hall.

Creswell, J. W. (2003). Research design: Qualitative, quantitative, and mixed methods approaches (2nd ed.). Thousand Oaks, CA: Sage.

Darling-Hammond, L. (2005). Teaching as a profession: Lessons in teacher preparation and professional development. Phi Delta Kappan, 8 7(3), 23 7-240.

Darling-Hammond, L. (2006). Securing the right to learn: Policy and practice for powerful teaching and learning. Educational Researcher, 35(7), 13-24.

Dudt, K. P., & Garrett, J. (1997). Using video conferencing to improve the supervision of student teachers and pre student teachers. Proteus, 14, 22-24.

Feldman, K., & Denti, L. (2004). High-access instruction: Practical strategies to increase active learning in diverse classrooms. Focus on Exceptional Children, 36(7), 1 -10, 12.

Franklin, T., Sexton, C., Lu, Y., & Ma, H. A. (2007). PDAs in teacher education: A case study examining mobile technology integration. Journal of Technology in Teacher Education, 15(1), 39-57.

Frederick, W. C. (1977). The use of classroom time in high schools above or below the median reading score.

Urban Education, 21, 459-465.
Fredricks, A. J., & Dossert, D. L. (1983). Attitude-behavior relations: A comparison of the Fishbein-Ajzen and the Bentler-Speckart models. Journal of Personality and Social Psychology, 45, 501-502.
Gable, R. A. (2004). Hard times and an uncertain future: Issues that confront the field of emotional/ behavioral disorders. Education and Treatment of Children, 27(4), 341-352.
Gallant, J. P., & Thyer, B. A. (1989). The "bug-in-the-ear" in clinical supervision: A review. The Clinical Supervisor, 7(2/3), 43-58.
Gersten, R., Morvant, M., & Brengelman, S. (1995). Close to the classroom is close to the bone: Coaching as a means to translate research into classroom practice. Exceptional Children, 62(1), 52-66.
Giebelhaus, C. R., & Cruz, J. (1992). The third ear mechanical device: A supervision alternative. Journal of Early Childhood Teacher Education, 42(13), 8-12.
Giebelhaus, C. R., & Cruz, J. (1994). The mechanical third ear device: An alternative to traditional student teaching supervision strategies. Journal of Teacher Education, 45, 365-373.
Giebelhaus, C. R., & Cruz, J. (1995). Implementing the BIE intervention strategy with early field experience student teachers (Final Report No. ED393808).
Gunter, P. L., & Reed, T. M. (1996). Self-evaluation of instruction: A protocol for functional assessment of teaching behavior. Intervention in School and Clinic, 31(4), 225-230.
Hancock, G.R., & Klockars, A.J. (1996). The quest for a: Developments in multiple comparison procedures in the quarter century since Games (1971). Review of Educational Research, 66 (3), 269-306.
Herold, P., Ramirez, M., & Newkirk, J. (197 1). A portable radio communication system for teacher education. Educational Technology, 11, 30-32.
Imig, D. G., & Imig, S. R. (2006). The teacher effectiveness movement: How 80 years of essentialist control have shaped the teacher education profession. Journal of Teacher Education, 5 7(2), 167-180.
Kahan, D. (2002). The effects of a bug-in-the-ear device on intralesson communication between a student teacher and a cooperating teacher. Journal of Teaching in Physical Education, 22(1), 86-104.
Korner, I. N., & Brown, W. H. (1952). The mechanical third ear. Journal of Consulting Psychology, 16, 81-84.
Lincoln, Y. S., & Guba, E. G. (1985). Naturalistic inquiry. Thousand Oaks, CA: Sage.
McMillan, J.H. and Schumacher, S. (1984). Research in Education: A Conceptual Introduction. Little, Brown and Company.
Phillips, B., & Halle, J. (2004). The effects of a teacher-training intervention on student interns' use of naturalistic language teaching strategies. Teacher Education and Special Education, 2 7(2), 81-96.
Polsgrove, L. (2003). Reflections on the past and future. Education and Treatment of Children, 26, 337-344.
Random House. (2006). Random House unabridged dictionary (2nd ed.). New York: Author.
Ripen, K. J., & Brooks, D. W. (2000). Using personal digital assistants in clinical supervision of student teachers. Journal of Science Education and Technology, 9, 207-211.
Rock, M. L., Thead, B.K., Gable, R.A., Hardman, M., & Van Acker, R. (2006). In pursuit of excellence: The past as prologue to a brighter future for special education. Focus on Exceptional Children. 38 (8), 1-18.
Sanders, W. L., & Horn, S. P. (1998). Research findings from the Tennessee value-added assessment system (tvaas) database: Implications for educational evaluation and research. Journal of Personnel Evaluation in Education, 12(3), 247-256.
Scheeler, M. C., & Lee, D. L. (2002). Using technology to deliver immediate corrective feedback to preservice teachers. Journal of Behavioral Education, 11(4), 231-241.
Scheeler, M.C., Ruhl, K.L., & McAfee, J.K. (2004). Providing performance feedback to teachers: A review. Teacher Education and Special Education, 27 (4), 396-407.
Scheeler, M. C., McAfee, J. K., Ruhl, K. L., & Lee, D. L. (2006). Effects of corrective feedback delivered via wireless technology on preservice teacher performance and student behavior. Teacher and Special Education, 29, 12-25.
Steele, D. (1995). Gentle teaching: A value based framework for helping others (ERIC Document Reproduction Service No. ED381983).
Sutherland, K., & Wehby, J. H. (2001). The effect of self-evaluation on teaching behavior in classrooms for students with emotional and behavioral disorders. Journal of Special Education, 35(3), 61-7 1.
Tashakkori, A., & Teddlie, C. B. (2003). Handbook of mixed methods social and behavioral research. Thousand

Oaks, CA: Sage.
Thomson, C. L., Holmberg, M. C., Baer, D. M., Hodges, W. L., & Moore, S. G. (1978). An experimental analysis of some procedures to teach priming and reinforcement skills to preschool teachers. Monographs of the Society for Research in Child Development, 43(4), 1-86.
Thurlow, M., Moen. R., & Altman, J. (2006). Annual performance reports: 2003-2004 state assessment data. Minneapolis: University of Minnesota, National Center on Educational Outcomes. (ERIC Document Reproduction Service No. A unique accession number assigned to each record in the database; also referred to as ERIC Document Number (ED Number) and ERIC Journal Number (EJ Number).ED495889)
U.S. Department of Education, Office of Special Education and Rehabilitative Services, Office of Special Education Programs, 27th Annual (2005) Report to Congress on the Implementation of the Individuals with Disabilities Education Act, vol. 2, Washington, D.C., 2007.
van der Mars, H. (1988). The effects of audio-cueing on selected teaching behaviors of an experienced elementary physical education specialist. Journal of Teaching in Physical Education, 8(1), 64-72.
Vockell, E. L., & Asher, W. J. (1995). Educational research (2nd ed.). Upper Saddle River, NJ: Prentice Hall.
Whiffen, R., & Byung-Hall, J. (1982). Family therapy supervision: Recent developments in practice. London: Academic Press.
Wiedmer, T. (1995). Instructional improvement: The goal of clinical supervision. Teacher Educator, 30(3), 6-18.
Wilson, S. M., Floden, R. E., & Ferrine-Mundy, J. (2002). Teacher preparation research: An insider's view from the outside. Journal of Teacher Education, 53(3), 190-204.
Wright, P. S., Horn, S. P., & Sanders, W. L. (1997). Teacher and classroom context effects on student achievement: Implications for teacher evaluation. Journal of Personnel Evaluation in Education, 11(1), 57-67.
Marcia L. Rock, PhD, is an associate professor in the Department of Special Education & Multiple Abilities at the University of Alabama. Her research Interests are positive behavior supports at the school-wide, class-wide, and individual student levels, reforming special education policies and practices, and improving general and special education teacher preparation.
Madeleine Gregg, PhD, is a professor in the Department of Special Education & Multiple Abilities at the University of Alabama. Her research interests are cognitive studies in geography education, biofunctional cognition, teacher education, and special education.
Beth K. Thead, MA, is an intervention specialist in Escambia County School District Pensacola, FL. Her research interests are autism, positive behavior supports (PBS), and assistive technology.
Sarah E. Acker, MA, is a former graduate assistant in the Department of Special Education & Multiple Abilities at The University of Alabama. Her research interest is educational leadership.
Robert A. Gable, PhD, is Constance and Colgate Darden professor of special education at Old Dominion University. He is also executive editor of Preventing School Failure. His research interests are serious behavioral disorders, positive behavior interventions, early interventions, and teacher training.
Naomi P. Zigmond, PhD, is a distinguished professor of education at the University of Pittsburgh in the Department of Instruction and Learning (General Special Education). Her research interests are the organization of special education services for students with learning disabilities in elementary and secondary schools and the impact of program organization, particularly full inclusion, on student achievement.