BUG-IN-EAR COACHING IN THE CLASSROOM

A Dissertation

by

SANDRA D. SMITH

Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Chair of Committee,	Kimberly J. Vannest
Co-Chair of Committee,	Jay Ganz
Committee Members,	George B. Cunningham
	Melissa Fogarty
	Christopher Thompson
Head of Department,	Shanna Hagan-Burke

August 2020

Major Subject: Educational Psychology

ABSTRACT

An ongoing issue in education is the preparedness and capacity of instructional staff to implement evidence-based practices. Stand-alone professional development is the norm for addressing the matter, yet research indicates that this type of delivery does not sustain or even generalize into the classroom. Bug-in-ear (BIE) coaching provides an alternative to the "one and done" workshop. Although BIE coaching is a growing practice and the literature base is expanding, the research has yet to be synthesized. The purpose of this dissertation was to: (a) conduct a systematic review of characteristics and quality of studies that examine the effect of BIE coaching in the classroom, (b) conduct a meta-analysis of the single-case research examining the effects and potential moderators of effects, and (c) use the results of the systematic review and meta-analysis to develop a BIE coaching protocol.

The results of the systematic quality review and the subsequent meat-analysis demonstrate that BIE coaching is an effective practice with a variety of participants across an array of settings. The conclusions of the quality review and the meta-analysis contributed to the iterative development of a BIE coaching protocol. A manual was developed, feedback was obtained, and revisions were made to improve the document.

DEDICATION

Dedicated to my father and to the many strong women in my life, especially my aunts, Belva and Helen Boston, and my dear friends, Nancy Tarvin and Cleo Davison. Thank you for possessing and actively encouraging a passion for inquiry, a relentless pursuit of excellence, and dogged determination. Your influence remains strong and you are sorely missed.

Gryfder, Dygnwch, & Uniondeb

(Strength, Tenacity, & Integrity)

ACKNOWLEDGEMENTS

I owe a colossal debt of gratitude to many. Thanks to Mom, Dad, and Ray for sharing your love of reading. A special thanks to Mom and Dad for answering every question I posed as a child with, "We have two sets of encyclopedias, go look it up."

Thank you to Diana, for not only believing I was capable of more, but expecting it from me. I would not have achieved this if it weren't for you.

Thanks to Leah Waheed for being a tremendous friend. You are my hero.

Thank you to The Council: Ulli Crane, Claire McKay, and Dana Schumann-Reus. Your continued presence and unconditional support carried me through some pretty tough times. I love you guys.

Thanks to the Pokies—I am grateful to be part of your amazing family.

Thank you to Sandy Kelly-Khan for taking a shot in the dark and hiring me. You are a tremendous mentor, leader, and friend.

Thanks to my "Let's play academia!" Zoom/study buddies: Christina Gushanas, Sherine Presley, April Haas, and Rachel Skov. Accountability matters, and the timer rules.

Thank you to my cohort members Martin Mendoza, Grace Ko, and Ching Yi Liao, and also to my colleagues and peers Emily Gregory, Brandie Semma, Maria Henry, Sanikan Wattanawongwan, Marcus Fuller, Mary Rose Sallese, and Armando Bernal. You made this journey easier.

Thank you to Pat Lynch and Scott Hill for providing me an amazing place to live and for encouraging me.

Thanks to my committee: Drs. Vannest, Ganz, Fogarty, Cunningham, and Thompson, for your guidance and support. A special thanks to Kimber Vannest, Jay Ganz, and Melissa Fogarty for taking me in, propping me up, and cheering me on.

CONTRIBUTORS AND FUNDING SOURCES

Contributors

This work was supervised by a dissertation committee consisting of Dr. Vannest (chair), Dr. Ganz (co-chair), Dr. Fogarty, and Dr. Thompson of the Department of Educational Psychology and Dr. Cunningham of the Department of Health and Kinesiology.

Work conducted for the dissertation was completed by the student independently.

Funding Sources

This work was also made possible in part by Preparing Academic and Behavioral Scholars for Special Education Faculty Positions in Higher Education (Project ABS) under Grant Number H325D130025. Its contents are solely the responsibility of the author and do not necessarily represent the official views of the U.S. Department of Education.

NOMENCLATURE

BC-SMD	Between-case standardized mean difference
BIE	Bug-in-Ear
BSP	Behavior specific praise
CEC	Council for Exceptional Children
CI	Confidence interval
Diag	Diagnostician
EBP	Evidence-based practice
eCoaching	Electronic coaching
ES	Effect size
FAQ	Frequently asked questions
IES	Institute of Education Sciences
IOA	Interobserver agreement
IRR	Interrater reliability
LSSP	Licensed specialist in school psychology
MBD	Multiple baseline design
PD	Professional development
PF	Performance feedback
QED	Quasi-experimental design
RCT	Randomized control trials
RPF	Real-time performance feedback

SCR	Single-case research
SLP	Speech language pathologist
WWC	What Works Clearinghouse

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CHAPTER I

INTRODUCTION TO BUG-IN-EAR COACHING

The ability for an instructor to provide meaningful feedback to a learner plays a prominent role throughout history. Socrates achieved this goal through dialogue; Aristotle by conducting studies alongside his students. Educators in the 1800s documented their feedback in written narratives. Feedback provided by the teacher to the student in the classroom is contemporaneously recognized as a probable chief component of high-quality instruction and learning (Svanes & Skagen, 2017) and one of the top ten influences on academic achievement (Hattie & Timperley, 2007).

1.1 Feedback

The word feedback originated in the initial period of electronic audio amplification and describes the caustic sound made from incorrectly set feed to a live microphone. It is interesting that this term "feedback" describes the response teachers provide to students, as it denotes a negative method of indicating an error (Nichols, 2012) and is not inclusive of corrective or positive feedback. Although, the purpose of performance feedback is to improve knowledge, skills, and comprehension of a concept (Shute, 2008); a more positive connotation. Performance feedback in educational contexts is described as communication from coaches, mentors, or supervisors providing educators with explicit information on an instructional or management performance, including how to improve or how their performance contributes to a larger goal (Pianta et al., 2012). Feedback that is specific and given in real-time is likely to provide greater support then

delayed or summative feedback, and this is particularly true for struggling learners (Hattie & Timperley, 2007). The most effective feedback is given during the moment, when the learner has the opportunity to utilize it immediately to adjust or maintain the current course of action (Fallon, et al., 2015; Nichols, 2012). If performance feedback is received after the fact, it oftentimes becomes frustrating or inconsequential (Fajfar et al., 2012; Tovani, 2012).

The person providing feedback is responsible for ensuring that the learner is aware of progress (Nichols, 2012) and to prevent uncertainty about how well the learner is doing. (Shute, 2008). Uncertainty is an unpleasant condition necessitating emotional energy to reduce the cognitive state, ultimately resulting in attention diverted away from task comprehension and completion (Shute, 2008). Decreasing confusion about performance leads to increased motivation and task engagement (Shute, 2008). The nature of feedback addresses behavioral engagement to improve the task (London, 2014). Pointing out specific performance details to educators provides discrete evidence of growth and encouragement to continue developing skills (Nichols, 2012).

The use of technology for providing feedback to improve professional practices is ubiquitous across fields (Blau et al., 2018; Choudhary et al., 2019). As technology has advanced, so have the means by which feedback can be delivered. Feedback can now be delivered in real-time via technology. This type of performance-based feedback is increasingly used in educational settings for electronic coaching (Rock, et al., 2009; Scheeler et al., 2006). Electronic coaching (eCoaching) was first identified in the literature as the mechanical third ear by Korner and Brown (1952) in a study with

clinical psychology trainees. In Korner and Brown's study, the trainees received immediate guidance from their supervisor via a hearing aid device connected by a long wire to a radio transmitter operated by the supervisor in the next room. Although the technology has improved significantly, the basic premise is the same: the provider of the feedback (coach) uses technology to provide suggestions in real-time to the recipient (coached participant). It is now possible for that relationship to exist across miles instead of across the room.

One form of eCoaching is referred to as "Bug-in-ear" (BIE), in which educators wear a small earpiece and receive discrete coaching provided by an expert or peer observer. Current telecommunication devices allow for the coach to be in the same room with a short-range radio device (e.g. a walkie-talkie) or, with the addition of internet technology (e.g. Skype™), over a hundred miles away (Coogle et al. , 2018; Rock et al., 2012). Unlike traditional delayed feedback, BIE technology provides an immediate and inobtrusive mechanism for staff training, preventing educators from developing or continuing errors in performance (Scheeler et al., 2004; Taie, 2011). In-situ BIE coaching maximizes the context related to the skill, thereby increasing the likelihood of skill retention (Taie, 2011; Tzetzis & Votsis, 2006).

1.2 Theoretical Framework

The work in this dissertation is grounded in the theories of andragogy; cognitive learning, specifically Social Cognitive Theory; experiential learning; and operant learning.

1.2.1 Andragogy

Also known as Adult Learning Theory, Andragogy consists of five underlying principles that an adult learner (1) has an independent self-concept and can direct his or her own learning, (2) has acquired a pool of experiences from which to draw on as a resource for learning, (3) has learning needs correlated with varying social roles, (4) is problem centered and motivated to immediately apply knowledge, and (5) is driven to learn by internal rather than external factors (Merriam, 2001). These principles are especially important in adult education because they focus on the relationship between what the learner already knows and what they learn within an experiential session (Mukhalalati & Taylor, 2019). The purpose of BIE coaching is to take knowledge the participant has and meaningfully apply it.

1.2.2 Cognitive Coaching

Cognitive coaching is a nonjudgmental, developmental, and reflective model that is built on the premise that cognitive coaches: (a) are skilled at posing questions intended to engage and transform thought, (b) value self-directed learning, (c) believe that behavior is determined by perception and that a change in perception is required for a change in behavior, and (d) are committed to ongoing growth (Costa & Garmston, 2002). Cognitive coaches ask questions that are intended to encourage people to think about their actions; they are active listeners, and they engage in a variety of communication strategies to cultivate and sustain the relationship that is crucial for meaningful conversations (Knight, 2007).

1.2.3 Experiential Learning Theory

The tenet of Experiential Learning Theory is that the process of learning and the acquisition of knowledge are promoted through interaction with an authentic or natural environment. That is, people are likely to learn the most about a concept or skill by experiencing it in an environment in which the concept or skill can be implemented (Mukhalalati & Taylor, 2019). BIE coaching in the classroom is explicitly intended to apply or improve a skill in the setting in which the teacher will use it.

1.2.4 Operant Learning Theory

The foundation of operant learning is that specific, immediate, and frequent feedback will increase the ability and the competence of the learner (Van Houten, 1980; Wallace & Kauffman, 1973). Feedback that is delayed allows the learner to practice errors. This is especially detrimental in the acquisition phase of learning as people that are allowed to repeat errors learn to perform the skill incorrectly (Heward, 1997). Feedback in teacher training programs typically occurs after the observed teaching session (Giebelhaus, 1994; Sharpe et al., 1997). This delay likely decreases effectiveness and efficiency of feedback that may be helpful to the teacher (Scheeler & Lee, 2002). The immediacy of BIE coaching removes the delay of feedback, allowing for correct practice and implementation.

1.3 Purpose

Stand-alone workshops or training sessions are an incomplete approach to establish and sustain instructional proficiency. BIE coaching has the potential to complement knowledge and skills developed in teacher preparation programs or professional

development sessions, yet there is a paucity of information regarding the characteristics of BIE studies, resulting in limited information about for whom and in which settings the intervention works. This three-manuscript dissertation aims to contribute to the research base and will review the scope and quality of in-situ coaching with technology (e.g. Bug-in-Ear) literature; conduct a meta-analytic examination of effects and moderators of effects, resulting in the iterative development of a manualized protocol for effective BIE coaching. The research questions for each study are as follows.

1.3.1 Research Questions

1.3.1.1 Study 1

1. What are the characteristics of the BIE studies (study design, typical participants, interventionists/coaches, settings in which the coaching occurred, the proximity of the coach to the participant, and outcome measures for participants)?
2. What is the quality of the literature as determined by descriptive comparisons of studies meeting and not meeting national organization and federal quality indicators?

1.3.1.2 Study 2

1. What are the overall effects of immediate feedback delivered to teachers via BIE as indicated by non-parametric and parametric effect sizes, confidence intervals, and p-values?

2. Do these effects differ by characteristics of participants, coaches, or settings (e.g. pre-service or in-service teachers; researcher as coach or peer coach; special education or general education) based on moderator analysis?

1.3.1.3 Study 3

1. What are the descriptive characteristics of a BIE coach?
2. What are the descriptive characteristics of a BIE coached participant?
3. What are the steps to BIE coaching?

1.4 References

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CHAPTER II

BUG-IN-EAR COACHING IN THE CLASSROOM: A REVIEW OF THE QUALITY OF THE RESEARCH

Immediate feedback delivered through BIE coaching is effective for pre-service teachers, novice special educators, and in-service teachers based on individual experimental studies, most of which are single-case research design (Goodman et al., 2008; Rock et al., 2009; Scheeler et al., 2010; Scheeler et al., 2004). However, the overall quality of the research is needed (CEC, 2014; WWC, 2014, 2017). This includes specific information related to bias in publications; the existence of gray literature, such as government reports, policy statements, or unpublished work; and within all studies, how threats to internal validity/conclusion validity are addressed. A quality review of the existing research is essential in order for educators to have evidence as to the veracity of an intervention. Through a quality review, crucial information is summarized and presented to administrators and practitioners in a way that is efficient and accessible (WWC, 2017).

2.1 Previous Reviews

Two comprehensive reviews of BIE coaching as an evidence-based practice (EBP) were published in the last few year: "Evaluating Immediate Feedback Via Bug-In-Ear As An Evidence-Based Practice For Professional Development" (Schaefer & Ottley, 2018) and "A Review Of The Evidence For Real-Time Performance Feedback To Improve Instructional Practice" (Sinclair et al., 2019). Schaefer and Ottley (2018)

examined 17 SCR intervention studies and evaluated the studies with the WWC quality standards. The review provided an examination of the characteristics of the studies, such as participant demographics, content areas, grade levels, and instructional settings, but an emphasis of the review was on the type of teacher behavior or outcome impacted by BIE coaching. Their conclusion was that immediate feedback delivered via BIE has a "strong evidence base for increasing frequency and accuracy of teaching behaviors of practitioners in a variety of classroom settings" (Schaefer & Ottley, 2018) and can be considered an EBP.

The review conducted by Sinclair et al. (2019) was more exhaustive. Sinclair et al. (2019) included gray literature, dissertations, and group design in the search parameters. The authors identified the intervention as "real-time performance feedback (RPF) offered to interventionists during instruction using technology" (Sinclair et al., 2019) rather than BIE coaching. The review included 32 studies in the analysis. Of the 32 studies, 26 were SCR and six were group designs. Sinclair et al. (2019) evaluated the quality of the designs with the Council for Exceptional Children (CEC) standards. Their conclusion was also that RPF can be considered an EBP.

Although the evaluations of the literature on BIE coaching were recently published, the Schaefer and Ottley (2018) review did not include group design studies or gray literature; thereby potentially excluding results of studies that may impact the determination of BIE as an EBP. Furthermore, the previous reviews conducted their searches with differing parameters and limited the searches to the databases of Academic Search Premier, ERIC, and PsycINFO (Schaefer & Ottley, 2018) and PsycINFO, ERIC,

and ProQuest Dissertations and Theses Global (Sinclair et al., 2019). Although the two recent reviews of this literature were systematic and comprehensive, there is a limited synthesis of study characteristics, such as type of participant or type of setting in which BIE is typically studied.

Most studies fit the characteristics of single-case-experimental design, providing details about participants, setting, procedures, and outcomes, but an extensive examination of these factors is lacking. Thus, further investigation is warranted in order to determine with whom BIE technology has been utilized as an intervention and under what conditions it may be effective (Horner et al., 2005).

In 2009, the What Works Clearinghouse (WWC) gathered a panel of experts to create standards that could be used to review the quality of SCR (WWC, 2017). Criteria based on the standards proposed by Horner et al. (2005) are used to determine if a study receives a rating of *Meets WWC Pilot Single-Case Design Standards without Reservations, Meets WWC Pilot Single-Case Design Standards with Reservations,* or *Does Not Meet WWC Pilot Single-Case Design Standards* (WWC, 2014).

2.2 Purpose

Research plays an important role in education. It is through research that the knowledge base expands and practices improve, with the ultimate outcome being improved education for students. Additionally, educational research is crucial as an unbiased means of informing policy (Crewel, 2015). The most essential function of educational research, though, is to identify what works, for whom, and under what circumstances (Odom et al., 2005).

2.3 Research Questions

1. What are the characteristics of the BIE studies (study design, typical participants, interventionists/coaches, settings in which the coaching occurred, the proximity of the coach to the participant, and outcome measures for participants)?
2. What is the quality of the literature as determined by descriptive comparisons of studies meeting and not meeting What Works Clearinghouse quality indicators?

2.4 Method

This review was conducted with careful attention to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Protocols 2015 (PRISMA-P) guidelines and checklists, (Moher et al., The PRISMA Group, 2009). PRISMA-P consists of a checklist that is designed to facilitate the development and reporting of a robust protocol for a systematic review (Moher et al., 2015). Publication bias may occur as a result of emphasis being placed on statistically significant findings rather than the process by which a theory is tested. Research has demonstrated that significant results are much more likely to be recommended for publication by reviewers and primary researchers (Cooper, 2017). Adherence to the PRISMA-P guidelines is likely to reduce the publication bias of systematic reviews (Moher et al., 2015).

2.4.1 Search Procedures

An inaugural examination of BIE coaching literature produced a number of key words. Key words from initial articles were reviewed with the reference librarian to develop additional search terms. These words were used to assess if an initial review in EBSCO would produce the desired types of studies. Next, keywords were refined

through a process using synonyms within a larger library database system (Moher et al., 2009). The terms used to compile the initial set of potential studies were: (performance feedback OR immediate feedback OR classroom coaching OR web-based coaching OR real-time coaching OR in the moment coaching OR in-vivo OR in situ) AND (mechanical third ear OR bug-in-ear OR bug-in-ear technology OR wireless technology). A systematic search of the literature was conducted with Google Scholar as well as EBSCO, utilizing databases: (a) ERIC, (b) Academic Search Ultimate, (c) Education Source, and (d) Education Full Text. Once records were identified by the search and duplicate records were removed, the titles and abstracts were placed in Rayyan, a no-cost web application designed for evaluating material for systematic reviews and meta-analyses (Ouzzani et al., 2016).

A hand search of 2015-2019 issues of journals *Teacher Education and Special Education, Journal of Technology and Teacher Education, Journal of Behavioral Education,* and *Journal of Staff Development* was also conducted. The journals were selected because they were where the majority of studies that remained after the full text review were published. In addition, an ancestral search was executed by examining the reference sections of the articles that remained after the title and abstract screening, detailed in the following section. The hand search and ancestral search yielded 31 additional articles. Initial and additional records discovered were subject to the review process described below.

After the searches were complete and duplicate documents were removed, a multi-step process was employed to evaluate published journal articles, gray literature,

and dissertation manuscripts. The procedure included a title and abstract search and screening, a full text review, a WWC Design Standards review, and culminated with variable coding. Gray literature and dissertations were included in order to reduce the possibility of publication bias (Carroll et al., 2017; Paez, 2017). Figure 2.1 (PRISMA chart) reports the process and outcomes.

2.4.1.1 Eligibility Criteria

Information included in the quality review met the following criteria: (a) the research report was written in English; (b) the study examined the effects of an intervention that incorporated BIE coaching as an component of the independent variable; (c) the research took place in settings in which education was the primary focus, such as such as public schools, private schools, charter schools, or alternative educational placements; (d) the participants were teachers, paraprofessionals, or other school-based educational staff; and (e) the design study was SCR or group design (Table 2.1).

2.4.1.2 Title and Abstract

Articles were initially evaluated by title and abstract. Eligibility criteria were applied. Studies were excluded if it was evident from the title and abstract that the eligibility criteria were not met. Research in which it was not evident that the exclusion criteria were met went on to be evaluated as part of the full text screening process. After 369 abstracts were eliminated, 26 moved on to the full text review.

2.4.1.3 Full Text Screening

Studies that were not excluded as a result of the title and abstract review were scrutinized in full to determine if they met the same eligibility criteria (Table 2.1). In order for studies to qualify for inclusion in this review, the description of the intervention must include phrases that indicate the teacher received feedback on his/her performance during the interactions with students. Examples include bug-in-ear/BIE, wireless technology (Bluetooth, web-based), eCoaching, mechanical third ear, in-vivo, or real time coaching (in the moment, in situ). Interventions that were based on the traditional consultation model (meeting with the teacher to discuss performance before or after observed interactions with students) were excluded. The setting must be educational in nature (school-based, pre-school, Head Start, elementary, middle, or high school; public, private, charter, alternative; or simulated classroom) and could not be a clinic, hospital, juvenile justice facility, residential treatment center, group home; or an industry or profession other than education. Participants had to be teachers (general education, special education, pre-service, student teachers), paraprofessionals (instructional assistants, teachers' aides, paraeducators), or some manner of school staff (counselors, administrators, instructional coaches). Research in which the recipients of the intervention were non-educational staff (i.e. parents or caretakers) were excluded.

Lastly, only studies that utilize randomized control trial (RCT) group designs and single case research (SCR) designs were included because causality can be plausibly inferred when studies with these methods are constructed and executed well (CEC, 2014). Case studies, qualitative studies, and editorials were excluded. Conducting

educational research in the classroom setting presents a complex challenge due in no small part to the variability of the participants. No research design can account for all possible explanations for results when conducted in classrooms; however, some designs do so more meaningfully than others (Cook et al., 2009). Disciplines such as biology, chemistry, and physics use RCT as the "gold standard" research methodology because of the randomization of the groups and the generally large sample size (Odom et al., 2005; Zoblotsky & Kaldon, 2018). An RCT is a controlled, quantitative experiment in which study participants are randomly, or by chance, divided into two groups: a control group and a treatment group. The control group receives no treatment, the standard ("business as usual") treatment, or a placebo; the treatment group receives the treatment or intervention of study (CEC, 2014; Shiel, n.d.). The random assignment of participants to treatment groups contributes to the minimization of bias in the experiment (Rumsey, 2011).

The dynamic nature of typical classrooms may make it difficult to administer effective RCTs (Odom et al., 2005). SCR is particularly informative for educational practices at the level of the individual (Horner et al., 2005). Demonstrating experimental control is accomplished by repeated measurement of the dependent variable within and across different yet adjacent conditions, or phases of the independent variable (Horner et al., 2005; Kennedy, 2005; WWC, 2017). The field of special education has recommended that at least three changes in behavior be demonstrated in order to establish a functional relation (Kratochwill et al., 2010). Multiple baseline designs (MBD) are used to accomplish this goal. MBDs compare baseline (A) and intervention

(B) conditions; however, there is no withdrawal of the intervention (Gast et al., 2018). Rather, the comparisons occur across multiple behaviors, contexts, or participants (Gast et al., 2018).

RCT and SCR methods are able to provide a level of experimental rigor beyond that found in traditional case studies (Horner et al., 2005). Additionally, the decision to include only experimental designs was made in order to focus on studies that contain a measurable outcome of the BIE process, rather than teachers' opinion of the process. Therefore, the studies needed to include data from which effect sizes could be determined. After the eligibility criteria were applied, 21 articles remained.

2.4.1.4 Interrater Reliability (IRR) for Screening

Interrater reliability (IRR) is the consistency of the determinations that are made by two or more observers in response to the same stimulus (Lavrakas, 2008). The purpose of interrater reliability is to ensure that the data collected through the process are trustworthy. Three raters evaluated the documents throughout each stage of the search process. The author, a doctoral student in special education at a university in the southwest United States, screened, coded, and evaluated all articles included in the review. The two other raters were doctoral students in the same special education program with experience conducting systematic literature reviews. The total number of titles and abstracts was divided by two and split between the two additional reviewers.

An important consideration that may have significant implications on IRR is the quality of training received by the evaluators (Lavrakas, 2008). Prior to screening the titles and abstracts, the three raters met to review the inclusion and exclusion criteria.

Once all reviewers understood the criteria, they independently evaluated titles and abstracts and then met as a group to discuss the results. Disagreements were reviewed and resolved as per the criteria. Interrater reliability (IRR) on title and abstract was 99%. Reviewers met and discussed disagreements and came to 100% agreement. The same process was employed with the same raters for the full text review. Twenty-one articles made it through the full text screening to be included in the review; however, two studies were removed for not meeting inclusion criteria during the coding process. Initial agreement was 97%.; reviewers met and came to 100% consensus. A total of nineteen *articles remained for completion of the coding process and quality review.*

2.4.1.5 IRR for WWC Design Standards

Five of the 18 SCR articles were chosen at random for IRR evaluation with the WWC Design standards, with 96% agreement between the two raters. The three group study designs were assessed by two raters, with 100% agreement.

2.4.2 Study Characteristics

The 21 articles that met the eligibility criteria for the review were coded for numerous elements. Each article was coded for the type of experimental design employed. Participant demographics that were coded from each study included the total number of participants and the role of the participants. Participants were identified as pre-service teachers, which included participants described as student teachers; in-service teachers; or paraprofessionals, which included participants identified as teaching assistants, teacher's aides, instructional assistants, or paraeducators. The settings of the studies were also coded by type (i.e. special education classroom, general education

classroom, both special education and general education, or augmented reality) and level. The levels were categorized as early childhood, which included preschool, pre-K, and Head Start settings; elementary, which spanned from kindergarten to fifth grade; and secondary, which ranged from sixth to twelfth grade. Proximity of the coach to the coached participant(s) was also recorded as whether the coach was in the same room as the participant(s) or if the coach was at a remote location. Outcome measures, or what the study measured to determine the effect of BIE coaching, was also coded.

2.4.3 Quality Review

Horner et al. (2005) initially proposed five standards that should be applied to single case research (SCR) in order to determine if the results reliably documented the practice (intervention) as evidence-based: The standards are (a) the practice is operationally defined; (b) the context in which the practice is to be used is defined; (c) the practice is implemented with fidelity; (d) results from SCR document that the practice is functionally related to change in dependent measures; and (e) the experimental effects are replicated across a sufficient number of studies, researchers, and participants to allow confidence in the findings. Horner and Kratchowill (2012) expanded the proposed standards in order to operational define "practice" to encourage the development of professional standards for visual and statistical analysis of SCR, and to propose a standard that uses SCR results to identify practices that can be considered evidence based.

As per WWC (2014/2017), five explicit design standards were used to appraise the studies: (1) systematic manipulation of the independent variable, (2) interobserver

agreement (IOA) is collected on a minimum of 20% of baseline and intervention sessions, ideally within each phase, (3) a minimum score of 80% IOA or .60 Kappa, (4) a minimum of three replications of effect, and (5) a minimum of three points of collected data (ideally five or more) per phase of the design. Studies that successfully met the criteria were deemed as *meets without reservation.* Studies that met the five standards but did not meet the full criteria for number of phases and data points per condition were categorized as *meets with reservation.* Studies that did not meet all five standards were identified as *does not meet.* Rating for quality used a coding system developed from the WWC standards (Appendix A). The WWC Design Standards can be found in full at https://ies.ed.gov/ncee/wwc/Docs/referenceresources/wwc_standards_handbook_v4.pdf.

Similarly, WWC guidelines were followed in the evaluation of the group studies. To be assigned the label of *meets without reservation* in this review, the participants had to be randomly assigned to groups, attrition reported, participant information aggregated at the group or participant level, and include an analysis of the effectiveness of the intervention. Studies that partially met the criteria or in which the information could be inferred were identified as *meets with reservations.* Studies that did not contain all the essential components were categorized as *does not meet.*

2.5 Results

2.5.1 Study Characteristics

Publication dates of the included articles ranged from 2006-2018. M. C. Scheeler was the primary author of five of the sixteen articles, J. R. Ottley was primary author on two articles and a contributing author on an additional three. C. G. Coogle was primary

author on three articles and a contributing author on one. Of the four articles C. G. Coogle contributed, J. R. Ottley contributed as well. In other words, M. C. Scheeler, J. R. Ottley, and C. G. Coogle were collectively involved in the research of eleven of sixteen articles.

Of the sixteen SCR articles (17 total studies) that were coded, 11 used multiple baseline design; two characterized the design as multiple baseline, multiple probe (Coogle et al., 2015; Coogle et al., 2017); Barron (2012) identified the design as a case study: AB design. The remaining two SCR studies utilized an ABA withdrawal design (Cooper et al., 2018) and an alternating treatment design (Elford, 2013). Each of the three group studies characterized the designs differently. Bowles and Nelson (1976) used a randomized controlled trial, Giebelhaus (1994) described a controlled trial design but did not indicate randomization of the participants into groups, and Rock, et al. (2009) identified their design as a mixed methods sequential explanatory strategy.

The total number of 117 participants were included in the 20 experiments. Pre-service teachers comprised 43 of the participants, in-service teachers accounted for 66 participants, and the remaining 8 participants were coded as paraprofessionals. Five of the studies were set in special education, 9 studies were set in general education classrooms, 3 studies were set in both special education and general education classrooms, 1 study took place in an augmented reality setting, and 1 study did not report the type of setting. Seven studies took place in an early childhood setting, 4 studies in an elementary environment, 1 study was set in a secondary setting, 6 studies had participants that spanned both elementary and secondary settings, and 1 study

utilized secondary teachers but took place in a university lab. In 10 studies the coach was located in the same room as the coached participant, 8 studies utilized remote coaching, and 1 study did not report the proximity of the coach to the participant.

Outcome measures included a variety of academic and behavioral measures. Five studies measured percentage of complete three-term contingency trials as the outcome. Four studies used the frequency of use of embedded communication strategies as the outcome measure. Two studies measured the use of high access instruction, which are strategies intended to increase student engagement (e.g., choral response, asking open-ended comprehensions and providing wait time). One of those two studies also included low access strategies; use of redirects, reprimands, and praise, and percentage of student engagement during a reading assignment in the outcome measures. The remaining eight studies included a study that measured the percentage of intervals prompted and spontaneous communication strategies; one study that measured the frequency of opportunities to respond and the frequency of positive feedback; a study that measured the frequency of behavior specific feedback; a study that measured the rate of learn units per minute; a study that measured the rate of praise per minute; one study that measured six teacher behaviors, including prompts, praise, and corrections; and a study that recorded the rate of 14 behaviors described as discrete teacher clarity behaviors, such as informing the student of the objective prior to the onset of the lesson, repeating things that are important, and checking for understanding. A summary of study characteristics can be found in Table 2.2.

2.5.2 Quality Review

Although there were sixteen SCR articles included in the review, one article contained two separate studies (Scheeler et al., 2009); therefore, seventeen studies were analyzed with the WWC quality standards (Table 2.3). Four studies met the criteria for *meets without reservation* (Coogle et al., 2015; Ottley et al., 2017; Ottley et al., 2014; Scheeler et al., 2018). Eight of the studies were identified as *meets with reservation* (Coogle et al., 2016; Coogle et al., 2015; Goodman et al., 2008; LaBrot et al., 2016; Scheeler et al., 2009 [experiment 1]; Scheeler et al., 2010; Scheeler et al., 2006; Scheeler & Lee, 2002;). Of the articles that were classified as *meets with reservations,* one did not report a minimum of 20% interobserver agreement (IOA) per phase, two had a minimum of three data points per phase but did not have five or more data points per phase, and the remaining five fell short in both the IOA category and the number of data points category. Lastly, five studies were categorized as *does not meet* (Barron, 2012; Cooper et al., 2018; Elford, 2013; Scheeler et al., 2012; Scheeler et al., 2009 [experiment 2]). One study did not report IOA: three studies did not attempt a minimum of three replications of effect; and one study did not report IOA, did not attempt a minimum of three replications of effect, and did not have a minimum of three data points per phase.

Traditionally, visual analysis is conducted on SCR studies that meet the standards either with or without reservation to determine if an effect has been demonstrated. Although there have been several attempts to standardize the process of visual analysis, the practice remains subjective and inconclusive (Valentine et al., 2016; Vannest & Ninci, 2015), particularly since visual analysis indicates if an effect has

occurred but does not measure the magnitude of the effect. Thus, visual analysis was not utilized as part of this review.

Each of the three group studies failed to contain the essential elements for this review. The Bowles and Nelson (1976) study reorganized their groups between the first and second phase of the experiment, rendering it impossible to determine if there was a causal effect between the first and second phases. The Giebelhaus (1994) study did not randomize the placement of the participants into the control and treatment groups, nor did it report the attrition rates. Rock et al. (2009) employed a design that does not meet the criteria for RTC or quasi-experimental design (QED).

2.6 Discussion

The purpose of the current quality review was two-fold: to determine the characteristics of the BIE studies (study design, typical participants, interventionists/coaches, settings in which the coaching occurred, the proximity of the coach to the participant, and outcome measures for participants) and to evaluate the quality of the literature as determined by national organization (WWC) standards. This quality review systematically identified and analyzed 17 SCR studies and three group studies that evaluated the effect of BIE coaching in the classroom. Three researchers collectively contributed to greater than 50% of the studies. The WWC standards were applied to appraise the quality of the studies. In addition to the utilization of the WWC standards, the articles were coded for potentially relevant variables, such as role of the participant(s) (i.e. pre-service, in-service, or paraprofessional), the settings in which the studies took place (i.e. special education, general education, elementary, or secondary),

and the proximity of the coach to the participant. The majority of studies were conducted with in-service teachers, took place in general education settings, and were located in early childhood settings. Proximity of the coach to the participant was almost evenly split between in the same room and remote.

2.6.1 Limitations

A limitation of this review is the lack of a reliable procedure for SCR that identifies a causal relationship. While visual analysis of studies that meet standards with or without reservation has historically been the method by which a demonstration of effect is determined, the practice is highly subjective and ambiguous. A further limitation of this review is that there was a paucity of group studies that met the inclusion criteria, and the studies that were included did not meet the WWC standard criteria. Additionally, although the search strategy was designed to include gray literature and dissertations, no gray literature and very few dissertations made it through the screening process. The result is potential publication bias. A regression test for funnel plot asymmetry was run to determine estimated amount of total heterogeneity (Figure 2.2). The results indicated that zero studies were missing from the right side of the funnel plot and approximately four studies were missing from the left side. In other words, in order to reduce the likelihood of publication bias, four additional studies similar to the studies on the left of the funnel plot need to be included in this review. Future researchers should expand the search to include more databases that house dissertations (e.g., Dissertations and Theses Global) and conference proceedings (e.g., Scopus).

2.7 Conclusion

The results of this quality review indicate that there is a room for improvement in the quality of studies that measure the effect of BIE coaching. It is likely that the quality will improve as more studies are conducted with adherence to the WWC evidence standards initially proposed in 2005. Although the fact that several of the SCR studies met criteria with and without reservations to suggests that BIE coaching is an effective intervention, a definitive conclusion can only be drawn when there are more than four SCR studies that meet criteria without reservation and/or RTC or QED studies that meet basic quality standards. Therefore, caution is encouraged in declaring BIE coaching an EBP until additional, reliable evidence is provided. Nevertheless, the analysis of the quality of the included studies plus the breakdown of each study by multiple variables extends the literature of BIE coaching in the classroom.

2.8 References

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Table 2.1 Eligibility Criteria

Variable	Include	Exclude	Code in Rayyan
Publication Language	English	Non-English language	Foreign Language
Intervention	bug-in-ear/BIE, wireless technology, (Bluetooth, web-based), eCoaching, mechanical third ear, in-vivo, real time coaching (in the moment, in situ)	Consultation: meeting with teacher to discuss performance before or after observed interactions with students	Wrong Drug
Setting	Educational setting, school-based, pre-school, Head Start, elementary, middle, or high school; public, private, charter, alternative; simulated classroom	Clinic, hospital, juvenile justice facility, residential treatment center, group home; Industry or profession other than education	Wrong outcome
Participant	Teachers (general education, special education, pre-service, student teachers), Paraprofessionals (instructional assistants, teachers' aides, paraeducators), school staff	Parents, caretakers	Wrong population
Study Design	Single case research design or group design	Case study, no experimental variable, qualitative/descriptive study, theory, editorial, or commentary	Wrong Publication Type

Table 2.2 Summary of Study Characteristics

Authors	Year	Design	# of Participants	Role of Participant	Setting	Level	Proximity of Coach	Outcome
SCR Studies								
Barron	2012	Case study: AB	3	Pre-service	GenEd	Elem	Remote	Percentage of high-access strategies
Coogle, Ottley, Storie, Rahn, & Burt	2017	Multiple baseline, multiple probe	1	In-service	GenEd	EC	Remote	Percentage of intervals prompted and spontaneous communication strategies
Coogle, Rahn, & Ottley	2016	Multiple baseline	2	In-service	Sped & GenEd	EC	Remote	Frequency of use of embedded communication strategies
Coogle, Rahn, Ottley, & Storie	2015	Multiple baseline, multiple probe	3	In-service	GenEd	EC	Remote	Frequency of use of embedded communication strategies
Cooper, Whitney, & Lingo	2018	ABA withdrawal	1	In-service	GenEd	Elem	Same room	Frequency of opportunities to respond and frequency of positive feedback
Elford	2013	Alternating treatment	4	In-service	Sped & GenEd Augmented reality	Sec	Remote	Frequency of behavior specific feedback
Goodman, Brady, Duffy, Scott & Pollard	2008	Multiple baseline	3	In-service	Sped	Elem & Sec	Same room	Rate of Learn Units per minute
LaBrot, Pasqua, Dufrene, Brewer & Goff	2016	Multiple baseline	4	Para	GenEd	EC	Same room	Rate of praise per minute
Ottley & Hanline	2014	Multiple baseline	4	In-service	GenEd	EC	Remote	Frequency of use of embedded communication strategies

Table 2.2 Continued

Authors	Year	Design	# of Participants	Role of Participant	Setting	Level	Proximity of Coach	Outcome
Ottley, Coogle, Rahn, & Spear	2017	Multiple baseline	8	In-service	GenEd	EC	Same room	Frequency of use of embedded communication strategies
Scheeler & Lee	2002	Multiple baseline	3	Pre-service	Sped	University classroom (Lab)	Same room	Percentage of complete three-term contingency trials
Scheeler, Congdon, & Stansbery	2010	Multiple baseline	6	In-service	GenEd	Elem & Sec	Same room	Percentage of complete three-term contingency trials
Scheeler, McAfee, Ruhl, & Lee	2006	Multiple baseline	5	Pre-service	Sped	EC	Same room	Percentage of complete three-term contingency trials
Scheeler, McKinnon, & Stout	2012	Multiple baseline	5	Pre-service	GenEd	Elem	Remote	Percentage of complete three-term contingency trials
Scheeler, Morano, & Lee	2018	Multiple baseline	4	Para	Sped	Elem & Sec	Same room	Percentage and rate of specific praise
Scheeler, Bruno, Grubb, & Seavey	2009	Multiple baseline	5	Pre-service	Sped	Elem & Sec	Same room	Percentage of complete three-term contingency trials
RTC Studies								
Bowles & Nelson	1976	Randomized controlled trial	19	In-service	Sped & GenEd	Elem	Same room	6 teacher behaviors, including prompts, praise, and corrections
Giebelhaus	1994	Controlled trial (randomization not reported)	22	Pre-service	Not reported	Elem & Sec	Not reported	Rate of 14 discrete teacher clarity behaviors
Rock, Gregg, Thead, Acker, Gable, & Zigmond	2009	Mixed methods sequential explanatory strategy	15	In-service	Sped & GenEd	Elem & Sec	Remote	High access and low access strategies; use of redirects, reprimands, and praise, as well as percentage of student engagement

Table 2.3 WWC Design Standard Designation

Authors	Year	WWC Quality Designation
SCR Studies		
Coogle, Rahn, & Ottley	2015	Meets
Ottley, Coogle, & Spear	2017	Meets
Ottley & Hanline	2014	Meets
Scheeler, Morano, & Lee	2018	Meets
Coogle, Ottley, Storie, Rahn, & Burt	2017	Meets with Reservations
Coogle, Rahn, Ottley, & Storie	2016	Meets with Reservations
Goodman, Brady, Duffy, Scott, Pollard	2008	Meets with Reservations
LaBrot, Pasqua, Dufrene, Brewer, & Goff	2016	Meets with Reservations
Scheeler, Congdon, & Stansbery	2010	Meets with Reservations
Scheeler, Bruno, Grubb, & Seavey (exp. 1)	2009	Meets with Reservations
Scheeler & Lee	2002	Meets with Reservations
Scheeler, McAfee, Ruhl, & Lee	2006	Meets with Reservations
Barron	2012	Does Not Meet
Cooper, Whitney, & Lingo	2018	Does Not Meet
Elford	2013	Does Not Meet
Scheeler, Bruno, Grubb, & Seavey. (exp. 2)	2009	Does Not Meet
Scheeler, McKinnon, & Stout	2012	Does Not Meet
RTC Studies		
Bowles & Nelson	1976	Does Not Meet
Giebelhaus	1994	Does Not Meet
Rock, Gregg, Thead, Acker, Gable, & Zigmond, N.	2009	Does Not Meet

Figure 2.1 BIE PRISMA Diagram

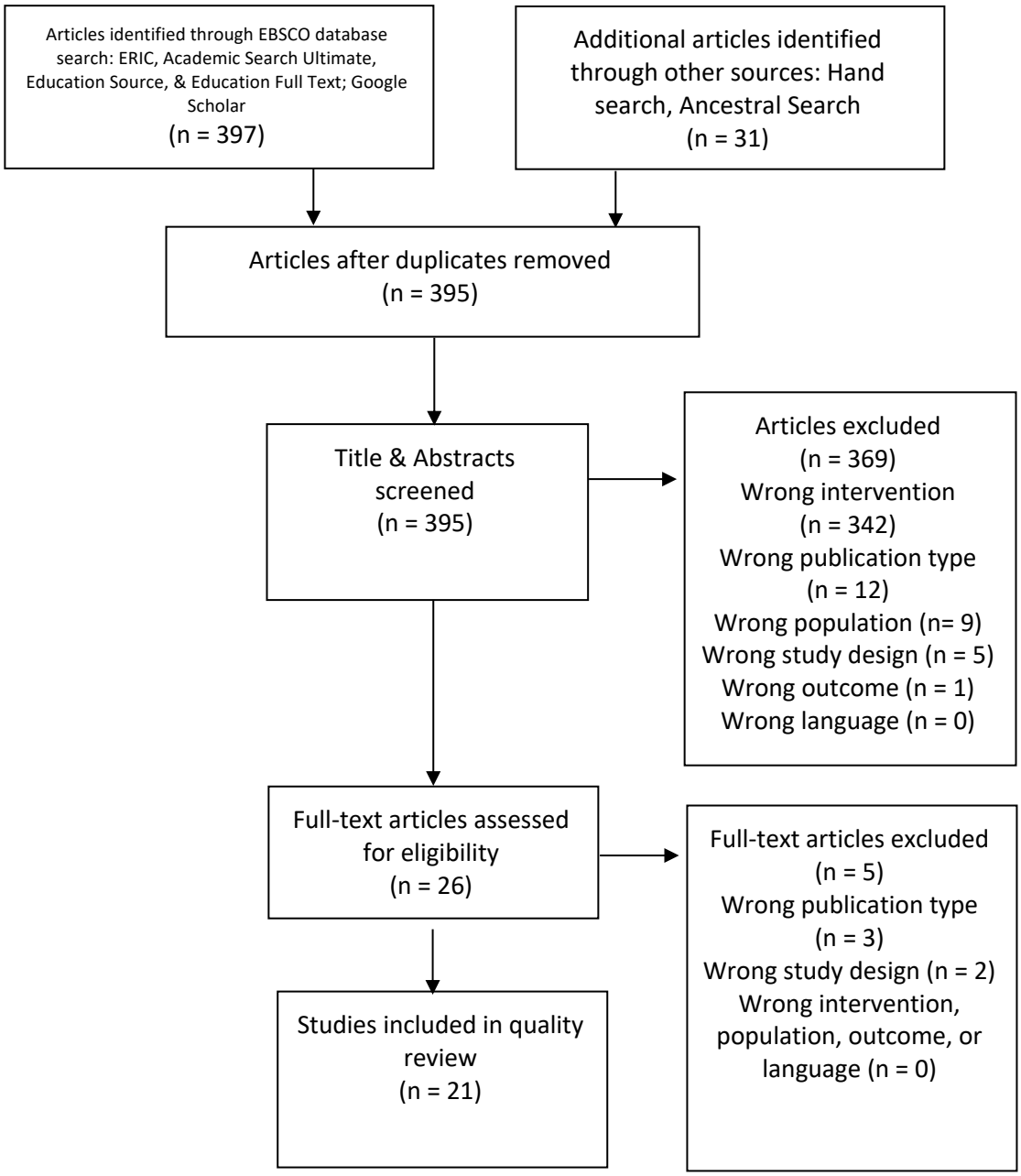
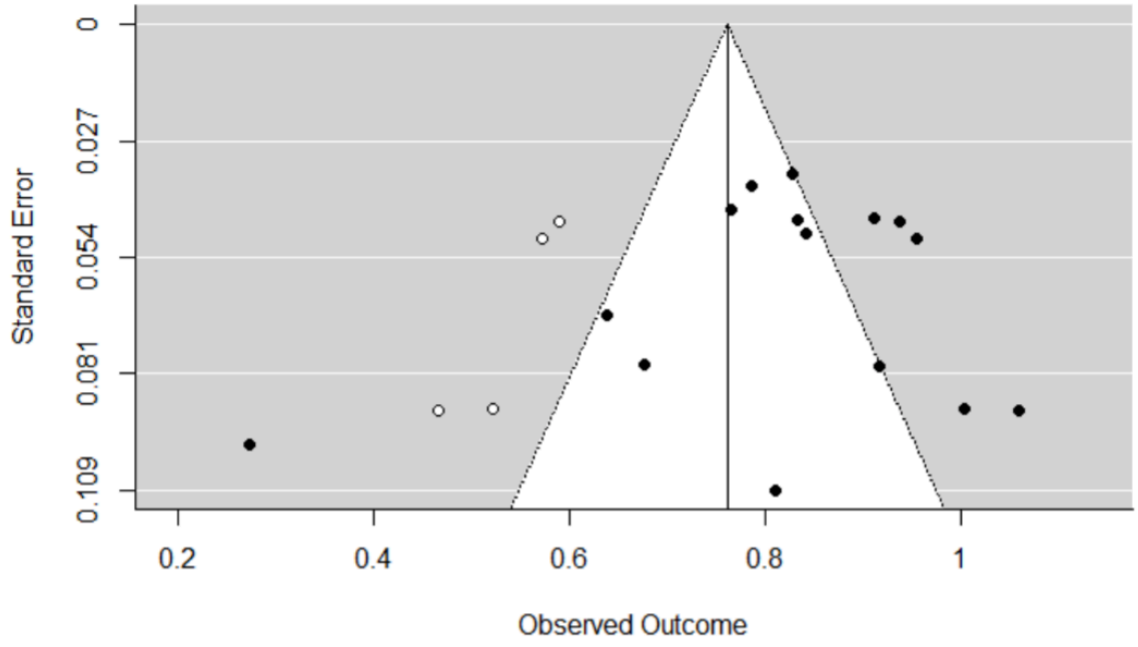


Figure 2.2 Funnel Plot Indicating Potential Publication Bias



CHAPTER III

BUG-IN-EAR COACHING IN THE CLASSROOM: A META-ANALYSIS OF RESEARCH ON THE EFFECTS

Pervasive issues in teacher recruitment and retention are high turnover rates and teacher shortages due to poorly prepared or inadequately practiced skill sets (Sutcher et al., 2016). These problems are often exacerbated by stand-alone professional development that may be high-priced yet inadequate (Bethune, 2012; Kennedy, 2016). Teachers frequently struggle to apply the information gained in their pre-service or in-service training in their classrooms (Fallon et al., 2015). Providing performance feedback to teachers, or coaching, is a valid way to increase generalization of acquired skills (Cantrell & Hughes, 2008). Performance feedback is a method utilized in both business and education to improve performance (Hattie & Timperley, 2007; Cavanaugh, 2013). In addition, the use of technology to provide feedback to improve professional practices is common across fields (Blau et al., 2018; Choudhary et al., 2019). The technology has improved significantly in recent years, allowing for feedback to be discreetly delivered in real-time. The delivery of performance feedback in this manner is increasingly used in educational settings (Rock, et al., 2009; Scheeler et al., 2006). "Bug-in-ear" (BIE) is real-time, telecommunication-based coaching in which classroom teachers receive discrete performance feedback via an earpiece during instructional activities as they implement targeted evidence-based strategies with students. Although

BIE coaching in the classroom is occurring more frequently, the relative effects of BIE coaching on type of educator and in what setting is largely unknown.

Electronic coaching (eCoaching) was first described as the mechanical third ear by Korner and Brown (1952) in a study with clinical psychology trainees, in which the trainees received immediate guidance from their supervisor via a hearing aid device connected by a long wire to a radio transmitter operated by the supervisor in the next room. Current technology allows for wireless communication across greater distances, yet the basic premise is the same: the provider of the feedback, or the coach, uses technology to provide suggestions in real-time to the recipient, or the coached.

BIE is a form of eCoaching in which teachers or paraprofessionals wear a small earpiece and receive immediate and discrete performance feedback provided by an expert or peer observer. Telecommunication devices allow for the coach to be in the same room with a short-range radio device (e.g. a walkie-talkie) or, with the addition of internet technology (e.g. Skype™), over a hundred miles away (Coogle et al., 2018; Rock et al., 2012). BIE coaching provides an inconspicuous and immediate method for teacher training. A benefit of in situ feedback is that it keeps educators from developing or continuing errors (Heward, 1997; Scheeler et al., 2004). In addition, in-the-moment BIE coaching gives context to the skill, thereby increasing the likelihood of skill retention (Scheeler et al., 2004).

3.1 Previous Reviews

Two systematic and comprehensive reviews were published in recent years. Schaefer and Ottley (2018) conducted a systematic review of 17 single-case research

studies and evaluated the quality of the studies with the What Works Clearinghouse (WWC) design standards (WWC, 2014). Seven studies met WWC standards without reservations, and eight studies met standards with reservations. The results of this review indicate that immediate feedback via BIE met the criteria as an evidence-based intervention for changing preservice and in-service teacher behavior (Schaefer & Ottley, 2018).

Sinclair et al. (2019) included 32 studies, 24 SCR and 6 group design, in their review of real-time performance feedback (RPF) delivered via technology. An adapted version of the CEC quality indicators (Council for Exceptional Children [CEC], 2014) was applied to evaluate the methodological quality of the studies. Twenty-two SCR studies and one group design study met all quality indicators. The authors divided the studies that met quality indicators into the categories of RPF alone, in which RPF was the only independent variable introduced during the intervention, and RPF enhanced, in which additional training components (e.g., an explanation of the importance of behavior-specific praise, professional development including guided practice prior to the onset of the intervention) were added during the treatment phase, potentially confounding the ability to determine the effect of the RPF. After further analysis of the two subgroups, the authors concluded that both the RPF alone and the RPF enhanced qualify as EBP based on the CEC indicators. The Sinclair et al. (2019) review was more inclusive than the Shaefer and Ottley (2018) review in that it included dissertations and gray literature.

However, there are limitations to the reviews, primarily that neither attempted to analyze the magnitude of change demonstrated by the intervention beyond visual analysis of the graphs associated with each study. Furthermore, the literature search for the Schaefer and Ottley (2018) review did not include group designs or gray literature, potentially excluding essential data. Thus, the overall effects of immediate feedback delivered to teachers via BIE as indicated by non-parametric and parametric effect sizes, confidence intervals, and p-values is currently unknown.

Of the participants in the studies included in the Schaefer and Ottley (2018) review, 38% were pre-service teachers, 56% were in-service teachers, and 6% were paraprofessionals. The participants of the included studies of the Sinclair et al. (2019) were 39% pre-service teachers, 58% in-service teachers, and 3% paraprofessionals. Similarly, the breakdown by role of participant in the quality review conducted in Chapter 2 of this dissertation was 37% pre-service teacher, 56% in-service teacher, and 7% paraprofessional. The disparity between the percentage of study participants who are pre-service teachers and teachers who are beyond the novice stage may skew the results to indicate that BIE coaching is effective with all teachers, when it may be less effective with experienced teachers. Therefore teacher "type" is a potential moderator of effects. However, no aggregation of effects for BIE are currently found in the literature. Most studies fit the characteristics of single-case-experimental design, providing details about participants, setting, procedures, and outcomes, but there is limited examination by any of these factors. As a result, a number of unknown potential moderators exists. Thus, it is

critical to examine the effects of BIE coaching as it relates to a variety of potential moderators.

3.2 Purpose

It is through research that knowledge is acquired and practices are improved, with the critical outcome being better education for students. Educational research also provides impartial information that may inform policy (Crewel, 2015). The chief purpose of educational research, though, is to identify what works, for whom, and under what circumstances (Odom et al., 2005). Therefore, the purpose of this meta-analysis is to determine the overall effects of BIE delivered feedback and to evaluate the potential impact of varying participant characteristics on the effects.

3.2.1 Research Questions

1. What are the overall effects of immediate feedback delivered to teachers via BIE as indicated by non-parametric and parametric effect sizes, confidence intervals, and p-values?
2. Do these effects differ by type of setting (i.e. special education classroom, general education classroom, both special education and general education, or augmented reality), (e) level of setting (early childhood, elementary, and secondary, which ranged from sixth to twelfth grade), (f) proximity of the coach to the coached participant(s) (in the same room as the participant(s) or at a remote location, and (g) whether any type of relationship building (i.e. pre-conference) had occurred between the coach and the participant(s) prior to the onset of the intervention

3.3 Method

A meta-analysis is a mode of research in which the characteristics of studies, rather than people, are analyzed (Lipsey & Wilson, 2001). A single study provides only information specific to the participant and context of that study; consequently, the value of each study must be regarded in the context of the sum of the literature (Moeyaert et al., 2018). Meta-analytic methods provide a mechanism to synthesize outcomes across studies, which results in strengthening external validity by allowing for generalization of broad conclusions about the state of the evidence (Beratvas & Chung, 2008; Moeyaert et al., 2018). In general, there are three domains to evaluate in a meta-analysis: study characteristics, study rigor, and study outcomes. (Gast & Ledford, 2018).

This meta-analysis was conducted with adherence to Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Protocols 2015 (PRISMA-P) guidelines and checklists (Moher, Liberati, Tetzlaff, Altman, The PRISMA Group, 2009). The publication bias of systematic reviews is likely to be reduced with adherence to the PRISMA-P guidelines (Moher et al., 2015). The systematic methods for identification of studies of the quality review conducted in Chapter Two of this dissertation were employed for this meta-analytic review.

3.3.1 Search Procedures

A review of literature related to in-situ coaching using technology resulted in the compilation of key words. Keywords from the initial articles were collaboratively reviewed with the university reference librarian in order to refine existing terms and to develop additional search terms. These search terms were used to determine if a basic

exploration in EBSCO would result in the desired types of studies. Then the key words were honed through a process using synonyms within a more comprehensive library database system (Moher et al., 2009). The search terms used to gather the potential studies were: (performance feedback OR immediate feedback OR classroom coaching OR web-based coaching OR real-time coaching OR in the moment coaching OR in-vivo OR in situ) AND (mechanical third ear OR bug-in-ear OR bug-in-ear technology OR wireless technology). A systematic search of the literature was conducted in EBSCO using databases: (a) ERIC, (b) Academic Search Ultimate, (c) Education Source, and (d) Education Full Text as well as in Google Scholar. After the duplicates were removed, the titles and abstracts were uploaded into Rayyan, a free web application designed for assessing text for systematic reviews and meta-analyses (Ouzzani et al., 2016).

In addition, a hand-search of 2015-2019 issues of four peer-reviewed journals was conducted: Teacher Education and Special Education, Journal of Technology and Teacher Education, Journal of Behavioral Education, and Journal of Staff Development. These journals were chosen because the majority of articles selected for full text review from the initial search were published in them. An ancestral search was conducted by inspecting the references of the studies that remained after the title and abstract screening described in the next section. Initial and additional documents found went through the review process below.

Following the searches, duplicates were removed, and a multi-step procedure was utilized in which published journal articles, gray literature, and dissertation manuscripts were evaluated via a title and abstract search, a full text review, a quality

indicator review, then coded for variables. Gray literature and dissertations were included to reduce the risk of publication bias (Carroll et al., 2017; Paez, 2017). The process and outcomes are reported in Figure 2.1).

3.3.1.1 Eligibility Criteria

Data included in this meta-analysis met the following criteria: (a) the research report was in English; (b) the study evaluated the effects of an intervention that incorporated BIE coaching as an element of the independent variable; (c) the research was conducted in settings in which education was the primary focus, such as public or private schools, charter schools, or alternative education placements; (d) the participants were teachers, paraprofessionals, or other school-based educational staff; and (e) the study design was SCR or group design (Table 2.1).

3.3.1.2 Title and Abstract Review

Eligibility criteria were applied to each title and abstract. Articles were excluded if it was evident that the eligibility criteria were not met. Research in which it was not evident that the eligibility criteria were not met remained to be evaluated as part of the full text screening process. A total of 369 abstracts were excluded; 26 moved forward to full text review.

3.3.1.3 Full Text Review

Studies that were not excluded as a result of the title and abstract review were examined in full against the same criteria to establish eligibility (Table 2.1). The description of the intervention must contain words or phrases that indicate the teacher received performance feedback during interactions with students for studies to qualify

for inclusion. Examples include bug-in-ear/BIE, wireless technology (Bluetooth, web-based), eCoaching, mechanical third ear, in-vivo, or real time coaching (in the moment, in situ). Interventions that employed the traditional consultation model of meeting with the teacher to discuss performance before or after observed interactions with students were excluded. The setting had to be educational (school-based, pre-school, Head Start, elementary, middle, or high school; public, private, charter, alternative; or simulated classroom) and could not be a clinic, hospital, juvenile justice facility, residential treatment center, group home; or an industry or profession other than education. Participants must be teachers (general education, special education, pre-service, student teachers), paraprofessionals (instructional assistants, teachers' aides, paraeducators), or some manner of school staff (counselors, administrators, instructional coaches). If the recipients of the intervention were non-educational staff (parents or caretakers), the studies were excluded.

Finally, only studies that utilize randomized control trial (RCT) group designs and single case research (SCR) designs were included due to the fact that causality can be plausibly inferred when studies with these methods are designed and conducted well (CEC, 2014). Case studies, qualitative studies, and editorials were excluded because causality cannot be ascertained.

3.3.1.4 Interrater Reliability (IRR) for Screening

The author reviewed 100% of the titles and abstracts. The total number of titles and abstracts was split evenly between the two secondary reviewers. The author, a doctoral student in special education at a university in the southern United States,

screened, coded, and evaluated all the articles included in the review. The two other raters were doctoral students in the same special education program with experience conducting systematic literature reviews. Prior to screening the titles and abstracts, the three raters met to debrief the eligibility criteria. Once all reviewers understood the criteria, they independently evaluated titles and abstracts and then met as a group to discuss the results. Disagreements were discussed and resolved as per the criteria. Interrater reliability (IRR) on title and abstract was 99%. Reviewers met and discussed disagreements and came to 100% agreement. Twenty-six articles remained after the eligibility criteria were applied and disagreements were resolved.

The same process was employed with the same raters for the full text review. The first author conducted a full text review. IRR was conducted on all articles by two additional reviewers, with each reviewer examining 50% of the articles. Titles and abstracts were independently evaluated by each reviewer. The group of raters then met to discuss the results and resolve disagreements. Additional studies were excluded during the resolution discussion because the in-the-moment coaching consisted of pre-recorded prompts rather than live prompts, resulting in 20 studies included in the quality review.

3.3.2 Quality Review

The WWC (WWC, 2014) design standards were used to assess the studies. These standards are: (a) systematic manipulation of the independent variable, (b) Interobserver agreement (IOA) is collected on a minimum of 20% of baseline and intervention sessions, ideally within each phase, (c) a minimum score of 80% IOA or .60 Kappa, (d)

a minimum of three replications of effect, and (e) a minimum of three points of collected data (ideally five or more for multiple baseline) per phase of the design. Studies that successfully met the criteria, including the five or more data points per phase, were classified as *meets without reservation.* Studies that met the five standards but did not meet the full criteria for number of phases and data points per condition were labeled *meets with reservation.* Studies that did not meet all five standards were determined *does not meet.*

Likewise, WWC guidelines were followed in the evaluation of the group study design (WWC, 2014). To earn the label of *meets without reservation* in this review, the (a) participants had to be randomly assigned to groups, (b) attrition reported, (c) participant information aggregated at the group or participant level, and (d) an analysis of the effectiveness of the intervention included. Studies that met the criteria in part or in which the information could be inferred were identified as *meets with reservations.* Studies that did not contain all the essential components were categorized as *does not meet.*

3.3.2.1 IRR for WWC Design Standards

A random selection of five (26% of 19) SCR studies were evaluated for IRR with WWC Design Standards. The two raters agreed with an average of 96%. Two raters evaluated 3 of 3 group design studies with WWC Design Standards with 100% agreement. Due to lack of experimental rigor, the group studies evaluated in the quality review were not included in the meta-analysis. The SCR studies included in this meta-analysis and the corresponding WWC designation can be found in Table 3.1.

3.4. Variable Coding

The meta -analysis process categorizes effects by variables in order to compare the moderators and determine sources of variability in the outcomes (Glass, 1976; Lipsey & Wilson, 2001). Articles that met the eligibility criteria were coded for an array of variables. Each article was coded for (a) experimental design, (b) total number of participants, (c) role of the participants (pre-service teachers, which included participants described as student teachers; in-service teachers; or paraprofessionals, which included participants identified as teaching assistants, teacher's aides, instructional assistants, or paraeducators), (d) type of setting (i.e. special education classroom, general education classroom, both special education and general education, or augmented reality), (e) level of setting (early childhood, which included preschool, pre-K, and Head Start settings; elementary, which spanned from kindergarten to fifth grade; and secondary, which ranged from sixth to twelfth grade), (f) proximity of the coach to the coached participant(s) (in the same room as the participant(s) or at a remote location, and (g) whether any type of relationship building (i.e. pre-conference) had occurred between the coach and the participant(s) prior to the onset of the intervention. Evaluation of outcome measures as a moderator was excluded because the focus of this dissertation is on the process of BIE coaching in the classroom, not on the skill taught.

3.4.1 Design

Fourteen of the 17 studies utilized a multiple baseline design; therefore, an analysis by type of study design was not conducted due to lack of diversity.

3.4.2 Quality

This moderator was divided into two categories. The quality evaluation conducted in Chapter II provided the basis for the studies included in the moderator analysis. The first quality category included all studies in the quality review. This moderator is identified as *omnibus.* The second quality category is comprised of the four studies that met the basic WWC quality standards and is identified as *quality without reservation.*

3.4.3 Role of Coached Participant

This moderator was split into three categories. If the coached participant(s) was described as a student teacher or pre-service teacher, the studies were identified as *pre-service.* If the study indicated that the participant(s) was a teacher or educator that was certified or was not a pre-service or student teacher, the study was identified as *in-service.* The studies in which the coached participant(s) was described as a paraprofessional, instructional aide, instructional assistant, teacher's aide, or paraeducator were identified as *paraprofessional.*

3.4.4 Role of Coach

The studies that characterized the person providing the BIE coaching as a peer to the person being coached were identified as *peer coaching.* The studies that identified the person providing the BIE coaching as the researcher and the studies that did not provide details to indicate the relationship of the BIE coach were identified as *researcher as coach/coach role not specified.*

3.4.5 Type of Setting

This moderator included two categories. The studies that were described as taking place in a special education setting were identified as *special education setting.* The studies that were set in a general education setting or a non-special education setting were identified as *general education setting.*

3.4.6 Level of Setting/Staff

This moderator consisted of three categories. The studies in which the setting or the coached participant(s) were described as early childhood, pre-K, pre-school, or Head Start were identified as *early childhood.* Studies that described the coached participant(s) or the setting as kindergarten, first grade, second grade, third grade, fourth grade, or fifth grade were identified as *elementary.* Studies that described the coached participant(s) or the setting as sixth grade, seventh grade, eighth grade, ninth grade, tenth grade, eleventh grade, or twelfth grade were identified as *secondary.*

3.4.7 Proximity

This moderator was split into two categories. If the coach was in the same room as the participant(s), it was coded as *coach in same room.* If the coaching was done from a location other than within the same room as the participant(s), it was coded as *remote.*

3.4.8 Relationship Building

This moderator was divided into two categories. If the article indicated that an effort was made to develop a relationship between the coach and the coached participant beyond any professional development that took place (i.e. pre-conference), it was coded as *relationship building.*

3.4.9 IRR for Variable Coding

Three evaluators coded four to eight of the 17 studies each. Seven studies were randomly selected to obtain IRR across seven coding variables (i.e. role of participant, role of coach, type of setting, level of setting, proximity, and relationship building). A second evaluator for the seven articles determined whether there was an agreement or disagreement with each code by referencing the original article under review. IRR average was 93% (range 67%-100%).

3.5. Data Extraction and Analysis of Effects

Engauge Digitizer version 12.1 was utilized to extract the data from the graphs in each study. Engauge Digitizer is free, online software found at https://www.bytesin.com/software/Engauge-Digitizer/ that converts an image file of a graph into numbers. The numbers are an estimation of the values on the x-axis in relation to the numbers on the y-axis that can then be exported to a spreadsheet. These numbers represent the data points for the baseline-intervention (AB) phase of each experiment.

3.5.1 Effect Size

Although it has been argued that statistical analysis is not necessary because visual analysis reveals intervention effects large enough to be important to clinicians and practitioners (Baer, Wolf, & Risley, 1968), visual analysis typically only determines if a change occurred upon the introduction of an intervention, not the magnitude of the change (Valentine et al., 2016). Furthermore, because visual analysis is non-standardized and highly subjective, the results are often inconsistent between raters and cannot be

aggregated across studies. Determining an effect size (ES) quantifies the amount of change between treatment conditions (Parker & Hagan-Burke, 2007). ES also aids in summarizing data across studies (Bowman-Perrott et al., 2013). There are no agreed upon standards for determining ES in SCR (Kratochwill et al., 2010), yet non-parametric statistics (e.g. percentage of nonoverlapping data, nonoverlap of all pairs, Tau-U) are generally utilized because, given the small sample size, the assumption that the data will be normally distributed cannot be made (Moeyaert et al., 2018). The challenge for meta-analysis in SCR is that most meta-analytic procedures are based on between-groups research designs (Moeyaert et al., 2018).

Tau-U and between-case standardized mean difference (BC-SMD) were employed in this meta-analysis in order to determine ES. Tau-U is a nonparametric quantitative method for evaluating data provided by studies with SCR that goes beyond the information provided by visual analysis alone (Parker et al., 2011). Tau-U combines nonoverlap data across conditions that can correct a trend in baseline; the values of the Tau-U ES range from -1 to 1. The use of Tau-U is preferred over other measures because, in addition to its ability to correct baseline trends, it includes all data points, is highly sensitive, and provides ease of calculation (Parker et al., 2011). The current meta-analysis utilized Tau-U to determine ES for each baseline-intervention (AB) phase of included studies. Tau-U computations of ES were conducted using the free online calculator available at www.singlecaseresearch.org (Vannest et al., 2010).

BC-SMD is a method for calculating ES in single-case multiple baseline design and alternating treatments design. It allows for the estimation of ES that are

commensurate with ES from between-group designs, thereby allowing for the meta-analytic synthesis of findings from both SCR designs and between-group designs (Valentine et al., 2016). BC-SMD effect size calculation is powered by the statistical program R and is conducted by accessing the web application at https://jepusto.shinyapps.io/scdhlm/. No experience with R programming is necessary (Valentine et al., 2016). These approaches allow for the standardization and combination of ES, making it possible to calculate overall treatment effect estimates (Moeyaert et al., 2018).

To help provide a reference for comparison between Tau-U moderator ESs a scale was used in which ES<0.20 is considered a small change, 0.20<0.60 is a moderate change, 0.60<0.80 is a large change, and ES>0.80 is considered a very large change (Vannest & Ninci, 2015). The scale for BC-SMD moderator ESs followed the "rule of thumb" guidelines suggested by Cohen (1988) in which an ES<0.20 is a small effect, 0.50 (0.20<>0.80) is a medium effect, and >0.80 is a large effect (Table 3.2)

3.6. Results

Table 3.3 provides a side-by-side comparison of Tau-U and BC-SMD ESs, CIs, *p*-values, and magnitude of effect. In general, the standard for statistical significance in non-medical studies is considered to be a *p*-values of less than 0.05 (Kyriacou, 2016). In accordance with this standard, the Tau-U ESs of all subgroups in each moderator can be considered statistically significant, as each had a *p*-values of less than 0.01. The BC-SMD ESs for all subgroups also had *p*-values of less than 0.01, with the exception of *secondary* under *level of setting* with a *p*-value of 0.08 and *relationship building* with a

p-value of 0.13. Table 3.4 displays the summary of Tau-U moderator analysis and Table 3.5 displays the summary of the BC-SMD moderator analysis. Figures 3.1-3.7 and 3.8-3.14 display the forest plots of the Tau-U ESs and CIs and the BC-SMD ESs and CIs, respectively.

3.6.1 Quality

A very large omnibus Tau-U ES of 0.83 was calculated for all included studies with a CI of 0.73<>0.92. The BCDSM ES of 1.60 (CI1.04<>2.17) also falls into the category of a very large effect. A Tau-U ES of 0.95 with a CI of .77<>1.00 was calculated for the four studies that met the WWC Design Standards without reservation (Coogle et al., 2015; Ottley & Hanline, 2014; Ottley et al., 2017; Scheeler et al., 2018). The BC-SMD ES the four *meets without reservation* studies was 1.90 with a CI 0.84<>2.95. For the *meets without reservation* studies, the Tau-U ES is considered very large and the BC-SMD ES is a large effect.

3.6.2 Role of Coached Participant

Five studies included 19 pre-service teacher participants (Barron, 2012; Coogle et al., 2015; Scheeler & Lee, 2002; Scheeler et al., 2006; Scheeler et al., 2012), nine studies included 33 in-service teachers (Coogle et al., 2016; Coogle et al., 2017; Cooper et al., 2018; Elford, 2013; Goodman et al., 2008; LaBrot et al., 2016; Ottley & Hanline, 2014; Ottley et al., 2017; Scheeler et al., 2010), and eight participants of two studies were paraprofessionals (LaBrot et al., 2016; Scheeler et al., 2018). The *in-service* Tau-U ES was a large change (Tau-U ES 0.77, CI 0.63<>0.90) The BC-SMD ES was a very large change (ES 1.90, CI 0.90<>2.97). The Tau-U and BC-SMD ES can be considered

very large for *pre-service* (Tau-U ES 0.91, CI 0.74<>1.00; BC-SMD ES 1.16, CI 0.49<>1.82) and *paraprofessionals* (Tau-U ES 1.00, CI 0.83<>1.00; BC-SMD ES 3.09, CI 2.17<>4.07). However, the results of the *paraprofessionals* analysis should be considered with caution due to the be imbalance in the number of studies and participants as compared to the *in-service and pre-service* categories.

3.6.3 Role of Coach

Three studies used peers as coaches (Ottley et al., 2017; Scheeler et al., 2010; Scheeler et al., 2018), and the Tau-U ES was 1.00, CI 0.78<>1.00, indicating a very large change. The BC-SMD was 4.36, CI 1.48<>7.24 , indicating a large change. Fourteen studies comprised *researcher as coach/coach role not specified* (Barron, 2012; Coogle et al., 2015; Coogle et al., 2016; Coogle et al., 2017; Cooper et al., 2018; Elford, 2013; Goodman et al., 2008; LaBrot et al., 2016; Ottley & Hanline, 2014; Scheeler & Lee, 2002; Scheeler et al., 2006; Scheeler, et al., 2009a (exp. 1); Scheeler et al., 2009 (exp. 2); Scheeler et al., 2012). Tau-U for *researcher as coach/coach role not specified* was 0.78, CI 0.69<>0.86, indicating a large change. BC-SMD ES was 1.03, CI 0.83<>1.79, indicating a large effect.

3.6.4 Type of Setting

Four studies took place in special education settings (Goodman et al., 2008; Scheeler & Lee, 2002; Scheeler et al., 2006; Scheeler et al., 2018). These studies had a large change Tau-U ES of 0.64, CI 0.53<>0.81, and a large BC-SMD ES of 1.41, CI 0.49<>2.33. The nine general education setting studies (Barron, 2012; Coogle et al., 2015; Coogle et al., 2017; Cooper et al., 2018; LaBrot et al., 2016; Ottley & Hanline,

2014; Ottley et al., 2017; Scheeler et al., 2010; Scheeler et al., 2012) had a Tau-U ES of 0.94, CI 0.80<>1.00, or a very large change, and a BC-SMD ES of 2.11, CI 1.14<>3.08, or a large effect.

3.6.5 Level of Setting/Staff

The three categories of this moderator were *early childhood*, with seven studies (Coogle et al., 2015; Coogle et al., 2016; Coogle et al., 2017; LaBrot et al., 2016; Ottley & Hanline, 2014; Ottley et al., 2017; Scheeler et al., 2006); *elementary,* with six studies (Barron, 2012; Cooper et al., 2018; Goodman et al., 2008; Scheeler et al., 2010; Scheeler et al., 2012; Scheeler et al., 2018); and *secondary*, with three studies (Goodman et al., 2008; Scheeler et al., 2010; Scheeler et al., 2018). The Tau-U range of change for this moderator was large (*elementary* ES 0.77, CI 0.59<>0.94; *secondary* (ES 0.80, CI 0.56<>1.00) to very large (*early childhood* ES 0.91, CI 0.76<>1.00). The BC-SMD ESs can all be considered large effects (*early childhood* 1.70, CI 1.06<>2.35; *elementary* 1.72, CI 0.96<>2.48; *secondary* 2.13, CI -0.19<>4.46).

3.6.6 Proximity

There were 10 studies in which the coach remained in the same room as the participant (Cooper et al., 2018; Goodman et al., 2008; LaBrot et al., 2016; Ottley et al., 2017; Scheeler & Lee, 2002; Scheeler et al., 2006; Scheeler, et al., 2009 (experiments 1 & 2); Scheeler et al., 2010; Scheeler et al., 2018). These ten studies a Tau-U ES of 0.84, CI 0.77<>0.97, and a BC-SMD ES of 2.30, CI 1.27<>3.33). Seven studies (Barron, 2012; Coogle et al., 2015; Coogle et al., 2016; Coogle et al., 2017; Elford, 2013; Ottley & Hanline, 2014; Scheeler et al., 2012) conducted the intervention from a remote

location and had a Tau-U ES of 0.83, CI 0.70<>0.90, and a BC-SMD ES of 1.08,CI 0.56<>1.61. The Tau-U ES of both the *coach in same room* group and the *remote* group is interpreted as a very large change. The BC-SMD ES of each is interpreted as a large effect.

3.6.7 Relationship Building

Two studies (Goodman et al., 2008; LaBrot et al., 2016) were included in this moderator. This moderator had a moderate change Tau-U ES of 0.34, CI of 0.14<>0.55. The BC-SMD effect for this group was large with an ES of 1.86, CI -0.52<>4.24. The analysis of this moderator should be interpreted with caution, however, as only two of 17 studies indicated that some type of relationship building beyond PD occurred.

3.7 Discussion

The first purpose of this meta-analysis was to determine the overall effects of feedback delivered to educators via BIE. The Tau-U ESs ranged from 0.34 to 1.00 and the description of the magnitudes of change ranged from moderate to very large, indicating that BIE coaching in the classroom in an effective intervention. BC-SMD results support the conclusion. BC-SMD ESs ranged from 1.03 to 4.36 and the magnitude of change for all moderators was categorized as a large effect.

The second purpose was to evaluate the potential impact of varying characteristics of participants, coaches, settings, and proximity of coach to participant (e.g. pre-service or in-service teachers; researcher as coach or peer coach; special education or general education; coach in the same room or remote) on the effects based on moderator analysis. The overlap of confidence intervals for each moderator group

(Tau-U Figures 3.1-3.7; BC-SMD Figures 3.8-3.14) indicate that, although there is some variation in ES, there is no fundamental difference between the groups within each moderator. That is, BIE coaching in the classroom can be considered effective regardless of: (a) quality of the study, (b) the role of the coached participant, (c) the role of the coach, (d) the type of setting, (e) the level of setting, or (f) the proximity of the coach to the coached participant.

3.7.1 Limitations

Although the present meta-analysis presents information to guide the implementation of BIE coaching in the classroom with a variety of participants across a range of settings, the conclusions are subject to some limitations. First, the ES comparison of quality was between all 17 studies (16 articles) and the four that were identified as *meets without reservation*, rather than a comparison all 17 studies minus the four *meets without reservation* studies against the four *meets without reservation* studies. In the *role of coach* moderator category, there were two moderator groups: *Peer Coaching* and *Researcher as Coach/Coach Role not Specified* . More information regarding potential moderator impact may be gained if the moderator group identified as *Researcher as Coach/Coach Role not Specified* were divided into two distinct moderators: *Researcher as coach* and *Coach Role not Specified.* Second, variability in the number of studies and number of participants within the studies for moderators may influence the ES results. For example, in the moderator category of the role of the coached participant, Tau-U was 0.77 for in-service teachers, 0.91 for preservice teachers, and 1.00 for paraprofessionals. The in-service teacher moderator consisted of nine

studies with 33 participants and 4,436 pairwise comparisons; the pre-service group consisted of five studies, 19 participants, and 709 pairwise comparisons; and the paraprofessional moderator had two studies, eight participants, and 611 pairwise comparisons. It is possible that the ESs would be closer in range if the sample sizes and number of data points were equivalent. Third, all of the included AB phase contrasts were taken from SCR studies in which the individual participants comprise the unit of analysis; subsequently, the results may not easily generalize to broader applications. Therefore, judgments made based on ES estimates should be viewed with caution.

3.7.2 Implications for Research

The participants of the studies included in this meta-analysis were limited to educator participants and did not take into account student outcomes. Future BIE coaching in the classroom research should measure not only changes in teacher behavior, but also the impact that change has on student behavioral and academic outcomes. In addition, definitive conclusions could not be drawn regarding the relationship between the coach and the coached participant due to the fact that there was not enough information reported on whether some type of relationship building beyond PD occurred prior to the onset of the coaching sessions. Future investigators may want to consider the potential impact of relationship building on the outcomes of BIE coaching.

3.7.3 Implications for Practice

Teacher preparation programs and school districts should be encouraged by the results of this meta-analysis. The ESs across all moderators indicate that BIE coaching is an effective practice across participant types and settings. In addition, a powerful

effect was demonstrated in the studies in which the BIE coach was a peer to the coached participant. This provides school districts the option of using "in-house" resources to provide the coaching, thereby reducing the cost of the intervention and creating a sustainable system of coaching. Furthermore, the effect is strong regardless of the proximity of the coach to the participant. Given the advances of technology that allows for reliable remote coaching to occur, a single coach can schedule numerous sessions to separate educators per day, without incurring the loss of time and cost associated with travel.

3.8 Conclusion

The results of the current systematic review indicate that bug-in-ear coaching in the classroom is an effective intervention across settings and roles. Given the ongoing struggle in education to provide quality professional development to teachers with limited budget, BIE coaching offers a potentially robust and cost-efficient avenue to support educators' acquisition, implementation, and generalization of evidence-based practices. School districts and teacher preparation programs should consider incorporating BIE coaching into their standard practice.

3.9 References

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Table 3.1 WWC SCR Design Standard Designation

Authors	Year	WWC Quality Designation
Coogle, Rahn, & Ottley	2015	Meets
Ottley, Coogle, Rahn, & Spear	2017	Meets
Ottley & Hanline	2014	Meets
Scheeler, Morano, & Lee	2018	Meets
Coogle, Ottley, Storie, Rahn, & Burt	2017	Meets with Reservations
Coogle, Rahn, Ottley, & Storie	2016	Meets with Reservations
Goodman, Brady, Duffy, Scott, & Pollard	2008	Meets with Reservations
LaBrot, Pasqua, Dufrene, Brewer, & Goff	2016	Meets with Reservations
Scheeler, Congdon, & Stansbery	2010	Meets with Reservations
Scheeler, Bruno, Grubb, & Seavey, (exp. 1)	2009	Meets with Reservations
Scheeler & Lee	2002	Meets with Reservations
Scheeler, McAfee, Ruhl, & Lee	2006	Meets with Reservations
Barron	2012	Does Not Meet
Cooper, Whitney, & Lingo	2018	Does Not Meet
Elford	2013	Does Not Meet
Scheeler, Bruno, Grubb, & Seavey (exp. 2)	2009	Does Not Meet
Scheeler, McKinnon, & Stout	2012	Does Not Meet

Table 3.2 Interpretation of ES Magnitude

Tau-U ES	Magnitude descriptor	BC-SMD (analogous to Cohen's d)	Magnitude descriptor
<0.20	Small change	<0.20	Small effect
0.20<0.60	Moderate change	0.20<0.80	Medium effect
0.60<0.80	Large change	0.80<	Large effect
0.80<	Very large change		

Table 3.3 Side-by-Side Tau-U and BC-SMD ESs, Cis, p-values, &. Magnitude of Effect

	Tau-U				BC-SMD			
Moderator	ES	CI 95%	p-value	Magnitude descriptor	ES	CI 95%	*p*-value	Magnitude descriptor
Omnibus	0.83	0.73<>0.92	<0.01	Very large change	1.60	1.04<>2.17	<0.01	Large effect
Quality *without reservation*	0.95	0.77<>1.00	<0.01	Very large change	1.90	0.84<>2.95	<0.01	Large effect
Role of Coached Participant								
Pre-service	0.91	0.74<>1.00	<0.01	Very large change	1.16	0.49<>1.82	<0.01	Large effect
In-service	0.77	0.63<>0.90	<0.01	Large change	1.94	0.90<>2.97	<0.01	Large effect
Paraprofessional	1.00	0.83<>1.0	<0.01	Very large change	3.09	2.17<>4.01	<0.01	Large effect
*Role of Coach								
Peer Coaching	1.00	0.78<>1.00	<0.01	Very large change	4.36	1.48<>7.24	<0.01	Large effect
Researcher as Coach/Coach Role not Specified	0.78	0.69<>0.86	<0.01	Large change	1.03	0.83<>1.79	<0.01	Large effect
Type of Setting								
Special Education	0.64	0.53<>0.81	<0.01	Large change	1.41	0.49<>2.33	<0.01	Large effect
General Education	0.94	0.80<>1.00	<0.01	Very large change	2.11	1.14<>3.08	<0.01	Large effect
Level of Setting/Staff								
Early Childhood	0.91	0.76<>1.00	<0.01	Very large change	1.70	1.06<>2.35	<0.01	Large effect
Elementary	0.77	0.59<>0.94	<0.01	Large change	1.72	0.96<>2.48	<0.01	Large effect
Secondary	0.80	0.56<>1.00	<0.01	Large change	2.13	-0.19<>4.46	0.08	Large effect

Table 3.3 Continued

	Tau-U				BC-SMD			
Moderator	ES	CI 95%	p-value	Magnitude descriptor	ES	CI 95%	*p*-value	Magnitude descriptor
**Proximity								
Coach in Same Room	0.84	0.77<>0.97	<0.01	Very large change	2.30	1.27<>3.33	<0.01	Large effect
Remote	0.83	0.70<>0.90	<0.01	Very large change	1.08	0.56<>1.61	<0.01	Large effect
Studies that explicitly identified relationship building component (i.e. pre-intervention conference)								
Relationship building	0.34	0.14<>0.55	<0.01	Moderate change	1.86	-0.52<>4.24	0.13	Large effect

Note: *statistical significance between *Peer coaching* and R*esearcher as coach/coach role not specified*, *p-value = 0.02,* **statistical significance between *Coach in same room* and *Remote*, p-value = .005

Table 3.4 Summary of Tau-U Analysis by Moderator

Analysis	# of articles	# of participants	# of studies	# of AB phase contrasts	# of data points	Tau-U	*p*-value	CI 95%
Omnibus	16	61	17	89	5902	0.83	<0.01	0.73<>0.92
Quality: meets *without reservation*	4	19	4	34	3846	0.95	<0.01	0.77<>1.00
Role of Coached Participant								
Pre-service	5	19	5	22	709	0.91	<0.01	0.74<>1.00
In-service	9	33	9	54	4436	0.77	<0.01	0.63<>0.90
Paraprofessional	2	8	2	12	611	1.00	<0.01	0.83<>1.00
*Role of Coach								
Peer Coaching	3	18	3	22	596	1.00	<0.01	0.78<>1.00
Researcher as Coach/Coach Role not Specified	13	43	14	67	5306	0.78	<0.01	0.69<>0.86
Type of Setting								
Special Education	4	15	4	22	1265	0.64	<0.01	0.53<>0.81
General Education	9	35	9	52	4061	0.94	<0.01	0.80<>1.00

Table 3.4 Continued

Analysis	# of articles	# of participants	# of studies	# of AB phase contrasts	# of data points	Tau-U	*p*-value	CI 95%
Level of Setting/Staff								
Early Childhood	7	27	7	47	4157	0.91	<0.01	0.76<>1.00
Elementary	6	16	6	20	900	0.77	<0.01	0.59<>0.94
Secondary	3	6	3	10	434	0.80	<0.01	0.56<>1.00
**Proximity								
Coach in Same Room	9	39	10	47	2339	0.84	<0.01	0.77<>0.97
Remote	7	22	7	42	4116	0.83	<0.01	0.70<>0.90
Studies that explicitly identified relationship building component (i.e. pre-intervention conference)								
Relationship building	2	7	2	10	643	0.34	<0.01	0.14<>0.55

Note: The trend range for all studies was -100 to 59, with 27 undesirable trends. All dependent variables were intended to increase.
*statistical significance between *Peer coaching* and R*esearcher as coach/coach role not specified*, *p-value = 0.02,*
***statistical significance between *Coach in same room* and *Remote*, *p-value* = .005

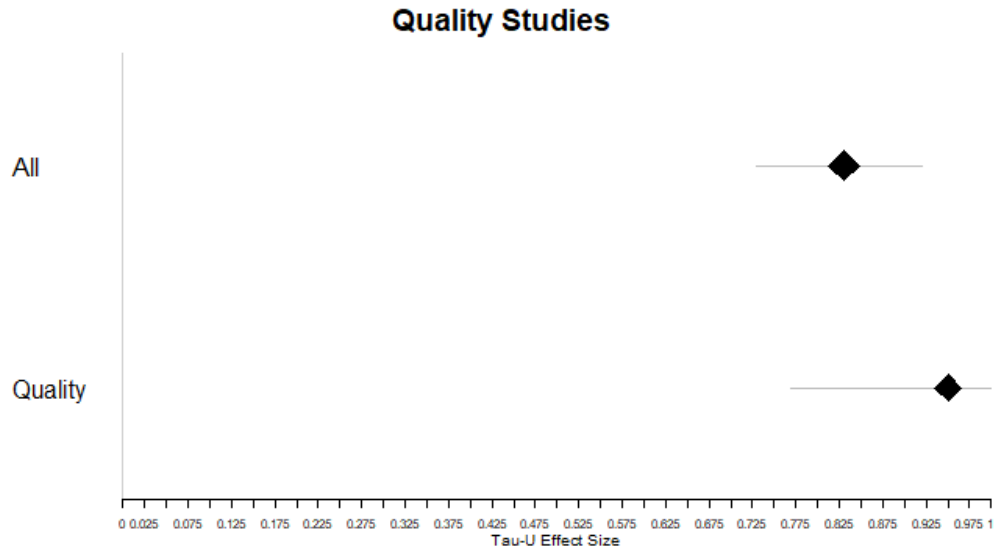
Table 3.5 Summary of BC-SMD Analysis by Moderator

Analysis	# of articles	# of participants	# of studies	ES	*p*-value	CI 95%
Omnibus	16	61	17	1.60	<0.01	1.04<>2.17
Quality *without reservation*	4	19	4	1.90	<0.01	0.84<>2.95
Role of Coached Participant						
Pre-service	5	19	5	1.16	<0.01	0.49<>1.82
In-service	9	33	9	1.94	<0.01	0.90<>2.97
Paraprofessional	2	8	2	3.09	<0.01	2.17<>4.01
Role of Coach						
Peer Coaching	3	18	3	4.36	<0.01	1.48<>7.24
Researcher as Coach/Coach Role not Specified	13	43	14	1.03	<0.01	0.83<>1.79
Type of Setting						
Special Education Setting	4	15	4	1.41	<0.01	0.49<>2.33
General Education Setting	9	35	9	2.11	<0.01	1.14<>3.08

Table 3.5 Continued

Analysis	# of articles	# of participants	# of studies	ES	*p*-value	CI 95%
Level of Setting/Staff						
Early Childhood	7	27	7	1.70	<0.01	1.06<>2.35
Elementary	4	14	4	1.72	<0.01	0.96<>2.48
Secondary	2	4	2	2.13	0.08	-0.19<>4.46
Proximity						
Coach in Same Room	9	39	10	2.30	<0.01	1.27<>3.33
Remote	7	22	7	1.08	<0.01	0.56<>1.61
Studies that explicitly identified relationship building component (i.e. pre-intervention conference)						
Relationship building	2	7	2	1.86	0.13	-0.52<>4.24

Figure 3.1 Tau-U Forest Plots: Omnibus and Meets without Reservation, CI 95%



Note: All = Omnibus ES of all studies.

Figure 3.2 Tau-U Forest Plots: Role of Coached Participant, CI 95%

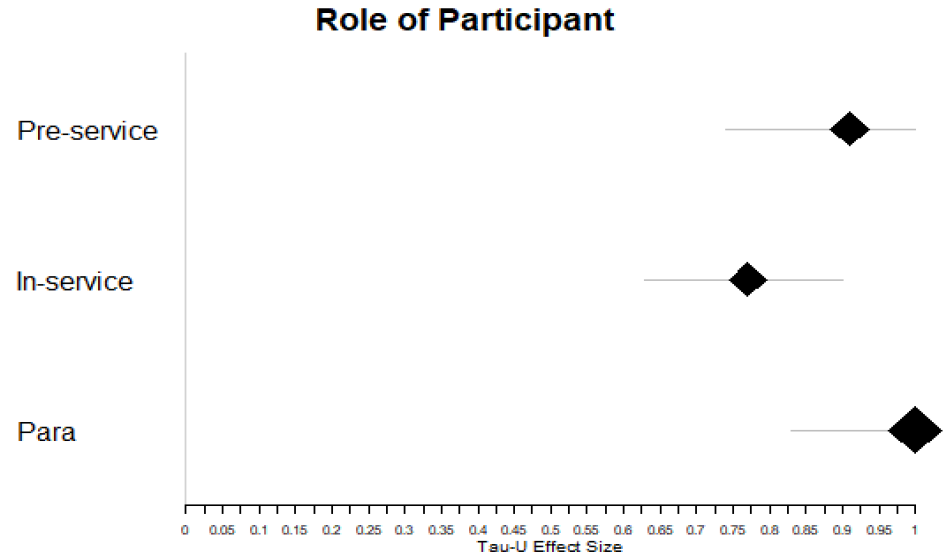


Figure 3.3 Tau-U Forest Plots: Role of Coach, CI 95%

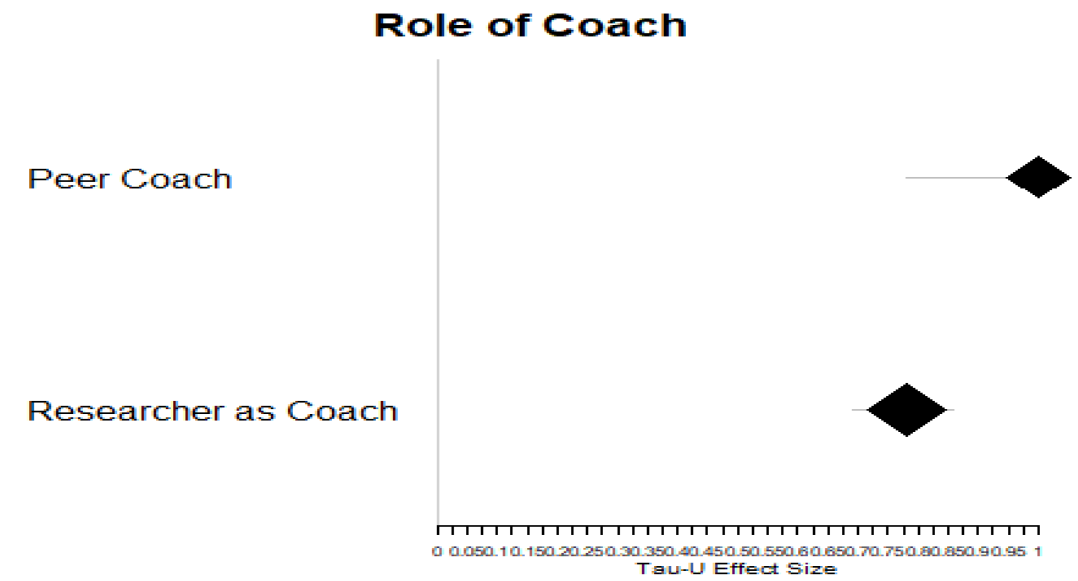


Figure 3.4 Tau-U Forest Plots: Type of Setting, CI 95%

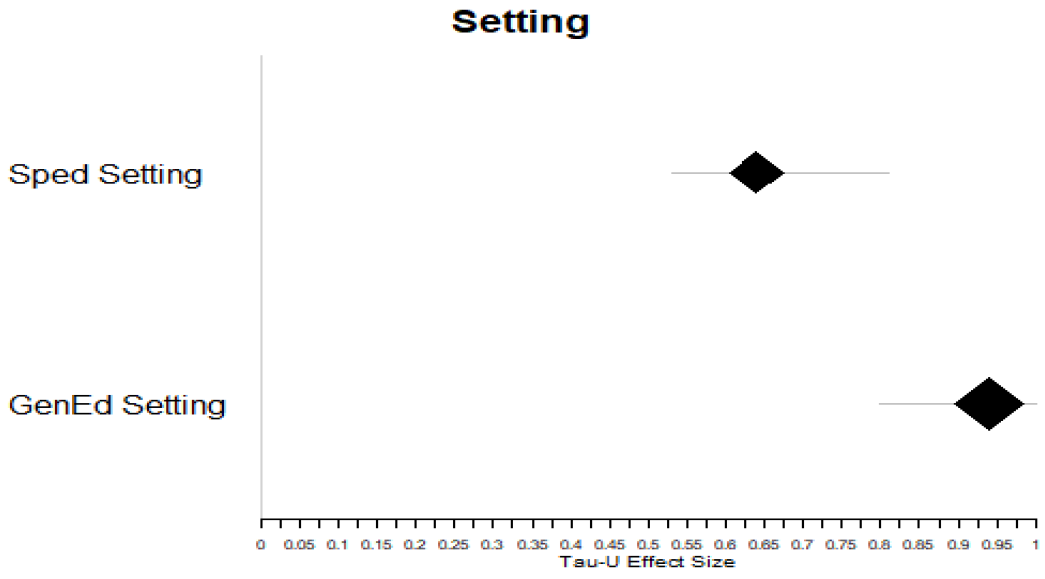


Figure 3.5 Tau-U Forest Plots: Level of Setting/Staff, CI 95%

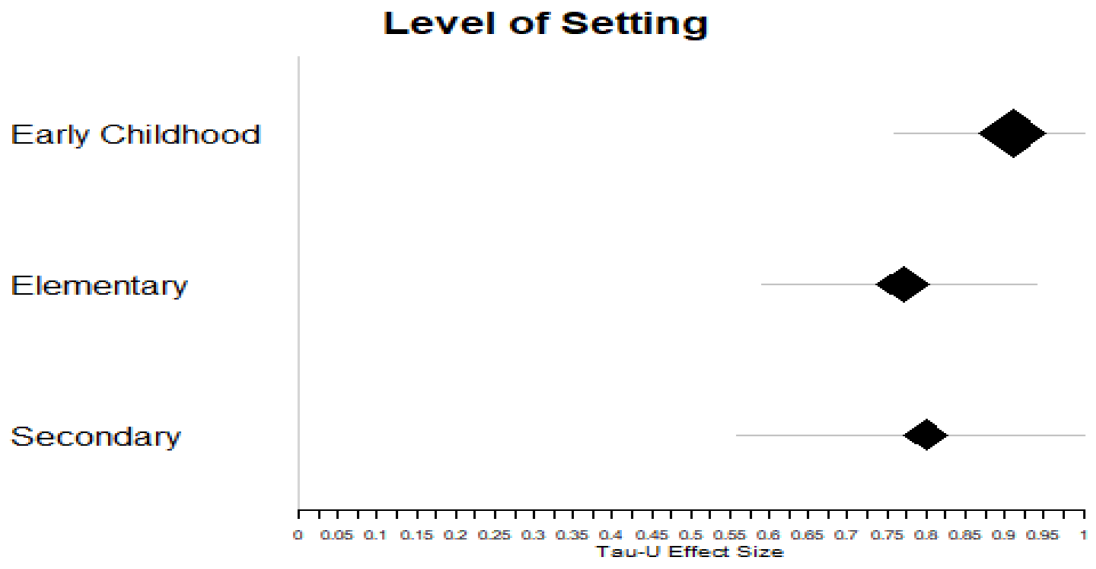
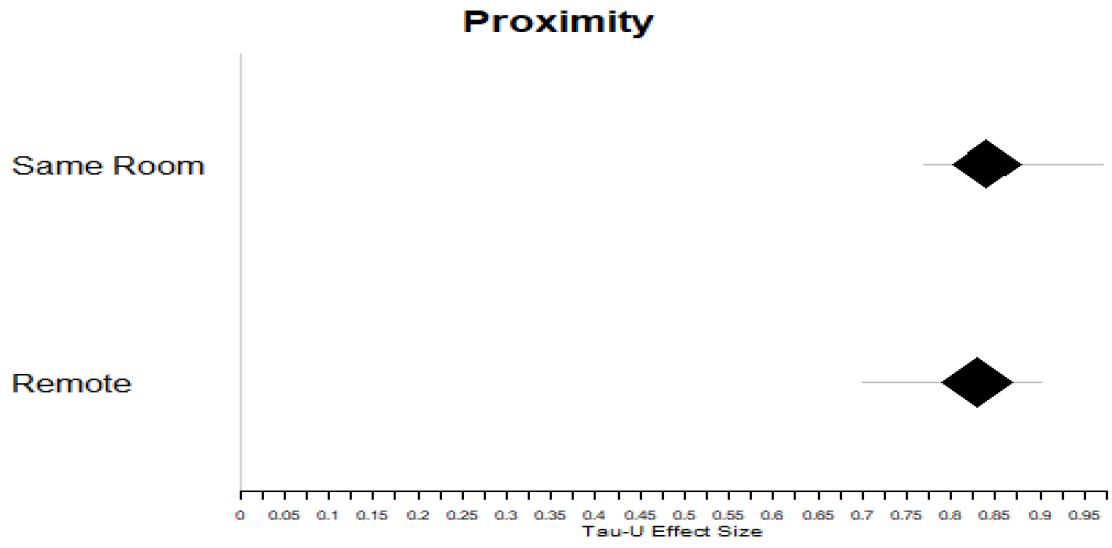


Figure 3.6 Tau-U Forest Plots: Proximity, CI 95%



Note: statistical significance between *Coach in same room* and *Remote*, *p*-value = .005

Figure 3.7 Tau-U Forest Plots: Relationship Building, CI 95%

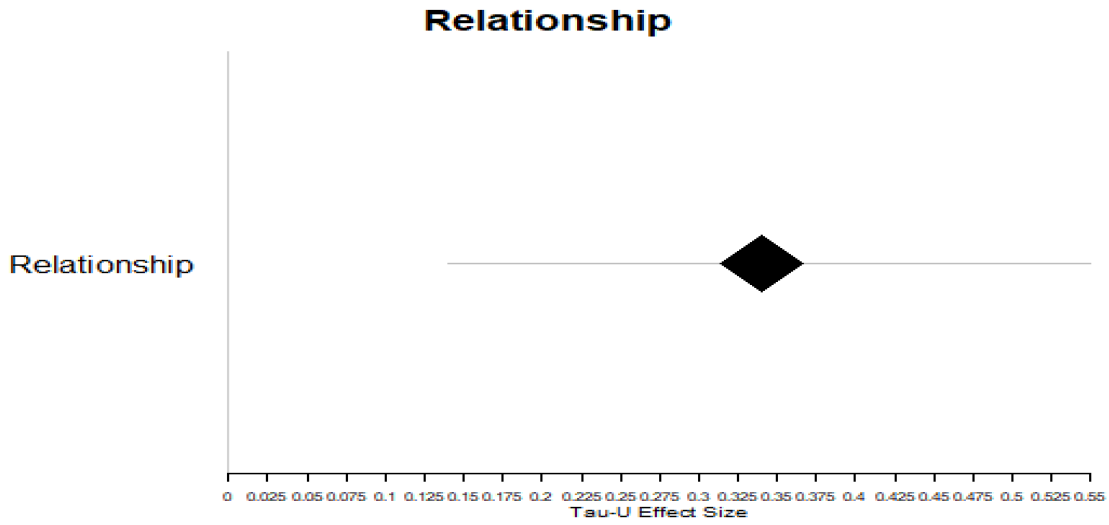


Figure 3.8 BC-SMD Forest Plot: Omnibus (All) and Meets without Reservation, CI 95%

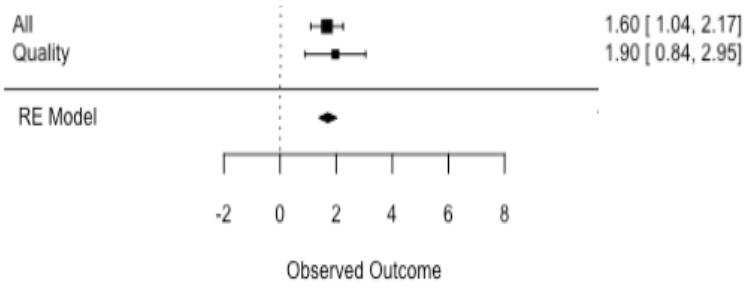


Figure 3.9 BC-SMD Forest Plot: Role of Coached Participant, CI 95%

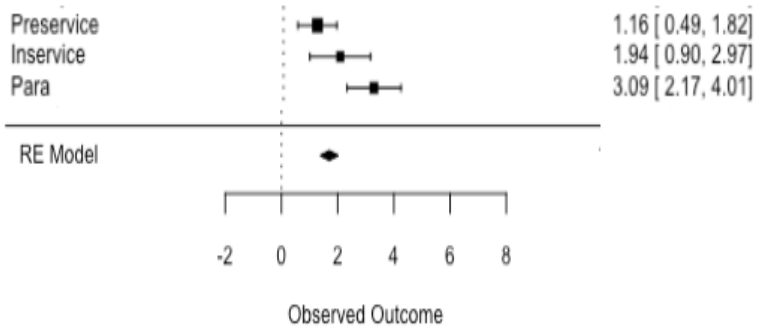


Figure 3.10 BC-SMD Forest Plot: Role of Coach, CI 95%

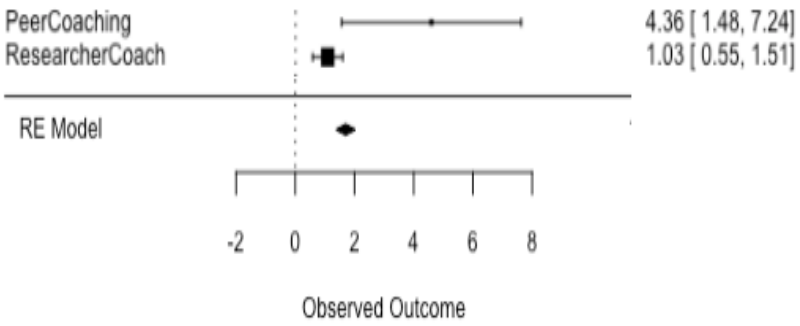


Figure 3.11 BC-SMD Forest Plot: Type of Setting, CI 95%

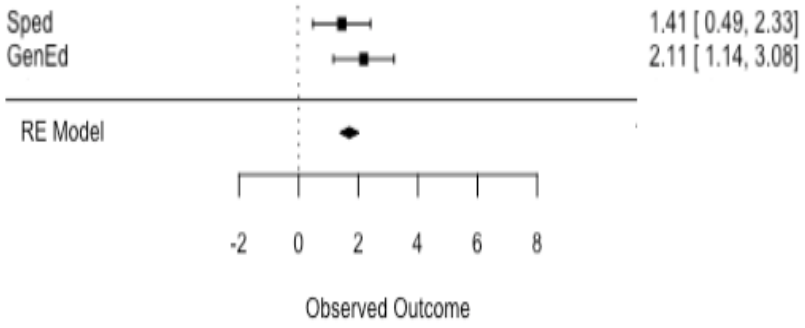


Figure 3.12 BC-SMD Forest Plot: Level of Setting/Staff, CI 95%

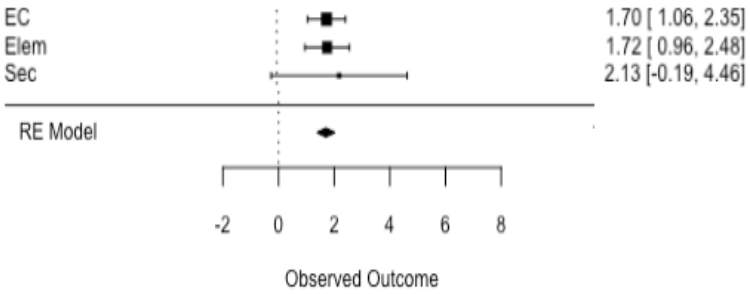


Figure 3.13 BC-SMD Forest Plot: Proximity, CI 95%

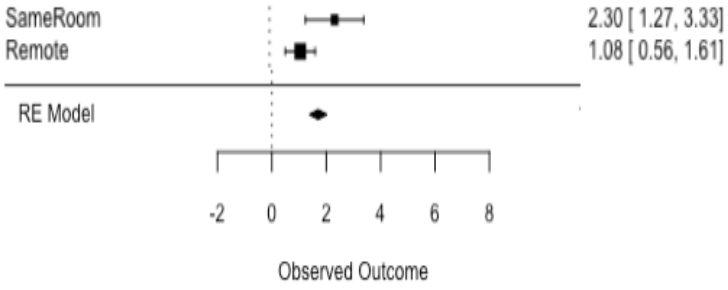
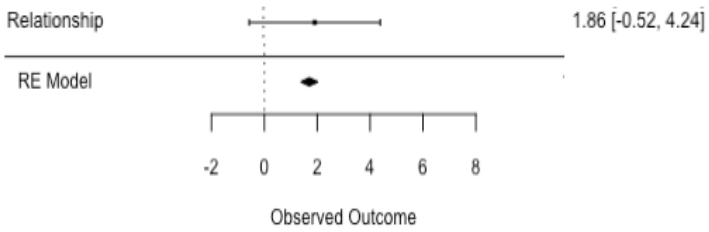


Figure 3.14 BC-SMD Forest Plot: Relationship Building, CI 95%



CHAPTER IV

THE ITERATIVE DEVELOPMENT OF A PROTOCOL FOR COACHING IN THE CLASSROOM VIA BUG-IN-EAR

The need for ongoing coaching of classroom teachers emerges from high turnover rates and teacher shortages due to poorly prepared or inadequately practiced skill sets (Sutcher et al., 2016) and the high cost of stand-alone professional development that may be ineffective (Bethune, 2012; Kennedy, 2016). Teachers often struggle to generalize the information acquired in their pre-service or in-service training to their classroom (Fallon et al., 2015). Coaching teachers has been demonstrated as an effective way to increase teacher application of acquired skills (Cantrell & Hughes, 2008). "Bug-in-ear" (BIE) technology allows for immediate, in the moment coaching to the teacher. BIE is a technology-based approach to real-time coaching that involves classroom teachers wearing an earpiece to receive coaching in a discrete manner within classroom sessions as they practice their skills in implementing new/targeted evidence-based strategies with students.

BIE coaching has sufficient support to be considered an evidence-based practice for changing teacher behavior (Fallon et al., 2015; Schaefer & Ottley, 2018), yet the practice is not widely used in the school setting. It is possible that this is due to a lack of emphasis on how to train coaches in the strategy. Fifteen of the seventeen studies reviewed in the quality review in chapter two of this dissertation identified the coach as "the researcher" or did not specify the role of the coach, two identified the coach as a

peer teacher. This may indicate that BIE coaching is most likely to occur when a researcher is involved. Creating a manual that describes the process of BIE coaching may increase accessibility to a broader population, particularly teacher preparation programs and school districts. BIE coaching offers a relatively low-cost ongoing professional development to teacher preparation programs and school districts, particularly when done remotely (via webcam). Once the district or program has incurred the initial cost of the equipment, funding need only be provided for the coaching sessions rather than for the potentially prohibitive cost of significant time and travel of a district employee or consultant.

4.1 Theoretical Foundation

The development of the BIE coaching protocol is based on the theories of andragogy; cognitive learning; experiential learning; and operant learning.

4.1.1 Andragogy

Frequently referred to as Adult Learning Theory, Andragogy consists of five underlying principles that an adult learner (a) has an autonomous self-image and can regulate their own learning, (b) has developed a collection of experiences to draw on as a resource for learning, (c) has learning needs associated with fluctuating social roles, (d) is problem centered and driven to apply knowledge quickly, and (e) is inclined to learn by internal factors rather than external factors (Merriam, 2001). These principles are critical to adult education as the emphasis is on the relationship between the existing knowledge of the learner and the acquisition of new knowledge within an experiential

period (Mukhalalati & Taylor, 2019). The purpose of BIE coaching is to take knowledge the participant has and generalize it in a meaningful way.

4.1.2 Cognitive Coaching

Cognitive coaching is an unbiased, developmental, and reflective model that is built on basic assumptions that cognitive coaches: (a) are adept at posing questions intended to activate and transform thought, (b) value self-directed learning, (c) believe that behavior is determined by perception and that a change in perception is required for a change in behavior to occur, and (d) are dedicated to continuous improvement (Costa & Garmston, 2002). Cognitive coaches ask questions that encourage people to reflect on their actions they are active listeners, and they engage in an array of communication strategies to develop and maintain the rapport that is essential for substantial conversations (Knight, 2007).

4.1.3 Experiential Learning Theory

Experiential Learning Theory hypothesizes that the mechanism of learning and the attainment of proficiency are advanced through interaction with a genuine or natural environment. In other words, people are most likely to master a skill by experiencing it in an environment in which the skill can be applied (Mukhalalati & Taylor, 2019). BIE coaching in the classroom is explicitly intended to develop or enhance a skill in the classroom.

4.1.4 Operant Learning Theory

The basis of operant learning is that specific, immediate, and frequent feedback will increase the capacity and the competence of the learner (Van Houten, 1980; Wallace

& Kauffman, 1973). Delayed feedback allows the learner to practice mistakes. This is particularly unfavorable in the acquisition stage of learning as errors that are repeated become habits (Heward, 1997). Feedback in teacher training programs generally happens after the observed teaching session (Giebelhaus, 1994; Sharpe et al., 1997). This lag likely decreases effectiveness and efficiency of feedback that may be beneficial to the educator (Scheeler & Lee, 2002). The immediacy of BIE coaching eliminates the delay of feedback and promotes appropriate practice.

4.2 Components of BIE Coaching

In addition to the theoretical framework that guides the process of coaching, there are essential components to BIE coaching: (a) performance feedback, (b) immediate feedback, (c) coaching, and (d) technology (Figure 4.1). The four components were identified based on reviews of BIE coaching literature and recommendations made to educators in research and practitioner publications.

4.2.1 Performance Feedback

Performance feedback (PF) is a method utilized in both business and education to improve performance (Hattie & Timperley, 2007; Cavanaugh, 2013). The purpose of feedback is to guide behavior in order to promote change and growth (London, 2014). Pointing out specific performance details to educators provides both opportunities for growth and encouragement to improve skills (Nichols, 2012). As such, PF is a crucial educational construct in the development of teachers in order for them to be adequately prepared for the workplace (Luck et al., 2017). Further, studies demonstrate that educators feel most supported when given specific and meaningful feedback to improve

their instructional practices (Sayeski & Paulsen, 2012). Performance feedback involves a brief meeting between a consultant, supervisor, or mentor and a consultee in which the delivery of a practice or strategy is discussed. The consultee is the individual who is responsible for implementing the strategy in the classroom and who receives PF (e.g., special education teacher, paraeducator) (Fallon et al., 2015; Noell, 2010). Performance feedback in the context of BIE coaching is characterized as communication from coaches that is intended to provide educators with explicit information on their implementation of an instructional or management strategy; specifically, how to improve their performance (Pianta et al., 2012). In general, and for the purposes of this protocol, positive feedback refers to the act of providing verbal reinforcement for desired behavior and corrective feedback refers to the act of verbally redirecting or correcting undesired behavior (Seevers et al., 2014).

4.2.2 Immediate Feedback

Feedback is essential to the learning process and the temporal relationship between the teaching session and the feedback makes a difference (Suhrheinrich & Chan, 2017). After conducting a review of literature on providing feedback to teachers, Scheeler et al. (2004) determined that immediate feedback was an important aspect of long-term change in teacher behavior. Coaching that utilizes immediate feedback is more effective than coaching that utilizes delayed feedback (Scheeler et al., 2009) because the coached participant can immediately adjust their technique or implementation of an intervention (Nichols, 2012; Suhrheinrich & Chan, 2017).

4.2.3 Coaching

Coaching is a job-embedded PD method that overcomes some of the limitations of stand-alone PD and facilitates the transfer of knowledge and skills into the classroom (Reddy et al., 2019). Coaching is individualized, setting and context specific, implemented over a period of time, such as a semester or school year, and focuses on a distinct set of skills (Kraft et al., 2018).

4.2.4 Technology

Technology is a promising component to promote implementation of strategies (Suhreinrich & Chan, 2017). Coaching efforts are likely to benefit from the use of technology to provide online training and to access coaching supports (Reddy et al., 2019).

4.3 Purpose

The purpose of this project was to utilize the iterative treatment process described by Kern et al. (2011) and DuPaul et al. (2018) to develop a remote BIE in situ coaching protocol that promotes improved instructional and behavioral practices by classroom teachers. Development of this protocol followed guidelines presented in the IES Common Guidelines for Education Research and Development for design development and research. As per the guidelines, projects such as this build on "existing theory and evidence to design and iteratively develop interventions or strategies…" (IES, 2013, p. 9)

4.3.1 Research Questions

1. What are the characteristics of a successful BIE coach?
2. What are the characteristics of a BIE coached participant?
3. What are the steps to remote BIE coaching?

4.4 Intervention Development and Refinement Process

4.4.1 Goals

The primary goal for the intervention development and refinement was to establish a BIE coaching process that will result in substantial and purposeful change in teacher behavior, as well as be perceived as acceptable by the participants. To achieve this, a collaborative relationship was developed with stakeholders, such as potential coaches and coached participants, to determine acceptability. A secondary goal is to increase the availability of the BIE coaching process.

4.4.2 Steps

The iterative procedure for this protocol was a three-step process that involved a feedback loop in which potential coaches and coached participants reviewed the proposed manual and provided feedback, and the design was revised based on the feedback. The steps were (Figure 4.2):

1. Develop the BIE coaching procedure and list necessary equipment
2. Acquire feedback from educators across settings
3. Revise the protocol based on feedback

4.4.2.1 Step 1: Development of the BIE Coaching Protocol

4.4.2.1.1 Characteristics of the Coach

Attention should be paid to the characteristics of the person who is providing coaching to the teacher. Professional development programs that demonstrate greater efficacy are offered by individuals who have histories of working with teachers, are familiar with challenges teachers face, and base the training they provide on their own experience and expertise. Less effective PD programs are offered by facilitators who are hired specifically for the program or study and who may have limited familiarity with teaching and teacher learning (Kennedy, 2016). The results of meta-analysis conducted in chapter 3 of this dissertation indicate that, although the effect size was large for both the peer coach (Tau-U = 1.00) and researcher as coach/coach role not specified (Tau = 0.78), there was a statistically significant difference between the two (p-value = 0.02). Therefore, schools may want to consider utilizing peer coaches whenever possible when implementing BIE coaching.

4.4.2.1.2 Characteristics of the Coached Participant

The result of the meta-analysis presented in chapter 3 of this dissertation suggest that pre-service teachers, in-service teachers, and paraprofessionals benefit from BIE coaching. BIE coaching is also effective regardless of the setting in which it occurs, whether it be special education or general education, and regardless of the level of the setting, whether it be early childhood, elementary, or secondary. Therefore, there is no restriction on who would benefit as the recipient of BIE coaching.

4.4.2.1.3 Equipment

4.4.2.1.3.1 Computer or Tablet

The coached participant will need a computer or tablet equipped with a webcam and corresponding software. A tablet is flat computer with a touchscreen, much like a smartphone, that is approximately the size of a book or magazine (https://www.digitalunite.com/technology-guides/computer-basics/getting-started/what-tablet-computer). The coach does not need a computer or tablet with a webcam but will need to have a device that allows them to view the live video feed.

4.4.2.1.3.2 Webcam

A webcam is a camera that is housed in or connected to either a computer or a tablet that allows for an activity or setting to be broadcast live (live streamed) via the Web to a receiving computer or tablet (https://www.techopedia.com/definition/5333/webcam). Many computers have a default webcam application installed that facilitates live streaming (https://www.geckoandfly.com/27574/webcam-software-streaming-recording/). Skype™ is the application used for this protocol.

4.4.2.1.3.3 Skype™

Skype™ is a free computer or tablet software application that allows for visual and voice communication between individuals or small groups over the internet (https://support.skype.com/en/faq/FA6/what-is-skype). The coached participant broadcasts a live stream visual from their classroom to the coach, the coach provides

verbal feedback to the participant who wears a Bluetooth earpiece or headset to receive the feedback.

4.4.2.1.3.4 Bluetooth

A Bluetooth device is a required piece of equipment for remote BIE coaching. Bluetooth is a secure communication technology that allows devices to transmit wirelessly (https://www.lifewire.com/what-is-bluetooth-2377412). A Bluetooth device is small, worn in the ear of both the coach and the coached participant, and allows the participants to speak and listen to each other without people nearby hearing both sides of the conversation. In other words, the coach can speak to the coached participant without anyone else hearing. Bluetooth technology is compatible with Skype™.

4.4.2.2 Procedure

In general, coaching is a three-step process: (1) pre-coaching conference, (2) coaching session(s), and (3) post-coaching conference (Knight, 2007; Kucharczyk et al., 2012). The pre-observation conference can be ten to thirty minutes, during which the coach and the participant establish for which EBP or aspect of EBP the coach will provide feedback (e.g., rate of OTR). The coached participant will determine the goal they want to accomplish during the session (e.g., five OTRs per ten-minute coaching session) The coach and the coached participant establish what type of data will be collected, how it will be collected (e.g., frequency count of OTRs, frequency count of prompts from the coach), what types of prompts the coached participant is likely to respond to (e.g., “Make sure you reinforce Johnny for raising his hand” or “Nice job using wait time”), and when the session will take place (e.g., Tuesday during math class,

9:30-9:45). The coach and coached participant will schedule a time to meet for the post-observation conference prior to the conclusion of the pre-observation conference.

4.4.2.2.1 Coaching Session

The coach will deliver multiple 10-minute sessions, to the teacher across time (e.g. one to two sessions per week across six weeks). The number of sessions may be predetermined and set in the pre-coaching conference or may be based on completion of the goal developed in the pre-coaching session. The session length of 10 minutes was chosen based on previous research suggesting that feedback delivered for a short duration could be effective in improving practice (Coogle et al., 2015; Coogle et al., 2018). During each BIE coaching session, the teacher directs the webcam to where the activity is visible to the coach. Wearing the Bluetooth device, the teacher calls the coach using the communication mode (e.g. Skype™, Zoom, or a platform provided by the school district). The coach answers the call and disables the video so that the students cannot see the coach during the session.

During the first minute of the activity, the coach observes without providing feedback to allow a period of time for the teacher to begin the activity and for the coach to understand the nature of the activity. The coach then delivers prompts to the teacher to use strategies at a rate of up to one prompt per minute. For example, if the strategy being coached is behavior specific praise (BSP), the coach delivers prompts on opportunities to deliver BSP, such as, “Tell the student on your right that you see that he is paying attention.” or “redirect the student behind you to listen and take notes”. After each prompt, the coach provides affirmative feedback if the teacher delivered the strategy

correctly (e.g., “Good job thanking her for following directions.”) or corrective feedback if the teacher did not use the strategy or used it incorrectly. Affirmative feedback is also given for spontaneous use of the strategies. Occasionally, the coach may wait a minute or two during the session to allow the teacher the opportunity to spontaneously provide feedback. If it appears as though the teacher is not using naturalistic opportunities within two minutes, the coach should provide a prompt to deliver the strategy.

4.4.2.3 Step 2: Acquire Feedback from Educators

4.4.2.3.1 Participants

Participants involved in education at some level, including behavior specialists, Education Service Center education specialists, in-service teachers, pre-service teachers, campus administrators were recruited. Participants were recruited via a Facebook post on the author’s home page (Figure 4.3).

4.4.2.3.2 Feedback Form

A link to a Google Doc was provided to interested participants. Google Docs is a free online word processor that allows a user to create and share documents with other users. Demographic information and input regarding the components of the protocol was collected anonymously. Feedback questions were developed by the author and were organized by the following categories: (a) visual appearance, (b) clarity of procedures, (c) need for additional information, (d) formatting and organization, (e) feasibility of procedures, (f) social validity. The feedback form (Appendix B) was structured with a primary question for each category. The participants scored their response using a five-point Likert scale that ranged from 1 (strongly disagree) to 5 (strongly agree). Each

primary question was followed by an open-ended question intended to expand the answers gained from the Likert scale. Each question required a response before the next question could be accessed.

4.4.2.3.3 Results from Feedback Form

4.4.2.3.3.1 Demographic Information

There were 17 total responses. The number and category of respondents included:

- six in-service teachers
- three administrators
- two LSSP/Diag/SLPs (Assessment)
- two behavior specialists
- one higher ed./teacher prep program
- one education consultant/Educator Service Center employee
- two "other"--one researcher and one retired Life Skills teacher/administrator

4.4.2.3.3.2 Responses

4.4.2.3.3.2.1 Visual Appearance

Answers to the statement, "The BIE protocol is visually appealing" included seven 5s, six 4s, and four 3s, indicating that, in general, the respondents found the look of the protocol to be acceptable. Suggestions from the open-ended question regarding the appearance included recommendations to include more graphics, make the bullet points on the pre-coaching session page "pop" more, change the term "coachee" to "participant" in order to reduce potential confusion, and to use a font that is easier to read than Times New Roman.

4.4.2.3.3.2.2 Clarity of Procedures

Answers to the statement, "The procedures are clear and easy to understand" were primarily fours and fives on the Likert scale. The total was nine 5s, seven 4s, and one 3. Recommendations from the open-ended question in the section include to allow for a streaming platform other than Skype™ , as Skype™ is not used in some school districts because it may not meet the confidentiality requirements mandated by the Family Educational Rights and Privacy Act (FERPA). It was also suggested that clarification should be provided with regards to who determines what will be coached and how many sessions there will be. Two responses related to the equipment set-up phase of the protocol. One respondent suggested that the protocol should explicitly state that the set-up and practice with the equipment should be done when students are not in the room. The other expressed that the graphic associated with the set-up phase should be more pronounced.

4.4.2.3.3.2.3 Need for Additional Information

Responses to the statement, "After reading the protocol, I still have questions that I would need answers to in order to utilize the protocol" were mixed, with two 5s, three 4s, four 3s, three 2s, and five 1s. One respondent indicated that the suggested prompt rate of one prompt per minute would be distracting and the rate of prompting from the coach should be dependent on the strategy of focus, the lesson plan, and the students. Concerns about the reliability and security of Skype™ were reiterated by multiple respondents. It was also suggested that a graphic that provides a visual of the process be included in the protocol. One respondent questioned the accessibility of BIE coaching in

a deaf classroom, even if the teacher is hearing due to the fact that it may be difficult for the coach to see the signed responses from the students. Lastly, it was recommended that a "frequently asked questions" (FAQ) section be added.

4.4.2.3.3.2.4 Formatting and Organization

The statement for this section was, "The protocol is organized in a logical way." Fifteen respondents replied with 5s and two with 4s. A few of the recommendations reiterated suggestions made in previous sections, such as a desire for a platform other than Skype™. One respondent repeated the need for an agreement between the coach and the participant regarding the rate and pacing of the prompts. Lastly, one respondent advocated for larger headings and a designated color for each phase of the protocol.

4.4.2.3.3.2.5 Feasibility

Answers to the statement, "The procedures are appropriate and feasible for teachers and instructional personnel in the field" included eight 5s, five 4s, and four 3s. Recommendations consisted of proposing the inclusion of a recommended schedule of reinforcement for various steps in the coaching session, using a swivel camera as the webcam in order to follow the teacher around the classroom, and more information on the necessary characteristics of the coach. One respondent asked that clarification be provided on the issue of confidentiality and that some teachers may not have the disposition for BIE coaching. One respondent stated that they felt this was a good idea, but that is not feasible for teachers of deaf children. Another respondent stated a concern that the reading level of the protocol may be too high for some paraprofessionals.

4.4.2.3.3.2.6 Social Validity

Information regarding the potential social validity was gained through the statement, “I believe educators and students would benefit from the BIE process described in this protocol.” Responses included nine 5s, four 4s, and four 3s. Additional comments proposed using live coaching in conjunction with a recording of the session so the teacher can review the session and prompts afterwards. Most respondents stated that they believe BIE coaching is a good idea, but also expressed concerns about the potential of feeling stressed by someone talking to them as they teach, that teachers may feel overwhelmed with “another thing to do”, and that fear of technology may hinder some teachers. The respondent recommended a longer practice time with the equipment to address that possibility.

4.4.2.4 Step 3: Revisions to Protocol

Many revisions were made to the protocol as a result of the feedback (Appendix C). The changes recommended via the feedback form were incorporated into the second version of the protocol as much as reasonably possible. In the few instances in which suggestions were in conflict, the revisions were made based on which viewpoint was expressed more frequently in the feedback form. Changes include simplifying some of the language (e.g., ”coachee” was replaced with “participant”), changing the font from Times New Roman to Arial, color coding the sections, clarifying the language regarding the number of coaching sessions, and including a statement addressing confidentiality concerns.

4.5 Discussion

The purpose of the iterative development of a BIE coaching protocol was to extend the results gleaned from the quality review and meta-analysis of this dissertation. Specifically, to incorporate information gained regarding characteristics of the coach and the coached participant that will increase the likelihood of effective and impactful BIE coaching and to outline the necessary steps to BIE coaching. The information from the previous chapters of this dissertation was applied to a protocol intended to increase the capacity and ability of potential coaches and participants to implement BIE coaching. To ensure that the steps were easily understood and feasible, the protocol was evaluated by a small sample of educators that were recruited via social media. In general, the feedback for the first version of the protocol was positive, though many suggestions were made for improvement. Recommendations were incorporated into a revision of the protocol.

4.5.1 Limitations

While the iterative development of the BIE coaching protocol offers potential participants a guide to actualize the process, it is limited in that only one iteration occurred. Additionally, the pool of educator respondents who provided feedback consisted of less than 20 people, and not all anticipated participant roles were represented (i.e. pre-service teachers and paraprofessionals did not contribute). Another limitation is that only one social media platform was used, thereby limiting the potential sample size. Future attempts to elicit feedback should include a concerted effort to reach a larger and more diverse population of educators. The iterative development was also

hindered by the fact that the feedback form was developed in Google Forms. Only people with Gmail accounts were able to access the form. Future iterations should be developed in a format that can be readily accessible to a greater population.

4.5.2 Implications for Practice

The development of a BIE coaching protocol shows great promise. Feedback from respondents regarding the essential features of the first version of the protocol were generally positive. Comments indicated that most respondents felt that BIE coaching is likely to have a positive impact on teachers and students. The practice has potential to benefit school district and teacher preparation programs with a relatively low-cost, sustainable system for improving teacher performance, particularly since the role of the coach does not need to be filled by an outside consultant with specialized expertise.

4.6 Conclusion

The imperfect training practices of teacher preparation programs and school district professional development sessions contribute to teacher attrition and shortages that are ubiquitous in education (Sutcher et al., 2016). BIE coaching provides a reasonable and cost-effect method for improving the practices of educators in the classroom (Fallon et al., 2015; Schaefer & Ottley, 2018), thereby increasing the likelihood of teacher retention and student success. The development of a protocol to train BIE coaches offers school districts and teacher preparation programs a practical tool to enhance the ability of educators to deliver effective instruction in the classroom.

4.7 References

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Figure 4.1 Foundational Components of BIE Coaching

Figure 4.2 BIE Protocol Development Flowchart

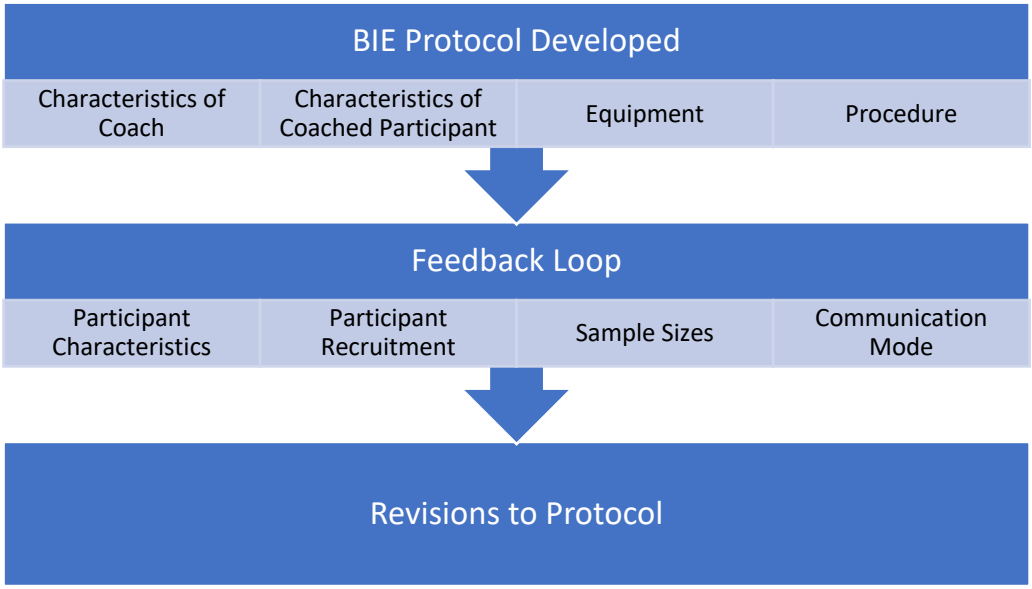
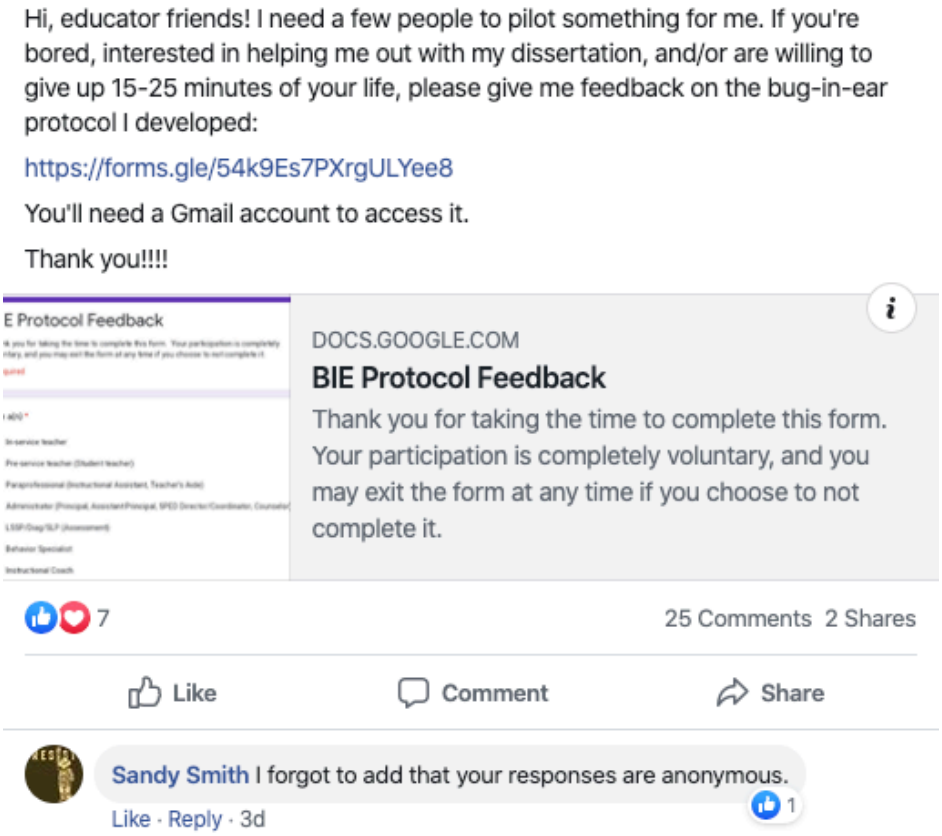


Figure 4.3 Image of Facebook Recruitment Post



CHAPTER V

SUMMARY AND CONCLUSIONS

BIE coaching is a decades-old practice in education, yet there is a dearth of synthesized information about the types of participants who respond positively to BIE coaching, the characteristics of an effective BIE coach, and possible moderators that may influence the effect of BIE coaching. In recent years, two systematic reviews attempted to fill the void (Schaefer & Ottley, 2018; Sinclair et al. (2019), but more analyses of the BIE coaching literature is necessary to provide researchers and practitioners the data and expertise necessary to effectively implement the intervention.

The first study in this dissertation systematically: (a) identified studies that examined the effect of BIE coaching on educator behavior, (b) identified the characteristics of participants, coaches, type of setting, and level of setting, (c) and evaluated the identified studies by applying the WWC Design Standards (WWC 2014). The systematic quality review resulted in a summary of the characteristics of the SCR design studies evaluated, including role of the participant (pre-service teacher, in-service teacher, or paraprofessional), the role of the coach (peer coach or researcher as coach/coach role not specified), the type and level of setting (special education, general education, early childhood, elementary, or secondary), and the proximity of the coach to the participant (in the same room or remote). Of the evaluated studies, four met the standard for *meets without reservations* and eight were designated as *meets with reservation.*

The second study built on the results of the first, culminating in a meta-analytic review of the overall effects of feedback delivered to educators via BIE and assessed the potential influence of various characteristics of participants, coaches, settings, and proximity of coach to participant (e.g. pre-service or in-service teachers; researcher as coach or peer coach; special education or general education; coach in the same room or remote) on the effects. The magnitude of change of BIE coaching was moderate to very large across all moderator categories.

The results of the two studies indicate that BIE coaching is an extremely effective intervention with a variety of participants across a variety of settings. The conclusions of the quality review and the meta-analysis informed the third component of this dissertation, the iterative development of a BIE coaching protocol. A guide was developed, feedback was obtained, and revisions were made to improve the document. However, additional feedback and further revisions are necessary in order to complete a thorough protocol.

APPENDIX A

WWC SCR DESIGN STANDARDS FORM

*Step 1. Is the independent variable systematically manipulated, with the researchers determining when and how the independent variable conditions change?

a. Meets

b. Does not meet

*Step 2A. Was IOA collected?

a. Meets

b. Does not meet

*Step 2B. Was IOA collected for at least 20% per each phase?

a. Meets (20% foe each phase)

b. Meets with reservations (20% as a whole)

c. Does not meet (below 20%)

d. N/A (not collected/reported)

*Step 2C. Was IOA score at least 80%?

a. Meets

b. Does not meet

c. N/A (not collected/reported)

*Step 3. Does the study attempt to demonstrate at least three effects of the intervention?

a. Meets

b. Does not meet

*Step 4. Are the number of data points in each phase appropriate for the study design? (see WWC document figure E.1)

a. Meets

b. Meets with reservations

c. Does not meet

Notes:

**indicates that an answer is required in order to proceed to the next question*

APPENDIX B

BIE PROTOCOL FEEDBACK QUESTIONS

Section 1: BIE Protocol Feedback

Thank you for taking the time to complete this form. Your participation is completely voluntary, and you may exit the form at any time if you choose to not complete it.

I am a(n):

a) In-service teacher
b) Pre-service teacher (Student teacher)
c) Paraprofessional (Instructional Assistant, Teacher's Aide)
d) Administrator (Principal, Assistant Principal, SPED Director/Coordinator, Counselor)
e) LSSP/Diag/SLP (Assessment)
f) Behavior Specialist
g) Instructional Coach
h) Higher Ed/Teacher Prep Program
i) Educational Consultant/Education Service Center
j) Other

Section 2: BIE Coaching in the Classroom

Please read through the following booklet and answer the questions that follow. You can expect this to take 15-25 minutes.

Cover page

Bug-in-Ear Coaching in the Classroom

A guide to in-the-moment coaching using remote technology

0

Introduction

Educators often struggle to generalize the information acquired in training to their classroom. Coaching teachers has been demonstrated as an effective way to increase teacher application of acquired skills. "Bug-in-ear" (BIE) technology allows for immediate, in-the-moment coaching to the teacher or paraprofessional. BIE is a technology-based approach to real-time coaching that involves classroom teachers wearing an earpiece to receive coaching in a discrete manner during classroom sessions as they practice their skills or implement new/targeted evidence-based strategies.

BIE coaching offers a relatively low-cost ongoing professional development to school districts and teacher preparation programs, particularly when done remotely (via webcam).

The purpose of this protocol is to establish a BIE coaching process that will result in purposeful change in teacher behavior and be perceived as acceptable by the staff who are coached.

There are four main steps to the BIE coaching process:

Participants

There are two roles in the BIE coaching relationship: the coach and the coachee. The coach can be a supervisor, an instructional coach, a behavior specialist, or a peer. In general, the coach can be anyone the coachee is willing to be coached by. The coachee is any educator who is interested in improving their instructional practice, such as an in-service teacher, a pre-service teacher (student teacher), or a paraprofessional.

Setting up the equipment

Phase 1: What you need

Webcam. A webcam is a camera that is housed in or connected to either a computer or a tablet that allows for an activity or setting to broadcast live (live stream) via the Web to a receiving computer or tablet. Many computers have a default webcam application already installed that facilitates live streaming. Skype™ is the application used for this protocol.

Computers or tablets. The coached participant will need a computer or tablet equipped with a webcam and corresponding software. The coach does not need a webcam but will need to have a computer or tablet that allows them to view the live video feed.

Skype™. Skype™ is a free computer or tablet software application that allows for visual and voice communication between individuals or small groups over the internet. The coached participant can use Skype™ to broadcast a live

stream visual from their classroom to the coach, the coach provides verbal feedback to the participant who wears a Bluetooth earpiece or headset to receive the feedback.

Bluetooth. Equipment required for remote BIE coaching includes a Bluetooth device for the coachee. Bluetooth is a secure communication technology that allows devices to transmit wirelessly. The Bluetooth device is small, worn in the ear of both the coach and the coachee, and allows the participants to speak and listen to each other without people close by hearing both sides of the conversation. In other words, the coach can speak to the coachee without anyone else hearing. Bluetooth technology is compatible with Skype™.

Phase 2: Using to the equipment

Practice. The coach and the coachee should spend a few minutes testing the equipment and getting used to the process. A "dress rehearsal" session is strongly recommended. Most participants report that they get used to it in about ten minutes.

Page 5

Pre-coaching conference

Time

- plan for 10-30 minutes

Determine practice or strategy that will be the focus of the coaching session

- e.g., "I want to increase the amount of times I'm providing opportunities to respond. I would like to be offering at least 5 opportunities per ten minutes of a lesson."
- make sure the coachee understands what the skill is and how it should be implemented

Decide what data will be collected and how

- e.g., frequency count of opportunities to respond provided during ten minute session

Establish sample statements the coach will use to prompt or reinforce the coachee

- e.g., "This is a good time to do a thumbs up, thumbs down to check for understanding"
- or "Great job of reinforcing Stuart for participating."

Schedule the coaching session

- the session should be 10-20 minutes

Schedule the post-coaching conference

5

Coaching session

- √ During each BIE coaching session, the teacher directs the webcam to where the activity is visible to the coach (e.g., if the teacher will be working with a small group, point the camera so the coach can clearly see the coachee working with the group).
- √ Wearing the Bluetooth device, the teacher calls the coach using the communication mode (i.e. Skype™).
- √ The coach answers the call and disables the video so that the children cannot see the coach during the session.
- √ The coach sets a timer for the agreed upon length of the session.
- √ During the first minute of the activity, the coach observes the activity without providing feedback. This allows the teacher to begin and for the coach to understand the nature of the activity.
- √ At a rate of approximately one prompt per minute, the coach then delivers prompts to the teacher to use strategies.
- √ After each prompt, the coach provides affirmative feedback if the teacher delivered the strategy correctly or corrective feedback if the teacher did not use the strategy or used it incorrectly.
    - Affirmative feedback is also given for spontaneous use of the strategies.
- √ The coach may wait a minute or two during the session to allow the teacher the opportunity to spontaneously deliver the strategy to the student(s).
    - If the teacher is not using naturalistic opportunities within two minutes, the coach should provide a prompt to deliver the strategy.

Post-coaching conference

- The coach should ask questions of the coachee before giving feedback.
  - e.g., "Was this lesson typical?", "Did this lesson go the way it usually does?", or "How do you think it went?"
- The coach should use objective terms to describe what went well.
  - e.g., "You explained the objective of the lesson before you started."
- The coach should use objective terms to relay the data.
  - e.g., "You gave 6 opportunities to respond in 5 minutes. Three of them were prompted and two were spontaneous."
- Allow and encourage the coachee to ask questions.
- Schedule the next coaching session.

Coaching Tip: It can be stressful for the coachee to have someone watch them teach. Even with a positive relationship, it is hard for the coachee to not feel judged. Make sure you start every post-coaching session with positives about what you observed, even if they are not directly related to the goal strategy.

Section 3: Provide Feedback on the Protocol

Now that you've read through the protocol, please answer the following questions. Be honest, we are not looking for agreement, but accurate, honest feedback.

The BIE protocol is visually appealing

Strongly Disagree 1 2 3 4 5 Strongly Agree

Are there sections/pages that could use some help? Is there something about the appearance that might be helpful to change? Please explain. If not, please put N/A.

The procedures are clear and easy to understand.

Strongly Disagree 1 2 3 4 5 Strongly Agree

Are there specific sections that were unclear or confusing? Please explain. If not, please put N/A.

After reading the protocol, I still have questions that I would need answers to in order to utilize the protocol.

Strongly Disagree 1 2 3 4 5 Strongly Agree

Would you need additional information in order to proceed with the protocol? Please explain. If not, please put N/A.

The protocol is organized in a logical way.

Strongly Disagree 1 2 3 4 5 Strongly Agree

Are there formatting or organization tips you would suggest? Please explain. If not, please put N/A.

The procedures are appropriate and feasible for teachers and instructional personnel in the field.

Strongly Disagree 1 2 3 4 5 Strongly Agree

If not, please explain. Do you have suggestions to increase feasibility? (Feasibility means the likelihood that you could and would use this?). Please put N/A if you don't have suggestions.

I believe educators and students would benefit from the BIE process described in this protocol.

Strongly Disagree 1 2 3 4 5 Strongly Agree

If not, please explain. Again, be honest, we are not looking for agreement, but accurate, honest feedback. If this is not useful or beneficial please tell us why so we can improve the accessibility.

Provide any additional comments including suggestions for improvement and things about the protocol you liked.

APPENDIX C

REVISED BIE PROTOCOL

Bug-in-Ear Coaching in the Classroom

A guide to in-the-moment coaching using remote technology

0

Introduction

Educators often struggle to generalize the information acquired in training to their classroom. Coaching teachers has been demonstrated as an effective way to increase teacher application of acquired skills. "Bug-in-ear" (BIE) technology allows for immediate, in-the-moment coaching to the teacher or paraprofessional. BIE is a technology-based approach to real-time coaching that involves classroom teachers wearing an earpiece to receive coaching in a discrete manner during classroom sessions as they practice their skills or implement new/targeted evidence-based strategies.

BIE coaching offers a relatively low-cost ongoing professional development to school districts and teacher preparation programs, particularly when done remotely (via webcam).

The purpose of this protocol is to establish a BIE coaching process that will result in purposeful change in teacher behavior and be perceived as acceptable by the staff who are coached.

There are four main steps to the BIE coaching process:

2

Participants

There are two roles in the BIE coaching relationship: the coach and the participant. The coach can be a supervisor, an instructional coach, a behavior specialist, or a peer. In general, the coach can be anyone the participant is willing to be coached by. However, research indicates that peer coaching is especially effective.

The participant is any educator who is interested in improving their instructional practice, such as an in-service teacher, a pre-service teacher (student teacher), or a paraprofessional.

Students are an indirect part of the coaching session, although the coach does not directly interact with the students. Confidentiality expectations for web-based coaching are the same as when an approved observer is physically in the same room. As long as the sessions are not recorded, media release are typically not required. However, check with your school administrator regarding the specific policy in your district.

Setting up the equipment

Phase 1: What you need

Webcam. A webcam is a camera that is housed in or connected to either a computer or a tablet that allows for an activity or setting to broadcast live (live stream) via the Web to a receiving computer or tablet. Many computers have a default webcam application already installed that facilitates live streaming. If budget or circumstances allow, a webcam that can be controlled remotely to track or move with the teacher may enhance the visibility of the teacher in different parts of the classroom.

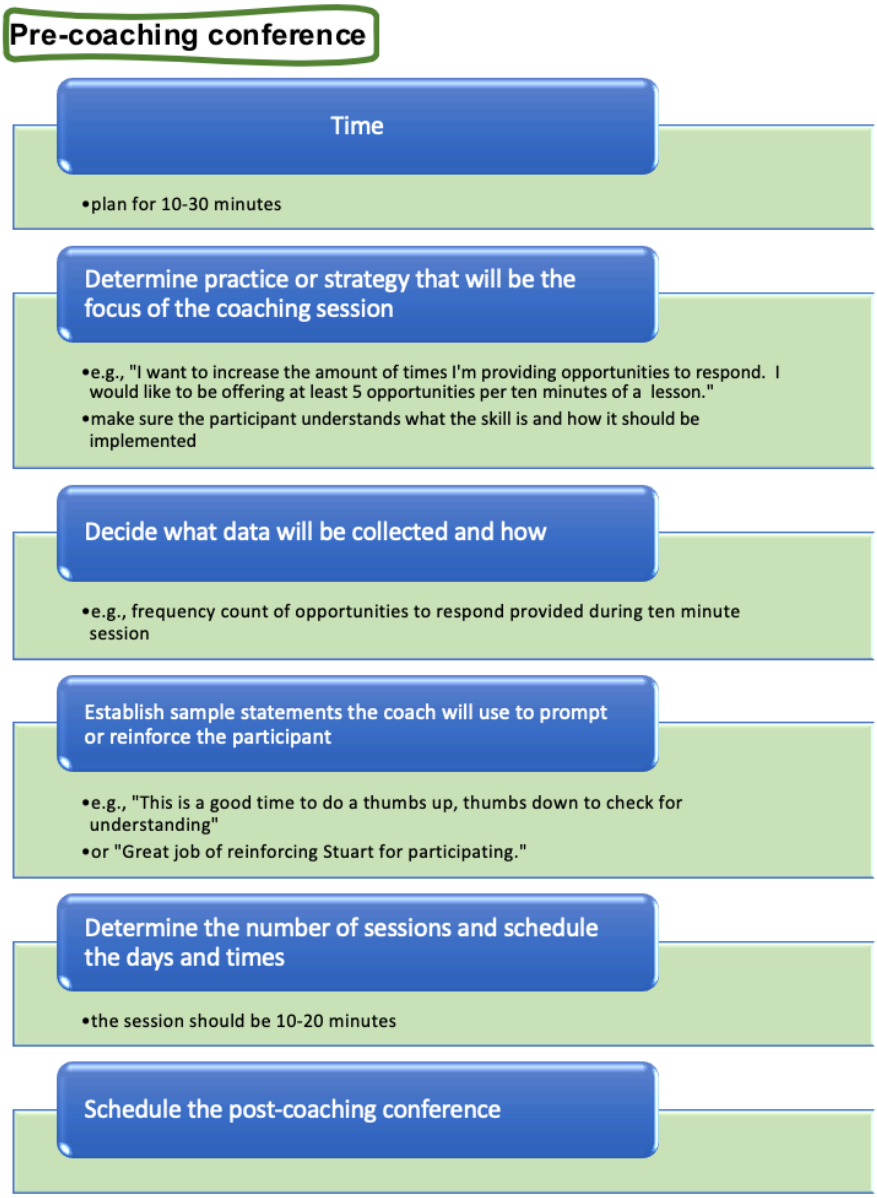
Computers or tablets. The coached participant will need a computer or tablet equipped with a webcam and corresponding software. The coach does not need a webcam but will need to have a computer or tablet that allows them to view the live video feed.

Live stream application. Skype™, FaceTime, and Zoom are examples of computer or tablet software applications that allow for visual and voice communication between individuals or small groups over the internet. The coached participant can use the application to broadcast a live stream visual from their classroom to the coach, the coach provides verbal feedback to the participant who wears a Bluetooth earpiece or headset to receive the feedback. Most school districts have a preferred platform that meets their security and technology specifications.

Bluetooth. Equipment required for remote BIE coaching includes a Bluetooth device for the participant. Bluetooth is a secure communication technology that allows devices to transmit wirelessly. The Bluetooth device is small, worn in the ear of both the coach and the participant, and allows the participants to speak and listen to each other without people close by hearing both sides of the conversation. In other words, the coach can speak to the participant without anyone else hearing. Bluetooth technology is compatible with most live stream platforms.

Phase 2: Using to the equipment

Practice. The coach and the participant should spend a few minutes testing the equipment and getting used to the process. A "dress rehearsal" session is strongly recommended and, ideally, will happen when there are no students in the room. Most participants report that they get used to the Bluetooth and voice in their ear in about ten minutes.


Pre-coaching conference
Time
•plan for 10-30 minutes
Determine practice or strategy that will be the focus of the coaching session
•e.g., "I want to increase the amount of times I'm providing opportunities to respond. I would like to be offering at least 5 opportunities per ten minutes of a lesson."
•make sure the participant understands what the skill is and how it should be implemented
Decide what data will be collected and how
•e.g., frequency count of opportunities to respond provided during ten minute session
Establish sample statements the coach will use to prompt or reinforce the participant
•e.g., "This is a good time to do a thumbs up, thumbs down to check for understanding"
•or "Great job of reinforcing Stuart for participating."
Determine the number of sessions and schedule the days and times
•the session should be 10-20 minutes
Schedule the post-coaching conference

6

Coaching session

- √ During each BIE coaching session, the participant directs the webcam to where the activity is visible to the coach (e.g., if the participant will be working with a small group, point the camera so the coach can clearly see the participant working with the group).
- √ Wearing the Bluetooth device, the participant calls the coach using the communication mode (e.g., Skype™, Zoom, or district provided platform).
- √ The coach answers the call and disables the video so that the children cannot see the coach during the session.
- √ The coach sets a timer for the agreed upon length of the session.
- √ During the first minute of the activity, the coach observes the activity without providing feedback. This allows the participant to begin and for the coach to understand the nature of the activity.
- √ At a rate of approximately one prompt per minute or at a general rate agreed upon during the pre-coaching conference, the coach then delivers prompts to the participant to use strategies.
- √ After each prompt, the coach provides affirmative feedback if the participant delivered the strategy correctly or corrective feedback if the participant did not use the strategy or used it incorrectly.
    - Affirmative feedback is also given for spontaneous use of the strategies.
- √ The coach may wait a minute or two during the session to allow the participant the opportunity to spontaneously deliver the strategy to the student(s).
    - If the participant is not using naturalistic opportunities within two to three minutes, the coach should provide a prompt to deliver the strategy.

Post-coaching conference

- The coach should ask questions of the participant before giving feedback.
  - e.g., "Was this lesson typical?", "Did this lesson go the way it usually does?", or "How do you think it went?"
- The coach should use objective terms to describe what went well.
  - e.g., "You explained the objective of the lesson before you started."
- The coach should use objective terms to relay the data.
  - e.g., "You gave 6 opportunities to respond in 5 minutes. Three of them were prompted and two were spontaneous."
- Allow and encourage the participant to ask questions.
- Schedule the next coaching session.
- Repeat as necessary.
- Once the scheduled sessions are complete, the coach and the participant may wish to schedule a check-in or follow-up appointment to evaluate the effectiveness of the coaching and the sustainability of the practice or skill that was coached.

Coaching Tip: It can be stressful for the participant to have someone watch them teach. Even with a positive relationship, it is hard for the participant to not feel judged. Make sure you start every post-coaching session with positives about what you observed, even if they are not directly related to the goal strategy.