EFFECTS OF A PROTOTYPICAL TRAINING PROGRAM ON THE IMPLEMENTATION OF SYSTEMATIC OBSERVATIONAL DATA COLLECTION ON IEP OBJECTIVES FOR THE CORE DEFICITS OF AUTISM SPECTRUM DISORDERS

Jessica L. Harkins

Dissertation Prepared for the Degree of

DOCTOR OF PHILOSOPHY

UNIVERSITY OF NORTH TEXAS

May 2013

APPROVED:

Smita Mehta, Committee Chair
Bertina Combes, Committee Member
Anne Rinn, Committee Member
Frances Van Tassell, Committee Member
Kevin Callahan, Committee Member
Abas Tashakoori, Chair of the Department of Educational Psychology
Jerry Thomas, Dean of the College of Education
Mark Wardell, Dean of the Toulouse Graduate School

Harkins, Jessica L. *Effects of a prototypical training program on the implementation of systematic observational data collection on IEP objectives for the core deficits of autism spectrum disorders.* Doctor of Philosophy (Special Education), May 2013, 164 pp., 3 tables, 6 figures, references, 130 titles.

Legal mandates and best practice recommendations for the education of students with autism spectrum disorders (ASD) emphasize the importance of systematic, ongoing observational data collection in order to monitor progress and demonstrate accountability. The absence of such documentation in decision-making on instructional objectives indicates a weakness in bridging the research-to-practice gap in special education. Utilizing a multiple baseline design across participants, the current study evaluated the effects of a prototypical teacher training program (i.e., workshop, checklist, in-classroom training with feedback, and maintenance with a thinned schedule of feedback) on the frequency of data collection on core deficits of ASD and the use of data-based decision-making. Results indicate increases in daily mean frequency of data collection following intervention. Maintenance and generalization indicates variable responding across participants. Effect size (Cohen's *d*) indicates a large, clinically significant effect of the training program. Results are discussed in relation to training models, maintenance, and future research.

ACKNOWLEDGEMENT

Sincere appreciation is extended to the US Department of Education and the authors of the Systematic Training for Autism Researchers and School Personnel Grant (US Department of Education-H325D060017-09), also known as Project STARS, for providing full funding for this study and the coursework that led up to its completion. Without this extremely generous support, I would not have been able to accomplish all that I have for individuals with autism, their families, and the professionals that work with them. I am looking ahead to all the future impact I will be able to make as a result of the support of this grant in the research and degree it has funded.

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

EFFECTS OF A PROTOTYPICAL TRAINING PROGRAM ON THE IMPLEMENTATION OF SYSTEMATIC OBSERVATIONAL DATA COLLECTION ON IEP OBJECTIVES FOR THE CORE DEFICITS OF AUTISM SPECTRUM DISORDERS

Introduction

The Individuals with Disabilities Education Act (IDEA [P.L. 101–476]) of 1990 and its amendments of 1997 and 2004 emphasized the importance of measuring and documenting progress for individuals with disabilities. Subsequent legislation (e.g., No Child Left Behind Act [NCLB], 2002) has added additional accountability in the form of assessment and documentation by including individuals with disabilities in the requirement for adequate yearly progress (AYP; Sopko, 2003; Yell, Drasgow, & Lowery, 2005). IDEA (2004) requires public school districts to develop an individualized education plan (IEP) for each student who is eligible to receive special education services. The IEP must list learning objectives in a clear, observable and measurable manner in order to facilitate monitoring and documentation of progress (Burns, 2001; Yell & Stecker, 2003). It is a substantive violation of IDEA if data are not collected to determine student progress or if collected data are not utilized for educational decision-making (Yell, Katsiyannis, Drasgow, & Herbst, 2003).

With the reauthorization of IDEA in 2004, known as the Individuals with Disabilities Education Improvement Act (IDEIA), continued emphasis was placed on measurable objectives, ongoing measurement, and indication of the method of measurement within the IEP. These propositions were further reiterated in the IDEIA Regulations of 2006 (Yell, Katsiyannis, Ryan, McDuffie, & Mattocks, 2008; Yell, Shriner, & Katsiyannis, 2006). It is undisputed that documentation of student progress needs to be based on data collected in a systematic and

scientific manner and educational decisions made on the basis of these data. This aspect is a critical component in the interpretation of the IDEIA mandated "free and appropriate public education" (FAPE), requiring educators to monitor and report student progress for the purpose of efficient delivery of educational services and for accountability (Crockett & Yell, 2008; Drasgow, Yell, & Robinson, 2001).

Accountability through data collection on IEP objectives is required and essential for the formative evaluation of progress for all students with disabilities. However, documentation of ongoing educational performance and progress is particularly crucial for students with ASD for several reasons. First, the pervasive nature of the disorder results in multiple skill deficits across domains, for example, deficits in social communication, interaction skills, and nonfunctional routines (American Psychiatric Association, 2000). Keeping track of progress on a variety of skills and domains necessitates systematic documentation of progress. Second, early and intensive intervention using evidence-based practices is recommended for students with ASD to ameliorate the severity of functional deficits. This recommendation is a requirement for FAPE under IDEIA (Fenske, Zalenski, Krantz, & McClannahan, 1985; Freeman, 1997; McEachin, Smith, & Lovaas, 1993; Yell et al., 2003). This requires programming for each core skill deficit area and progress-monitoring (Alberta Education, 2006; Colorado University Center for Collaborative Educational Leadership, 1998; Lovaas, 1987; Ogletree & Oren, 2001). Third, the current prevalence of ASD, as estimated by the Centers for Disease Control (CDC), appears to be rising for both boys and girls and has been reported as frequently as 1 in every 50 children (Blumberg et al., 2013). This rise in rate presents an increase in the number of students requiring services, and consequently the cost of educational resources needed to ensure FAPE

and providing accountability. Finally, the progress-monitoring component is designed to comprehensively address effectiveness of instruction on the acquisition and fluency of skills identified as deficits, observe and monitor maintenance of these skills, and track generalization of skills already learned and mastered. In addition to legal requirements and evidence-based recommendations, public support has been provided by parents, teachers and administrators who indicate the need for data collection as an important component of educational programming for individuals with ASD (Callahan, Henson, & Cowan, 2008).

Need for Data Collection and Documentation

Systematic observational data collection and progress monitoring for documentation are essential components of programming in special education programs (Fuchs & Fuchs, 1986; Gunter, Callicott, Denny, & Gerber, 2003). There is a variety of methods for collecting performance data for the purpose of documentation of progress, such as forms and data sheets containing learning objectives (e.g., Cheney, 2000; Lerman, Hovanetz, Strobel, & Tetreault, 2009; Romanczyk, 1996), portfolios (Carothers & Taylor, 2003), visual permanent products (Suarez, 2010) and electronic systems (e.g., Graff, 2007; Saunders, Saunders, & Saunders, 1993). Comparisons have been made between electronic and handwritten data collection methods in attempts to improve logistical concerns for data collection. Results vary by product but indicate no significant differences in accuracy between the two methods with handwritten data collection occurring slightly faster than electronic (e.g., Tarbox, Wilke, Findel-Pyles, Bergstrom, & Granpeesheh, 2009). Regardless of the method, systematic observational data collection systems support observable and measurable change and should be created and

tailored to student goals and objectives to make progress monitoring more systematic and manageable (McLaughlin, 1993; Schwartz, & Olswang, 1996).

A lack of connection between IEP objectives and behaviors observed in the classroom might lead to a decrease in the likelihood for classroom staff to collect data (Sandall, Schwartz, & LaCroix, 2004). Goals and objectives included in IEPs should be observable, measurable, and include a specific dimension of behavior to be measured (i.e., rate, duration, latency) to promote ease of systematic observational data collection (Alberto & Troutman, 2009; Cooper, Heron, & Heward, 2007).

Another consideration relates to the format of data collection systems in order to increase efficiency and time management in the classroom, balancing a need for progress monitoring without disrupting quality instruction. Despite the availability of data collection systems, teachers indicate that this function is often neglected because it is perceived to interfere with instruction and classroom management (Sandall et al., 2004; Wesson, King, & Deno, 1984; Yell, Deno, & Marston, 1992; Walton, 1985). Yet, implementation of evidence-based practices also requires systematic observational data collection to make instructional decisions in order to bridge the gap between research and practice (Heward, 2003).

Even when teachers report that they collect systematic observational data on student behavior, only a small number indicate using graphing as a data collection and decision-making tool (Cooke, Heward, Test, Spooner, & Courson, 1991). Graphing numerical data assists in informed decision-making by allowing for ongoing visual inspection of student data as a reflection of student performance and teaching effectiveness (Cooper et al., 2007; Utley, Zigmond, & Strain, 1987). It is critical to include both of these procedures, systematic data

collection and graphing with data-based decision-making, in professional development activities for teachers and training teams (Fuchs & Fuchs, 1986; Hojnoski et al., 2009).

Current accountability expectations for special education go beyond compliance to procedural safeguards to focus on student achievement (Wolf & Hassel, 2001). For students who are excluded from state testing, some type of accountability methods are still required. To account for variable responding and latency between milestones for individuals with severe deficits, accountability measures that "involve multiple measures over time will result in more accurate and reliable information than one-shot assessments" (Ysseldyke & Olsen, 1999, p. 183). Data collection on an individual level based on the IEP facilitates progress monitoring, which is critical for instructional decision-making and individual accountability. Additionally, IEP-based data can be translated into standard performance indicators used to assess system-wide accountability (McLaughlin & Thurlow, 2003).

The absence of systematic observational data collection is evidence of the research-to-practice gap, suggesting a critical need for effective teacher training. Training on the method and interpretation of data collection is essential to promote effective use of systematic and direct observation and recording of student behavior. Preservice training often fails to teach candidates to collect ongoing student data to demonstrate changes in skill development, which furthers the research-to-practice gap (Greenwood & Maheady, 1997; 2001). When increases in desired target behaviors are noted, teachers tend to accurately identify the trend without continuous data collection; however, for variable, unchanging or decreasing trends in behavior, there is inconsistent accuracy in interpretation without continuous data collection (Munger & Lloyd, 1989; Munger, Snell, & Lloyd, 1989). This also suggests a need to assess the extent of use

and quality of interpretation of the data collected. Making individualized instructional changes based on student data, as noted previously, has been linked to increased student achievement (Stecker & Fuchs, 2000).

Considering the importance of progress monitoring for all students with a disability, including individuals with ASD and the core deficits of ASD (i.e., communication, social skills, stereotypic and repetitive behavior), the next step is to determine the most appropriate manner in which to train teachers to collect data for accountability and identify effective staff training models to teach classroom teachers how to implement those procedures in the classroom.

Effective Teacher Training on Systematic Data Collection

A common strategy employed to train teachers and human service workers (e.g., paraeducators) focuses on inservice workshops and conferences involving presentation of information to be implemented in the classroom. Workshops and conferences alone have limited generalizability and may leave participants unprepared or with undeveloped skills that could be counter-productive or have no effect on student outcomes (Smith, Parker, Taubman, & Lovaas, 1992; Stein, 1975). The components of training that have demonstrated generalizability involve general hands-on training or training in the classroom and time to plan for implementation (Ducharme & Feldman, 1992; Noell et al., 2005; Penuel, Fishman, Yamaguchi, & Gallagher, 2007). Therefore, the on-the-job follow-up on the application of learned knowledge appears to be an important part in acquisition, along with a professional development approach including a combination of workshop-type information presentation,

modeling, practice, on-the-job follow-up, and/or feedback (Mautone, Luiselli, & Handler, 2006; Tschannen-Moran & McMaster, 2009).

Additional important facets of effective teacher training relate to specific strategies used to promote acquisition of the content presented in training. For example, content on evidence-based practices, written checklists, case examples within workshops, and feedback have been included (Ducharme & Feldman, 1992). Of these various training components, providing feedback on target behaviors has effectively increased staff performance (Panyan, Boozer, & Morris, 1970; Pellecchia et al., 2011; Quilitch, 1975). Based on empirical findings, it can be expected that acquisition of skills following training may have an impact on teacher behavior, as well as an indirect impact on students; teachers who participate in effective staff development report a perceived increase in student functioning and learning (Lowden, 2006).

One such long-standing training model is prototypical teacher training. A prototypical model offers the individualization that has been demonstrated to be effective for education and human service employees (Reid & Parsons, 2006). Prototypical training utilizes checklists to task analyze the steps of the targeted staff skill following a systematic format for introduction of the skill for the staff. The training steps include: (1) Specify the skill; (2) Provide a checklist of the skill; (3) Describe the skill and its rationale; (4) Demonstrate the skill; (5) Provide opportunities for staff to practice the skill; (6) Provide on-the-job performance feedback (Reid & Parsons, 2006). This model combines demonstration of competency-based and performance-based component skills rather than acquisition of knowledge alone. While the traditional workshop setting encompasses an example of methodology for competency-based training delivery, on-the-job training with feedback and follow-up provides opportunity

for performance-based training (Reid et al., 2003). Although valuable information can be presented in workshop training, issues might arise in the generalization of the skills presented from the workshops to the applied setting of the classroom. Involving supervisors in the training components can assist with maintenance and generalization of skills (Haberlin, Beauchamp, Agnew, & O'Brien, 2012). An important aspect of training is not only the presentation of content material and acquisition of skills, but also maintenance of acquired skills. In fact, if acquired skills are not maintained, it is assumed that the purpose of staff training has not been attained. To encourage maintenance, an appropriate criterion level must be reached prior to fading the performance feedback, and the trained behavior should be placed under a natural contingency of reinforcement (Arco, 1991). Transferring responsibility to a trained supervisor is a beneficial component of staff training, as it has been shown that training supervisors to provide feedback to direct care staff helps maintain staff behavior over time (Haberlin et al., 2012; Parsons & Reid, 1995).

Collective findings from studies that have utilized the prototypical staff/teacher training program show that the combination of workshop, in some cases a checklist or manual and handbook, and in-classroom performance feedback were effective in increasing the targeted data collection and data-based decision making skills of participants (e.g., Browder, Karvonen, Davis, Fallin, & Courtade-Little, 2005; Codding, Skowron, & Pace, 2005; Farmer, Wolery, Gast, and Page, 1988; Hundert, 1982; Pellecchia et al., 2011). For those studies that have reported effect sizes in their results, the effects ranged from medium (Browder et al., 2005) to highly effective (Pellecchia et al., 2011). The results have implications for training on data collection skills for staff or teachers. Research has also shown that teacher data collection skills

generalized beyond the target students in the classroom to other students and in some cases other goals (Farmer et al., 1988; Pellecchia et al., 2011). Training teachers in data collection skills affects IEP progress monitoring and alternative assessment ability, and may override any individual characteristics of students which impede learning, resulting in more efficient instruction based on data-based decisions (Browder et al., 2005). Training teachers to measure behavior might not have been sufficient to change student responding without also systematically training them to make decisions based on the measurement (Hundert, 1982).

Group training (i.e., workshop) showed no results in one study, but authors suggest it may be a necessary prerequisite for effective skill acquisition (Farmer et al., 1988). A combination of workshop and in-classroom training with feedback was found to be cost effective, time efficient and easily implemented in a preschool environment (Farmer et al., 1988). In addition, group performance feedback provided not just to classroom teachers, but the classroom or intervention team as an entity, can also be effective in increasing skills of each member of the team (or the team as a whole) (Pellecchia et al., 2011). Training for teachers should not only utilize an in-classroom component with feedback, in addition to any group instruction workshops, but should include both IEP progress monitoring and alternative assessment (Browder et al., 2005), graphing and data-based decision making (Hundert, 1982), and systematic thinning of the feedback schedule to bring it under the control of natural reinforcers (Farmer et al., 1988).

In a study conducted by Farmer et al. (1988), the effects of workshop training, in-classroom follow-up training with feedback, and feedback fading on the frequency of data collection by classroom teachers were investigated. Increases in the frequency of data

collection were observed across participants. Observed frequency levels maintained at a slightly lower rate when feedback was faded completely following the completion of intervention. Building upon the methodology of this study, the current study examines updating the training materials and modifying the maintenance component of the intervention to determine the long-term effects. The following study examines the effects on daily mean frequency of data collection on IEP objectives, specifically for students with ASD when using workshop training, checklists for data collection procedures provided to participants, in-classroom follow-up training with feedback, and a long-term performance feedback program to determine the effects on maintenance.

Rationale for the Study

Despite legal requirements and research recommendations for on-going documentation of student progress, teacher reports indicate that many educators rely on informal observations to determine and report student outcomes on the IEP or hold systematic observational data collection in low regard (Alberto & Troutman, 2009; Fuchs, Fuchs, & Warren, 1982). Teacher opinion has been demonstrated to be less accurate when compared to systematic observational data collection in program decision-making (Fuchs et al., 1982; Holvoet, O'Neil, Chazdon, Carr & Warner, 1983). Systematic observational data collection is recommended for professionals to monitor student progress and performance, as formative evaluation has been linked to increases in student achievement (Cooper et al., 2007; Fuchs & Fuchs, 1986; Krasch & Carter, 2009).

Data should be collected to assist in determining progress and instructional decision-making, and teachers need to be fluent at performing both processes (Pindiprolu, Peterson, & Berglof, 2007; Yell et al., 2005). Training should include strategies and technologies to make the process of data collection systematic and manageable within the classroom (Gunter et al., 2003). Programming and training for data collection and analysis are a focus of existing research in education and government initiatives (e.g., Heritage & Chen, 2005; McAffee, 1987), but published studies in the area of teacher training on data collection and data-based decision-making in the current literature appear to be limited.

Although limited research has evaluated the effectiveness of prototypical staff training to increase the frequency of teachers' data collection or use of data collection procedures, research has examined the effects of training to increase a variety of other behaviors for teachers who had direct contact with individuals with disabilities. Skills targeted using similar training packages include portfolio quality for teachers, instructional techniques (i.e., teacher scripts, assessments, signals, error correction) demonstrated by instructors of students with ASD, structured teaching, teacher performance, and fidelity of following CBM and measurable objective-writing procedures. In such studies, the prototypical-type training packages had demonstrated acquisition, maintenance, and generalization of a variety of staff performance skills (e.g., Arco & Millett, 1996; Browder et al., 2005; Codding et al., 2005; Hundert, 1982; Realon, Lewallen, & Wheeler, 1983; Scott & Martinek, 2006) and thus should be utilized for training educators to collect ongoing, direct and systematic observational data for students with disabilities. The current study was proposed to investigate a series of research questions focusing on the relationship between prototypical teacher training and: (a) the daily mean

frequency of data-recorded on IEP objectives in the core deficit domains for ASD, and (b) procedures with which participants document and utilize collected data for decision making and IEP accountability.

Research Questions

(1) What are the effects of a prototypical teacher training program (including: (1) a hands-on workshop with time for implementation planning, (2) a skills checklist, (3) on-the-job follow-up with delivery of fixed schedule of performance feedback, and (4) available incentives for attainment of goals) on:

   a) The daily mean frequency of systematic observational data collection of IEP objectives in classrooms serving students with ASD?

   b) Data management and data-based decision-making behaviors of teachers in classrooms serving students with ASD?

(2) What are the effects of intermittent performance feedback during follow-up observations after transference of feedback delivery to district personnel on the continued maintenance of:

   a) The daily mean frequency of systematic observational data collection by participants?

   b) Data management and data-based decision-making behaviors of participants in classrooms serving students with ASD?

Method

Participants and Setting

The study was conducted in two settings: a public independent school district and university-operated treatment center in north central Texas. The school district served students within the range of early childhood (EC) through age 21 years, with the study focusing on elementary campuses serving kindergarten through sixth grade. The treatment center served school-aged children with ASDs. At both locations, a meeting room used for staff

conferences and trainings served as the setting for workshop sessions. The instructional placement of the students taught by participants consisted primarily of classrooms and activity rooms on the elementary campus and the treatment center. These rooms encompassed the settings for all experimental conditions, including baseline, in-classroom training, and maintenance.

Participants included lead teachers and lead interventionists supervising teams of support staff (see for example, Pellecchia et al., 2011). The lead teachers included a pool of all elementary (EC-6) school teachers certified in special education who had at least four students in their classroom with an eligibility of autism (AU) according to their IEPs or intake diagnoses, as well as at least two goals and/or objectives in each of the core deficit areas of ASD (i.e., communication, social skills, and stereotypic/repetitive behavior).

Only those teachers or interventionists who met the criteria and the paraeducators who worked with them were included as potential participants in the study: (1a) teachers certified to teach special education; (1b) interventionists meeting qualifications to work at the center for children with ASDs; (2) participants with at least four students with an eligibility of AU in their classroom and on their caseload; (3) participants with responsibility for implementation and documentation of intervention plan and accountability for the students with AU. Exclusions were made for those classroom teams already collecting frequent or systematic data in the classroom per supervisor report and those who were pursuing or had completed graduate or specialized study in behavior analysis or the equivalent.

From this pool of potential participants, two lead teachers and three lead interventionists were selected as participants in the study. Amy was a 60-year-old teacher with

18 years of experience teaching elementary special education. She had an undergraduate degree in sociology and elementary education. Beth was a 28-year-old teacher with an undergraduate degree and certification in both general and special education. She had over 4 years of teaching experience in the classroom and was certified to teach general and special education. Caleb was a 26-year-old lead interventionist with a Master's degree in educational psychology. He had been in his current or an equivalent role for less than one year. Dee was a 51-year-old interventionist with 14 years of experience in the classroom and in center-based program delivery. She held an undergraduate degree in elementary education and was certified to teach both special and general education. The fifth participant, Eva, a 36-year-old interventionist with a Master's degree in kinesiology, had less than a year of experience in her current role or its equivalent.

All five participants remained through baseline data collection and the workshop training. Amy was withdrawn from the study during initial intervention when she disclosed additional information about her classroom arrangement that did not meet the inclusion criteria for the students on her caseload (i.e., she was not the one responsible for data collection for the IEP objectives of the students with ASD). This information was not provided at the time of recruitment to the study. Eva left her position at the treatment center and the study during the baseline phase. Even though best practice in single case experimental designs suggests the need for four participants, five were originally recruited for the study (Gast, 2010). However, only three participants, Beth, Caleb, and Dee, completed all experimental phases of the study (See for example, multiple baseline with only three replications in Chezan, Drasgow, & Marshall, 2012).

Materials

Minimal materials were used for this study, most of which were for the workshop. They included a computer, an LCD projector and a screen for delivering the presentation, a workshop script for the trainer, and tables and chairs for participants. Additional materials for participants included presentation handouts, workshop notes, workshop practice exercises, observer forms for collecting study data, and classroom feedback forms for the trainer and the supervisor of the participants.

Dependent Measures

The study was designed to investigate the effect of a prototypical teacher training program on systematic observational data collection and methods for IEP objectives relating to the core deficits of ASD by teachers of students with ASD. The dependent variables (DV) included: (1) the mean frequency per day of data collection for specific IEP objectives and (2) the presence or absence of discrete procedures for data collection presented to participants in workshop training.

Frequency of Data Collection on IEP Objectives

Frequency of systematic observational data collection of IEP objectives for the core deficits of ASD was the primary dependent variable in the study and was the measure used to inform decisions for changes in the experimental phases for the study. Systematic observational data collection on an objective is defined as the written presence of <u>all</u> of the following four components: (1) Use of some permanent data sheet or form (paper or

electronic); (2) Record of any dimension of one or more target behaviors (i.e., daily mean frequency/rate, duration, and latency) indicating student performance. (3) Recorded data are graphed; and (4) Notation of data-based decision-making (DBDM) is indicated on the data sheet and/or graph (e.g., objective mastered, continue objective, change intervention, change prompting level, change in schedule of reinforcement, introduce new target or discriminative stimulus) (adapted from Farmer et al., 1988). In order for an objective to have been scored as an instance of "data collection of an objective," and therefore be included in the frequency count, all four components of the data collection definition had to be present.

Daily mean frequency of data collection was measured by recording the total number of objectives in the core domains for which the four data collection criteria (i.e., permanent data form used, dimension of behavior recorded, data graphed, and DBDM noted) were met for all target students with ASD and dividing by the total number of students (i.e., dividing by two if both students were present that day and by one if only one was present).

Data Collection Checklist Procedures

In addition to measuring the frequency of data collection for objectives, the investigator also measured participant skills associated with data collection procedures taught in the workshop. Data collection procedures in this study consisted of seven skills involved in systematic observational data collection (Alberto & Troutman, 2009; Cooper et al., 2007; Farmer et al., 1988; Pellecchia et al., 2011): (1) Data collection materials are visible; (2) Data collection materials are accessible to the classroom team (i.e., teacher participant and paraprofessional participants); (3) The participant records data during the observation session;

(4) Paraeducators or support staff record data during the observation session; (5) Data are recorded multiple times during or after at least one instruction activity observed; (6) Data are recorded during or after multiple instructional activities during the observation session; and (7) Data are recorded using a data collection system.

Procedures for Data Collection of Dependent Measures

Detailed data collection procedures for the study are discussed below. The mean frequency of data collection on IEP objectives collected by participants was the measure used to determine decision-making and phase change within the study. This measure was collected for each consecutive school day through a permanent product. The measure for observing participant data collection behavior using the observational data collection procedure checklist was measured throughout the study on a weekly basis, but this DV did not dictate phase change decisions for a participant.

Mean Frequency of Data Collection on Core Objectives

Permanent product data collection was used to obtain the daily mean frequency of objectives that meet the four criteria for data collection behavior recorded by the participants. The permanent products, in the case of this study, were the data collection systems obtained and retained by the participants for the target students with ASD on their caseload. The study personnel had access to the data collection systems of participants to determine the frequency of data meeting criteria. The daily mean frequency of IEP objectives documented included data collected by participants or their agents (e.g., paraeducators).

The target student names and all identifying information were not visible to the study personnel or the investigator and were replaced with a code. The IEP documentation of target students was coded to ensure complete confidentiality of the students. From each target student's IEP, objectives that fell under the core domains of ASD (i.e., communication, social skills, and stereotypic/repetitive behavior) were indicated as core objectives. For each of these objectives, (a) the target student code, date and domain were indicated, (b) each of the four components of data collection were recorded as observed/correct or unobserved/incorrect, and (c) the dimension recorded was listed.

Once coding was complete, the documentation (i.e., data collection system) was used to assess daily data collection behavior for participants using the permanent products data collection form, including the four components of data collection (i.e., recorded dimension of behavior indicating student performance, use of a permanent data collection system, graphed data, and DBDM notation). If no record of a data collection system existed for a given student for a given day, it was noted on the checklist as "no data" and all components were scored applicably. There was a distinction made in the compilation of the results between objectives that did not meet all the four criteria (i.e., a data collection system was present, but zero components were observed for that day) and instances where no data collection system was present (i.e., zero components observed because no data were collected).

Data Collection Procedures Checklist

In addition to permanent products, a checklist matching the checklist provided to participants in the workshop was used to document probes of direct observation of participant

data collection behavior. This checklist, consisting of eight key components of data collection that was provided to the participants in training, served as a measure of adherence to data collection procedures. For each observation, the eight skill components (six components if no other staff or students were in the room) were indicated as observed/correct or unobserved/incorrect and the percentage was calculated for the observation. The checklist steps were assessed during 20-minute observation sessions, which occurred during different instructional activities when possible to avoid participant predictability and reactivity.

Following an observation session, each step of the checklist would indicate whether the skill was observed or not observed during that session. The eight skills targeted in the checklist included components of (1) data preparation skills, (2) concurrent data collection skills, and (3) data tracking strategies. Percentage of "observed steps" was calculated for each probe observation session.

Observer Training

There were two observers, a primary and a secondary observer for data collection activities for the study. A doctoral student served as the primary observer, and the study investigator served as the secondary observer. Training for observers took place prior to the initiation of the study and consisted of familiarization with the permanent products forms and data collection procedures checklist, presentation of definitions, examples and non-examples of the dependent measures, and direct observation sessions including scoring, and calibration of accuracy. Discrepancies were discussed. Criterion was met when each data collector had demonstrated 90% or higher accuracy for at least five consecutive examples and non-examples

for at least three consecutive practice sessions prior to the initiation of formal data collection for the study.

Interobserver Reliability

The interobserver agreement (IOA) was calculated on the occurrence and non-occurrence of target responses for at least 33% of sessions and both agreement of occurrence and non-occurrence (presence or absence of a component on the data collection procedure checklist) was recorded. To take into account any agreement by chance, Cohen's Kappa was calculated at the end of the study. To determine Cohen's Kappa, the following formula was used:

$$K=(P_O-P_C) / (100-P_C),$$

where P_O= the proportion of agreements between observers and P_C= the proportion of agreements expected by chance (Cohen, 1968).

Social Validity of the Intervention

A social validity questionnaire requesting information regarding perceptions of the effectiveness and acceptability of the training package from the participants was used. The questionnaire included a Likert-type scale from 1-4 indicating a range of responses from strongly disagree (1) to strongly agree (4). Questions spanning each step of the treatment package were included to assess perceptions of the "efficacy, helpfulness, and difficulty" of collecting and analyzing data for instructional decisions (Farmer et al., 1988, p. 138). Topics included participant perceptions of increases in levels of understanding and implementation of

skills targeted in training phases, increases in daily mean frequency of data collection for IEP objectives, increases in use of data collection procedures, of appropriateness of difficulty level, and additional training needs. Opportunities for participants to indicate the effectiveness of individual and combined components of the training were included for each item. An open response option was provided at the end of the 10-item questionnaire, allowing for any additional information the participants chose to share. Participants were given the questionnaire at the end of the study in-person or via email based on personal preference.

Independent Variable

The independent variable utilized in the study consisted of various components of a prototypical teacher training program package, which included: (1) Workshop training with embedded time for practice; (2) A performance checklist provided at the workshop and used for follow-up training; (3) an in-classroom follow-up training with performance feedback and reinforcement for attaining goals; and (4) a maintenance program including a plan for generalization of performance feedback to maintain target behavior over time. The study examined the effects of these components as they were applied to each participant's frequency and quality of data collection and analysis activities.

The workshops were open to all certified special education teachers at the elementary (EC-6) schools of the district who had at least four students in their classroom with an eligibility of autism (AU), according to their IEPs. Paraprofessionals and other team members of lead teachers were invited to attend the workshop as well. The workshop at the treatment center was open to all full-time interventionists and senior staff. In order to be a participant, teachers

and interventionists had to attend the workshop and provide informed consent. The workshop format contained a slide presentation of material to the large group by the trainer (lead investigator), followed by individual/small group activities to practice skills. This included developing observable and measurable IEP objectives, identification and selection of dimensions of behavior, data collection practice with video examples, data collection system development, graphing, and efficient strategies for data collection.

Additionally, the workshop included the distribution of the data collection procedures checklist to all attendees. All workshop attendees, regardless of whether or not they provided informed consent to participate or qualified for participation in the study, received a certificate of participation for the training. All attendees also had an opportunity to receive data collection tools (e.g., timers, clickers, and golf counters) for attending, provided in a drawing at the end of each workshop. Three identical workshops were presented at three different locations for recruiting participants with 47 total attendees. A fidelity checklist and a workshop script were used to ensure content and activities were consistent across workshops.

The in-classroom component consisted of the trainer (lead investigator) observing and providing feedback to each participant on data collection frequency and procedures for a 20-minute session each week. A goal was set at the beginning of this phase and a reinforcer (i.e., a $25 restaurant gift card) was available for attaining this goal. The maintenance and generalization component also contained performance feedback sessions following classroom observation, but was conducted by district/center representatives rather than the trainer.

Experimental design and procedures

A single subject, multiple baseline design across participants was used to assess the relation between the prototypical training package and mean daily frequency of data collection on IEP objectives, along with percentage of observed data collection procedures. Following a two-part baseline condition (i.e., a pre-workshop baseline with consistent data points for all participants per setting and a staggered post-workshop baseline), the intervention phase was implemented (i.e., in-classroom follow-up training), followed by maintenance with generalization. Phase change occurred in a staggered fashion for one participant at a time, upon reaching stability of the determining dependent variable (i.e., mean frequency), as determined by the median for the data points in the previous phase. Phase change for the next participant did not occur until there was stability for previous participant(s). The resulting data provided staggered effects of the introduction of the IV across participants, allowing interpretation of the potential relation between IV and DV and replication of effect.

Baseline

Baseline for all participants contained both pre- and post-workshop data points. All participants had at least five data points (Phase A-1) prior to attending the workshop. However, data collection for the post-workshop baseline (Phase A-2) was staggered across participants to preserve the integrity of the research design.

Pre-workshop (Baseline Phase A-1). Following participant selection during the workshops (see description of selection process below), baseline data on mean frequency were collected retroactively by scoring data collection of IEP objectives for two target students of

each participant classroom team from a minimum of the previous five consecutive school days, using a permanent products measurement form.

Following selection of the five participants during the workshops, the participant team randomly selected (i.e., random number assignment) two of the minimum of four students on their caseload who had an eligibility of ASD as the target students. The un-mastered objectives for each of the target students were listed and categorized by core domains for ASD: communication, social skills, and stereotypic or repetitive behavior. Any objectives not meeting these domains were not considered in this study. All students with an eligibility of autism should have had goals within each of these domains, as they are the defining deficits of ASD. All identifying student information was coded and completely unavailable to study observers, data collectors, and the investigator.

Workshop. The workshop presentation consisted of a series of presentation slides related to measurable IEP objectives, procedures for collecting and graphing data (Alberto & Troutman, 2009) and additional current resources. There was a script for the trainer to follow, and workshop notes were distributed to each attendee for reference during and after the workshop in order to ensure replicability and fidelity of implementation of intervention procedures. Participants attended the workshop with other colleagues who were not necessarily participants in the study nor necessarily met the criteria for participation in the study. The district/center supervisors responsible for training the participant teams and for accountability of systematic data collection in the classroom were also invited to attend the workshop, combining a component supported by a pyramidal staff training model (i.e., Train-the-Trainer) in hopes to enhance the likelihood of continuation of skills for participant

classroom teams (Haberlin et al., 2012). The workshop included a series of pre-determined exercises for attendees and participants in the study for practicing learned skills. All attendees and participants were given a copy of the data collection procedures checklist, consisting of a task analysis of all components needed to ensure that data collection procedures were in place in the classroom.

Attendees were given information to provide informed consent to participate in the study at the beginning of each workshop. Demographic information was also collected to determine whether each individual met the inclusion criteria to participate. Seven attendees gave informed consent to participate, but only five of them indicated demographic information to meet criteria. These five were selected as the participants.

Post-workshop (Baseline Phase A-2). Data collection continued in a similar manner as described in pre-workshop baseline (Phase A-1 above). The permanent product checklist was used to assess IEP objectives for the target students with ASD meeting the four criteria for data collection for each consecutive school day for all five participants and their teams. Also, weekly direct observation probes were conducted, during which observers recorded the data collection behavior of each participant, using the data collection procedures checklist.

In-Classroom Follow-Up Training with Performance Feedback

Following stability in responding and consistent with the multiple baseline design, in-classroom follow-up training with feedback phase was introduced. The participant and his/her classroom team whose post-workshop baseline data were considered the most stable and who had been in baseline the longest were the first to enter intervention, while the remainder of

participants remained in the post-workshop baseline condition. This first participant and his/her team met with the trainer in his/her classroom during class time for a 20-minute session to observe and review the data collection system. Feedback was provided using the in-classroom feedback checklist; if a single "no" was indicated by the feedback checklist, additional practice was provided using modeling and/or exercises from the workshop. In this first session of in-classroom follow-up training with feedback, the trainer identified a data collection goal for the participant [e.g., to collect data for at least five objectives daily for each student (so a mean daily frequency of 5) for five consecutive days (Farmer et al., 1988)].

A predetermined incentive (i.e., potential positive reinforcer of a gift card) was discussed in relation to meeting the data collection goal. The trainer/interventionist informed the participants that she would return at least weekly to assist the participant in reaching his/her goal by continuing to provide feedback. A copy of the feedback form was provided to the participants for reference.

Subsequent weekly 20-minute sessions followed the same procedure, except goal-setting was omitted (which had been completed already): (1) Participant and trainer reviewed the data collection system; (2) Feedback was provided with an opportunity for practice as needed, using the checklists; (3) The goal and reinforcers for meeting the goal were reviewed; (4) The trainer provided a copy of the feedback and informed the participant of his/her next session. Concurrent with these feedback sessions, data continued to be collected using permanent products data collection for daily data and direct observation probes with the data collection procedures checklist.

When the first participant attained criterion level, s/he received the reinforcer for reaching the goal. At this time, the intervention phase of in-classroom follow-up training with feedback began for the second participant's team and the first participant entered the maintenance phase of the reinforcement. The procedures were repeated for each subsequent participant in a staggered manner until s/he reached criterion level.

Maintenance and Generalization

Upon reaching criterion level, weekly in-classroom training sessions ceased and data were only collected for participants on a weekly or bi-weekly schedule to determine if the levels of responding maintained. In addition, district/center representatives were offered the option of providing a thinned schedule of feedback to enhance maintenance (see for example Jahr, 1998). District/center representatives who chose to engage in the maintenance and generalization phase underwent a brief training session on how to use the feedback checklist and all their questions were answered. The district's/center's goals, expectations, and policy on accountability in the form of systematic observational data collection for IEP goals were reviewed. Transfer of feedback sessions (i.e., transfer of responsibility of feedback sessions from the trainer to the district representative) occurred at the beginning of the maintenance phase.

During the maintenance phase, permanent product data were scored for the two target students at each quality check in the same manner as the previous phases, and a data collection procedures checklist was completed for the participant by the district representative, if a representative was available. During the maintenance and generalization phase, the

performance feedback session schedule was faded to a variable schedule of one and a half weeks. Feedback sessions were then in the form of quality checks conducted by a district/center representative or his/her agent trained in the use of the feedback checklist and consisted of: (1) Participant and district representative reviewed the data collection system; (2) Feedback was provided in the form of the feedback checklist; (3) The district/center representative discussed the importance of accountability for all students and explained the district's/center's goal of maintaining at criterion level for frequency of data collection of IEP objectives (e.g., at least five objectives daily for a randomly selected student in the class upon a quality check) and data collection procedures checklist (e.g., 8 of 8 procedures upon quality check). This phase of the study was an important step in transferring any positive impact from the intervention into a more natural setting that continues over time, for those settings that chose to participate. The mean frequency of data collection for the date of the maintenance feedback session was recorded.

Fidelity of Intervention Procedures

Fidelity of implementation of the independent variable is an essential component of the single subject research methodology and should be defined and measured for integrity of the intervention procedures (Gast, 2010; Gresham, Gansle, & Noell, 1993). Fidelity of intervention procedures was determined using a series of checklists, both for recording the fidelity of the implementation of training to participants (i.e., workshop presentation checklist and in-classroom feedback checklist), and for serving as a prompt for teachers to implement the data collection procedures with fidelity. Fidelity checklists of general intervention procedures

included a workshop presentation checklist, in-classroom feedback checklist, and a maintenance system checklist. Treatment fidelity was monitored for 100% of sessions of the intervention. Intervention fidelity was calculated by summing the total steps observed for the intervention procedure and dividing by the total number of steps required for the intervention procedure.

Data Analysis

Visual analysis of data on a line graph was used to determine the relationship between daily mean frequency of data collection (DV) and the components of the prototypical training package (IV). Graphs (See Figures 1-2) representing the multiple baseline design across participants display individual responding for dependent measures and applicable ancillary measures over consecutive school days. Results were evaluated with respect to the level stability, trend, and percent of overlapping and non-overlapping data (Gast, 2010).

Finally, effect size (ES) was calculated for the multiple baseline design using Cohen's (1988) *d* statistic. ES was needed in order to determine the magnitude to which a functional relation exists between the IV and the DV (APA, 2009). Although visual and inferential statistics can provide information on the statistical significance of a study, the calculation of ES assists consumers of research in determining the clinical significance of the intervention utilized in the study (Grissom & Kim, 2005). For this study, *d* was calculated for the baseline and intervention conditions using the formula

$$d=(M_I - M_B)/\left(SD_P/\sqrt{2(1-r)}\right),$$

where M_I represents the mean score for Intervention, M_B represents the mean score for baseline, and SD_P is the pooled standard deviation for both experimental phases, and *r* is the correlation between the baseline and intervention data (Dunst, Hamby, & Trivette, 2004). This formula for ES is recommended when comparing correlations between phases for single subject research where the number of data points across adjacent phases are unequal (Dunst et al., 2004). ES was calculated by assessing first, each participant's behavior during his/her own baseline and intervention condition; second, ES was computed for all baseline and intervention conditions (pooled) across all participants (Beeson & Robey, 2006).

Results

Mean Frequency of Data Collection for Core Objectives

Results (see Figure 1) indicate no change in rates of mean daily frequency between pre-workshop baseline and post-workshop responding across participants. There were observed changes in responding at varying times after in-classroom intervention sessions were introduced. The mean daily frequencies of data collection for core objectives are displayed for all participants for pre-workshop baseline, post-workshop baseline, intervention, and maintenance/generalization phases in Figure 1 across consecutive school days (i.e., each day students were present, excluding weekends and holiday breaks occurring between days 28-29, 46-47, and 87-88).

Pre-workshop and post-workshop baseline responding was at zero levels for all participants (i.e., for all participants, there were zero instances in baseline for which they met all four criteria of data collection for any core objective). For Beth, an increasing trend was

observed after the second weekly in-classroom training session, although the data were variable. Data did not begin to follow an increasing trend for Caleb until after the fifth weekly in-classroom training session. At this time, skills were demonstrated in the sessions, but were not represented in the participant's responding. The decision was made by the trainer to introduce the participant's supervisor and begin transferring control of the accountability to the natural environment prior to the maintenance and generalization phase. After the introduction of accountability of data systems (i.e., participant provided data sheets and graphs daily to the trainer and supervisor for training purposes), an increasing trend in responding was observed. Dee showed similar skills in the training sessions, so after the second weekly training session, the trainer began transferring control to the participant's supervisor by requesting accountability (i.e., participant provided data sheets and graphs daily to the trainer and supervisor for training purposes). At that time, there was an increasing trend of responding. Eva left her position at the center, and therefore the study, while still in baseline.

Amy's responding is not included in the results (Figure 1), as it was discovered in the second weekly intervention session that she was not the responsible party for data collection for the students with ASD on her caseload and therefore did not meet the selection criteria for the study. Data collected up to that point indicated zero levels for pre- and post-workshop baseline, as well as zero levels for seven consecutive school days of intervention. These data were based on the data collection procedures of someone other than the participant or her classroom team, however, so they are not included in the study analysis.

Effect size coefficients between baseline responding and responding during intervention indicated a large effect (Cohen, 1977) and practical or clinical significance (Wolf, 1986) for each

individual participant, as well as for responding for all participant baseline and intervention conditions (pooled). Responding between baseline to intervention for Beth (d = 1.85, p < 0.05), Caleb (d = 1.14, p < 0.05), and Dee (d = 3.54, p < 0.05) indicated clinical significance of the change in responding during the intervention phase. In addition, when responding for all three participants was examined, results were similar (d = 1.71, p < 0.05).

Data Collection Procedures Checklist

During weekly direct observation probes, the data collection procedures checklist was completed for each participant. The number of observed steps on the checklist was divided by the total number of steps, resulting in a percentage of steps observed. The mean percentage of steps observed per observation was calculated for each participant (Figure 2). For Beth, the mean percentage of steps observed was calculated for baseline (M = 97%, SD = 6) and intervention (M = 97%, SD = 5.86). Baseline (M = 97%, SD = 6), intervention (M = 100%, SD = 0), and maintenance/generalization (M = 100%, SD = 0) phases were determined for Caleb. The mean percentage of steps observed per observation was also calculated for baseline (M = 100%, SD = 0) and intervention (M = 84%, SD = 18.88) for Dee; there was also one maintenance session during which time her responding had decreased (50%). The mean percentage of steps observed was calculated for baseline (M = 85%, SD = 26.89) for Eva, although no intervention data were available due to attrition. Also, although her classroom arrangement was revealed during intervention to not meet the criteria for this study because the primary DV was not a result of the behavior of her classroom team, the data collection procedures checklist *was* based on observation of her behavior, so results are included for additional information to the

reader. The mean percentage of steps observed was calculated for baseline (*M* = 54%, *SD* = 29.70) and intervention (*M* = 88%, *SD* = 0) for Amy.

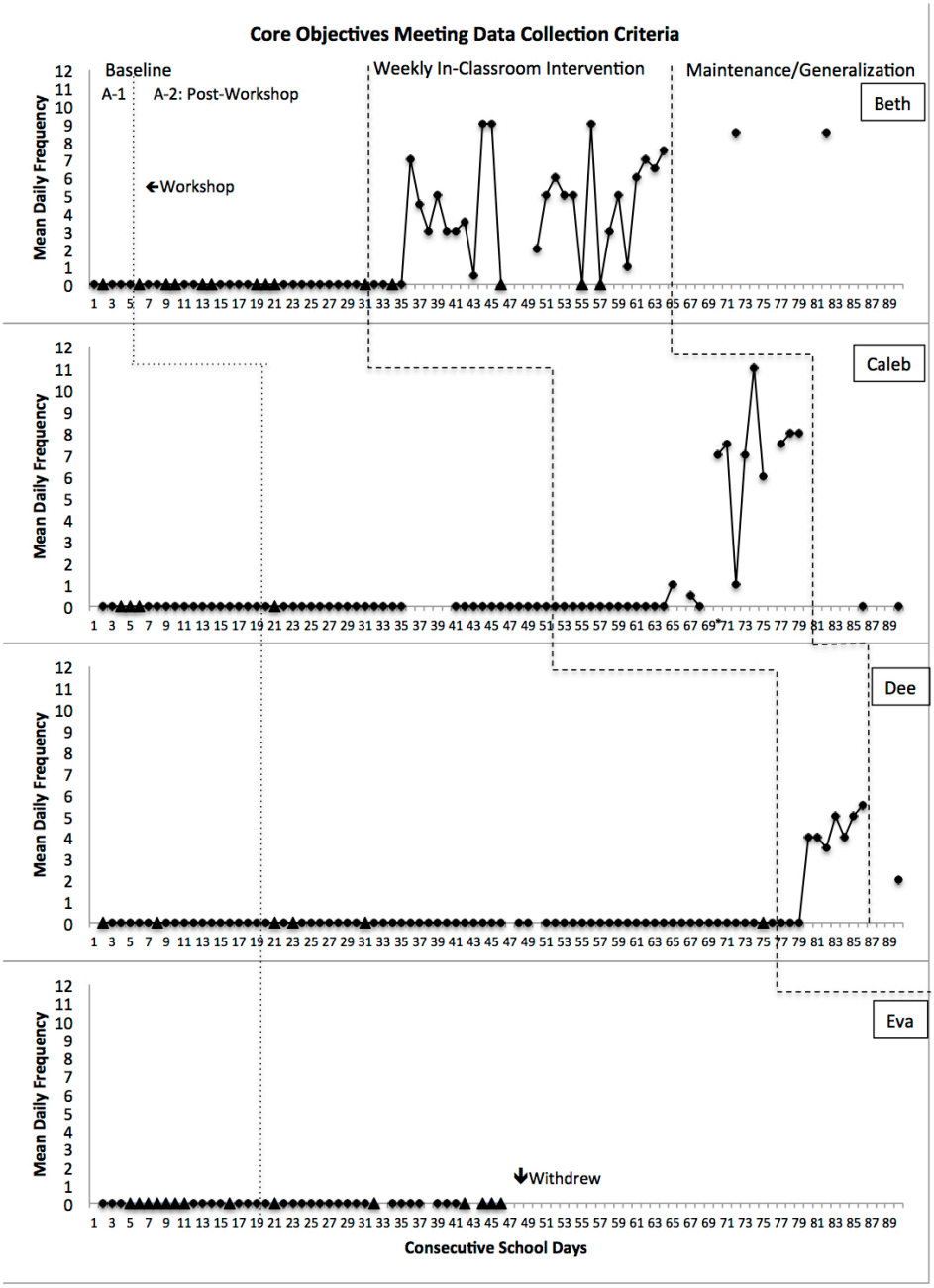

Figure 1. The effects of a prototypical training program on the daily frequency of objectives meeting criteria for systematic observational data collection.

Inter-Observer Agreement, Kappa, and Fidelity Measures

The mean daily frequency scores of each participant for the 90 school days were assessed for occurrence (IOA = 100% agreement) and non-occurrence (IOA = 100% agreement) agreement by two independent observers for 50% of school days for baseline, intervention, and maintenance conditions. Similarly, for 33% of direct observations using the data collection procedures checklist. To assess the agreement of observers with respect to the likelihood of the agreement occurring by chance, the kappa coefficients for mean daily frequency baseline (K = 1.0) and intervention (K = 1.0), as well as for direct observation data (K = 1.0), were found and indicate near perfect agreement.

Fidelity of implementation was assessed for workshop sessions and in-classroom training sessions. Participants' supervisors were also provided with fidelity checklists for maintenance feedback sessions. Three workshop sessions were conducted with 100% fidelity of implementation for 100% of sessions. For the 21 in-classroom training sessions, 100% fidelity of implementation was found for 100% of sessions. For the three maintenance and generalization sessions conducted by a center supervisor, 100% fidelity of implementation was reported by the supervisor for 100% of sessions. Finally, each participant who did not withdraw or was not withdrawn indicated 100% of steps of the intervention were accessed with fidelity.

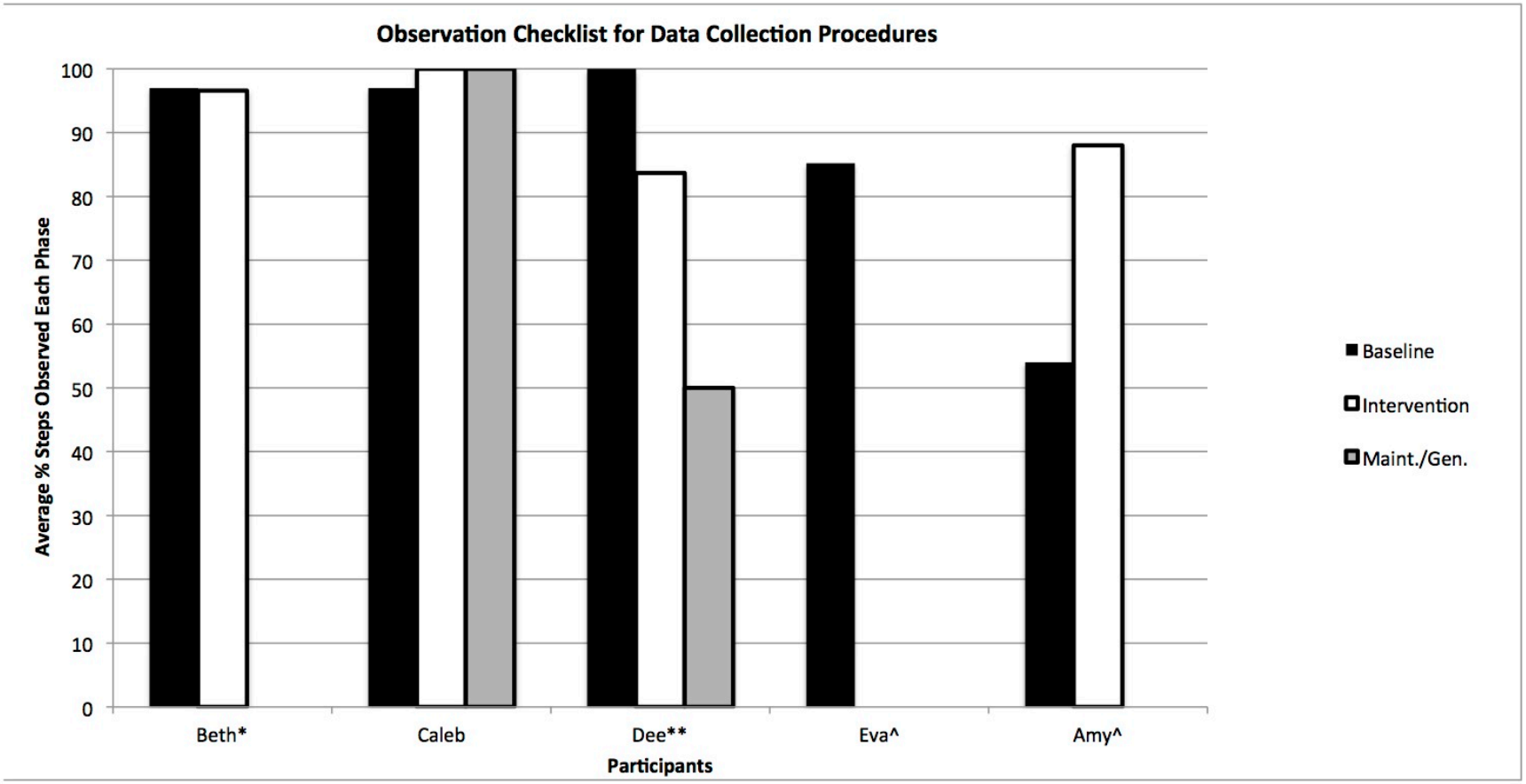

Figure 2. The average percentage of steps observed on the data collection procedures checklist for weekly observation probes in baseline, intervention, and generalization phases. [*No generalization data available. **Data collection procedures checklists for intervention and generalization sessions had limited opportunity for demonstrating data collection skills. ^Participants withdrawn or withdrew from the study prior to completion.]

Social Validity

Social validity surveys were provided to all three participants, as well as to Amy who was withdrawn from the study during intervention. Three of the four surveys were returned at the time of this summary. Reminders and subsequent requests were made to those who had not yet submitted this information.

Results of the survey indicate that Beth and Caleb "strongly agreed" and Dee "agreed" that their participation in the study increased their knowledge in measurement, data collection system development, classroom preparation for data collection, data collection strategies, graphing, and DBDM. In addition, it was indicated that as a result of the workshop and in-classroom training combined, daily data collection systems were developed in their classrooms.

For these targeted skills, there was some variability in responding pertaining to which training method was perceived as most effective. Beth indicated combinations of all three options (i.e., "workshop alone", "in-classroom sessions alone", and "workshop and in-classroom training combined") as the most effective training method for the various skills, as well as indicating "none of these" for the skill of increasing the number of times per day data are collected in the classroom. Caleb indicated that the "in-classroom sessions alone" were most effective for some skills, and the "workshop and in-classroom training combined" were most effective for the remaining listed skills. Dee indicated that the "workshop and in-classroom training combined" was perceived as the most effective training strategy for all skills. Overall, both Beth and Caleb indicated that the most effective training method for them for data collection and analysis for accountability was the "in-classroom sessions alone," while Dee indicated that it was "workshop and in-classroom training combined." Given the variability of

responses (workshop alone, *n* = 6 responses; in-classroom sessions alone, *n* = 6 responses; workshop + in-classroom training, *n* = 17 responses; none of these, *n* = 1 response), the use of some combination of workshop and in-classroom training seems supported.

Discussion

According to existing research, a combination of workshop (in-service training) and in-classroom professional development (on-the-job training) has been effective in increasing the daily mean frequency of data collection (Farmer et al., 1988). In an attempt to address issues of maintenance, transfer of control to the natural environment was planned for all participants (and attained for 2 of 3) by programming for a thinned schedule of performance feedback; this feedback from direct supervisors potentially functioned as positive or negative reinforcement to increase target skills, which is based on behavior analytic literature and principles (Ogletree & Oren, 2001).

The effect of the prototypical training program on mean daily frequency of data collection for core objectives of ASD was large and clinically significant. Responding for systematic observational data collection, as measured by mean daily frequency, indicated an increase in responding following the implementation of the in-classroom training portion intervention. There was some variation amongst participants in the number of sessions prior to the increase in mean daily frequency. Overall, the effect of the prototypical training program on the data management and data-based decision-making behaviors of participants serving students with ASD was variable amongst participants, with a large clinically significant effect for one participant, but no notable effects for one and even a decreasing effect for another.

The maintenance levels of mean daily frequency were also variable, with two participants maintaining levels of responding equivalent to intervention and one reverting back to baseline levels. Generalization of the data collection procedures checklist was completed for two of three participants. Results indicated that one participant maintained responding equivalent to intervention, the other saw a decrease in responding.

Implications of the Study

Other factors that affect the frequency of systematic observational data collection, such as student responding, goal-writing, and frequency of measurement, must be taken into account when discussing some of the variability in responding for data collection. The way IEP goals and objectives are written appear to play a role in how frequently a teacher or interventionist collects data. For example, if objectives are written in a manner requiring bi-weekly data probes, then daily data collection will vary depending on which day of the week the data probes are performed. In addition, student behavior can have a huge impact on the frequency of systematic data collection. If a student has a day with significant maladaptive behavior, the number of objectives targeted that day might decrease simply because the time was devoted to managing behavior. Along the same line, illness or fatigue might affect student responding, which in turn affects the number of objectives on which a teacher or interventionist is able to target and collect data. Logistics and maladaptive behavior affected the responding for Dee with regard to the data collection procedures checklist as well, potentially skewing the results of the effect of the training. During the final intervention observation session, her student spent the majority of the time in the restroom, resulting in

limited opportunity to collect data on targeted core deficits of ASD. During the one maintenance session for Dee, the student engaged in maladaptive behavior during the entire observation, also limiting data collection opportunities as the priority was student safety and de-escalation. The relation between student behavior and frequency of data collection should be investigated further, as well as how the phrasing in IEP objectives affects data collection and DBDM.

Workshop Effects

Although the workshop presentation was not set up to provide a functional relation between pre- and post-workshop baseline, some information can still be gained from comparing responding pre- and post-workshop during baseline. The frequency of objectives meeting all four criteria for data collection (i.e., permanent record, dimension of behavior rather than anecdotal data recorded, graphed data, and notation of data-based decision-making) showed no change in responding from pre-baseline to post-baseline for any of the participants. When we look at objectives for which some data were collected (e.g., permanent record, dimension rather than anecdotal data recorded), all criteria were not met; there are some differences in responding. Cohen's *d* indicates that there is a moderate effect between pre- and post-baseline levels for all participants, with the exception of Beth, in the percentage of core objectives for which some observational data were collected. In the social validity survey, the three participants indicated the importance of the workshop component, as well as the workshop combined with in-classroom support in their acquisition of knowledge and skills. This supports previous research that has implied that the presentation of information in a

workshop format is an important prerequisite component to effective training models. However, there were zero effects (d = 0.00, p < 0.05) between pre- and post-workshop baseline rates of objectives meeting all four criteria of data collection taught in the workshop, further indicating an examination of the importance of in-classroom follow-up training components of the prototypical training model.

Implications for Teaching and Working with Students with ASD

The challenge of utilizing evidence-based practices for teaching students with ASD involves some considerations including (a) the type and number of deficits across domains, and (b) the need for teachers to effectively plan data-collection activities for numerous IEP goals and objectives. In the current study, baseline data showed that teachers and interventionists were collecting limited amount of data but did not engage in data-based decision-making (DBDM) for the core deficit areas. In the absence of DBDM, accurate monitoring of student progress for skill acquisition, maintenance, and generalization is likely to be compromised. Additionally, because a growing number of students are diagnosed with ASD, a growing number of skills must be taught, monitored, and used for instructional decision-making. Results from this study indicated that workshop training alone did not result in increased data collection and decision-making by participants. However, these activities were observed to increase following in-class training and support. Thus, a prototypical approach should be considered by teacher trainers to promote acquisition of skills taught in a workshop format but followed up with hands-on coaching in the classroom. Finally, consideration for a systemic change in the

accountability of collecting and using these data should be considered in future research and public policy discussions.

Accountability

Originally this study was designed to transfer accountability and feedback from the trainer to the natural supervisor in the environment during the maintenance and generalization stage; however, in the case of two of the participants, it was deemed appropriate to introduce some accountability of the data systems and graphs prior to transferring the feedback sessions to the supervisors. Accountability in the workplace, in its very nature, is motivated by escape/avoidance of perceived aversive consequences, such as disapproval, negative performance reviews, termination (Reed, Fienup, Luiselli, & Pace, 2010), which is also known as negative reinforcement. Negative reinforcement occurs when an individual performs a task more frequently to escape or avoid said consequences. This naturally occurring reinforcer potentially affected responding for participants in this study, although not consistently across participants. Beth, who was in a classroom environment, only had accountability to the trainer when providing data and graphs. Her responding remained variable. Caleb and Dee demonstrated increases in responding following the introduction of accountability to the trainer and supervisor for their daily data systems and graphs. In addition, during maintenance and generalization, when no stated accountability to provide data systems and graphs was given in advance, Caleb's levels dropped back down to zero core objectives meeting all four criteria. The implications of the need for accountability are such that providing training, providing checklists, observing demonstrations of proficiency in training, setting goals, and

providing a small positive reinforcer for meeting goals were not enough in this study to increase levels of systematic observational data collection for core deficits of autism without that accountability component. There were also not enough to maintain responding of all participants. This brings into question the extent to which teachers and interventionists need to provide more frequent examples of their systematic observational data collection systems (including graphs) to a supervisor via personal or public posting of the data. If the data are not being collected or DBDM not being utilized, then simply providing a remark every six to nine weeks on whether progress has been made may not capture whether the objective is being documented as indicated in the intervention plan and as required by IDEA. Accountability to a supervisor should be examined in future research within this training model.

Maintenance and Generalization

Maintenance data were gathered for all three participants following mastery in intervention. The generalization component was offered to the supervisors of each participant; however, for one of the participants in the public school environment, the arrangement of a supervisor to begin providing feedback was not possible with the logistics and time constraints in place. The supervisor declined. For this participant, however, maintenance responding remained high with only the accountability of the trainer gathering the data in place. At the same time, for the participants who did have a supervisor take over the role of providing feedback, when there was no specific statement of the expectation of graphs or DBDM, responding dropped during maintenance. Further investigation into the variables at work in maintenance and generalization is warranted.

Limitations of the Study

Although the questions posed in this study prompted the use of a single subject design to analyze the progression of data throughout training, the limited number of participants following attrition of two of the five starting the study posed a threat to the external validity of the results. Additional research and replication are necessary to enhance understanding of the effects of the prototypical training program on data collection behavior. Design standards of multiple baseline designs were also not met and were out of the control of the investigators as a result of attrition of the two participants.

Upon introduction of the weekly in-classroom training sessions, there was a delay in the advent of increased responding for meeting data collection criteria. The delay varied in length by participant. For Caleb and Dee, it warranted introduction of accountability factors after they had demonstrated in training sessions their proficiency in performing the data collection skills but the proficiency had not translated to following through outside of those training sessions. Even for Beth, a single weekly session was not enough to see increases in results. It should be taken into consideration when implementing an in-classroom training model or a prototypical model that the number of sessions to see results could vary and are most likely greater than one session, and this should be considered for future research in training models.

This study did not investigate the accuracy of the data collected by the participants; it simply recorded whether or not data and DBDM were present. Limitations of this include whether the training provided taught the skill of accurate data collection, as well as whether the data that were collected matched the skills performed by the students. This facet of

systematic observational data collection and a prototypical training model should be investigated in future studies.

Implications for Future Research

The results of this study have prompted additional questions and areas to be the focus of future research in training models and systematic observational data collection. As mentioned earlier, investigating the effects of negative reinforcement (i.e., accountability), the optimal number of in-classroom training sessions, and the accuracy of data collection are important areas in which to focus. In addition, future investigations should focus specifically on targeting maintenance of responding, an analysis of workshop and in-classroom training components, the link between goal development and data collection frequency, the appropriateness of the method or validity of the selection of dimension of behavior, examination of the target population on whom data are collected with generalization to other populations, and promoting an even greater effect on the percentage of objectives with full systematic observational data collection criteria met.

Limitations of Research in Applied Settings

Several challenges of conducting research in applied settings were experienced in the course of undertaking this study. Recruitment was an issue despite the offer of a free workshop and in-class training for participants; many districts responded that they were simply not interested. When working with interested districts, several workshops were conducted before even two participants agreed to participate with informed consent. With no other

districts accepting the invitation, a decision was made to broaden the recruitment net to include treatment centers for training classroom staff. Recruitment in that environment had a smaller pool of potential participants but more interventionists volunteered to participate.

Once participants were recruited, a second challenge of research in applied settings became evident. First, the role of one of the participants was not accurately explained to the investigator during the recruitment process; it was not until the trainer began working in the classroom that it was apparent that the participant did not meet the eligibility criteria of the study. Shortly after the attrition of the first participant, another participant left her position at the treatment center. In applied settings, when roles change or people leave, their participation in the study ceases, not only limiting external validity of the results but forcing investigators to compromise with the quality of the research design.

Additionally, obtaining and maintaining communication and participation of key stakeholders becomes much more difficult in applied research settings. Staff and supervisors have many responsibilities outside of the study implementation. In addition, logistical concerns, schedule availability, perception of importance of the study, and role changes all affect participation with study activities. These factors also potentially have an effect on studying maintenance and generalization effects of interventions.

Conclusion

A prototypical teacher training program including a pre-intervention workshop; a skill checklist; in-classroom training with feedback, goal-setting, and incentive for attaining the goal; and transfer of accountability and feedback to the natural supervisor was implemented.

Following implementation of the in-classroom training component of the workshop, increases were observed in the frequency at which data were collected for core objectives of ASD. The implications of the effects of a prototypical teacher training program on systematic observational data collection for core objectives indicate the use of a combination of training components, including in-classroom follow-up with supervisor accountability and feedback in training classroom teachers and interventionists. Implementing effective training programs in classrooms might help to efficiently bridge the research-to-practice gap in the field of special education, especially in an area as essential as documentation of progress and accountability of intervention.

References

Alberta Education. (2006*). Essential components of educational programming for students with behaviour disabilities. Standards for special education*. Edmonton, Alberta: Author. Retrieved from ERIC database.

Alberto, P. A., & Troutman, A. C. (2009). *Applied behavior analysis for teachers* (8th ed.). Upper Saddle River, NJ: Merrill.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (Revised 4th ed.). Washington, DC: Author.

American Psychological Association. (2009). *Publication manual of the American Psychological Association* (6th ed.). Washington, DC: Author.

Arco, L. (1991). Effects of outcome performance feedback on maintenance of client and staff behavior in a residential setting. *Behavioral Residential Treatment*, *6*, 231-247. Retrieved from Academic Search Complete database.

Arco, L., & Millett, R. (1996). Maintaining instructional behavior after on-the-job training with process-based performance feedback. *Behavior Modification*, *20*, 300-320. doi:10.1177/01454455960203004.

Baer, D., Wolf, M., & Risley, T. (1968). Some current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis*, *1*, 91-97. doi: 10.1901/jaba.1968.1-91.

Baer, D., Wolf, M., & Risley, T. (1987). Some still-current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis*, *20*, 313-27. doi: 10.1901/jaba.1987.20-313.

Beeson, P. M., & Robey, R. R. (2006). Evaluating single-subject treatment research: Lessons learned from the aphasia literature. *Neuropsychology Review*, *16*, 161-169. doi:10.1007/s11065-006-9013-7.

Blumberg, S.J., Bramlett, M.D., Kogan, M.D., Schieve, L.A., Jones, J.R., & Lu, M.C. (2013). Changes in prevalence of parent-reported autism spectrum disorder in school-aged U.S. children: 2007 to 2011-2012. *National Health Statistics Reports, 65*, 1-8. Retreived from www.cdc.gov/nchs/data/nhsr/nhsr065.pdf.

Browder, D., Karvonen, M., Davis, S., Fallin, K., & Courtade-Little, G. (2005). The impact of teacher training on state alternate assessment scores. *Exceptional Children*, *71*, 267-282. Retrieved from Academic Search Complete database.

Bucklin, B. R., Alvero, A. M., Dickinson, A. M., Austin, J., & Jackson, A. K. (2000). Industrial-organizational psychology and organizational behavior management: An objective comparison. *Journal of Organizational Behavior Management*, *20*(2), 27-75. doi:10.1300/J075v20n02_03.

Burgio, L. D., Whitman, T. L., & Reid, D. H. (1983). A participative management approach for improving direct-care staff performance in an institutional setting. *Journal of Applied Behavior Analysis*, *16,* 37-53. Retrieved from PubMed Central.

Burns, E. (2001). *Developing and implementing IDEA-IEPs: An individualized education program (IEP) handbook for meeting Individuals With Disabilities Education Act (IDEA) requirements*. Springfield, IL: C.C. Thomas.

Callahan, K., Henson, R., & Cowan, A. (2008). Social validation of evidence-based practices in autism by parents, teachers, and administrators. *Journal of Autism and Developmental Disorders*, *38*, 678-692. Retrieved from E-Journals database.

Carothers, D., & Taylor, R. (2003). The use of portfolios for students with autism. *Focus on Autism and Other Developmental Disabilities*, *18*, 125-128. doi:10.1177/108835760301800206.

Cheney, C. O. (2000). Ensuring IEP accountability in inclusive settings. *Intervention in School & Clinic*, *35*, 185. Retrieved from Academic Search Complete database.

Chezan, L.C., Drasgow, E., & Marshall, K.J. (2012). A report on using general-case programming to teach collateral academic skills to a student in a post-secondary setting. *Focus on Autism and Other Developmental Disabilities, 27*, 22-30. doi: 10.1177/1088357611428334.

Codding, R., Skowron, J., & Pace, G. (2005). Back to basics: Training teachers to interpret curriculum-based measurement data and create observable and measurable objectives. *Behavioral Interventions*, *20*, 165-176. doi:10.1002/bin.194.

Cohen, J. (1968). Weighted kappa: Nominal scale agreement provision for scaled disagreement or partial credit. *Psychological Bulletin*, *70*, 213-220. doi:10.1037/h0026256.

Cohen, J. (1977). *Statistical power analysis for behavioral sciences* (revised ed.). New York: Academic Press.

Cohen J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates; Hillsdale, NJ.

Colorado University Center for Collaborative Educational Leadership. (1998). *Social skills classroom training packet. LEAP outreach project*. Retrieved from ERIC database.

Cooke, N., Heward, W. L., Test, D. W., Spooner, F., & Courson F. H. (1991). Student performance data in the classroom: Measurement and evaluation of student progress. *Teacher Education and Special Education, 14*, 155-161. Retrieved from ERIC database.

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). Measuring behavior. In Applied behavior analysis (2nd ed., pp. 72-101). Upper Saddle River, NJ: Pearson.

Crockett, J. B., & Yell, M. L. (2008). Without data all we have are assumptions: Revisiting the meaning of a free appropriate public education. *Journal of Law & Education, 37*, 381-392.

Culig, K. M., Dickinson, A. M., McGee, H. M, & Austin, J. (2005). An objective comparison of applied behavior analysis and organizational behavior management research. *Journal of Organizational Behavior Management, 25*, 35-72 doi:10.1300/J075v25n01_02.

Daniels, A. C., & Daniels, J. E. (2004). *Performance management: Changing behavior that drives organizational effectiveness* (4th ed.). Atlanta, GA: Performance Management Publications.

Drasgow, E., Yell, M., & Robinson, T. (2001). Developing legally correct and educationally appropriate IEPs. *Remedial & Special Education*, *22*(6), 359-373. Retrieved from Education Research Complete database.

Ducharme, J. M., & Feldman, M. A. (1992). Comparison of staff training strategies to promote generalized teaching skills. *Journal of Applied Behavior Analysis*, 25, 165-179. doi: 10.1901/jaba.1992.25-165.

Dunst, C. J., Hamby, D. W., & Trivette, C. M. (2004). Guidelines for calculating effect sizes for practice-based research synthesis. *Evidence-based Approaches to Early Childhood Development, 3*, 1-10.

Farmer, R., Wolery, M., Gast, D. L, & Page, J. L. (1988). Individual staff training to increase the daily mean frequency of data collection in an integrated preschool program. *Education and Treatment of Children, 11*, 127-142. Retrieved from ERIC database.

Fenske, E. C., Zalenski, S., Krantz, P. J., & McClannahan, L. E. (1985). Age at intervention and treatment outcome for autistic children in a comprehensive intervention program. *Analysis and Intervention in Developmental Disabilities, 5*, 49-58. Retrieved from Education Research Complete database.

Frederiksen, L. W., & Lovett, S. B. (1980). Inside organizational behavior management: Perspectives on an emerging field. *Journal of Organizational Behavior Management, 4*, 193-203.

Frederiksen, L. W., & Riley, A. (Eds.). (1984). *Improving staff effectiveness in human service settings: Organizational behavior management approaches.* New York, NY: Hawthorne Press.

Freeman, B. (1997). Guidelines for evaluating intervention programs for children with autism. *Journal of Autism and Developmental Disorders*, *27*, 641-651. Retrieved from E Journals database.

Frick, T., & Semmel, M. I. (1987). Observer agreement and reliabilities of classroom observational measures. *Review of Educational Research, 48*, 157-184. doi: 10.3102/00346543048001157.

Fuchs, L., & Fuchs, D. (1986). Effects of systematic formative evaluation: A meta-analysis. *Exceptional Children*, *53*, 199-208. Retrieved from Education Research Complete database.

Fuchs, L., Fuchs, D, & Warren, L. (1982). Special education practice in evaluating student progress toward goals. *Institute for Research on Leaning Disabilities Research Report, 81*, 1-34. Retrieved from ERIC database.

Gast, D. L. (2010). *Single subject research methodology in behavioral sciences*. New York, NY: Routledge.

Graff, H. (2007). Technology adoption and usage of a data collection tool in a school setting servicing students with autism: A qualitative look at the process and perspectives. *Dissertation Abstracts International Section A*, 68, Retrieved from PsycINFO database.

Greenwood, C. R., & Maheady, L. (1997). Measurable change in student performance: Forgotten standard in teacher preparation? *Teacher Education and Special Education: The Journal of the Teacher Education Division of the Council for Exceptional Children, 20*, 265-275. doi: 10.1177/088840649702000307.

Greenwood, C. R., & Maheady, L. (2001). Are future teachers aware of the gap between research and practice and what should they know? *Teacher Education and Special Education: The Journal of the Teacher Education Division of the Council for Exceptional Children, 24,* 333-347. doi: 10.1177/088840640102400407.

Gresham, F., Gansle, K., & Noell, G. (1993). Treatment integrity in applied behavior analysis with children. *Journal of Applied Behavior Analysis*, *26*(2), 257-263. doi:10.1901/jaba.1993.26-257.

Grissom, R. J., & Kim, J. J. (2005). *Effect sizes for research: A broad practical approach*. Mahwah, NJ US: Lawrence Erlbaum Associates Publishers.

Gross, A. M., & Ekstrand, M. (1983). Increasing and maintaining rates of teacher praise: A study using public posting and feedback fading. *Behavior Modification, 7,* 126-136.

Gunter, P., Callicott, K., Denny, R., & Gerber, B. (2003). Finding a place for data collection in classrooms for students with emotional/behavioral disorders. *Preventing School Failure*, *48*, 4-8. Retrieved from Academic Search Complete database.

Haberlin, A. T., Beauchamp, K., Agnew, J., & O'Brien, F. (2012). A comparison of pyramidal staff training and direct staff training in community-based day programs. *Journal of Organizational Behavior Management, 32*, 65-74. doi: 10.1080/01608061.2012.646848.

Harris, R., Simons, M., Willis, P., & Carden, P. (2003). Exploring complementarity in on- and off-job training for apprenticeships. *International Journal of Training and Development*, *7*, 82-92. doi:10.1111/1468-2419.00173.

Heritage, M., & Chen, E. (2005). Why data skills matter in school improvement. *Phi Delta Kappan*, *86*, 707-710. Retrieved from MasterFILE Premier database.

Heward, W. L. (2003). Ten faulty notions about teaching and learning that hinder the effectiveness of special education. *Journal of Special Education, 36*, 186-205. doi:10.1177/002246690303600401.

Hojnoski, R. L., Caskie, G. I., Gischlar, K. L., Key, J. M., Barry, A., & Hughes, C. L. (2009). Data display preference, acceptability, and accuracy among urban head start teachers. *Journal of Early Intervention, 32*, 38-53. doi: 10.1177/1053815109355982.

Holvoet, J*., C.,* Chazdon, L., Carr*,* D. & Warner, J. (1983). Hey, do we really have to take data? *Journal of the Association for People with Severe Handicaps*, *8*, 56-70. Retrieved from ERIC database.

Hundert, J. (1982). Training teachers in generalized writing of behavior modification programs for multihandicapped deaf children. *Journal of Applied Behavior Analysis*, *15*, 111 122. Retrieved from PubMed Central.

Individuals with Disabilities Education Act. (1990). 20 U.S.C. § 1400 *et seq.*

Individuals with Disabilities Education Act Amendments. (1997). 20 U.S.C. § 1415.

Individuals with Disabilities Education Improvement Act, (2004). H.R. 1350, 108th Congress.

Iwata, B. A., Dorsey, M. F., Slifer, K. J., & Bauman, K. E. (1994). Toward a functional analysis of self-injury. *Journal of Applied Behavior Analysis*, *27*, 197-209. doi:10.1901/jaba.1994.27-197.

Iwata, B. A. (1994). Functional analysis methodology: Some closing comments. *Journal of Applied Behavior Analysis*, *27*, 413. doi:10.1901/jaba.1994.27-413.

Jahr, E. (1998). Current issues in staff training. *Research in Developmental Disabilities, 19*, 73-87. doi:10.1016/S0891-4222(97)00030-9.

Kissel, R. C., Whitman, T. L., & Reid, D. H. (1983). An institutional staff training and self management program for developing self-care skills in severely/profoundly retarded individuals. *Journal of Applied Behavior Analysis* , *16*, 395-415. Retrieved from PubMed Central.

Krasch, D., & Carter, D. (2009). Monitoring classroom behavior in early childhood: Using group observation data to make decisions. *Early Childhood Education Journal*, *36*, 475-482. doi:10.1007/s10643-009-0316-1.

Kunz, G. G, Lutzker, J. R., Cuvo, A. J., Eddleman, J., Lutzker, S. Z., Megson, D., & Gulley, B. (1982). Evaluation strategies to improve careprovider performance on health and developmental tasks in an infant care facility. *Journal of Applied Behavior Analysis, 15,* 521-531. Retrieved from PubMed Central.

Lerman, D., Hovanetz, A., Strobel, M., & Tetreault, A. (2009). Accuracy of teacher-collected descriptive analysis data: A comparison of narrative and structured recording formats. *Journal of Behavioral Education*, *18*, 157-172. doi:10.1007/s10864-009-9084-7.

Lovaas, O. I. (1987). Behavioral treatment and normal educational and intellectual functioning in young autistic children*. Journal of Consulting and Clinical Psychology, 55*, 3-9. Retrieved from PsycINFO database.

Lowden, C. (2006). Reality check: Survey highlights the disparity between the ideal and real in professional learning programs. *Journal of Staff Development*, *27*, 61-64. Retrieved from ERIC database.

Mautone, J., Luiselli, J., & Handler, M. (2006). Improving implementation of classroom instruction through teacher-directed behavioral consultation: A single-case demonstration. *International Journal of Behavioral Consultation & Therapy*, *2*, 432-438. Retrieved from Academic Search Complete database.

McAfee, J. (1987). Integrating therapy services in the school: A model for training educators, administrators, and therapists. *Topics in Early Childhood Special Education*, *7*, 116-126. doi:10.1177/027112148700700311.

McEachin, J. J., Smith, T., & Lovaas, O. I. (1993). Long-term outcome for children with autism who received early intensive behavioral treatment. *American Journal of Mental Retardation, 4*, 359-372. Retrieved from Education Research Complete database.

McLaughlin, T. (1993). An analysis and evaluation of educator selected data collection procedures in actual school settings. *Child & Family Behavior Therapy*, *15*, 61-64. Retrieved from E-Journals database.

McLaughlin, M. J., & Thurlow, M. (2003). Educational accountability and students with disabilities: Issues and challenges. *Educational Policy, 17*, 431-451. doi: 10.1177/0895904803254962.

Munger, G., & Loyd, B. (1989). Effects of daily mean frequency of data collection and graph characteristics on visual inference. *Assessment For Effective Intervention (AEI)*, *14*, 112-124. Retrieved from E-Journals database.

Munger, G., Snell, M., & Loyd, B. (1989). A study of the effects of daily mean frequency of probe data collection and graph characteristics on teachers' visual analysis. *Research In Developmental Disabilities*, *10*, 109-127. Retrieved from MEDLINE database.

No Child Left Behind (NCLB) Act of 2001, Pub. L. No. 107-110, § 115, Stat. 1425 (2002).

Noell, G., Witt, J., Slider, N., Connell, J., Gatti, L., Williams, K., Koenig, J. L., Resetar, J. L., & Duhon, G. J. (2005). Treatment implementation following behavioral consultation in schools: A comparison of three follow-up strategies. *School Psychology Review, 34*, 87–106.

Ogletree, B., & Oren, T. (2001). Application of ABA principles to general communication instruction. *Focus on Autism and Other Developmental Disabilities*, *16*, 102-109. Retrieved from Education Research Complete database.

Owston, R., Wideman, H., Murphy, J., & Lupshenyuk, D. (2008). Blended teacher professional development: A synthesis of three program evaluations. *Internet and Higher Education*, *11,* 201-210. Retrieved from ERIC database.

Panyan, M., Boozer, H., & Morris, N. (1970). Feedback to attendants as a reinforcer for applying operant techniques. *Journal of Applied Behavior Analysis*, *3*, 1-4. Retrieved from PubMed Central.

Parsons, M., & Reid, D. (1995). Training residential supervisors to provide feedback for maintaining staff teaching skills with people who have severe disabilities. *Journal of Applied Behavior Analysis*, *28*, 317-22. Retrieved from ERIC database.

Parsons, M., Reid, D., & Green, C. (1993). Preparing direct service staff to teach people with severe disabilities: A comprehensive evaluation of an acceptable training program. *Behavioral Residential Treatment*, *8*, 163-185. Retrieved from Psychology and Behavioral Sciences Collection database.

Pellecchia, M., Connell, J. E., Eisenhart, D., Kane, M., Schoener, C., Turkel, K., Riley, M., & Mandell, D. S. (2011). We're all in this together now: Group performance feedback to increase classroom team data collection. *Journal of School Psychology, 49*, 411-431. doi:10.1016/j.jsp.2011.04.003.

Penuel, W. R., Fishman, B. J., Yamaguchi, R., & Gallagher, L. P. (2007). What makes professional development effective? Strategies that foster curriculum implementation. *American Educational Research Journal, 44*, 921-958. doi: 10.3102/0002831207308221.

Pindiprolu, S., Peterson, S., & Berglof, H. (2007). School personnel's professional development needs and skill level with functional behavior assessments in ten midwestern states in the United States: Analysis and issues. *Journal of the International Association of Special Education*, *8*, 31-42. Retrieved from Education Research Complete database.

Quilitch, R. (1975). A comparison of three staff-management procedures. *Journal of Applied Behavior Analysis*, *8*, 59-66. Retrieved from PubMed Central.

Realon, R., Lewallen, J., & Wheeler, A. (1983). Verbal feedback vs. verbal feedback plus praise: The effects on direct care staff's training behaviors. *Mental Retardation*, *21*, 209-212. Retrieved from Education Research Complete database.

Reed, D. D., Fienup, D. M., Luiselli, J. K., & Pace, G. M. (2010). Performance improvement in behavioral health care: Collateral effects of planned treatment integrity observations as an applied example of schedule-induced responding. *Behavior Modification, 34*, 367-385. doi:10.1177/0145445510383524.

Reid, D. H., & Parsons, M. B. (2006). *Motivating human service staff: Supervisory strategies for maximizing work effort & work enjoyment* (2nd ed.). Morganton, NC: Habilitative Management Consultants, Inc.

Reid, D. H., Rotholz, D. A., Parsons, M. B., Morris, L. A., Braswell, B. A., Green, C. W., & Shell, R. M. (2003). Training human service supervisors in aspects of PBS: Evaluation of a statewide, performance based program. *Journal of Positive Behavior Interventions, 5*, 35-46. doi:10.1177/10983007030050010601

Romancyzk, R. G. (1996). Behavioral analysis and assessment: The cornerstone to effectiveness. In C. Maurice, G. Green, & S. Luce (Eds.) *Behavioral intervention for young children with autism* (pp. 195-220). Austin, TX: Pro-ed.

Sandall, S., Schwartz, I., & Lacroix, B. (2004). Interventionists' perspectives about data collection in integrated early childhood classrooms. *Journal of Early Intervention*, *26*, 161-174. doi:10.1177/105381510402600301.

Saunders, M., Saunders, J., & Saunders, R. (1993). A program evaluation of classroom data collection with bar codes. *Research in Developmental Disabilities*, *14*, 1-18. Retrieved from ERIC database.

Scott, T. M., & Martinek, G. (2006). Coaching positive behavior support in school settings: Tactics and data-based decision making. *Journal of Positive Behavior Interventions, 8*, 165-173.

Schwartz, I., & Olswang, L. (1996). Evaluating child behavior change in natural settings: Exploring alternative strategies for data collection. *Topics in Early Childhood Special Education*, *16*, 82-101. doi:10.1177/027112149601600108.

Smith, T., Parker, T., Taubman, M., & Lovaas, O. I. (1992). Transfer of staff training from workshops to group homes: A failure to generalize across settings. *Research In Developmental Disabilities*, *13*, 57-71. Retrieved from MEDLINE database.

Sopko, K. (2003). *The IEP: A synthesis of current literature since 1997*. Alexandria, VA: National Association of State Directors of Special Education.

Stecker, P. M., & Fuchs, L. S. (2000). Effecting superior achievement using curriculum-based measurement: The importance of individual progress monitoring. *Learning Disabilities Research and Practice, 15*, 128–134.

Stein, T. (1975). Some ethical considerations of short-term workshops in the principles and methods of behavior modification. *Journal of Applied Behavior Analysis*, *8*, 113-115. Retrieved from MEDLINE database.

Suarez, S. (2010). Show me again what I can do: Documentation and self-determination for students with social challenges. *Theory into Practice*, *49*, 21-28. Retrieved from E Journals database.

Tarbox, J., Wilke, A., Findel-Pyles, R., Bergstrom, R., & Granpeesheh, D. (2009). A comparison of electronic to traditional pen-and-paper data collection in discrete trial training for children with autism. *Research in Autism Spectrum Disorders, 4*, 65-75. doi:10.1016/j.rasd.2009.07.008.

Tawney, J. W., & Gast, D. L. (1984). *Single subject research in special education*. New York, NY: Merrill.

Tschannen-Moran, M., & McMaster, P. (2009). Sources of self-efficacy: Four professional development formats and their relationship to self-efficacy and implementation of a

new teaching strategy. *Elementary School Journal*, *110*, 228-245. Retrieved from ERIC database.

Utley, B. L., Zigmond, N., & Strain, P. S. (1987). How various forms of data affect teacher analysis of student performance. *Exceptional Children, 53*, 411-422.

Walton, W. T. (1985). Educators' responses to methods of collecting, storing, and analyzing behavioral data. *Journal of Special Education Technology, 7*, 50–55.

Wesson, C. L., King, R. P., & Deno, S. L. (1984). Direct and frequent measurement of student performance: If it's good for us, why don't we do it? *Learning Disability Quarterly, 7*, 45–48.

Wolf, F.M. (1986). *Meta-analysis: Quantitative methods for research synthesis*. Beverly Hills, CA: Sage.

Wolf, P. J., & Hassel, B. C. (2001). Effectiveness and accountability (Part 1): The compliance model. In Int. Finn, Int. Rotherham, & Int. Hokanson (Eds.), *Rethinking special education for a new century* (pp. 53-75). Washington, D.C.: Thomas B. Fordham Foundation and the Progressive Policy Institute.

Yell, M., Deno, S. L., & Marston, D. B. (1992). Barriers to implementing curriculum-based measurement. *Diagnostique*, *18*, 99-112. Retrieved from ERIC database.

Yell, M., Drasgow, E., & Lowrey, K. (2005). No Child Left Behind and students with autism spectrum disorders. *Focus on Autism and Other Developmental Disabilities*, *20*, 130-139. Retrieved from Health Source - Consumer Edition database.

Yell, M., Katsiyannis, A., Drasgow, E., & Herbst, M. (2003). Developing legally correct and educationally appropriate programs for students with autism spectrum disorders. *Focus on Autism and Other Developmental Disabilities*, *18*, 182-191. Retrieved from Health Source - Consumer Edition database.

Yell, M., Katsiyannis, A., Ryan, J., McDuffie, K., & Mattocks, L. (2008). Ensure compliance with the Individuals with Disabilities Education Improvement Act of 2004. *Intervention in School and Clinic*, *44*, 45-51. Retrieved from ERIC database.

Yell, M., Shriner, J., & Katsiyannis, A. (2006). Individuals with Disabilities Education Improvement Act of 2004 and IDEA regulations of 2006: Implications for educators, administrators, and teacher trainers. *Focus on Exceptional Children*, *39*, 1-24. Retrieved from Education Research Complete database.

Yell, M., & Stecker, P. (2003). Developing legally correct and educationally meaningful IEPs using curriculum-based measurement. *Assessment for Effective Intervention*, *28,* 73-88. Retrieved from ERIC database.

Ysseldyke, J., & Olsen, K. (1999). Putting alternative assessments into practice: What to measure and possible sources of data. *Exceptional Children, 65*, 175-185

APPENDIX A

TEACHER TRAINING FOR DATA COLLECTION AND DATA-BASED DECISION-MAKING:

A META-ANALYSIS OF PROTOTYPICAL TRAINING

Introduction

The Individuals with Disabilities Education Act [IDEA (P.L. 101–476)] of 1990 and its amendments of 1997 and 2004 emphasized the importance of measuring and documenting progress for individuals with disabilities. Subsequent legislation [e.g., No Child Left Behind Act (NCLB), 2002] added additional accountability in the form of assessment and documentation by including individuals with disabilities in the requirement for adequate yearly progress (AYP) (Sopko, 2003; Yell, Drasgow, & Lowery, 2005). IDEA (2004) requires public school districts to develop an individualized education plan (IEP) for each student who is eligible to receive special education services. The IEP must list learning objectives in a clear, observable and measurable way in order to facilitate monitoring and documentation of progress (Burns, 2001; Yell & Stecker, 2003). It is a substantive violation of IDEA if data are not collected to determine student progress or if collected data are not utilized for educational decision-making (Yell, Katsiyannis, Drasgow, & Herbst, 2003).

Accountability and Educational Law

With the reauthorization of IDEA in 2004, known as the Individuals with Disabilities Education Improvement Act (IDEIA), continued emphasis was placed on measurable objectives, ongoing measurement, and indication of the method of measurement within the IEP. These propositions were further reiterated in the IDEIA Regulations of 2006 (Yell, Katsiyannis, Ryan, McDuffie, & Mattocks, 2008; Yell, Shriner, & Katsiyannis, 2006). It is undisputed that documentation of progress needs to be based on data collected in a systematic and scientific manner and educational decisions made on the basis of these data. This aspect is a critical

component in the interpretation of the IDEIA mandated free and appropriate public education (FAPE) that requires educators to monitor and report student progress for the purpose of efficient delivery of educational services and for accountability (Crockett & Yell, 2008; Drasgow, Yell, & Robinson, 2001).

Current special education accountability expectations go beyond compliance to procedural safeguards with specific focus on student achievement (Wolf & Hassel, 2001). For students who are excluded from state testing, some type of accountability is still required to account for variable responding and latency between milestones. For individuals with severe skill deficits, accountability measures that "involve multiple measures over time [that] result in more accurate and reliable information than one-shot assessment" should be the standard (Ysseldyke & Olsen, 1999, p. 183). Data collection on an individual level based on the IEP provides progress monitoring that can be used for instructional decision-making and individual accountability, as well as translated into the standard performance indicators used to assess system-wide accountability (McLaughlin & Thurlow, 2003).

Despite the availability of data collection systems, teachers indicate that this function is often neglected because of logistical concerns of collecting data during instruction and ongoing classroom management (Sandall, Schwartz, & LaCroix, 2004; Yell, Deno, & Marston, 1992; Walton, 1985; Wesson, King, & Deno, 1984). Yet, implementation of evidence-based instructional practices necessitates decisions based on systematic observational data in order to bridge the gap between research and practice (Heward, 2003). The absence of systematic and consistent observational data collection is an evidence of the research-to-practice gap,

suggesting a critical need for effective preservice and inservice teacher training in this area (Greenwood & Maheady, 1997; 2001; Morrier, Hess, & Heflin, 2011).

Considering the importance of progress monitoring for all students with a disability, including individuals with autism spectrum disorders (ASD), the next step is to determine the most appropriate manner in which to train teachers to collect data for accountability and to identify effective staff training models for teaching classroom teachers how to implement those procedures. The following section will review and discuss current research on personnel training methods in relation to the data collection skills identified.

Effective Teacher Training on Systematic Data Collection

Based on empirical findings, it can be expected that teachers who participate in effective staff development report a perceived increase in student functioning and learning (Lowden, 2006). One of the most common strategies employed to train teachers and human service workers (e.g., paraeducators) focuses on inservice workshops and conferences involving presentation of information to be implemented in the classroom (Lerman, Hovanetz, Strobel, & Tetreault, 2009). However, workshops or conferences alone have limited generalizability and may leave participants unprepared or with undeveloped skills that could be counter-productive or have no long term effect on student outcomes (Morrier et al., 2011; Smith, Parker, Taubman, & Lovaas, 1992; Stein, 1975; Suhrheinrich, 2011). Important facets of effective teacher training relate to specific strategies used to promote acquisition of the content presented in training, for example, content on evidence-based practices, written checklists, case examples within workshops, and performance feedback (Ducharme & Feldman, 1992). Of these various training

components, providing constructive feedback (Panyan, Boozer, & Morris, 1970; Pellecchia et al., 2011; Quilitch, 1975) as well as goal setting with reinforcers provided for meeting goals (Farmer, Wolery, Gast, & Page, 1988; Panyan et al., 1970; Quilitch, 1975) has shown to effectively increase staff performance. Additional components of training that have improved generalizability include general hands-on training as well as time to plan for implementation (Ducharme & Feldman, 1992; Mautone, Luiselli, & Handler, 2006; Noell et al., 2005; Penuel, Fishman, Yamaguchi, & Gallagher, 2007; Tschannen-Moran & McMaster, 2009).

Training Strategies and Components

The existing literature indicates that two of the most common alternatives to workshop-alone staff development involve combining workshop with on-the-job-training (e.g., prototypical staff training) and training the supervisors or other staff to train their co-workers (e.g., pyramidal staff training). Both intervention types contain training components that have demonstrated effective acquisition in a variety of settings and industries.

Pyramidal training, or training supervisors to train staff who work directly with students or clients, has increased appropriate staff behavior, which in return appears to improve student/ or client skills. Also known as trainer-of-trainer model, this training model has been shown that training supervisors to provide feedback to direct care staff helps maintain staff behavior over time (Parsons & Reid, 1995). It should be noted, however, that this method alone may have limited generalization effects (Page, Iwata, & Reid, 1982; Shore, Iwata, Vollmer, Lerman, & Zarcone, 1995). While maintenance effects are reported, the lack of generalization of outcomes could be a concern.

Another long-standing training model containing effective training components is prototypical staff training, or teacher training. A prototypical model offers the individualization that has been demonstrated to be effective for education and human service employees (Reid & Parsons, 2006). Prototypical training utilizes checklists to task analyze the steps of the targeted staff skill following a systematic format for introduction of the skill for the staff. The training steps include: (1) specify the skill; (2) provide a checklist of the skill; (3) describe the skill and its rationale; (4) demonstrate the skill; (5) provide opportunities for staff to practice the skill; and (6) provide on-the-job performance feedback (Reid & Parsons, 2006). This model combines competency-based and performance-based component skills rather than just acquisition of knowledge. While the traditional workshop setting encompasses an example of methodology for competency-based training delivery, on-the-job training with feedback and follow-up provides opportunity for performance-based training (Reid et al., 2003).

An important aspect of training is not only the presentation of content material and acquisition of skills, but also maintenance and generalization of acquired skills to ensure success in applied settings. In fact, if acquired skills are not maintained, it is assumed that the purpose of training has not been attained. To encourage maintenance, an appropriate criterion level must be reached prior to fading the performance feedback, and the trained behavior should be placed under a natural contingency of reinforcement (Arco, 1991). It has been shown that training supervisors to provide feedback to direct care staff helps maintain staff behavior over time (Parsons & Reid, 1995). Including the pyramidal staff training component with the effective prototypical model can assist with transferring the responsibility of feedback delivery from the interventionist to trained supervisors in order to promote maintenance (Haberlin,

Beauchamp, Agnew, & O'Brien, 2012). This involves consultant trainers providing staff training to supervisors and participating in the supervisors' training of the direct care staff. This model has shown increases in both the training behavior of supervisors and content learning of direct care staff (Ducharme, Williams, Cummings, Murray, & Spencer, 2001).

The prototypical training model has been shown to be effective across various disciplines involving personnel training. Research in the labor industry supports the use of a combination of off- and on-the-job training components to enhance worker performance in skills required of tradesmen, which encourages the question across professions of the effectiveness of informational and hands-on training (Harris, Simons, Willis, & Carden, 2003). The use of checklists and charts has been effective for increasing staff caregiver target responses with school students and hospitalized patients (Kunz, et.al, 1982), whereas the combination of in-service with on-the-job follow-up was effective in teaching direct care staff and teachers to work with individuals with severe disabilities (Owston, Wideman, Murphy, & Lupshenyuk, 2008; Parsons, Reid, & Green, 1993). Staff in behavior-based programs have shown increases in teaching skills for children and adolescents with ASD in natural settings and structured teaching environments using components of prototypical training (Palmen, Didden, & Korzilius, 2010; Suhrheinrich, 2011; Weinkauf, Zeug, Anderson, & Ala'i-Rosales, 2011). Additionally, self-management training embedded in a prototypical approach using data collection/checklists and graphing following a workshop was utilized to increase fidelity of performance procedures in direct care staff (Burgio, Whitman & Reid, 1983; Kissel, Whitman, & Reid, 1983). While valuable information can be presented in workshop training, issues might

arise in the generalization of the skills presented from the workshops to applied setting of the classroom.

Training in Data Collection and Analysis

When identifying effective training programs, it is important to review not only the need for training and available effective training strategies, but also the skills on which the training content needs to focus. Systematic observational data collection and decision-making encompass the component skills needed to track progress, make instructional changes based on that progress, and maintain legal accountability to the students and their families. The importance and requirement of systematic observational data collection has been discussed, along with effective components of teacher training. Next, specific skills related to data collection and analysis are presented.

Methods of Data Collection

Systematic observational data collection and progress monitoring for documentation are essential components of programming in special education programs (Fuchs & Fuchs, 1986; Gunter, Callicott, Denny, & Gerber, 2003). There is a variety of methods for collecting performance data for the purpose of documentation of progress, such as forms and data sheets containing learning objectives (Cheney, 2000; Lerman et al., 2009; Romanczyk, 1996), portfolios (Carothers & Taylor, 2003), visual permanent products (Suarez, 2010) and electronic systems (e.g., Graff, 2007; Saunders, Saunders, & Saunders, 1993). Comparisons have been made between electronic and handwritten data collection methods in an attempt to improve logistical concerns for data collection. Results vary by product but indicate no significant

differences in accuracy between the two methods with handwritten data collection occurring slightly faster than electronic (Tarbox, Wilke, Findel-Pyles, Bergstrom, & Granpeesheh, 2009). Regardless of the method, systematic observational data collection systems support observable and measurable change and should be created and tailored to student goals and objectives to make progress monitoring more systematic and manageable (McLaughlin, 1993; Schwartz, & Olswang, 1996).

Frequency of Data Collection

Another consideration relates to the format of data collection systems in order to increase efficiency and time management in the classroom, balancing a need for progress monitoring without disrupting quality instruction. One way to address the logistical concerns regarding continuous data collection is to utilize intermittent probe data collection as an alternative to monitor progress and decrease the amount of time devoted to data collection rather than teaching (Cummings, 2005; Cummings & Carr, 2009; Najdowski et al., 2009; Van Acker, Grant, & Getty, 1991). The existing literature indicates divergent views regarding the frequency of data collection for a single objective at differing stages of learning (Alberto & Troutman, 2009; Webber & Scheuermann, 2008). While some authors suggest that daily data collection is more preferable for superior outcomes (Fuchs & Fuchs, 1986), others suggest that more frequent data collection is warranted when a new skill is introduced (Webber & Scheuermann, 2008).

Resources and Strategies

It has been suggested that a lack of connection between IEP objectives and behaviors observed in the classroom might lead to a decrease in the likelihood for classroom staff to collect continuous or consistent data (Sandall et al., 2004). Goals and objectives included in IEPs should be observable, measurable, and include a specific dimension of behavior to be measured (i.e., rate, duration, latency) (Alberto & Troutman, 2009; Cooper, Heron, & Heward, 2007).

Whether probe or continuous data are collected daily or data are recorded only a few times per week for an objective, most students do not have only a single objective on their IEP. Data should be collected for all objectives at some point throughout the week and this will most likely mean that data need to be collected for multiple objectives per day. Efficient practices in data collection include recording responses as they occur during instructional activities using observational recording techniques (Webber & Schuermann, 2008). Ensuring that data collection materials are available and accessible to the classroom team promotes the likelihood that frequent, efficient and accurate data collection will occur. Regardless of the method, data should be collected systematically and consistently in order to make educated and informed decisions regarding student progress and to demonstrate accountability.

Another solution to logistical concerns is utilizing all the staff resources within a classroom team. When available in a classroom, paraeducators with support from the lead teacher can be a valuable resource to assist in data collection of progress, in addition to their other responsibilities (Jones, Ratcliff, Sheehan, & Hunt, 2012). The use of required documentation as a staff development tool has changed the ways in which educators

collaborate and work to change their documentation behavior as a group (Given et al., 2010). Other team members (i.e., speech therapists, occupational therapists, etc.), students, or peers could also be valuable resources for progress tracking in a classroom (Cooke, Heward, Test, Spooner, & Courson, 1991).

Graphing Data and Data-Based Decision-Making (DBDM)

When increases in desired target behaviors are observed, teachers tend to accurately identify the trend without daily data collection; however, for variable, unchanging or decreases in student performance or behavior, accurate interpretation of data appears to be compromised (Munger & Lloyd, 1989; Munger, Snell, & Lloyd, 1989). This also suggests a need to assess the use and interpretation of the data collected. Making individualized instructional changes based on student data has been linked to increased student achievement (Stecker & Fuchs, 2000).

Graphing data is a way to incorporate visual analysis into daily progress monitoring to assist in data-based decision-making. Even when teachers report that they collect systematic observational data on student behavior, only a small number indicate using graphing as a data collection and decision-making tool (Cooke et al., 1991). Graphing numerical data assists in informed decision-making by allowing for ongoing visual inspection of data as a reflection of student performance and teaching effectiveness (Cooper et al., 2007; Utley, Zigmond, & Strain, 1987). It is critical to include both of these procedures in professional development activities for teachers and training teams (Fuchs & Fuchs, 1986; Hojnoski et al., 2009).

Purpose of the Literature Review

Legal and best-practice requirements indicate a need for systematic observational data collection and data-based decision-making for teachers of students with disabilities, not only because this is good practice but also because application of this skill will help to close the research-to-practice gap. This warrants an investigation into the effectiveness of a long-researched training strategy specifically for data collection skills in the classroom. The purpose of this review and meta-analysis is to: (1) Review the literature to identify the published research investigating the effect of the prototypical staff training model (i.e., workshop training with on-the-job follow-up) on the extent and quality of data collection by teachers of students with disabilities; and (2) Determine the outcomes and general effectiveness of the prototypical staff training model with the data collection skills of teachers with students served by special education programs through meta-analysis.

Method

Study Identification and Selection

To identify published research in order to conduct a meta-analysis, an university-accessible EBSCO-host research database service was utilized with multiple databases related to education and the social sciences (e.g., Academic Search Complete; Education Research Complete; ERIC; Family & Society Studies Worldwide; Family Studies Abstracts; Health and Psychosocial Instruments; Health Source - Consumer Edition; MasterFILE Premier; Professional Development Collection; PsycARTICLES; PsycCRITIQUES; Psychology and Behavioral Sciences Collection; PsycINFO; Social Sciences Abstracts (H.W. Wilson); SocINDEX with Full Text;

TOPICsearch). Studies published between 1975-2012 were explored using specific search terms and combinations that included: *data analysis, data analysis and education, data analysis and teacher, data collection and teacher, data collection and analysis, data analysis and teacher and training, data collection and teacher and training, preservice and teacher training, preservice and teacher training and data, data-based decision-making, systematic observational data collection and education, inservice and teacher training and data, data-based decision-making and training, data-based decision-making and classroom, accountability in education, data collection and professional development and teacher*. Articles unavailable electronically were obtained manually through the library or requested through library loan procedures. Reference lists for identified articles were also reviewed for additional articles meeting eligibility criteria, and any such articles were located either electronically or in paper format.

Inclusion-Exclusion Criteria

To be included in this analysis, studies were examined using specific inclusion and exclusion criteria (Kokina & Kern, 2010; Odom et al., 2005; Shukla-Mehta, Miller, & Callahan, 2010). Collectively, studies met the inclusion criteria if they: (1) Examined teacher training interventions including workshop and classroom follow-up for data collection skills (including data collection and analysis and data-based decision-making); (2) Were published in peer-reviewed sources between 1975 and 2012; (3) Followed a research design that allowed for evaluation of intervention effects on performance (beyond satisfaction/perspective scales) (Shukla-Mehta et al., 2010); (4) Were conducted in a public or private school; (5) Included participants working with students ages 3-21 years with special education eligibility as teachers

or paraprofessionals; and (6) Were published in the English language. Contrarily, studies met the exclusion criteria if they: (1) Utilized a non-experimental research design and/or procedures; (2) Were published in journals or magazines that were not peer-reviewed; (3) Conducted in a setting other than a public or private school (e.g., a residential facility for adults); (4) Included participants working with individuals without an eligibility for special education services or outside the 3-21 year age group; and (5) Were published in a language other than English.

Studies were identified within these search parameters and combination of key words (i.e., data collection and analysis plus education, data analysis and teachers, data collection and analysis, preservice and teacher training). Of those narrowed results (n=10,644), most were excluded for participant population (i.e., participants working with individuals without an eligibility for special education services or outside the 3-21 year age group), setting (i.e., setting other than a public or private school), and studies with non-experimental research designs and procedures. Following these exclusions, a smaller sample was reviewed (n=277) using the inclusion criteria. Of these 277 studies, only five studies (n=5) met all the parameters of the inclusion criteria. Thus, this review of the literature analyzes research on the effects of prototypical staff training packages containing components of workshop (in-service training), follow-up on-the-job training, and performance feedback on skill development for data collection and analysis in schools (Browder, Karvonen, Davis, Fallin, & Courtade-Little, 2005; Codding, Skowron, & Pace, 2005; Farmer et al., 1988; Hundert, 1982; Pellecchia et al., 2011).

Data Analysis

The analysis of published research was conducted by evaluating the reported effect size of individual studies and by evaluating the methodological parameters to determine whether or not the studies met the scientific merit criteria for high quality research (Reichow, Volkmar, & Cicchetti, 2008). The latter assessment was included because several of the articles did not report effect size and it was important to include a strategy that compared all studies on the same scale. The scientific merit rating scale was created by Reichow and colleagues (2008; 2011) to evaluate the methodological parameters of studies to determine whether or not interventions for individuals with ASD met the criteria for evidence based practice (EBP). These criteria were selected for this meta-analysis because it allowed for comparison of the effectiveness of interventions for both single subject and group design studies, as was the case in this review of research on prototypical staff training with data collection.

The scientific merit rating scale is a concurrently validated method combining primary quality indicators and secondary quality indicators of EBP for group and single subject designs, strength ratings for research reports (i.e., Strong, Adequate, and Weak), and criteria for determining the level of EBP (i.e., Established EBP, Promising/Probable EBP, and Not EBP) (Reichow, Doehring, Cicchetti, & Volkmar, 2011; Reichow et al., 2008). The level of EBP can be calculated by using Reichow et al.'s Formula: $(Group_S*30) + (Group_A*15) + (SSED_S*4) + (SSED_A*2) = Z,$ where $Group_S$, is the total number of group design research studies with a strength rating of strong; $Group_A$ is the total number of group design research studies with a strength rating of adequate; $SSED_S$ is the total number of single subject research design studies

with a strength rating of strong; $SSED_A$ is the total number of single subject research design studies with a strength rating of adequate.

This evaluative method was originally developed to identify evidence-based practices for participants diagnosed with ASD. Although the participants in this review were not individuals with ASD, the students targeted by the participants were eligible for special education services, including ASD. Therefore, one modification that was made for this meta-analysis was for one primary indicator involving participant characteristics. Instead of assessing whether participant characteristics included age, gender, specific diagnostic information with standardized test scores for all participants with ASD (Reichow et al., 2008), for the purposes of this review, the participant primary indicator was scored as present on the evaluative method rubric (i.e., "Yes") if the following was reported: (1) the participant's gender, years of experience, and/or age; and (2) the number and characteristics of the target students with whom the participants worked during the study.

Results and Discussion

Characteristics of Studies Reviewed

Participants targeted in training programs included combinations of teachers with special education certification or background (Codding et al., 2005), paraeducators and teachers in special education programs (Farmer et al., 1988), students with disabilities and their teachers (Browder et al., 2005; Hundert, 1982), and teams of consultants, teachers, and paraeducators (Pellecchia et al. 2011). The majority of target students taught by participants included or was comprised only of students with ASD, but also included multiple impairments

with intellectual functioning in the range of moderate or severe/profound disability (Browder et al., 2005; Farmer et al., 1985), language delays, cerebral palsy, visual impairments (Farmer et al., 1985), and comorbid conditions (e.g., ASD with hearing loss, intellectual disability with hearing loss, emotional disturbance with hearing loss) (Hundert, 1982), and acquired brain injury (Codding et al., 2005). Settings for these studies included private and public schools serving preschool through elementary aged students. The characteristics of the reviewed studies ate presented in Table A.1.

With respect to specific training components, the prototypical training model utilized written manuals in some cases (Browder et al., 2005; Hundert, 1982), delivered workshop/ inservice and provided in-class follow-up feedback sessions to increase a variety of data collection skills. This training model targeted data collection and decision-making skills ranging from frequency of data collection (Farmer et al., 1988; Pellecchia et al., 2011), percentage of observed data collection skills and procedures (Codding et al., 2005; Hundert, 1982), pre- and posttest knowledge of data collection components (Farmer et al., 1988), and pre-and posttest scores from state alternative assessment portfolios (Browder et al., 2005). The specific components of the independent and dependent variables are described in Table A.2.

Outcomes

Relatively few studies have been conducted on the effects of prototypical training on data collection behavior in the published literature. Findings from studies that have utilized the prototypical staff/teacher training program show that the combination of workshop, in some cases a checklist or manual and handbook, and in-classroom performance feedback were

effective in increasing the targeted data collection and data-based decision making skills of participants. Research has also shown that teacher data collection skills generalized beyond the target students in the classroom to other students, and in some cases, other goals (Farmer et al., 1988; Pellecchia 2011). Training teachers in data collection skills affects IEP progress monitoring and alternative assessment ability, and may override any individual characteristics of students that impede learning, resulting in more efficient instruction based on data-based decisions (Browder et al., 2005). Training teachers to measure behavior might not have been sufficient to change student responding without training them to make decisions based on the measurement.

Group training (i.e., workshop) showed no results in one study, but authors suggest it may be a necessary prerequisite for effective skill acquisition (Farmer et al., 1988). A combination of workshop and in-classroom training with feedback was found to be cost-effective and time-efficient, easily implemented in a preschool environment (Farmer et al., 1988).

In addition, group performance feedback provided not just to classroom teachers, but also to the team, can be effective in increasing skills of each member of the team (or the team as a whole) (Pellecchia et al., 2011). Training for teachers should not only utilize an in-classroom component with feedback, in addition to any group instruction workshops, but should include both IEP progress monitoring and alternative assessment (Browder et al., 2005), graphing and data-based decision making (Hundert, 1982), and systematic thinning of the feedback schedule to bring under the control of natural reinforcers (Farmer et al., 1988).

Table A.1.

Characteristics of Studies Included in Meta-Analysis

Author(s)	Design	Participants	Setting	Characteristics of the Target Students
Browder, Karvonen, Davis, Fallin, & Courtade-Little (2005)	Group Design; Quasi-experimental Pretest-post-test with Control Group	Teachers working with special education programs (n=25) Students with disabilities-experimental group (n=28) Students with disabilities-control group (n=285)	Urban school district k-12	Experimental group (n=28): ASD=36%, Moderate Mental Disability=39%, Severe/profound mental disability=21%, Multiple impairments=4%, Other=0% Control group (n=285): ASD=26%, Moderate Mental Disability=34%, Severe/profound mental disability=16%, Multiple impairments=17%, Other=7%
Codding, Skowron, & Pace (2005)	Single Subject, MBL across Participants	Teachers with background in special education (n=3)	Private school for brain injury	Intervention phase: Simulated data Maintenance phase: Students with acquired brain injury
Farmer, Wolery, Gast, & Page (1988)	Single Subject, MBL across Participants	Teachers and paraeducators (n=4)	Integrated private school	n=8 Students with moderate to severe intellectual disability, language delays, cerebral palsy, and visual impairments
Hundert (1982)	Single Subject, MBL across Participants	Teachers of special education programs (n=2) Students in the classes of the teacher participants (n=4)	Large school for the deaf	n=4 Students with “Multi-handicap”: ASD, intellectual disability, or emotional disturbance by independent diagnosis; all had tested hearing loss
Pellecchia et al. (2011)	Single Subject; MBL across Classroom Teams	Teams in four classrooms (n=4): Consultants (n=4); Teachers certified in early childhood or special education (n=4); Paraeducators (n=8)	Public early intervention program	n=32 after attrition Students with ASD independent diagnosis

Table A.2

Target Data Collection Skills and Intervention Components

Author(s)	Target Data Collection Skills (DV)	Intervention Components (IV)
Browder, Karvonen, Davis, Fallin, & Courtade-Little (2005)	North Carolina Alternative Assessment Portfolio (NCAAP): data sheets with BL data and progress, additional evidence (e.g., anecdotal, work samples, video, etc.) in the areas of curriculum access, data collection, instructional effectiveness as measured by: NCAAP scores	Manual, 3 inservice days (PP slides, video examples, and application activities), 3 onsite follow-up visits from training staff
Codding, Skowron, & Pace (2005)	Percentage of steps correctly completed in CBM in the categories of assessment information, current performance, annual goal, benchmarks	All previously attended a workshop on CBM (prior to start of study) Packet, modeling, practice & performance feedback; 1:1 in the classroom
Farmer, Wolery, Gast, & Page (1988)	Percentage of objectives on which participants collected data	Group inservice, individual instruction sessions, feedback
Hundert (1982)	Percent correct of behavior modification procedures (writing measurable behavior definitions, measuring behavior, and examining functional relationships between changes in teaching and student responding)	Written instructions manual, individual training sessions with practice, feedback, and question/answer
Pellecchia et al. (2011)	Percentage of daily data points collected by each team during daily activities where instruction occurred	Performance feedback sessions within the classroom provided by team consultant (Consultant received training prior to study

Effectiveness of the Prototypical Teacher Training Intervention

As noted previously, effectiveness of the prototypical teacher training model was conducted by assessing the reported effect size of individual studies and by evaluating the methodological parameters to determine whether or not the studies met the scientific merit criteria for high quality research (Reichow, Volkmar, & Cicchetti, 2008). In this review, only two of the five published studies reported effect sizes in their results. The magnitude of effect of the intervention was in the medium range in one study (Browder et al., 2005) and high in the other (Pellecchia et al., 2011). Additionally, the prototypical teacher training model for data collection skills for special educators could be considered to be a promising or probable evidence-based practice (Z=42 points), based on the scientific rating scale or evaluative method for evaluating the quality of the research methodology (Reichow et al., 2008).

The limited number of studies identified in this review and the alteration of the participant primary quality from the evaluative method (Reichow et al., 2008) to adjust for the participant population targeted in this review must be considered when interpreting these results. Additional studies using prototypical staff training interventions to train data collection skills for teachers and classroom staff should be conducted to further evaluate the effectiveness of this intervention. In addition, the evaluative method should be further tested to determine its validity for other participant populations beyond individuals with ASD.

Implications

The authors of the body of research in this area note several implications for future lines of research in the area of training staff or teachers on data collection and data-based decision

making. It was suggested that priming effects of group instruction (i.e., workshop) prior to individual training should be investigated (Codding et al., 2005). Future research might also examine types of training and the effect on different instructional goals, as well as the relative benefits and cost for specific instructional problems (Hundert, 1982) or the use of external consultants in training programs (Pellecchia et al., 2011). Specific focus should be placed on the effects of these training components on using the data they have collected to make instructional decisions (Pellecchia et al., 2011). The results have implications for training on data collection skills for staff or teachers.

As summarized earlier, in most of the studies identified the majority of target students taught by participants included or comprised only of students with ASD. Accountability through data collection on IEP objectives is required and essential for the formative evaluation of progress for all students with disabilities. However, documentation of ongoing educational performance and progress is particularly crucial for students with ASD for several reasons.

Table A.3

Outcomes and Effectiveness of Studies: Effect Size Calculated or Not

Effect Size Calculated	Author(s)	Outcomes	Evaluative Method of Research*	Overall Effectiveness of Intervention (Rating)
Yes	Reichow et al., 2011			
No	Codding, Skowron, & Pace (2005)	Effectiveness of the individual training and feedback was demonstrated	• 3/7 Secondary Quality Indicators • 5/6 Primary Quality	Adequate
No	Farmer, Wolery, Gast, & Page (1988)	• Group workshop training showed no results • Workshop may be a necessary prerequisite • Prototypical training cost	• 6/6 Primary Quality Indicators* • 4/7 Secondary Quality Indicators	Strong

First, the pervasive nature of the disorder results in multiple skill deficits across domains, for example, deficits in social communication, interaction skills, and nonfunctional routines (American Psychiatric Association, 2000). Keeping track of progress on a variety of skills and domains necessitates systematic documentation of progress. Second, early and intensive intervention using evidence-based practices is recommended for students with ASD to ameliorate the severity of functional deficits. This recommendation is a requirement for FAPE under IDEIA (Fenske, Zalenski, Krantz, & McClannahan, 1985; Freeman, 1997; McEachin, Smith, & Lovaas, 1993; Yell et al., 2003). This requires programming for each core skill deficit area and progress-monitoring (Alberta Education, 2006; Colorado University Center for Collaborative Educational Leadership, 1998; Lovaas, 1987; Ogletree & Oren, 2001). Third, the current prevalence of ASD, as estimated by the Centers for Disease Control (CDC), appears to be rising for both boys and girls and averages at 1 in every 50 children (Blumberg et al., 2013). This rise in rate presents an increase in the number of students requiring services, and consequently the cost of educational resources needed to ensure FAPE and providing accountability. Finally, the progress-monitoring component is designed to comprehensively address effectiveness of instruction on the acquisition and fluency of skills identified as deficits, observe and monitor maintenance of these skills, and track generalization of skills already learned and mastered. In addition to legal requirements and evidence-based recommendations, public support has been provided by parents, teachers and administrators who indicate the need for data collection as an important component of educational programming for individuals with ASD (Callahan, Henson, & Cowan, 2008).

Conclusion

The current requirements of IDEA and socially-validated expectations for EBP in data collection in the classrooms of individuals with disabilities have created a need to examine training of teachers and classroom staff. These staff members are expected to implement EBP within their classrooms, so it follows then that training programs should incorporate current training research to ensure that the training of our educators also follows EBP in training. Prototypical staff (i.e., teacher and classroom staff) training programs in data collection skills, although limited, have shown to be a promising or potential EBP. Incorporating the components of prototypical training (e.g., workshop, modeling, checklists and manuals, on-the-job in-classroom follow-up, reinforcers and goal setting, and supervisor training with transfer) into research and training for preservice and current teachers and classroom staff is warranted to continue to determine best practice for training data collection skills.

References

Studies with an (*) next to them were included in the meta-analysis.

Alberta Education. (2006). *Essential components of educational programming for students with behaviour disabilities. Standards for special education*. Edmonton, Alberta: Author. Retrieved from ERIC database

Alberto, P. A., & Troutman, A .C. (2009). *Applied behavior analysis for teachers* (8th ed.). Upper Saddle River, NJ: Merrill.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (Revised 4th ed.). Washington, DC: Author.

Arco, L. (1991). Effects of outcome performance feedback on maintenance of client and staff behavior in a residential setting. *Behavioral Residential Treatment*, *6*, 231-247. Retrieved from Academic Search Complete database

*Browder, D., Karvonen, M., Davis, S., Fallin, K., & Courtade-Little, G. (2005). The impact of teacher training on state alternate assessment scores. *Exceptional Children*, *71*, 267-282. Retrieved from Academic Search Complete database

Blumberg, S.J., Bramlett, M.D., Kogan, M.D., Schieve, L.A., Jones, J.R., & Lu, M.C. (2013). Changes in prevalence of parent-reported autism spectrum disorder in school-aged U.S. children: 2007 to 2011-2012. National Health Statistics Reports, 65, 1-8. Retreived from www.cdc.gov/nchs/data/nhsr/nhsr065.pdf.

Burgio, L. D., Whitman, T. L., & Reid, D. H. (1983). A participative management approach for improving direct-care staff performance in an institutional setting. *Journal of Applied Behavior Analysis*, *16,* 37-53. Retrieved from PubMed Central.

Burns, E. (2001). *Developing and implementing IDEA-IEPs: An individualized education program (IEP) handbook for meeting individuals with disabilities education act (IDEA) requirements*. Springfield, IL: C.C. Thomas.

Callahan, K., Henson, R., & Cowan, A. (2008). Social validation of evidence-based practices in autism by parents, teachers, and administrators. *Journal of Autism and Developmental Disorders*, *38*, 678-692. Retrieved from E-Journals database

Carothers, D., & Taylor, R. (2003). The use of portfolios for students with autism. *Focus on Autism and Other Developmental Disabilities*, *18*, 125-128. doi:10.1177/108835760301800206.

Cheney, C. O. (2000). Ensuring IEP accountability in inclusive settings. *Intervention in School & Clinic*, *35*, 185-189. Retrieved from Academic Search Complete database

*Codding, R., Skowron, J., & Pace, G. (2005). Back to basics: Training teachers to interpret curriculum-based measurement data and create observable and measurable objectives. *Behavioral Interventions*, *20*, 165-176. doi:10.1002/bin.194.

Colorado University Center for Collaborative Educational Leadership. (1998). *Social skills classroom training packet. LEAP outreach project*. Retrieved from ERIC database

Cooke, N., Heward, W. L., Test, D. W., Spooner, F., & Courson, F. H. (1991) Student performance data in the classroom: Measurement and evaluation of student progress. *Teacher Education and Special Education, 14*, 155-161. Retrieved from ERIC database

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). Measuring behavior. In *Applied Behavior Analysis* (2nd ed.). Upper Saddle River, NJ: Pearson.

Crockett, J. B., & Yell, M. L. (2008). Without data all we have are assumptions: Revisiting the meaning of a free appropriate public education. *Journal of Law & Education, 37*, 381-392.

Cummings, A. R., & Carr, J. E. (2009). Evaluating progress in behavioral programs for children with autism spectrum disorders via continuous and discontinuous measurement. *Journal of Applied Behavior Analysis, 42*, 57-71. doi:10.1901/jaba.2009.42-57

Cummings, A. R. (2005). *Evaluating progress in behavioral programs for children with pervasive developmental disorders: Continuous versus intermittent data collection*. Unpublished doctoral dissertation. Western Michigan University.

Drasgow, E., Yell, M., & Robinson, T. (2001). Developing legally correct and educationally appropriate IEPs. *Remedial & Special Education*, *22*, 359-373. Retrieved from Education Research Complete database

Ducharme, J. M., & Feldman, M. A. (1992). Comparison of staff training strategies to promote generalized teaching skills. *Journal of Applied Behavior Analysis, 25*, 165-179. doi:10.1901/jaba.1992.25-165

Ducharme, J. M., Williams, L., Cummings, A., Murray, P., & Spencer, T. (2001). General case quasi-pyramidal staff training to promote generalization of teaching skills in supervisory and direct-care staff. *Behavior Modification, 25*, 233-254. doi:10.1177/0145445501252004

*Farmer, R., Wolery, M., Gast, D. L, & Page, J. L. (1988). Individual staff training to increase the daily mean frequency of data collection in an integrated preschool program. *Education and Treatment of Children, 11*, 127-142. Retrieved from ERIC database

Fenske, E.C., Zalenski, S., Krantz, P.J., & McClannahan, L.E. (1985). Age at intervention and treatment outcome for autistic children in a comprehensive intervention program. *Analysis and Intervention in Developmental Disabilities, 5*, 49-58. Retrieved from Education Research Complete database

Freeman, B. (1997). Guidelines for evaluating intervention programs for children with autism. *Journal of Autism and Developmental Disorders*, *27*, 641-651. Retrieved from E Journals database

Fuchs, L., & Fuchs, D. (1986). Effects of systematic formative evaluation: A meta-analysis. *Exceptional Children*, *53*, 199-208. Retrieved from Education Research Complete database

Given, H., Kuh, L., LeeKeenan, D., Mardell, B., Redditt, S., & Twombly, S. (2010). Changing school culture: Using documentation to support collaborative inquiry. *Theory Into Practice, 49*(1), 36.

Graff, H. (2007). Technology adoption and usage of a data collection tool in a school setting servicing students with autism: A qualitative look at the process and perspectives. *Dissertation Abstracts International Section A*, 68, Retrieved from PsycINFO database

Greenwood, C. R., & Maheady, L. (1997). Measurable change in student performance: Forgotten standard in teacher preparation? *Teacher Education and Special Education: The Journal of the Teacher Education Division of the Council for Exceptional Children, 20*, 265-275. doi:10.1177/088840649702000307

Greenwood, C. R., & Maheady, L. (2001). Are Future Teachers Aware of the Gap Between Research and Practice and What Should They Know? *Teacher Education and Special Education: The Journal of the Teacher Education Division of the Council for Exceptional Children, 24*, 333-347. doi:10.1177/088840640102400407

Gunter, P., Callicott, K., Denny, R., & Gerber, B. (2003). Finding a place for data collection in classrooms for students with emotional/behavioral disorders. *Preventing School Failure*, *48*, 4-8. Retrieved from Academic Search Complete database

Haberlin, A. T., Beauchamp, K., Agnew, J., & O'Brien, F. (2012). A comparison of pyramidal staff training and direct staff training in community-based day programs. *Journal of Organizational Behavior Management, 32*, 65-74. doi:10.1080/01608061.2012.646848

Harris, R., Simons, M., Willis, P., & Carden, P. (2003). Exploring complementarity in on- and off-job training for apprenticeships. *International Journal of Training and Development*, *7*, 82-92. doi:10.1111/1468-2419.00173

Heward, W. L. (2003). Ten faulty notions about teaching and learning that hinder the effectiveness of special education. *Journal of Special Education, 36*, 186-205. doi:10.1177/002246690303600401

Hojnoski, R. L., Caskie, G. I., Gischlar, K. L., Key, J. M., Barry, A., & Hughes, C. L. (2009). Data display preference, acceptability, and accuracy among urban head start teachers. *Journal of Early Intervention, 32*, 38-53. doi:10.1177/1053815109355982

*Hundert, J. (1982). Training teachers in generalized writing of behavior modification programs for multihandicapped deaf children. *Journal of Applied Behavior Analysis*, *15*, 111-122. Retrieved from PubMed Central

Individuals with Disabilities Education Act. (1990). 20 U.S.C. § 1400 *et seq.*

Individuals with Disabilities Education Act Amendments. (1997). 20 U.S.C. § 1415.

Individuals with Disabilities Education Improvement Act, (2004). H.R. 1350, 108th Congress.

Jones, C., Ratcliff, N., Sheehan, H., & Hunt, G. (2012). An analysis of teachers' and paraeducators' roles and responsibilities with implications for professional development. *Early Childhood Education Journal, 40*, 19-24. doi:10.1007/s10643-011-0487-4

Kissel, R. C., Whitman, T. L., & Reid, D. H. (1983). An institutional staff training and self-management program for developing self-care skills in severely/profoundly retarded individuals. *Journal of Applied Behavior Analysis* , *16*, 395-415. Retrieved from PubMed Central

Kokina, A., & Kern, L. (2010). Social story interventions for students with autism spectrum disorders: A meta-analysis. *Journal of Autism and Developmental Disorders, 40*, 812-826. doi:10.1007/s10803-009-0931-0

Kunz, G. G, Lutzker, J. R., Cuvo, A. J., Eddleman, J., Lutzker, S. Z., Megson, D., & Gulley, B. (1982). Evaluation strategies to improve careprovider performance on health and developmental tasks in an infant care facility. *Journal of Applied Behavior Analysis, 15,* 521-531. Retrieved from PubMed Central

Lerman, D., Hovanetz, A., Strobel, M., & Tetreault, A. (2009). Accuracy of teacher-collected descriptive analysis data: A comparison of narrative and structured recording formats. *Journal of Behavioral Education*, *18*, 157-172. doi:10.1007/s10864-009-9084-7

Lovaas, O. I. (1987). Behavioral treatment and normal educational and intellectual functioning in young autistic children. *Journal of Consulting and Clinical Psychology, 55*, 3-9. Retrieved from PsycINFO database

Lowden, C. (2006). Reality check: Survey highlights the disparity between the ideal and real in professional learning programs. *Journal of Staff Development*, *27*, 61-64. Retrieved from ERIC database

Mautone, J., Luiselli, J., & Handler, M. (2006). Improving implementation of classroom instruction through teacher-directed behavioral consultation: A single-case demonstration. *International Journal of Behavioral Consultation & Therapy*, *2*, 432-438. Retrieved from Academic Search Complete database

McEachin, J. J., Smith, T., & Lovaas, O. I. (1993). Long-term outcome for children with autism who received early intensive behavioral treatment. *American Journal of Mental Retardation, 4*, 359-372. Retrieved from Education Research Complete database

McLaughlin, T. (1993). An analysis and evaluation of educator selected data collection procedures in actual school settings. *Child & Family Behavior Therapy*, *15*, 61-64. Retrieved from E-Journals database

McLaughlin, M. J., & Thurlow, M. (2003). Educational accountability and students with disabilities: Issues and challenges. *Educational Policy, 17*, 431-451. doi:10.1177/0895904803254962

Morrier, M. J., Hess, K. L., & Heflin, L. J. (2011). Teacher training for implementation of teaching strategies for students with autism spectrum disorders. *Teacher Education and Special*

Education: The Journal of the Teacher Education Division of the Council for Exceptional Children, 34, 119. doi:10.1177/0888406410376660

Munger, G., & Lloyd, B. (1989). Effects of daily mean frequency of data collection and graph characteristics on visual inference. *Assessment For Effective Intervention (AEI)*, *14*, 112-124. Retrieved from E-Journals database

Munger, G., Snell, M., & Lloyd, B. (1989). A study of the effects of daily mean frequency of probe data collection and graph characteristics on teachers' visual analysis. *Research In Developmental Disabilities*, *10*, 109-127. Retrieved from MEDLINE database

Nadjowski, C. A., Chilingaryan, V., Bergstrom, R., Granpeesheh, D., Blasanyan, S., Aguilar, B., & Tarbox, J. (2009). Comparison of data-collection methods in a behavioral intervention program for children with pervasive developmental disorders: A replication. *Journal of Applied Behavior Analysis. 42*, 827-832.

No Child Left Behind (NCLB) Act of 2001, Pub. L. No. 107-110, § 115, Stat. 1425 (2002).

Noell, G., Witt, J., Slider, N., Connell, J., Gatti, L., Williams, K., Koenig, J. L., Resetar, J. L., & Duhon, G. J. (2005). Treatment implementation following behavioral consultation in schools: A comparison of three follow-up strategies. *School Psychology Review, 34*, 87–106.

Odom, S. L., Brantlinger, E., Gersten, R., Horner, R. H., Thompson, B., & Harris, K. H. (2005). Research in special education: Scientific methods and evidence-based practices. *Exceptional Children, 71*, 137-148.

Ogletree, B., & Oren, T. (2001). Application of ABA principles to general communication instruction. *Focus on Autism and Other Developmental Disabilities*, *16*, 102-109. Retrieved from Education Research Complete database

Owston, R., Wideman, H., Murphy, J., & Lupshenyuk, D. (2008). Blended teacher professional development: A synthesis of three program evaluations. *Internet and Higher Education*, *11,* 201-210. Retrieved from ERIC database

Palmen A., Didden R., & Korzilius H. (2010). Effectiveness of behavior skills training on staff performance in a job training setting for high-functioning adolescents with autism spectrum disorders. *Research in Autism Spectrum Disorders. 4*, 731-740.

Panyan, M., Boozer, H., & Morris, N. (1970). Feedback to attendants as a reinforcer for applying operant techniques. *Journal of Applied Behavior Analysis*, *3*, 1-4. Retrieved from PubMed Central

Parsons, M., & Reid, D. (1995). Training residential supervisors to provide feedback for maintaining staff teaching skills with people who have severe disabilities. *Journal of Applied Behavior Analysis*, *28*, 317-22. Retrieved from ERIC database

Parsons, M., Reid, D., & Green, C. (1993). Preparing direct service staff to teach people with severe disabilities: A comprehensive evaluation of an acceptable training program. *Behavioral Residential Treatment*, *8*, 163-185. Retrieved from Psychology and Behavioral Sciences Collection database

*Pellecchia, M., Connell, J. E., Eisenhart, D., Kane, M., Schoener, C., Turkel, K., Riley, M., & Mandell, D. S. (2011). We're all in this together now: Group performance feedback to increase classroom team data collection. *Journal of School Psychology, 49*, 411-431. doi:10.1016/j.jsp.2011.04.003

Penuel, W. R., Fishman, B. J., Yamaguchi, R., & Gallagher, L. P. (2007). What makes professional development effective? Strategies that foster curriculum implementation. *American Educational Research Journal, 44*, 921-958. doi:10.3102/0002831207308221

Quilitch, R. (1975). A comparison of three staff-management procedures. *Journal of Applied Behavior Analysis*, *8*, 59-66. Retrieved from PubMed Central

Reichow, B., Doehring, P., Cicchetti, D. V., & Volkmar, F. R. (2011). *Evidence-based practices and treatments for children with autism* (Eds.). New York, NY: Springer Science + Business Media, LLC.

Reichow, B. V., Volkmar, F. R., & Cicchetti, D. V. (2008). Development of the evaluative method for evaluating and determining evidence-based practices in autism. *Journal of Autism & Developmental Disorders*, *38*, 1311-1319. doi:10.1007/s10803-007-0517-7

Reid, D. H., & Parsons, M. B. (2006). *Motivating human service staff: Supervisory strategies for maximizing work effort & work enjoyment* (2nd ed.). Morganton, NC: Habilitative Management Consultants, Inc.

Reid, D. H., Rotholz, D. A., Parsons, M. B., Morris, L. A., Braswell, B. A., Green, C. W., & Shell, R. M. (2003). Training human service supervisors in aspects of PBS: Evaluation of a statewide, performance based program. *Journal of Positive Behavior Interventions, 5*, 35-46. doi:10.1177/10983007030050010601

Romancyzk, R. G. (1996). Behavioral analysis and assessment: The cornerstone to effectiveness. In C. Maurice, G. Green, & S. Luce (Eds.) *Behavioral intervention for young children with autism* (pp. 195-220). Austin, TX: Pro-ed.

Sandall, S., Schwartz, I., & Lacroix, B. (2004). Interventionists' perspectives about data collection in integrated early childhood classrooms. *Journal of Early Intervention*, *26*(3), 161-174. doi:10.1177/105381510402600301

Saunders, M., Saunders, J., & Saunders, R. (1993). A program evaluation of classroom data collection with bar codes. *Research in Developmental Disabilities*, *14*(1), 1-18. Retrieved from ERIC database

Schwartz, I., & Olswang, L. (1996). Evaluating child behavior change in natural settings: Exploring alternative strategies for data collection. *Topics in Early Childhood Special Education*, *16*(1), 82-101. doi:10.1177/027112149601600108

Shore, B. A., Iwata, B. A., Vollmer, T. R., Lerman, D. C., & Zarcone, J. R. (1995). Pyramidal staff training in the extension of treatment for severe behavior disorders. doi:10.1901/jaba.1995.28-323

Shukla-Mehta, S., Miller, T., & Callahan, K. J. (2010). Evaluating the effectiveness of video instruction on social and communication skills training for children with autism spectrum disorders: A review of the literature. *Focus on Autism and Other Developmental Disabilities, 25*, 23-36, doi:10.1177/1088357609352901

Smith, T., Parker, T., Taubman, M., & Lovaas, O. I. (1992). Transfer of staff training from workshops to group homes: a failure to generalize across settings. *Research In Developmental Disabilities*, *13*(1), 57-71. Retrieved from MEDLINE database

Sopko, K. (2003). *The IEP: A synthesis of current literature since 1997*. Alexandria, VA: National Association of State Directors of Special Education.

Stecker, P. M., & Fuchs, L. S. (2000). Effecting superior achievement using curriculum-based measurement: The importance of individual progress monitoring. *Learning Disabilities Research and Practice, 15*, 128–134.

Stein, T. (1975). Some ethical considerations of short-term workshops in the principles and methods of behavior modification. *Journal of Applied Behavior Analysis*, *8*(1), 113-115. Retrieved from MEDLINE database

Suarez, S. (2010). Show me again what I can do: Documentation and self-determination for students with social challenges. *Theory into Practice*, *49*(1), 21-28. Retrieved from E Journals database

Suhrheinrich, J. (2011). Examining the effectiveness of a train-the-trainer model: Training teachers to use pivotal response training. *Society For Research On Educational Effectiveness*. Retrieved from ERIC

Tarbox, J., Wilke, A., Findel-Pyles, R., Bergstrom, R., & Granpeesheh, D. (2009). A comparison of electronic to traditional pen-and-paper data collection in discrete trial training for children with autism. *Research in Autism Spectrum Disorders, 4*(1), 65-75. doi:10.1016/j.rasd.2009.07.008

Tschannen-Moran, M., & McMaster, P. (2009). Sources of self-efficacy: Four professional development formats and their relationship to self-efficacy and implementation of a new teaching strategy. *Elementary School Journal*, *110*(2), 228-245. Retrieved from ERIC database

Utley, B. L., Zigmond, N., & Strain, P. S. (1987). How various forms of data affect teacher analysis of student performance. *Exceptional Children, 53*, 411-422.

Van Acker, R., Grant, S. H., & Getty, J. E. (1991). Observer accuracy under two different methods of data collection: The effect of behavior frequency and predictability. *Journal of Special Education Technology, 11*, 155–166.

Walton, W. T. (1985). Educators' responses to methods of collecting, storing, and analyzing behavioral data. *Journal of Special Education Technology, 7*, 50–55.

Webber, J., & Scheuermann, B. (2008). *Educating Students with autism: A quick start manual.* Pro-ed: Austin, TX.

Wesson, C. L., King, R. P., & Deno, S. L. (1984). Direct and frequent measurement of student performance: If it's good for us, why don't we do it? *Learning Disability Quarterly, 7*, 45–48.

Wolf, P. J., & Hassel, B. C. (2001). Effectiveness and accountability (Part 1): The compliance model. In Int. Finn, Int. Rotherham, & Int. Hokanson (Eds.), *Rethinking Special Education for a New Century*. (pp. 53-75)Washington, D.C.: Thomas B. Fordham Foundation and the Progressive Policy Institute.

Yell, M., Deno, S. L., & Marston, D. B. (1992). Barriers to implementing curriculum-based measurement. *Diagnostique*, *18*, 99-112. Retrieved from ERIC database

Yell, M., Drasgow, E., & Lowrey, K. (2005). No child left behind and students with autism spectrum disorders. *Focus on Autism and Other Developmental Disabilities*, *20*, 130-139. Retrieved from Health Source - Consumer Edition database

Yell, M., Katsiyannis, A., Drasgow, E., & Herbst, M. (2003). Developing legally correct and educationally appropriate programs for students with autism spectrum disorders. *Focus on Autism and Other Developmental Disabilities*, *18*, 182-191. Retrieved from Health Source - Consumer Edition database

Yell, M., Katsiyannis, A., Ryan, J., McDuffie, K., & Mattocks, L. (2008). Ensure compliance with the Individuals with Disabilities Education Improvement Act of 2004. *Intervention in School and Clinic*, *44*, 45-51. Retrieved from ERIC database

Yell, M., Shriner, J., & Katsiyannis, A. (2006). Individuals with disabilities education improvement act of 2004 and IDEA regulations of 2006: Implications for educators, administrators, and teacher trainers. *Focus on Exceptional Children*, *39*, 1-24. Retrieved from Education Research Complete database

Yell, M., & Stecker, P. (2003). Developing legally correct and educationally meaningful IEPs using curriculum-based measurement. *Assessment for Effective Intervention*, *28,*73-88. Retrieved from ERIC database

Ysseldyke, J., & Olsen, K. (1999). Putting alternative assessments into practice: What to measure and possible sources of data. *Exceptional Children, 65*, 175-185.

APPENDIX B

EXTENDED LITERATURE REVIEW

Introduction

The Individuals with Disabilities Education Act (IDEA [P.L. 101–476]) of 1990 and its amendments of 1997 and 2004 emphasized the importance of measuring and documenting progress for individuals with disabilities. Subsequent legislation (e.g., No Child Left Behind Act [NCLB], 2002) has added additional accountability in the form of assessment and documentation by including individuals with disabilities in the requirement for adequate yearly progress (AYP; Sopko, 2003; Yell, Drasgow, & Lowery, 2005). IDEA (2004) requires public school districts to develop an individualized education plan (IEP) for each student who iseligible to receive special education services. The IEP must list learning objectives in a clear, observable and measurable manner in order to facilitate monitoring and documentation of progress (Burns, 2001; Yell & Stecker, 2003). It is a substantive violation of IDEA if data are not collected to determine student progress or if collected data are not utilized for educational decision-making (Yell, Katsiyannis, Drasgow, & Herbst, 2003).

With the reauthorization of IDEA in 2004, known as the Individuals with Disabilities Education Improvement Act (IDEIA), continued emphasis was placed on measurable objectives, ongoing measurement, and indication of the method of measurement within the IEP. These propositions were further reiterated in the IDEIA Regulations of 2006 (Yell, Katsiyannis, Ryan, McDuffie, & Mattocks, 2008; Yell, Shriner, & Katsiyannis, 2006). It is undisputed that documentation of student progress needs to be based on data collected in a systematic and scientific manner and educational decisions made on the basis of these data. This aspect is a critical component in the interpretation of the IDEIA mandated “free and appropriate public education” (FAPE), requiring educators to monitor and report student progress for the purpose

of efficient delivery of educational services and for accountability (Crockett & Yell, 2008; Drasgow, Yell, & Robinson, 2001).

Accountability through data collection on IEP objectives is required and essential for the formative evaluation of progress for all students with disabilities. However, documentation of ongoing educational performance and progress is particularly crucial for students with ASD for several reasons. First, the pervasive nature of the disorder results in multiple skill deficits across domains, for example, deficits in social communication, interaction skills, and nonfunctional routines (American Psychiatric Association, 2000). Keeping track of progress on a variety of skills and domains necessitates systematic documentation of progress. Second, early and intensive intervention using evidence-based practices is recommended for students with ASD to ameliorate the severity of functional deficits. This recommendation is a requirement for FAPE under IDEIA (Fenske, Zalenski, Krantz, & McClannahan, 1985; Freeman, 1997; McEachin, Smith, & Lovaas, 1993; Yell et al., 2003). This requires programming for each core skill deficit area and progress-monitoring (Alberta Education, 2006; Colorado University Center for Collaborative Educational Leadership, 1998; Lovaas, 1987; Ogletree & Oren, 2001). Third, the current prevalence of ASD as estimated by the Centers for Disease Control (CDC) appears to be rising for both boys and girls and averages at 1 in every 50 children (Blumberg et al., 2013). This rise in rate presents an increase in the number of students requiring services, and consequently the cost of educational resources needed to ensure FAPE and providing accountability. Finally, the progress-monitoring component is designed to comprehensively address effectiveness of instruction on the acquisition and fluency of skills identified as deficits, observe and monitor maintenance of these skills, and track generalization of skills already learned and mastered. In

addition to legal requirements and evidence-based recommendations, public support has been provided by parents, teachers and administrators who indicate the need for data collection as an important component of educational programming for individuals with ASD (Callahan, Henson, & Cowan, 2008).

Need for Data Collection and Documentation

Systematic observational data collection and progress monitoring for documentation are essential components of programming in special education programs (Fuchs & Fuchs, 1986; Gunter, Callicott, Denny, & Gerber, 2003). There are a variety of methods for collecting performance data for the purpose of documentation of progress, such as forms and data sheets containing learning objectives (e.g., Cheney, 2000; Lerman, Hovanetz, Strobel, & Tetreault, 2009; Romanczyk, 1996), portfolios (Carothers & Taylor, 2003), visual permanent products (Suarez, 2010) and electronic systems (e.g., Graff, 2007; Saunders, Saunders, & Saunders, 1993). Comparisons have been made between electronic and handwritten data collection methods in attempts to improve logistical concerns for data collection. Results vary by product but indicate no significant differences in accuracy between the two methods with handwritten data collection occurring slightly faster than electronic (e.g., Tarbox, Wilke, Findel-Pyles, Bergstrom, & Granpeesheh, 2009). Regardless of the method, systematic observational data collection systems support observable and measurable change and should be created and tailored to student goals and objectives to make progress monitoring more systematic and manageable (McLaughlin, 1993; Schwartz, & Olswang, 1996).

It has been suggested that a lack of connection between IEP objectives and behaviors observed in the classroom might lead to a decrease in the likelihood for classroom staff to collect data (Sandall, Schwartz, & LaCroix, 2004). Goals and objectives included in IEPs should be observable, measurable, and include a specific dimension of behavior to be measured (i.e., rate, duration, latency) to promote ease of systematic observational data collection (Alberto & Troutman, 2009; Cooper, Heron, & Heward, 2007).

Another consideration relates to the format of data collection systems in order to increase efficiency and time management in the classroom, balancing a need for progress monitoring without disrupting quality instruction. Despite the availability of data collection systems, teachers indicate that this function is often neglected because of logistical concerns of collecting data during instruction and classroom management (Sandall et al., 2004; Yell, Deno, & Marston, 1992; Walton, 1985; Wesson, King, & Deno, 1984). Yet, implementation of evidence-based practices also requires systematic observational data collection to make instructional decisions in order to bridge the gap between research and practice (Heward, 2003).

Even when teachers report that they collect systematic observational data on student behavior, only a small number indicate using graphing as a data collection and decision-making tool ((Cooke, Heward, Test, Spooner, & Courson, 1991). 1991). Graphing numerical data assists in informed decision-making by allowing for ongoing visual inspection of student data as a reflection of student performance and teaching effectiveness (Cooper et al., 2007; Utley, Zigmond, & Strain, 1987). It is critical to include both of these procedures in professional

development activities for teachers and training teams (Fuchs & Fuchs, 1986; Hojnoski et al., 2009).

Current accountability expectations for special education go beyond compliance to procedural safeguards to focus on student achievement (Wolf & Hassel, 2001). For students who are excluded from state testing, some type of accountability methods are still required. To account for variable responding and latency between milestones for individuals with severe deficits, accountability measures that "involve multiple measures over time will result in more accurate and reliable information than one-shot assessments" (Ysseldyke & Olsen, 1999, p. 183). Data collection on an individual level based on the IEP facilitates progress monitoring, which critical for instructional decision-making and individual accountability. Additionally, IEP-based data can be translated into standard performance indicators used to assess system-wide accountability (McLaughlin & Thurlow, 2003).

The absence of systematic observational data collection is evidence of the research-to-practice gap, suggesting a critical need for effective teacher training. Training on the method and interpretation of data collection is essential to promote effective use of systematic and direct observation and recording of student behavior. Preservice training often failsto teach candidates to collect ongoing student data to demonstrate changes in skill development, which furthers the research-to-practice gap (Greenwood & Maheady, 1997; 2001). When increases in desired target behaviors are noted, teachers tend to accurately identify the trend without continuous data collection; however, for variable, unchanging or decreasing trends in behavior, there is inconsistent accuracy in interpretation without continuous data collection (Munger & Lloyd, 1989; Munger, Snell, & Lloyd, 1989). This also suggests a need to assess the extent of use

and quality of interpretation of the data collected. This is because making individualized instructional changes based on student data, as noted previously, has been linked to increased student achievement (Stecker & Fuchs, 2000).

Considering the importance of progress monitoring for all students with a disability, including individuals with ASD and the core deficits of ASD (i.e., communication, social skills, stereotypic and repetitive behavior), the next step is to determine the most appropriate manner in which to train teachers to collect data for accountability and identify effective staff training models to teach classroom teachers how to implement those procedures in the classroom. The following section will review and discuss current research on training methods in relation to frequency and procedures of systematic data collection.

Effective Teacher Training on Systematic Data Collection

A common strategy employed to train teachers and human service workers (e.g., paraeducators) focuses on inservice workshops and conferences involving presentation of information to be implemented in the classroom. Workshops and conferences alone have limited generalizability and may leave participants unprepared or with undeveloped skills that could be counter-productive or have no effect on student outcomes (Smith, Parker, Taubman, & Lovaas, 1992; Stein, 1975). The components of training that have demonstrated generalizability involve general hands-on training or training in the classroom and time to plan for implementation (Ducharme & Feldman, 1992; Noell et al., 2005; Penuel, Fishman, Yamaguchi, & Gallagher, 2007). Therefore, the on-the-job follow-up on the application of learned knowledge appears to be an important part in acquisition of the professional

development approach that might include a combination of workshop-type information presentation, modeling, practice, on-the-job follow-up, and/or feedback (Mautone, Luiselli, & Handler, 2006; Tschannen-Moran & McMaster, 2009).

Additional important facets of effective teacher training relate to specific strategies used to promote acquisition of the content presented in training. For example, content on evidence-based practices, written checklists, case examples within workshops, and feedback have been included(Ducharme & Feldman, 1992). Of these various training components, providing feedback on target behaviors has effectively increased staff performance (Panyan, Boozer, & Morris, 1970; Pellecchia et al., 2011; Quilitch, 1975). Based on empirical findings, it can be expected that acquisition of skills following training may have an impact on teacher behavior, as well as an indirect impact on students; teachers who participate in effective staff development report a perceived increase in student functioning and learning (Lowden, 2006).

One such long-standing training model is prototypical teacher training. A prototypical model offers the individualization that has been demonstrated to be effective for education and human service employees (Reid & Parsons, 2006). Prototypical training utilizes checklists to task analyze the steps of the targeted staff skill following a systematic format for introduction of the skill for the staff. The training steps include: (1) specify the skill; (2) provide a checklist of the skill; (3) describe the skill and its rationale; (4) demonstrate the skill; (5) provide opportunities for staff to practice the skill; and (6) provide on-the-job performance feedback (Reid & Parsons, 2006). This model combines competency-based and performance-based component skills rather than acquisition of knowledge alone. While the traditional workshop setting encompasses an example of methodology for competency-based training delivery, on-

the-job training with feedback and follow-up provides opportunity for performance-based training (Reid et al., 2003). An important aspect of training is not only the presentation of content material and acquisition of skills, but also maintenance of acquired skills. In fact, if acquired skills are not maintained, it is assumed that the purpose of staff training has not been attained. To encourage maintenance, an appropriate criterion level must be reached prior to fading the performance feedback, and the trained behavior should be placed under a natural contingency of reinforcement (Arco, 1991). Transferring responsibility to a trained supervisor is a beneficial component of staff training, as it has been shown that training supervisors to provide feedback to direct care staff helps maintain staff behavior over time (Parsons & Reid, 1995; Haberlin, Beauchamp, Agnew, & O'Brien, 2012).

The prototypical training model has been shown to be effective across various disciplines involving personnel training. Research in the labor industry supports the use of a combination of off- and on-the-job training components to enhance worker performance in skills required of tradesmen, which encourages the question across professions of the effectiveness of informational and hands-on training (Harris, Simons, Willis, & Carden, 2003). The use of checklists and charts has been effective for increasing staff caregiver target responses with school students and hospitalized patients (Kunz et.al, 1982). The combination of in-service or workshop training with on-the-job follow-up has also been effective in teaching direct care staff and teachers to work with individuals with severe disabilities (Owston, Wideman, Murphy, & Lupshenyuk, 2008; Parsons, Reid, & Green, 1993). Additionally, self-management training by a prototypical approach using data collection/checklists and graphing following a workshop can be utilized to increase fidelity of performance procedures in direct

care staff (Burgio, Whitman & Reid, 1983; Kissel, Whitman, & Reid, 1983). While valuable information can be presented in workshop training, issues might arise in the generalization of the skills presented from the workshops to applied setting of the classroom. Involving supervisors in the training components can assist with maintenance and generalization of skills (Haberlin et al., 2012).

A review of the literature documents investigations on the effects of staff training packages containing components of workshop (in-service training), follow-up on-the-job training, and performance feedback on skill development for data collection and analysis in schools (e.g., Browder, Karvonen, Davis, Fallin, & Courtade-Little, 2005; Codding, Skowron, & Pace, 2005; Farmer, Wolery, Gast, and Page, 1988; Hundert, 1982; Pellecchia et al., 2011). Participants targeted in training programs included combinations of teachers with special education certification or background (Codding et al., 2005), paraeducators and teachers in special education programs (Farmer et al., 1988), students with disabilities and their teachers (Browder et al., 2005; Hundert, 1982), and teams of consultants, teachers, and paraeducators (Pellecchia et al. 2011). Utilizing written manuals in some cases (Browder et al., 2005; Hundert, 1982), workshop/inservice, and in-class follow-up feedback sessions, training was conducted to increase a variety of data collection skills. These components of prototypical staff training for teachers and classroom personnel were used to target data collection and decision-making skills ranging from frequency of data collection (Farmer et al., 1988; Pellecchia et al., 2011), percentage of observed data collection skills and procedures (Codding et al., 2005; Hundert, 1982), pre- and posttest knowledge of data collection components (Farmer et al., 1988), and pre-and posttest scores from state alternative assessment portfolios (Browder et al., 2005).

Settings for these studies included private and public schools serving preschool through elementary aged students.

Collective findings from studies that have utilized the prototypical staff/teacher training program show that the combination of workshop, in some cases a checklist or manual and handbook, and in-classroom performance feedback were effective in increasing the targeted data collection and data-based decision making skills of participants. For those studies that have reported effect sizes in their results, the effects ranged from medium (Browder et al., 2005) to highly effective (Pellecchia et al., 2011). The results have implications for training on data collection skills for staff or teachers. Research has also shown that teacher data collection skills generalized beyond the target students in the classroom to other students and in some cases other goals (Farmer et al., 1988; Pellecchia et al., 2011). Training teachers in data collection skills affects IEP progress monitoring and alternative assessment ability, and may override any individual characteristics of students that impede learning, resulting in more efficient instruction based on data-based decisions (Browder et al., 2005). Training teachers to measure behavior might not have been sufficient to change student responding without training them to make decisions based on the measurement (

Group training (i.e. workshop) showed no results in one study, but authors suggest it may be a necessary prerequisite for effective skill acquisition (Farmer et al., 1988). A combination of workshop and in-classroom training with feedback was found to be cost effective, time efficient and easily implemented in a preschool environment (Farmer et al., 1988). In addition, group performance feedback provided not just to classroom teachers, but the team as an entity can also be effective in increasing skills of each member of the team (or

the team as a whole) (Pellecchia et al., 2011). Training for teachers should not only utilize an in-classroom component with feedback, in addition to any group instruction workshops, but should include both IEP progress monitoring and alternative assessment (Browder et al., 2005), graphing and data-based decision making (Hundert, 1982), and systematic thinning of the feedback schedule to bring under the control of natural reinforcers (Farmer et al., 1988).

The authors of the body of research in this area note several implications for future lines of research in the area of training staff or teachers on data collection and data-based decision making. It was suggested that priming effects (i.e., previous events effecting future events) of group instruction (i.e. workshop) prior to individual training should be investigated (Codding et al., 2005). Future research might also examine types of training and the effect on different instructional goals, as well as the relative benefits and cost for specific instructional problems (Hundert, 1982) or the use of external consultants in training programs (Pellecchia et al., 2011). Specific focus should be placed on the effects of these training components on using the data they have collected to make instructional decisions (Pellecchia et al., 2011).

In the study conducted by Farmer et al. (1988), the effects of workshop training, in-classroom follow-up training with feedback, and feedback fading on the frequency of data collection by classroom teachers were investigated. Increases in the frequency of data collection were observed across participants. Observed frequency levels maintained at a slightly lower rate when feedback was faded completely following the completion of intervention. Building upon the methodology of this existing research, the following study examines updating the training materials and modifying the maintenance component of the intervention to determine the long-term effects. Specifically, the study examines the effects on

daily mean frequency of data collection on IEP objectives specifically for students with ASD when using workshop training, checklists for data collection procedures provided to participants, in-classroom follow-up training with feedback, and a long-term performance feedback program to determine the effects on maintenance.

Theoretical Foundations for the Study

The purpose of the study is to assess the effects of a training strategy on the skill of data collection in the classroom by teachers. The components of a prototypical teacher training program include principles of behavior, and the type of data collection being discussed is a tenet of applied behavior analysis; therefore, discussion of specific theory and terms is warranted.

Applied Behavior Analysis

Cooper et al. (2007) have defined applied behavior analysis (ABA) as "the science in which tactics derived from the principles of behavior are applied systematically to improve socially significant behavior and experimentation is used to identify the variables responsible for behavior change" (p. 20). ABA has roots in the theory of behaviorism, radical behaviorism, and the experimental analysis of behavior (EAB).

ABA operates under seven characteristics: It is defined as being applied, behavioral, analytic, technological, conceptually systematic, effective, and a producer of generalized outcomes. In other words, research and practice that characterizes ABA seeks to make a socially significant impact on the lives of the participants and potentially their families (applied),

targets directly observable and measurable behavior of the participants, and measures and monitors the behavior to determine if there is a functional relationship between the behavior change and the intervention (Baer, Wolf, & Risley, 1968; 1987). It employs replicable target definitions of the behavior in question, utilizes procedures and strategies derived from basic principles of behavior, results in clinically and socially significant changes in the observed dimension of behavior, and the results are replicable across social settings and scenarios (Baer et al., 1968, 1987; Cooper et al., 2007). The current study attempts to encompass these seven characteristics, and therefore is rooted in the framework of ABA.

Assumptions and technology of behavior related to the current study

Within the framework of the current study, the target measures are observable behaviors that can be measured by direct observation and the permanent products of the behaviors. The proposed training strategy involves intervening by manipulating environmental variables in an attempt to change relevant behavior.

Behavior

Behavior is an action displayed by an organism. It can be defined and described in terms of the topography, which provides us with an operational definition that can be replicated and recognized by multiple observers (Cooper et al., 2007). All behavior has a function, which can be determined by conducting a systematic analysis by manipulating environmental stimuli that control a function (Iwata, Dorsey, Slifer, & Bauman, 1994; Iwata, 1994). For the purpose of the current study, the behavior of classroom teachers of individuals with autism is relevant. Also important to note, the behaviors observed in those teachers involves observing and recording

the behavior of their students. In simple terms, study personnel are observing and recording the behavior of teachers who are observing and recording the behavior of their students.

Basic principles of behavior

The science of behavior is based on several basic principles that are the building blocks to countless variations of effective intervention, making those interventions conceptually systematic (Baer et al., 1968). The current study builds directly on the principles of measurable change through data collection, reinforcement, and prompting and with the technology of task analysis. Reinforcement involves the increase in dimension of behavior when a stimulus is presented or withdrawn following the behavior. Reinforcement will be used to increase the rate of acquired skills related to teacher behavior. Prompting, or an added stimulus to assist in the occurrence of a behavior, will be both a part of the prototypical teacher training and also a potential skill that teachers would be expected to observe and record. The skills expected of teachers will be broken down to systematic steps using the technology of task analysis, with each un-mastered step targeted in intervention (Cooper et al., 2007).

Organizational Behavior Management

Organizational behavior management (OBM) is a subfield of applied behavior analysis focusing on the application of behavior analytic principles and procedures to employee large systems performance (Bucklin, Alvero, Dickinson, Austin, & Jackson, 2000; Culig, Dickinson, McGee, & Austin, 2005). Beyond its basis in behavior analysis, OBM focuses on employee performance improvement and effective goal attainment for organizations through direct observation of employee behavior (Frederiksen & Lovett, 1980). Although research in OBM, or

as it is sometimes referred to Performance Management (PM) (Daniels & Daniels, 2004), has spanned a wide range of industries, human service industries and staff working with individuals with disabilities have benefited from interventions based in OBM (Frederiksen & Riley, 1984). OBM, specifically the area of performance management and staff training, provides a framework for the intervention proposed in this study (Reid & Parsons, 2006). The proposed use of performance checklists, on-the-job follow-up training, performance feedback, and transference of responsibility to the stakeholders for maintenance are drawn from OBM.

Rationale for the Current Study

Despite legal requirements and research recommendations for on-going documentation of student progress, teacher reports indicate that many educators rely on informal observations to determine and report student outcomes on the IEP or hold systematic observational data collection in low regard (Alberto & Troutman, 2009; Fuchs, Fuchs, & Warren, 1982). Teacher opinion has been demonstrated to be less accurate when compared to systematic observational data collection in program decision-making (Fuchs et al., 1982; Holvoet, O'Neil, Chazdon, Carr & Warner, 1983). Systematic observational data collection is recommended for professionals to monitor student progress and performance, as formative evaluation has been linked to increases in student achievement (Cooper et al., 2007; Fuchs & Fuchs, 1986; Krasch & Carter, 2009).

Data should be collected to assist in determining progress and instructional decision-making, and teachers need to be fluent at performing both processes (Pindiprolu, Peterson, & Berglof, 2007; Yell et al., 2005). Training should include strategies and technologies to make

the process of data collection systematic and manageable within the classroom (Gunter et al., 2003). Programming and training for data collection and analysis are a focus of existing research in education and government initiatives (e.g., Heritage & Chen, 2005; McAffee, 1987), but published studies in the area of teacher training on data collection and data-based decision-making in the current literature appear to be limited.

Although limited research has evaluated the effectiveness of prototypical staff training to increase the frequency of teachers' data collection or use of data collection procedures, research has examined the effects of training to increase a variety of other behaviors for teachers who had direct contact with individuals with disabilities. Skills targeted using similar training packages include portfolio quality for teachers, instructional techniques (i.e., teacher scripts, assessments, signals, error correction) demonstrated by instructors of students with ASD, structured teaching session teacher performance, and fidelity of following CBM and measurable objective-writing procedures. In such studies, the training packages had demonstrated acquisition, maintenance, and generalization of a variety of staff performance skills (e.g., Arco & Millett, 1996; Browder et al., 2005; Codding et al., 2005; Hundert, 1982; Realon, Lewallen, & Wheeler, 1983; Scott & Martinek, 2006) and should be utilized for training educators to collect ongoing, direct and systematic observational data for students with disabilities. The current study was proposed to investigate a series of research questions focusing on the relationship between prototypical teacher training and: (a) the daily mean frequency of data-recorded on IEP objectives in the core deficit domains for ASD, and (b) procedures with which participants document and utilize collected data for decision making and IEP accountability.

Research Questions

(1) What are the effects of a prototypical teacher training program (including a hands-on workshop with time for implementation planning, on-the-job follow-up with delivery of fixed schedule of performance feedback, and available reinforcers for attainment of goals) on:

   c) The daily mean frequency of systematic observational data collection of IEP objectives in classrooms serving students with ASD?

   d) Data management and data-based decision-making behaviors of teachers in classrooms serving students with ASD?

(2) What are the effects of intermittent performance feedback during follow-up observations after transference of feedback delivery to district personnel on the continued maintenance of:

   c) The daily mean frequency of systematic observational data collection by participants?

   d) Data management and data-based decision-making behaviors of participants in classrooms serving students with ASD?

APPENDIX C

DETAILED METHODOLOGY

Participants and Setting

The study was conducted in two settings: A public independent school district and university-operated treatment center in north central Texas. The school district served students within the range of early childhood (EC) through age 21 years, with the study focusing on elementary campuses serving kindergarten through sixth grade. The treatment center served school-aged children with ASDs. At both locations a meeting room used for staff conferences and trainings served as the setting for workshop sessions. The instructional placement of the students taught by participants consisted primarily of classrooms and activity rooms on the elementary campus and the treatment center. These rooms encompassed the settings for all experimental conditions including baseline, in-classroom training, and maintenance.

Participants included lead teachers and lead interventionists supervising teams of support staff (e.g., Pellecchia et al., 2011). The lead teachers included a pool of all elementary (EC-6) school teachers certified in special education who had at least four students in their classroom with an eligibility of autism (AU) according to their IEPs or intake diagnoses, as well as at least two goals and/or objectives in each of the core deficit areas of ASD (i.e., communication, social skills, and stereotypic/repetitive behavior).

Only those teachers or interventionists that met the criteria and the paraeducators that worked with them were included as potential participants in the study: (1a) teachers certified to teach special education; (1b) interventionists meeting qualifications to work at the center for children with ASDs; (2) participants with at least four students with an eligibility of AU in their classroom and on their caseload; (3) participants with responsibility for implementation and

documentation of intervention plan and accountability for the students with AU. Exclusions were made for those classroom teams already collecting frequent or systematic data in the classroom per supervisor report and those that were pursuing or had completed graduate or specialized study in behavior analysis or the equivalent.

From this pool of potential participants, two lead teachers and three lead interventionists were selected as participants in the study. Amy was a 60-year-old teacher with 18 years of experience teaching elementary special education. She had an undergraduate degree in sociology and elementary education. Beth was a 28-year-old teacher with an undergraduate degree and certification in both general and special education. She had over 4 years of teaching experience in the classroom and was certified to teach general and special education. Caleb was a 26-year-old lead interventionist with a master's degree in educational psychology. He had been in his current or an equivalent role for less than one year. Dee was a 51-year-old interventionist with 14 years of experience in the classroom and in center-based program delivery. She held an undergraduate degree in elementary education and was certified to teach both special and general education. The fifth participant, Eva, a 36-year-old interventionist with a master's degree in kinesiology had less than a year of experience in her current role or its equivalent.

All five participants remained through baseline data collection and the workshop training. Amy was withdrawn from the study during initial intervention when she disclosed additional information about her classroom arrangement that did not meet the inclusion criteria for the students on her caseload (i.e., she was not the one responsible for data collection for the IEP objectives of the students with ASD). This information was not provided

at the time of recruitment to the study. Eva left her position at the treatment center and the study during the baseline phase. Even though best practice in single case experimental designs suggests the need for four participants, five were recruited were originally recruited for the study. However, only three participants, Beth, Caleb, and Dee, completed all experimental phases of the study.

Materials

Minimal materials were used for this study, most of which were for the workshop. They included a computer, an LCD projector and a screen for delivering the presentation, a workshop script for the trainer, and tables and chairs for participants. Additional materials for participants included presentation handouts, workshop notes, workshop practice exercises, observer forms for collecting study data, and classroom feedback forms for the trainer and the supervisor of the participants (see below).

Dependent Measures

The study was designed to investigate the effect of a prototypical teacher training program on systematic observational data collection and methods for IEP objectives relating to the core deficits of ASD by teachers of students with ASD. The dependent variables (DV) included (1) the mean frequency per day of data collection for specific IEP objectives and (2) the presence or absence of discrete procedures for data collection presented to participants in workshop training. In addition, certain ancillary measures were tracked throughout the study, such as information indicated on the data collection system (i.e. name of the data collector indicated,

student name (or initials/code) indicated, date recorded, visible IEP objective, and whether dimension of behavior measured matches the topography of the behavior and the dimension indicated in the IEP objective).

Frequency of Data Collection on IEP Objectives

Frequency of systematic observational data collection of IEP objectives was the primary dependent variable in the study and was the measure used to inform decisions for changes in the experimental phases for the study. Systematic observational data collection on an objective is defined as the written presence of all of the following four components: (1) Use of some permanent data sheet or form (paper or electronic); (2) Record of any dimension of one or more target behaviors (i.e., daily mean frequency/rate, duration, and latency) indicating student performance. Accuracy of data collection was not targeted for this study and is reserved for a future line of research dependent on results of this study; (3) Recorded data are graphed; and (4) Notation of data-based decision-making (DBDM) is indicated on the data sheet and/or graph (e.g., objective mastered, continue objective, change intervention, change prompting level, change in schedule of reinforcement, introduce new target or discriminative stimulus) (adapted from Farmer et al., 1988). In order for an objective to have been scored as an instance of "data collection of an objective," and therefore be included in the frequency count, all four components of the data collection definition had to be present.

Data Collection by Permanent Products

Today's Date: _____ Dates Recorded from: _____
Participant Code: _____ to: _____
Baseline / Intervention / Maintenance Observer/Recorder Initials: _____
IOA? Y/N

For each objective recorded in the core domains, indicate whether the criteria were met.
+=Criterion present; -- = Criterion absent/not indicated; x=No data collected; A=Student absent

Criteria
1) Used some permanent data sheet or form (paper or electronic)
2) Recorded dimension of behavior indicating student performance:
(e.g. rate, frequency, duration, interval, etc.)
3) Data were graphed
4) Notation of DBDM related to today's data on data sheet
(e.g. mastered, continue, change, etc.)

Ancillary Measures
A) Indicated name of data collector
B) Indicated child's name/code
C) Indicated IEP objective requirements
D) Recorded date
E) Dimension matched topography of behavior
F) Dimension matched that indicated in IEP objective

Domains
C: Communication SRB: Stereotypic/Repetitive Behavior
SS: Social Skills

Dimension
e.g. rate, duration, frequency, %, etc.

↓IF NO DATA ARE COLLECTED ON THE DATE=X (and leave remaining columns blank)

Date	Student	X?	Obj#	Domain	1	2	3	4	%	List dimension	A	B	C	D	E	F	%
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													
	1 2			C SS SRB													

Observation Checklist of Data Collection Procedures

Date of Observation: ____ Start Time: ____ End Time: ____ Baseline / Intervention / Maintenance
Participant Code: ____ Observer Initials: ____ T/O IOA? Y/N

Indicate whether the following are observed or not observed in the classroom this session: *+=present; -- =absent/not observed*

Preparation visible in the classroom

- ☐ Data collection materials visible
- ☐ Data collection materials accessible to participant
- ☐ Data collection materials accessible to support staff members

Data collection concurrently occurring with teaching

☐ Participant records data during this observation

*If +, then data during this observation are recorded by the participant (**Check all that apply**):*

during individual instruction activity	☐	immediately following group instruction activity	☐	during structured activities	☐
during group instruction activity	☐	immediately following individual instruction activity	☐	during unstructured activities	☐

☐ Other support staff members record data during this observation (Indicate here if no additional staff members were present for this observation): ____

*If +, then data during this observation are recorded by other staff in the room (**Check all that apply**):*

during individual instruction activity	☐	immediately following group instruction activity	☐	during structured activities	☐
during group instruction activity	☐	immediately following individual instruction activity	☐	during unstructured activities	☐

☐ Data are recorded multiple times during or after at least one instruction activity observed

*If +, the indicate which **one** most accurately describes how frequently data were collected this observation session:*

A single time during instruction	☐	A single time after an instruction activity	☐
Multiple times during instruction	☐	Multiple times after an instruction activity	☐

☐ Data are recorded during or after multiple instruction activities during this observation (Note: If only one activity observed this session, indicate +)

*If +, then indicate which **one** most accurately describes how may activities in which data were collected this observation session:*

During or after only 1 instruction activity observed (but not all)	☐	During or after all observed instruction activities	☐
During or after more than 1 instruction activity observed (but not all)	☐	Only one activity observed this session	☐

Strategies are used to track the student progress

☐ Data are recorded using a data collection system

*If +, then indicate **all** data collection systems observed this session:*

data sheet or notebook (I.e. pen, pencil, paper, binder, etc.)	☐	another strategy (I.e. golf counter, sticky note, beads, etc.)	☐
erasable surface (I.e. dry erase, chalk, etc.)	☐	List strategies:	
electronic device (I.e. tablet, pda, smart phone, touch screen, computer, etc.)	☐		

☐ ******Total items observed as present this session (out of 8 possible)******

If data were not recorded during this session, check this box: ☐

Fidelity of Implementation of In-Class Training Sessions

Date:
Participant Code:

Trainer Completed the following Steps for Each Session:

	Goals set at initial training session	☐
	Indicate + / -- (or N/A)	
1	Trainer/investigator observes instruction activities	☐
2	Feedback checklist completed during observation	☐
3	Participant & trainer/investigator review the data collection system	☐
4	Goals & incentives for meeting the goal(s) reviewed	☐
5	Feedback given using the checklist	☐
6	Trainer/investigator models skills as needed	☐
7	Trainer/investigator has participant practice as needed	☐
8	Provides a copy of the feedback	☐
9	Informs the participant of his/her next session	☐
	%	☐

Fidelity of Implementation of Workshop Presentation

Presenter discussed the following material and Activities:

Indicate + / --

1.	Rationale for Data Collection	
2.	Considerations for Students with Autism Spectrum Disorders (ASD)	
3.	Writing Measurable Objectives	
4.	Selecting How to Measure Behavior (Dimensions of Behavior)	
5.	Tying Objectives to Measurement of Behavior **Activity**	
6.	Developing Data Collection Systems	
7.	Data Collection Practice **Activity**	
8.	Graphing Data	
9.	Graphing **Activity**	
10.	Data-based Decision-Making	
11.	Data-based Decision-Making **Activity**	
12.	Effective, Efficient Data Collection Strategies	
13.	Efficiency Strategies Roundtable **Activity**	
14.	Summary: Putting it All Together	
15.	Provide Checklist	

Feedback for The Prototypical Staff Training Program Package on Observational Data Collection for IEP Objectives of Individuals with Autism in the Classroom

Your input is very important to us! Please take a few minutes to complete the following questions regarding your experiences with this training series.

Using the following scale, please indicate the most appropriate answer.

0=N/A, 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

1. The workshop training (inservice training) increased my level of understanding in identifying data collection systems

0 1 2 3 4 5

2. The workshop training (inservice training) increased my level of understanding in collecting observational data (I.e rate, duration, frequency, interval, etc.)

0 1 2 3 4 5

3. The workshop training (inservice training) increased my level of understanding in making data-based decisions (I.e. graphing, program changes, etc.)

0 1 2 3 4 5

4. The workshop training (inservice training) increased my level of understanding in how to facilitate implementation in my classroom

0 1 2 3 4 5

5. The training package (workshop training + in-classroom sessions) increased my level of understanding in identifying data collection systems

0 1 2 3 4 5

6. The training package (workshop training + in-classroom sessions) increased my level of understanding in collecting observational data (I.e rate, duration, frequency, interval, etc.)

0 1 2 3 4 5

Feedback for The Prototypical Staff Training Program Package on Observational Data Collection for IEP Objectives of Individuals with Autism in the Classroom

Using the following scale, please indicate the most appropriate answer.

0=N/A, 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

7. The training package (workshop training + in-classroom sessions) increased my level of understanding in making data-based decisions (I.e. graphing, program changes, etc.)

0 1 2 3 4 5

8. The training package (workshop training + in-classroom sessions) increased my implementation of data collection for target students in my classroom with autism eligibility (AU)

0 1 2 3 4 5

9. The training package (workshop training + in-classroom sessions) increased my implementation of data collection for non-target students in my classroom

0 1 2 3 4 5

10. The training package (workshop training + in-classroom sessions) increased my level of understanding in how to facilitate implementation in my classroom

0 1 2 3 4 5

11. The training package (workshop training + in-classroom sessions) increased my level of understanding in how to facilitate implementation in my classroom

0 1 2 3 4 5

12. The workshop training (inservice training) increased my implementation of data collection for target students in my classroom with autism eligibility (AU)

0 1 2 3 4 5

13. The workshop training (inservice training) increased my implementation of data collection for non-target students in my classroom

0 1 2 3 4 5

Feedback for The Prototypical Staff Training Program Package on Observational Data Collection for IEP Objectives of Individuals with Autism in the Classroom

Using the following scale, please indicate the most appropriate answer.

0=N/A, 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

14. This training package increased the frequency at which I collect data for IEP objectives for students in my classsroom

0 1 2 3 4 5

15. This training package increased my use of data collection components when taking data for my students

0 1 2 3 4 5

16. The level of diffculty of the workshop training was appropriate

0 1 2 3 4 5

17. The level of difficulty of the training package was appropriate

0 1 2 3 4 5

18. Other teaching staff should receive the workshop training

0 1 2 3 4 5

19. Other teaching staff should receive the training package

0 1 2 3 4 5

Thank you so much for your time and feedback!

20. Recommendations/Comments (If you have any additional information you would like to share, please do so here):

Daily mean frequency of data collection was measured by recording the total number of objectives in the core domains for which the four data collection criteria (i.e., permanent data form used, dimension of behavior recorded, data graphed, and DBDM noted) were met for all target students with ASD and dividing by the total number of students (i.e., dividing by two if both students were present that day and by one if only one was present).

Data collection checklist procedures

In addition to measuring the frequency of data collection for objectives, the investigator also measured participant skills associated with data collection procedures taught in the workshop. Data collection procedures in this study consisted of seven skills involved in systematic observational data collection (Alberto & Troutman, 2009; Cooper et al., 2007; Farmer et al., 1988; Pellecchia et al., 2011): (1) Data collection materials are visible; (2) Data collection materials are accessible to the classroom team (i.e., teacher participant and paraprofessional participants); (3) The classroom team member (lead teacher or paraeducator) records data during the observation session; (4) Lead teacher or paraeducator records data during the observation session; (5) Data are recorded multiple times during or after at least one instruction activity observed; (6) Data are recorded during or after multiple instructional activities during the observation session; and (7) Data are recorded using a data collection system.

Additional Measures

Ancillary measures were collected that were not primary dependent measures of the study, but could potentially provide additional information throughout the study and for

additional future research. The additional measures collected with the primary dependent measure of frequency of data-recorded-objectives included whether or not a data collection system or graph that study observers review contains the following record-keeping information: **(**1) Data collector name; (2) Student's name (or code); (3) IEP objective requirements of the behaviors being recorded; (4) The date of data collection for student responding. In addition, it was noted whether or not the dimension of behavior matched topography of behavior and whether the dimension of behavior matched the dimension indicated in objective.

Procedures for Data Collection of Dependent Measures

Detailed data collection procedures for the study are discussed below. The mean frequency of data collection on IEP objectives collected by participants was the measure used to determine decision-making and phase change within the study. This measure was collected for each consecutive school day through a permanent product. The measure for observing participant data collection behavior using the observational data collection procedure checklist was measured throughout the study on a weekly basis, but this DV did not dictate phase change decisions for a participant. Additional information was collected along with these two measures to provide the investigator with details surrounding the results obtained for the research questions, as well as information that might lead to future research.

Mean Frequency of Data Collection on Core Objectives

Detailed data collection procedures for the study are discussed below. The mean

frequency of data collection on IEP objectives collected by participants was the measure used to determine decision-making and phase change within the study. This measure was collected for each consecutive school day through a permanent product. The measure for observing participant data collection behavior using the observational data collection procedure checklist was measured throughout the study on a weekly basis, but this DV did not dictate phase change decisions for a participant.

Data Collection Procedures Checklist

In addition to permanent products, a checklist matching the checklist provided to participants in the workshop was used to document probes of direct observation of participant data collection behavior. This checklist consisting of eight key components to data collection that was provided to the participants in training served as a measure of adherence to data collection procedures. For each observation, the eight skill components (six components if no other staff or students were in the room) were indicated as observed/correct or unobserved/incorrect and the percentage was calculated for the observation. All observation sessions were 20 minutes in length and occurred during different instructional activities when possible to avoid participant predictability and reactivity.

Following an observation session, each step of the checklist would indicate whether the skill was observed or not observed during that session. The eight skills targeted in the checklist included components of (1) data preparation skills, (2) concurrent data collection skills, and (3) data tracking strategies. Percentage of "observed steps" was calculated for each probe observation session.

Additional Measures

Ancillary measures were also collected to provide additional information and detail related to logistical information, quality of objectives, DBDM, and generalization to other students. Components included in a permanent data collection form were recorded as either a positive, "+," if present or a negative, "-," if absent: (1) Data collector name; (2) Student's name (or code); (3) IEP objective requirements; (4) Date of data collection; (5) Dimension of behavior matches topography of behavior; (6) Dimension of behavior matches the dimension indicated in IEP objective.

Beyond the permanent product information, details related to the data collection procedures observational checklist were collected to provide additional information regarding when during instructional activities data are recorded, how often data collection is occurring, the type of data collection system in place, and whether data are recorded for multiple. All ancillary measures were measured as mutually exclusive categories and were recorded as observed/correct or unobserved/incorrect and discussed with the results. These measures did not impact study decision-making nor did they affect the scoring or reporting of participant responding for daily mean frequency of data collection and observed data collection procedures.

Observer Training

There were two observers, a primary and a secondary observer for data collection activities for the study. The study investigator served as the secondary observer. Training for observers took place prior to the initiation of study and consisted of familiarization with the

permanent products forms and data collection procedures checklist, presentation of definitions, examples and non-examples of the dependent measures, and direct observation sessions including scoring, and calibration of accuracy. Discrepancies were discussed. Criterion was met when each data collector had demonstrated 90% or higher accuracy for at least five consecutive examples and non-examples for at least three consecutive practice sessions prior to the initiation of formal data collection for the study.

Interobserver Reliability

The interobserver agreement (IOA) was calculated on the occurrence and non-occurrence of target responses for at least 33% of sessions and both agreement of occurrence and non-occurrence (presence or absence of a component on the data collection procedure checklist) was recorded. Occurrence IOA was calculated by calculating the total agreements of occurrence (component present) recorded by both observers and dividing by the total occurrence recorded by either observer, then multiplying by 100. Similarly, non-occurrence IOA was determined by calculating the total agreements of non-occurrence (component absent) recorded by both observers and dividing by the total non-occurrence recorded by either observer, and then multiplying by 100. If the IOA had fallen below 90% at any time during the study, the observers would have been re-trained.

To take into account any agreement by chance, Cohen's Kappa was calculated at the end of the study when there were a sufficient number of data points to accurately compute the Kappa statistic. Cohen's Kappa was used because it lends itself to calculating interobserver agreement between two observers, while other measures (i.e., Scott's Pi, Fleiss Kappa) are used

when there are more than two observers charged with data reliability (Frick & Semmel, 1987). To determine Cohen's Kappa, the following formula was used:

$$K=(P_O-P_C) / (100-P_C),$$

where P_O=the proportion of agreements between observers and P_C=the proportion of agreements expected by chance (Cohen, 1968).

Social Validity of the Intervention

A social validity questionnaire requesting information regarding perceptions of the effectiveness and acceptability of the training package from the participants was used. The questionnaire included a Likert-type scale from 1-4 indicating a range of responses from strongly disagree to strongly agree. Questions spanning each step of the treatment package were included to assess perceptions of the "efficacy, helpfulness, and difficulty" of collecting and analyzing data for instructional decisions (Farmer et al., 1988). Topics included participant perceptions of increases in levels of understanding and implementation of skills targeted in training phases, increases in daily mean frequency of data collection for IEP objectives, increases in use of data collection procedures, of appropriateness of difficulty level, and additional training needs. Opportunities for participants to indicate the effectiveness of individual and combined components of the training were included for each item. An open response option was provided at the end of the 10-item questionnaire allowing for any additional information the participants chose to share. Participants were given the questionnaire at the end of the study.

Independent Variable

The independent variable utilized in the study consisted of various components of a prototypical teacher training program package, which included: (1) Workshop training with embedded time for practice; (2) A performance checklist provided at the workshop and used for follow-up training; (3) an in-classroom follow-up training with performance feedback and reinforcement for attaining goals; and (4) a maintenance program including a plan for generalization of performance feedback to maintain target behavior over time. The study examined the effects of these components as they were applied to each participant's frequency and quality of data collection and analysis activities.

The workshops were open to all elementary (EC-6) school teachers of the district certified in special education who had at least four students in their classroom with an eligibility of autism (AU) according to their IEPs. Additionally, they needed to have at least two goals and/or objectives in each of the core deficit areas of ASD. Paraprofessionals and other team members of lead teachers were invited to attend the workshop as well. The workshop at the treatment center was open to all full time interventionists and senior staff. In order to be a participant, teachers and interventionists had to attend the workshop and provide informed consent. The workshop format contained a slide presentation of material to the large group by the trainer (lead investigator) followed by individual/small group activities to practice skills. This included developing observable and measurable IEP objectives, identification and selection of dimensions of behavior, data collection practice with video examples, data collection system development, graphing, and efficient strategies for data collection. Additionally, the workshop included the distribution of the data collection procedures checklist to all attendees. All

workshop attendees, regardless of whether or not they provided informed consent to participate or qualified for participation in the study, received a certificate of participation for the training. They also had an opportunity to receive data collection tools (e.g., timers, golf counters, and data collection technology such as touch pad handheld devices, cameras, software programs, etc.) in a drawing at the end of each workshop. Three identical workshops were presented at three different locations for recruiting participants. A fidelity checklist and a workshop script were used to ensure content and activities were consistent across workshops.

The in-classroom component consisted of the trainer (lead investigator) observing and providing feedback to each participant on data collection frequency and procedures for a 20-minute each week. A goal was set at the beginning of this phase and a reinforcer (i.e., a restaurant gift card) was available for attaining this goal. The maintenance and generalization component also contained performance feedback sessions following classroom observation, but was conducted by district/center representatives rather than the trainer.

Experimental Design and Procedures

A single subject, multiple baseline design across participants was used to assess the relation between the prototypical training package and mean daily frequency of data collection on IEP objectives, along with percentage of observed data collection procedures. Following a two-part baseline condition (i.e., a pre-workshop baseline with consistent data points for all participants per setting and a staggered post-workshop baseline), the intervention phase was implemented (i.e., in-classroom follow-up training), followed by maintenance with generalization. Phase change occurred in a staggered fashion for one participant at a time

upon reaching stability of the determining dependent variable (i.e., mean frequency) as determined by the median and the stability envelope for the data points in the previous phase. Phase change for the next participant did not occur until there was stability for previous participant(s). The resulting data provided staggered effects of the introduction of the IV across participants, allowing interpretation of the potential relation between IV and DV.

Teachers and interventionists of students with ASD would be considered a low incidence population, prompting the selection of a single subject multiple baseline design in order to measure response change on an individual level and across time, while still demonstrating a relationship between the independent and dependent variables. It allowed for the ability to assess the change in behavior across participants only when the experimental variable or training package conditions were applied in order to demonstrate replicability (Gast, 2010; Tawney & Gast, 1984).

Baseline

Baseline for all participants contained both pre- and post-workshop data points. All participants had at least five data points (Phase A-1) prior to attending the workshop. However, data collection for the post-workshop baseline (Phase A-2) was staggered across participants to preserve the integrity of the research design.

Pre-Workshop (Baseline Phase A-1)

Following participant selection during the workshops, baseline data on mean frequency were collected retroactively by scoring data collection of IEP objectives for two target students

of each participant classroom team from a minimum of the previous five consecutive school days using a permanent products measurement form.

Following selection of the five participants during the workshops, the participant team randomly selected (i.e., random number assignment) two of the four students on their caseload who had an eligibility of ASD as the target students. If there were more than four students on a participant's caseload with ASD eligibility, target students were randomly selected from the total number of students with ASD. The un-mastered objectives for each of the target students were listed and categorized by core domains for ASD: communication, social skills, and stereotypic or repetitive behavior. Any objectives not meeting these domains were not considered in this study. All students with an eligibility of autism should have had goals within these each of these domains, as they are the defining deficits of ASD. All identifying student information was coded and completely unavailable to study observers, data collectors, and the investigator.

Workshop

The workshop presentation consisted of a series of presentation slides related to measurable IEP objectives, procedures for collecting and graphing data (Alberto & Troutman, 2009) and additional current resources. There was a script for the trainer to follow, and workshop notes were distributed to each attendee for reference during and after the workshop in order to ensure replicability and fidelity of implementation of intervention procedures. Participants attended the workshop with other colleagues who were not necessarily participants in the study nor necessarily met the criteria for participation in the study. The

district/center supervisors responsible for training the participant teams and for accountability of systematic data collection in the classroom were also invited to attend the workshop, combining a component supported by a pyramidal staff training model (i.e., Train-the-Trainer) in hopes to enhance the likelihood of continuation of skills for participant classroom teams (Haberlin et al., 2012). The workshop included a series of pre-determined exercises for attendees and participants in the study for practicing learned skills. All attendees and participants were given a copy of the data collection procedures checklist, consisting of a task analysis of all components needed to ensure that data collection procedures were in place in the classroom.

Post-Workshop (Baseline Phase A-2)

Data collection continued in a similar manner as described in pre-workshop baseline (Phase A-1 above). The permanent product checklist was used to assess IEP objectives for the target students with ASD meeting the four criteria for data collection for each consecutive school day for all five participants and their teams. Also, the weekly direct observation probes were conducted during which observers recorded the data collection behavior of each participant using the data collection procedures checklist.

In-classroom follow-up training with performance feedback

Following stability in responding and consistent with the multiple baseline design, in-classroom follow-up training with feedback was introduced. The participant and his/her classroom team whose post-workshop baseline data were considered the most stable and who had been in baseline the longest were the first to enter intervention, while the remainder of

participants remained in the post-workshop baseline condition. This first participant and his/her team met with the trainer in his/her classroom during class time for a 20-minutes to observe and review their data collection system. Feedback was provided using the in-classroom feedback checklist; if a single "no" was indicated by the feedback checklist, additional practice was provided using modeling and/or exercises from the workshop. In this first session of in-classroom follow-up training with feedback, the trainer identified a data collection goal for the participant [e.g., to collect data for at least five objectives daily for each student (so a mean daily frequency of 5) for 5 consecutive days (Farmer et al., 1988)].

A predetermined reinforcer (i.e., positive reinforcer) was discussed in relation to meeting the data collection goal. The trainer/interventionist informed the participants that she would return at least weekly to assist the participant in reaching his/her goal by continuing to provide feedback. A copy of the feedback form was provided to the participants for reference.

Subsequent weekly 20-minutes followed the same procedure, except goal-setting (which had been completed already): (1) Participant and trainer reviewed the data collection system; (2) Feedback was provided with an opportunity for practice as needed using the checklists; (3) The goal and reinforcers for meeting the goal were reviewed; (4) The trainer provided a copy of the feedback and informed the participant of his/her next session. Concurrent with these feedback sessions, data continued to be collected using permanent products data collection for daily data and direct observation probes with the data collection procedures checklist.

When the first participant attained criterion level, s/he received the reinforcer for reaching the goal. At this time, the intervention phase of in-classroom follow-up training with

feedback began for the second participant's team and the first participant entered the maintenance phase of the reinforcement program with follow-up quality checks conducted by district/center representatives if available. The procedures were repeated for each subsequent participant in a staggered manner until s/he reached criterion level.

Maintenance and Generalization

In applied behavior analysis, maintenance has referred to "a condition in which treatment has been discontinued or partially withdrawn" (Cooper et al., 2007, p. 699). Generalization has referred to the transfer of a skill to other environments, stimuli or people (Cooper et al., 2007). Upon reaching criterion level, weekly in-classroom training sessions ceased and data were only collected for participants on a weekly or bi-weekly schedule to determine if the levels of responding maintained. In addition, district/center representatives were offered the option of providing a thinned schedule of feedback to enhance maintenance (e.g., Jahr, 1998). District/center representatives that chose to engage in the maintenance and generalization phase underwent a brief training session on how to use the feedback checklist and all their questions were answered. The district's/center's goals, expectations and policy on accountability in the form of systematic observational data collection for IEP goals were reviewed. Transfer of feedback sessions (i.e., transfer of responsibility of feedback sessions from the trainer to the district representative) occurred at the beginning of the maintenance phase.

During the maintenance phase, permanent product data were scored for the two target students at each quality check in the same manner as the previous phases, and a data collection

procedures checklist was completed for the participant by the district representative, if a representative was available. During the maintenance and generalization phase, the performance feedback session schedule was faded to a variable schedule of one and a half weeks. Feedback sessions were then in the form of quality checks conducted by a district/center representative or his/her agent trained in the use of the feedback checklist and consisted of: (1) Participant and district representative reviewed the data collection system; (2) Feedback was provided in the form of the feedback checklist; (3) The district/center representative discussed the importance of accountability for all students and explained the district's/center's goal of maintaining at criterion level for frequency of data collection of IEP objectives (e.g., at least five objectives daily for a randomly selected student in the class upon a quality check) and data collection procedures checklist (e.g., 8 of 8 procedures upon quality check). This phase of the study was an important step in transferring any positive impact from the intervention into a more natural setting that continues over time, for those settings that chose to participate. The mean frequency of data collection for the date of the maintenance feedback session was recorded.

Fidelity of Intervention Procedures

Upon reaching criterion level, weekly in-classroom training sessions ceased and data were only collected for participants on a weekly or bi-weekly schedule to determine if the levels of responding maintained. In addition, district/center representatives were offered the option of providing a thinned schedule of feedback to enhance maintenance (e.g., Jahr, 1998). District/center representatives that chose to engage in the maintenance and generalization

phase underwent a brief training session on how to use the feedback checklist and all their questions were answered. The district's/center's goals, expectations and policy on accountability in the form of systematic observational data collection for IEP goals were reviewed. Transfer of feedback sessions (i.e., transfer of responsibility of feedback sessions from the trainer to the district representative) occurred at the beginning of the maintenance phase.

During the maintenance phase, permanent product data were scored for the two target students at each quality check in the same manner as the previous phases, and a data collection procedures checklist was completed for the participant by the district representative, if a representative was available. During the maintenance and generalization phase, the performance feedback session schedule was faded to a variable schedule of one and a half weeks. Feedback sessions were then in the form of quality checks conducted by a district/center representative or his/her agent trained in the use of the feedback checklist and consisted of: (1) Participant and district representative reviewed the data collection system; (2) Feedback was provided in the form of the feedback checklist; (3) The district/center representative discussed the importance of accountability for all students and explained the district's/center's goal of maintaining at criterion level for frequency of data collection of IEP objectives (e.g., at least five objectives daily for a randomly selected student in the class upon a quality check) and data collection procedures checklist (e.g., 8 of 8 procedures upon quality check). This phase of the study was an important step in transferring any positive impact from the intervention into a more natural setting that continues over time, for those settings that

chose to participate. The mean frequency of data collection for the date of the maintenance feedback session was recorded.

Data Analysis

Visual analysis of data on a line graph was used to determine the relationship between daily mean frequency of data collection (DV) and the components of the prototypical training package (IV). Graphs representing the multiple baseline design across participants display individual responding for dependent measures and applicable ancillary measures over consecutive school days. Results were evaluated with respect to the level stability, trend, and percent of overlapping and non-overlapping data.

Finally, effect size (ES) was calculated for the multiple baseline design using Cohen's (1988) *d* statistic. ES was needed in order to determine the magnitude to which a functional relation exists between the IV and the DV (APA, 2009). Although visual and inferential statistics can provide information on the statistical significance of a study, the calculation of ES assists consumers of research in determining the clinical significance of the intervention utilized in the study (Grissom & Kim, 2005). For this study, *d* was calculated for the baseline and intervention conditions using the formula

$$d=(M_I - M_B)/\left(SD_P/\sqrt{2(1-r)}\right),$$

where M_I represents the mean score for Intervention, M_B represents the mean score for baseline, and SD_P is the pooled standard deviation for both experimental phases, and r is the correlation between the baseline and intervention data (Dunst, Hamby, & Trivette, 2004). This formula for ES is recommended when comparing correlations between phases for single subject

research where the number of data points across adjacent phases are unequal (Dunst, Hamby, & Trivette, 2004). ES was calculated by assessing first, each participant's behavior during his/her own baseline and intervention condition; second, ES was computed for all baseline and intervention conditions (pooled) across all participants (Beeson & Robey, 2006).

Expanded Operational Definitions

Data Collection Checklist Procedures

In addition to measuring the frequency of data collection for objectives, the investigator will also measure participant skills associated with data collection procedures taught in the workshop. Data collection procedures in this study consist of seven skills involved in systematic observational data collection (Alberto & Troutman, 2009; Cooper et al., 2007; Farmer et al., 1988; Pellecchia et al., 2011):

1. Data collection materials are visible. This is defined as having the data sheet (e.g., pen and paper, label, clipboard, etc.), device (e.g., touch screen device, laptop, timer, stopwatch, etc.), or other collection method (e.g., golf counter, white board, object counter, etc.) within sight of the trained study observers at any point during an observation probe session. Examples might include an iPod touch on a table within sight of a study observer, a clipboard labeled "data" hung on the wall, and a golf counter hanging on a lanyard worn by a teacher. Non-examples might include a drawer of data collection materials remains closed throughout the observation session (contents not visible to the study observer), a touch screen phone with data collection capability within a paraeducator's pocket that remains out of sight

throughout the session, and a data collection clipboard hanging outside the classroom observed only upon entry but not within the session.

2. Data collection materials are accessible to the participant (i.e., teacher participant or interventionist participant). This is defined as having the data sheet, device, or other collection method, within reach of the participant at any point during an observation probe session. Typical examples might include a data sheet on the table next to an interventionist, a sticky label with tally marks stuck on the leg of a teacher, a whiteboard with student objectives listed on it on the wall behind a paraeducator within arm's reach, a touch screen device in the apron pocket of a teacher, a sticky label with tally marks stuck on the leg of a speech paraeducator, a touch screen device in the apron pocket of a paraeducator, or a whiteboard with student objectives listed on it on the wall behind a teacher within arm's reach. Non-examples might include a golf counter sitting on the teacher's desk out of reach, a whiteboard on the other side of the room, or a laptop with a data program open but out of reach of teachers and staff.

3. Data collection materials are accessible to the other classroom team members (i.e., parapeducator). This is defined as having the data sheet, device, or other collection method, within reach of the team member at any point during an observation probe session. Typical examples might include a data sheet on the table next to a teacher, a sticky label with tally marks stuck on the leg of a paraeducator, a whiteboard with student objectives listed on it on the wall behind a paraeducator within arm's reach, a touch screen device in the apron pocket of a teacher, a sticky label with tally marks stuck on the leg of a speech paraeducator, a touch screen device in the apron pocket of a paraeducator, or a whiteboard with student objectives listed on it on the wall behind a teacher within arm's reach. Non-examples might include a golf

counter sitting on the teacher's desk out of reach, a whiteboard on the other side of the room, or a laptop with a data program open but out of reach of teachers and staff.

4. The classroom team member (lead teacher or paraeducator) records data during the observation session. This is defined as the participant being observed to indicate a record of student performance at any point during an observation probe session. Examples might include teacher writing down each instance of hitting behavior, teacher is observed writing down the number correct and the number incorrect during a one-on-one task, or observation of a teacher tapping a touch screen after turning off the stopwatch tracking the duration of on-task behavior. Some non-examples might be teacher writes on the classroom whiteboard related to the lesson (rather than a student objective) following a student response, teacher tapping on a touch screen device prior to interacting with students, or teacher typing at her computer while students are engaged in instructional activities with other staff members.

5. Paraeducator records data during the observation session. This is defined as observing at least one present support staff member indicating a record of student performance at any point during an observation probe session. Some examples might include paraeducator writing down each instance of hitting behavior, paraeducator is observed writing down 4 correct and 3 incorrect during a one-on-one task, or observation of a paraeducator tapping a touch screen after turning off the stopwatch tracking the duration of on-task behavior. Typical non-examples might be paraeducator writes on the classroom whiteboard related to the lesson (rather than a student objective) following a student response, speech therapist tapping on a touch screen device prior to interacting with students, or co-teacher

typing at her computer while students are engaged in instructional activities with other staff members.

6. Data are recorded multiple times during or after at least one instruction activity observed. This is defined as either the participant and/or at least one other support staff member are observed to record of student's performance during at least two occasions during an observation probe session regardless of the number of instructional activities (i.e., structured or unstructured activities with teacher ratios of one-on-one, small group less than one-to-six, or large group of one-to-six or more, such as circle time, free play, lecture, etc.). Examples might include a speech therapist using a counter to measure a student's one-word responses at least five times during a group activity, a paraeducator counting the number of beads in one pocket that s/he moved to track frequency of initiations to peers for three students during a small group activity, or a teacher tapping the start and stop time of each of 3 instances of out of seat behavior on a touch screen device as they occur. Typical non-examples might include observed staff members writing about student objectives prior to the start of any activity, or observation that all staff members only recorded data a single time between them during all observed activities.

7. Data are recorded during or after multiple instructional activities during the observation session. This is defined as either the participant and/or at least one other support staff member are observed to record student performance at any point during at least two instruction activities if more than one occur during an observation probe session or during the observation probe session if instruction activity occurs during its entirety. For example, a speech therapist using a counter to measure a student's one-word responses at least five times

during a group activity that extends through the entire study observation probe session; or a paraeducator counting a number of beads in one pocket that s/he moved to track frequency of initiations to peers after each activity for three students during a small group table activity, snack, and the outdoor activity and then recording the number on a whiteboard next to each student's initials. Additional examples might include observation that all staff members only recorded data a single time between them during all observed activities; or a teacher tapping the start and stop time of each of three instances of out of seat behavior on a touch screen device as they occur during independent work time and lecture. Typical non-examples might include observed staff members writing about student objectives prior to the start of any activity, or observation that all staff members recorded multiple data points during a single activity but not during at least two of the multiple observed activities.

8. Data are recorded using a data collection system. This is defined as having a specific data sheet, device, or other permanent collection method following student responding. Some typical examples might include staff member utilizing a clipboard, touch screen device, voice recorder dictating specific student responding, golf counter, sticky note, whiteboard with objectives, etc. immediately following a student response or activity in which student responded (i.e., vocal initiation, behavior intervention plan (BIP) target behavior response, mand, classroom routine behavior chain, etc.). Non-examples could include staff members stating the dimension of behavior out loud without recording it (e.g., "remind me to write down Tommy answered 70% correct"), no data are observed to be collected during this session by any staff members, all writing or recording is observed prior to any instructional activity and presumably unrelated to student responding, staff members are observed using potential data

collection materials (i.e., pen and paper, touch screen devices, computers, white boards, etc.) for purposes other than recording data (e.g., materials preparation, curriculum planning, attendance reporting, checking emails, etc.).

Definition of Key Terms

- *Accountability* in special education refers to the process of assuring that student outcomes are positive and meet the standards set forth.
- A*utism spectrum disorder* (*ASD*) refers developmental disorders classified as pervasive developmental disorders (*PDD*) by the DSM-IV-TR (2000) that are marked by severe impairments in functioning in the areas of social interaction, language and social communication, and symbolic play. The term PDD includes autism and Asperger syndrome. ASD encompasses the range of characteristics displayed with PDD from mild to severe.
- *Disabilities* refers to eligibilities under special education services. The term includes individuals meeting the criteria under IDEA and IDEIA.
- *Effect Size* (ES) is calculated in order to determine the magnitude to which a functional relationship exists between the IV and the DVs (APA, 2009). Although visual and inferential statistics can provide information on the statistical significance of a study, the calculation of ES assists consumers of research in determining the clinical significance of the intervention utilized in the study (Grissom & Kim, 2005).
- *Formative evaluation* assesses programs and procedures as they are occurring with the goal of improvement.

- *IDEA and IDEIA* are landmark acts set forth to protect the rights of individuals with disabilities in the United States (1990; 1997; 2004).
- *IEP objectives* are individualized and measurable short term and long term goals that must be included in an IEP.
- *IEP* refers to an individualized education plan containing the components mandated by IDEA and IDEIA.
- *In-classroom training* refers to *on-the-job training* for teachers.
- *Maintenance* refers to the stage of learning following acquisition and fluency, during which the target skill is demonstrated over time without the need for re-teaching (Alberto & Troutman, 2009).
- *Prototypical teacher training* refers to a staff training model utilizes checklists to task analyze the steps of the targeted staff skill, following a systematic format for introduction of the skill for the staff: Specify the skill, provide a checklist of the skill, describe the skill and its rationale, demonstrate the skill, have staff practice, and provide feedback (Reid & Parsons, 2006).
- *Quality checks* refer to the use of a checklist to ensure accuracy of to designated skill.
- *Reinforcement* in operant conditioning, the process of increasing behavior through the application or removal of stimuli to strengthen behavior over time (Cooper et al., 2007).
- *Systematic observational data collection, measurement* and *documentation* are used interchangeably to refer to the process of recording observed behavior.

- *Workshop training* is used to describe *in-service training* (training that occurs outside the designated work environment, such as in a conference room), but contains role playing and modeling opportunities.

APPENDIX D

COMPLETE/UNABRIDGED RESULTS

Mean Frequency of Data Collection for Core Objectives

Results indicate no change in rates of mean daily frequency between pre-workshop baseline and post-workshop responding across participants. There were observed changes in responding at varying times after in-classroom intervention sessions were introduced. The mean daily frequencies of data collection for core objectives are displayed for all participants for pre-workshop baseline, post-workshop baseline, intervention, and maintenance/generalization phases in Figure 1 across consecutive school days (i.e., each day students were present, excluding weekends and holiday breaks occurring between days 28-29, 46-47, and 87-88).

Pre-workshop and post-workshop baseline responding was at zero levels for all participants (i.e., for all participants, there were zero instances in baseline for which they met all four criteria of data collection for any core objective). For Beth, an increasing trend was observed after the second weekly in-classroom training session, although the data were variable. Data did not begin to follow an increasing trend for Caleb until after the fifth weekly in-classroom training session. At this time, skills were demonstrated in the sessions, but were not represented in the participant's responding. The decision was made by the trainer to introduce the participant's supervisor and begin transferring control of the accountability to the natural environment prior to the maintenance and generalization phase. After the introduction of accountability of data systems (i.e., participant provided data sheets and graphs daily to the trainer and supervisor for training purposes), an increasing trend in responding was observed. Dee showed similar skills in the training sessions, so after the second weekly training session, the trainer began transferring control to the participant's supervisor by requesting

accountability (i.e., participant provided data sheets and graphs daily to the trainer and supervisor for training purposes). At that time, there was an increasing trend of responding. Eva left her position at the center, and therefore the study, prior to winter break while still in baseline. Amy's responding is not included in the results (Figure 1), as it was discovered in the second weekly intervention session that she was not the responsible party for data collection for the students with ASD on her caseload and therefore did not meet the selection criteria for the study. Data collected up to that point indicated zero levels for pre- and post-workshop baseline, as well as zero levels for seven consecutive school days of intervention. These data were based on the data collection procedures of someone other than the participant or her classroom team, however, so they are not included in the study analysis.

Effect size coefficients between baseline responding and responding during intervention indicated a large effect (Cohen, 1977) and practical or clinical significance (Wolf, 1986) for each individual participant, as well as for responding for all participant baseline and intervention conditions (pooled). Responding between baseline to intervention for Beth (d = 1.85, $p < 0.05$), Caleb (d = 1.14, $p < 0.05$), and Dee (d = 3.54, $p < 0.05$) indicated clinical significance of the change in responding during the intervention phase. In addition, when responding for all three participants was examined, results were similar (d = 1.71, $p < 0.05$).

Data Collection Procedures Checklist

During weekly direct observation probes, the data collection procedures checklist was completed for each participant. The number of observed steps on the checklist was divided by the total number of steps, resulting in a percentage of steps observed. The mean percentage of

steps observed per observation was calculated for each participant (Figure 2). For Beth, the mean percentage of steps observed was calculated for baseline (*M* = 97%, *SD* = 6) and intervention (*M* = 97%, *SD* = 5.86). Baseline (*M* = 97%, *SD* = 6), intervention (*M* = 100%, *SD* = 0), and maintenance/generalization (*M* = 100%, *SD* = 0) phases were determined for Caleb. The mean percentage of steps observed per observation was also calculated for baseline (*M* = 100%, *SD* = 0) and intervention (*M* = 84%, *SD* = 18.88) for Dee; there was also one maintenance session during which time her responding had decreased (50%). The mean percentage of steps observed was calculated for baseline (*M* = 85%, *SD* = 26.89) for Eva, although no intervention data were available due to attrition. Also, although her classroom arrangement was revealed during intervention to not meet the criteria for this study because the primary DV was not a result of the behavior of he classroom team, the data collection procedures checklist *was* based on observation of her behavior, so results are included for additional information to the reader. The mean percentage of steps observed was calculated for baseline (*M* = 54%, *SD* = 29.70) and intervention (*M* = 88%, *SD* = 0) for Amy.

The results from the data collection procedures checklist indicate an increase with large, clinically significant effect from baseline to intervention for Caleb ($d = 1.00$, $p < 0.05$). Beth had no change in responding, indicating no effect ($d = 0.00$, $p < 0.05$) on observation checklist items between baseline and intervention. For Dee, there was a clinically significant decrease ($d = -2.24$, $p < 0.05$) in the number of checklist behaviors observed from baseline to intervention. Amy was observed during baseline and intervention before she was withdrawn from the study.

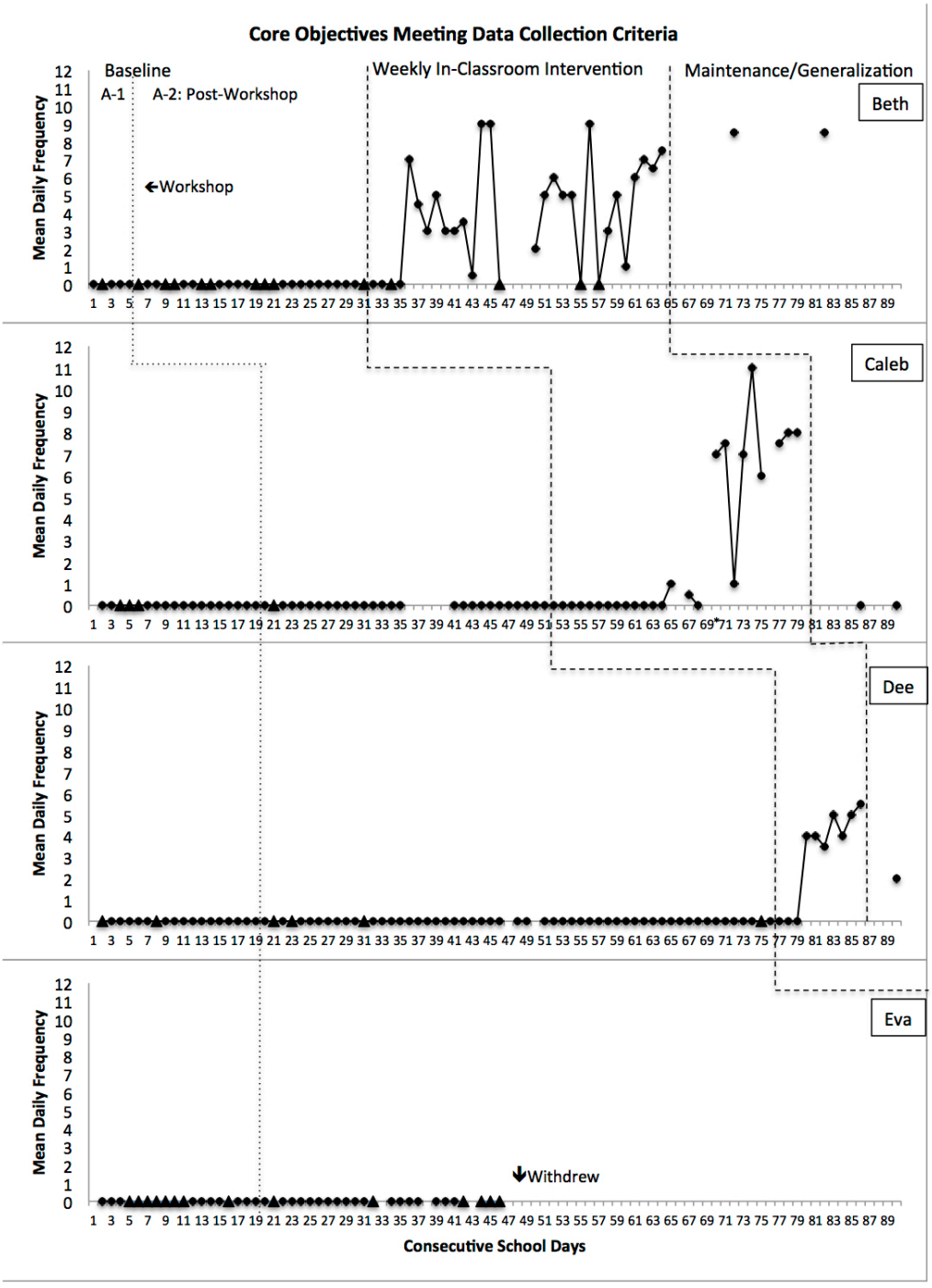

Figure D.1. The effects of a prototypical training program on the daily frequency of objectives meeting criteria for systematic observational data collection.

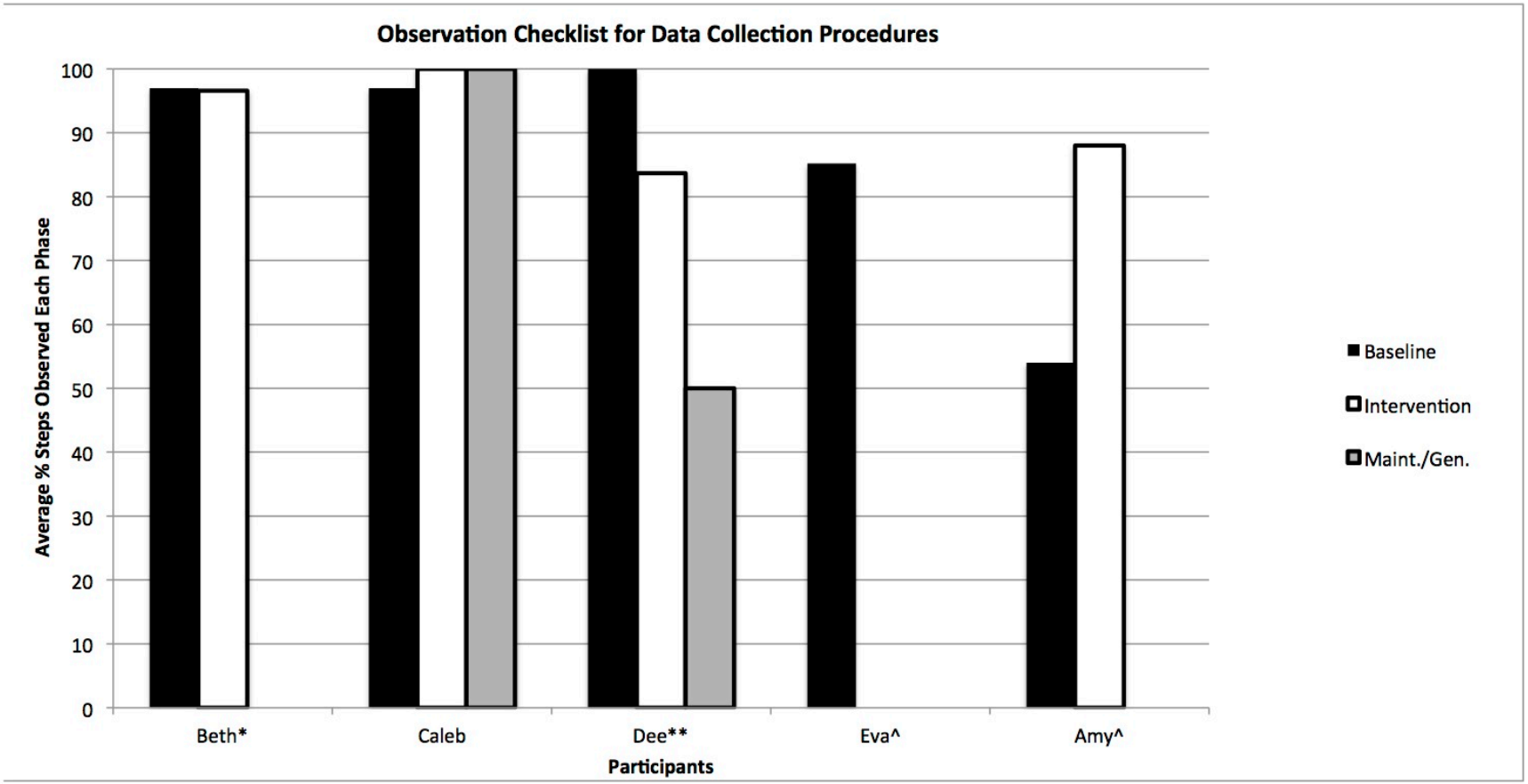

Figure D.2. The average percentage of steps observed on the data collection procedures checklist for weekly observation probes in baseline, intervention, and generalization phases. [*No generalization data available. **Data collection procedures checklists for intervention and generalization sessions had limited opportunity for demonstrating data collection skills. ^Participants withdrawn or withdrew from the study prior to completion. These preliminary results, while incomplete, indicated a large effect ($d = 2.29$, $p < 0.05$). Eva left the study during baseline data collection.]

Additional Measures

For each objective scored for the four criteria of systematic observational data collection, results were also scored indicating the presence or absence of (1) Data collector name; (2) Student's name (or code); (3) IEP objective requirements of the behaviors being recorded; (4) The date of data collection for student responding; (5) Dimension of behavior consistently matched topography of behavior; and (6) Dimension of behavior matched the dimensions indicated in the objectives. Beth consistently demonstrated 100% of these measures for each objective with any data collected. Caleb, Dee, and Eva met 83% of the measures consistently for objectives with data, with the "data collector name" being the measure that was usually not included. There were objectives for which Caleb and Eva did meet 100% of the measures, but this occurred fewer than 20 times in the hundreds of objectives scored.

Although the DV of the study involved a comparison of mean frequency for data meeting all four criteria, additional data obtained related to data collection for core objectives warrants attention. First, a closer examination for the percentage of objectives for which any permanent data were recorded (i.e., number of objectives with any data/total core objectives of ASD possible), yet did not meet the full criteria (i.e., graphing and/or DBDM were missing) was completed as displayed in Figure 3. Effect size coefficients between pre-workshop baseline and post-workshop baseline percentage of objectives for which any permanent data were recorded had varied results. Results indicated a moderate effect and practical or clinical significance for two participants and the participants pooled, a large clinically significant effect for one participant, and a moderately significant decreasing effect for one participant: Beth (*d* =

-0.64, $p < 0.05$), Caleb ($d = 0.80$, $p < 0.05$), Dee ($d = 1.47$, $p < 0.05$), and Eva ($d = 0.67$, $p < 0.05$); responding for all four participants ($d = 0.73$, $p < 0.05$). When the same measure was calculated between baseline and intervention, results were equally varied: Beth ($d = 0.17$, $p < 0.05$), Caleb ($d = 2.41$, $p < 0.05$), Dee ($d = -0.02$, $p < 0.05$), and Eva (withdrew prior to intervention); pooled responding for the three participants ($d = 0.73$, $p < 0.05$).

Percentage of objectives meeting all four criteria (i.e., number of objectives meeting all four criteria/total core objectives of ASD possible) was also considered in addition to the mean daily frequency, as displayed in Figure 4. This measure takes into account the number of possible objectives for which a participant could have collected data. Effect size coefficients between pre-and post-workshop baseline responding were all the same ($d = 0.00$, $p < 0.05$). Comparisons between baseline and intervention yielded a large effect and practical or clinical significance effect for each individual participant, as well as for responding for all participant baseline and intervention conditions (pooled): Beth ($d = 1.80$, $p < 0.05$), Caleb ($d = 1.17$, $p < 0.05$), and Dee ($d = 3.29$, $p < 0.05$) indicated clinical significance of the change in responding during the intervention phase. In addition, when responding for all three participants was examined ($d = 1.90$, $p < 0.05$), results were similar.

Inter-Observer Agreement, Kappa, and Fidelity Measures

The mean daily frequency scores of each participant for the 90 school days were assessed for occurrence (IOA = 100) and non-occurrence (IOA = 100) agreement by two independent observers for 50% of school days for baseline, intervention, and maintenance conditions.

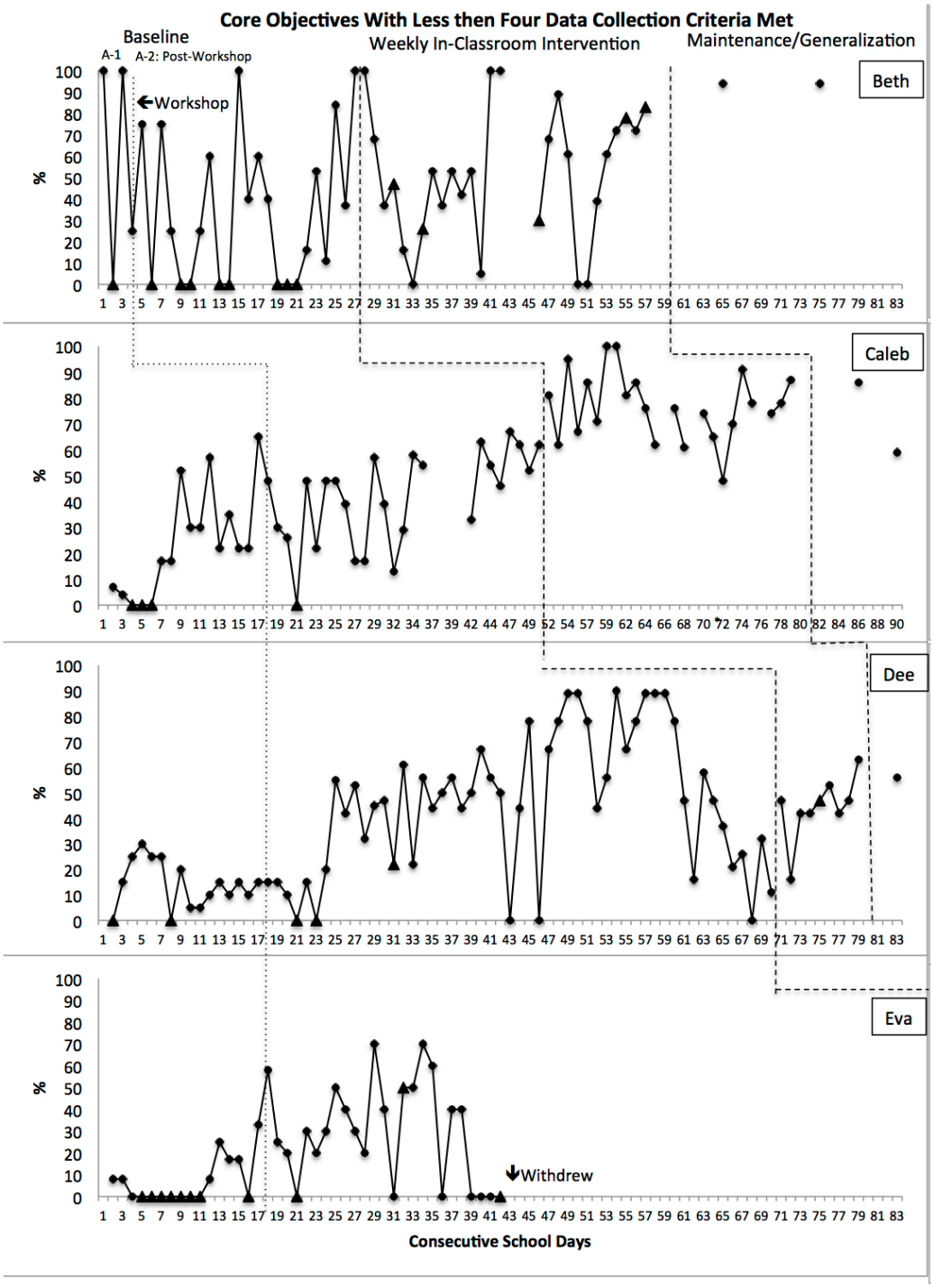

Figure D.3. The percentage of core objectives of ASD for which data were collected, but criteria were not met for systematic observational data collection.

Similarly, for 33% of direct observations using the data collection procedures checklist, occurrence (IOA = 100) and non-occurrence (IOA = 100) agreement by two independent observers was assessed for baseline and intervention conditions. To assess the agreement of observers with respect to the likelihood of the agreement occurring by chance, the kappa coefficients for mean daily frequency baseline (K = 1.0) and intervention (K = 1.0), as well as for direct observation data (K = 1.0) were found and indicate near perfect agreement.

Fidelity of implementation was assessed for workshop sessions and in-classroom training sessions. Participants' supervisors were also provided with fidelity checklists for maintenance feedback sessions. Three workshop sessions were conducted with 100% fidelity of implementation for 100% of sessions. For the 21 in-classroom training sessions, 100% fidelity of implementation was found for 100% of sessions. For the three maintenance and generalization sessions conducted by a center supervisor, 100% fidelity of implementation was reported by the supervisor for 100% of sessions. Finally, each participant that did not withdraw or was not withdrawn indicated 100% of steps of the intervention were accessed with fidelity.

Social Validity

Social validity surveys were provided to all three participants, as well as to Amy who was withdrawn from the study during intervention. Three of the four surveys were returned at the time of this summary. Reminders and subsequent requests were made to those who had not yet submitted this information.

Results of the survey indicate that Beth and Caleb "strongly agreed" and Dee "agreed" that their participation in the study increased their knowledge in measurement, data collection

system development, classroom preparation for data collection, data collection strategies, graphing, and DBDM. In addition, it was indicated that as a result of the workshop and in-classroom training combined, daily data collection systems were developed in their classrooms.

For these targeted skills, there was some variability in responding pertaining to which training method was perceived as most effective. Beth indicated combinations of all three options (i.e., "workshop alone", "in-classroom sessions alone", and "workshop and in-classroom training combined") as the most effective training method for the various skills, as well as indicating "none of these" for the skill of increasing the number of times per day data are collected in the classroom. Caleb indicated that the "in-classroom sessions alone" were most effective for some skills, and the "workshop and in-classroom training combined" were most effective for the remaining listed skills. Dee indicated that the "workshop and in-classroom training combined" was perceived as the most effective training strategy for all skills. Overall, both Beth and Caleb indicated that the most effective training method for them for data collection and analysis for accountability was the "in-classroom sessions alone", while Dee indicated that it was "workshop and in-classroom training combined". Given the variability of responses (Workshop Alone, n = 6 responses; In-classroom Sessions Alone, n = 6 responses; Workshop + In-classroom Training, n = 17 responses; None of These, n = 1 response), the use of some combination of workshop and in-classroom training seems supported.

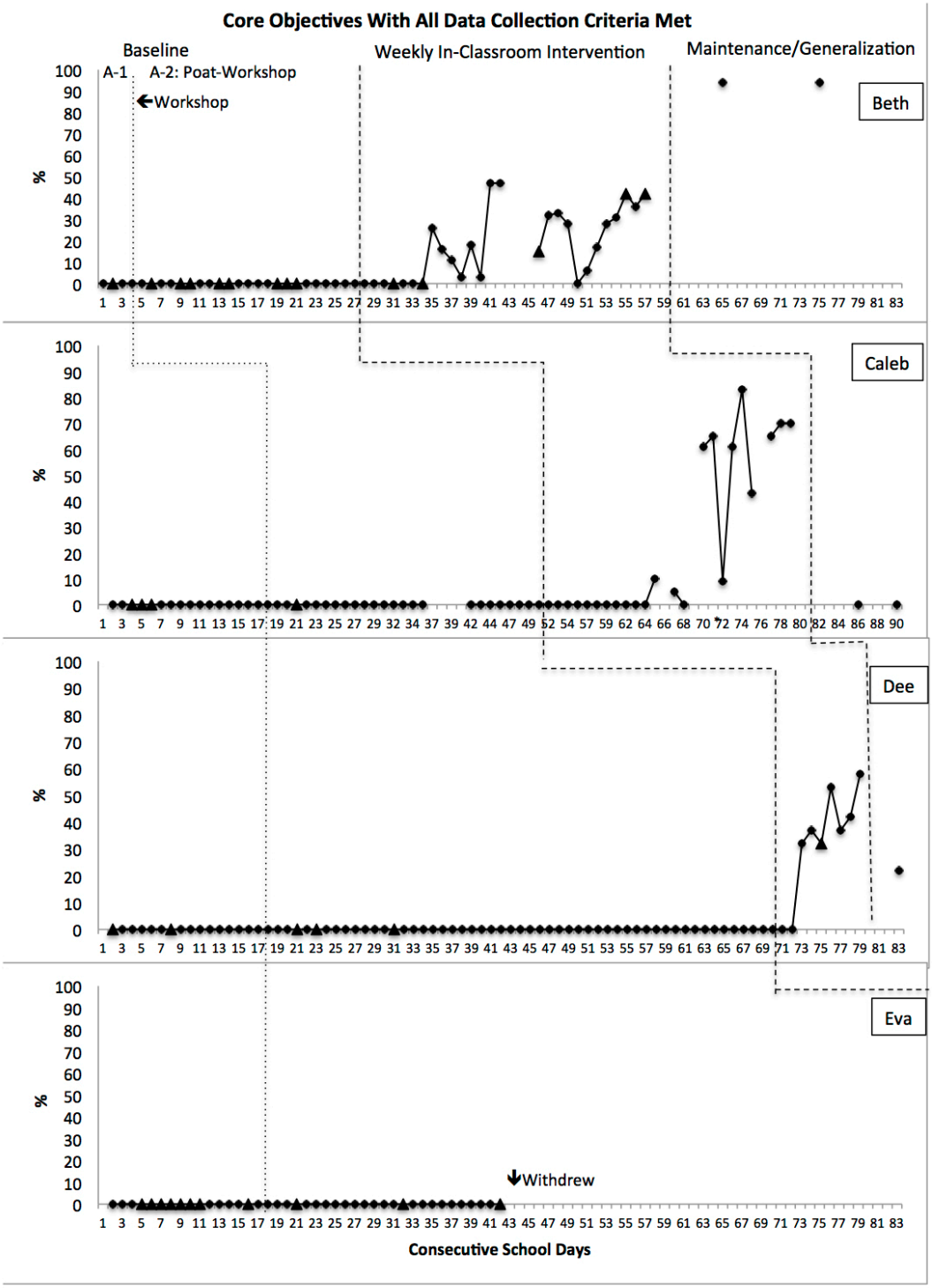

Figure D.4. The percentage of core objectives of ASD for which all four criteria were met for systematic observational data collection.

COMPREHENSIVE REFERENCE LIST

Studies with an (*) next to them were included in the meta-analysis.

Alberta Education. (2006*). Essential components of educational programming forstudents with behaviour disabilities. Standards for special education*. Edmonton, Alberta: Author. Retrieved from ERIC database.

Alberto, P. A., & Troutman, A. C. (2009). *Applied behavior analysis for teachers* (8th ed.). Upper Saddle River, NJ: Merrill.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (Revised 4th ed.). Washington, DC: Author.

American Psychological Association. (2009). *Publication manual of the American Psychological Association* (6th ed.). Washington, DC: Author.

Arco, L. (1991). Effects of outcome performance feedback on maintenance of client and staff behavior in a residential setting. *Behavioral Residential Treatment*, *6*, 231-247. Retrieved from Academic Search Complete database.

Arco, L., & Millett, R. (1996). Maintaining instructional behavior after on-the-job training with process-based performance feedback. *Behavior Modification*, *20*, 300-320. doi:10.1177/01454455960203004.

Baer, D., Wolf, M. & Risley, T. (1987). Some still-current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis*, *20*, 313-27. doi: 10.1901/jaba.1987.20-313.

Baer, D., Wolf, M., & Risley, T. (1968). Some current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis*, *1*, 91-97. doi: 10.1901/jaba.1968.1-91.

Beeson, P. M., & Robey, R. R. (2006). Evaluating single-subject treatment research: Lessons learned from the aphasia literature. *Neuropsychology Review*, *16*, 161-169. doi:10.1007/s11065-006-9013-7.

Blumberg, S.J., Bramlett, M.D., Kogan, M.D., Schieve, L.A., Jones, J.R., & Lu, M.C. (2013). Changes in prevalence of parent-reported autism spectrum disorder in school-aged U.S. children: 2007 to 2011-2012. National Health Statistics Reports, 65, 1-8. Retreived from www.cdc.gov/nchs/data/nhsr/nhsr065.pdf.

*Browder, D., Karvonen, M., Davis, S., Fallin, K., & Courtade-Little, G. (2005). The impact of teacher training on state alternate assessment scores. *Exceptional Children*, *71*, 267-282. Retrieved from Academic Search Complete database.

Bucklin, B. R., Alvero, A. M., Dickinson, A. M., Austin, J., & Jackson, A. K. (2000). Industrial-organizational psychology and organizational behavior management: An objective comparison. *Journal of Organizational Behavior Management*, *20*(2), 27-75. doi:10.1300/J075v20n02_03.

Burgio, L. D., Whitman, T. L., & Reid, D. H. (1983). A participative management approach for improving direct-care staff performance in an institutional setting. *Journal of Applied Behavior Analysis*, *16,* 37-53. Retrieved from PubMed Central.

Burns, E. (2001). *Developing and implementing IDEA-IEPs: An individualized education program (IEP) handbook for meeting Individuals with Disabilities Education Act (IDEA) requirements*. Springfield, IL: C.C. Thomas.

Callahan, K., Henson, R., & Cowan, A. (2008). Social validation of evidence-based practices in autism by parents, teachers, and administrators. *Journal of Autism and Developmental Disorders*, *38*, 678-692. Retrieved from E-Journals database.

Carothers, D., & Taylor, R. (2003). The use of portfolios for students with autism. *Focus on Autism and Other Developmental Disabilities*, *18*, 125-128. doi:10.1177/108835760301800206.

Cheney, C. O. (2000). Ensuring IEP accountability in inclusive settings. *Intervention in School & Clinic*, *35*, 185-189. Retrieved from Academic Search Complete database

Chezan, L.C., Drasgow, E., & Marshall, K.J. (2012). A report on using general-case programming to teach collateral academic skills to a student in a post-secondary setting. *Focus on Autism and Other Developmental Disabilities, 27*, 22-30. doi: 10.1177/1088357611428334.

*Codding, R., Skowron, J., & Pace, G. (2005). Back to basics: Training teachers to interpret curriculum-based measurement data and create observable and measurable objectives. *Behavioral Interventions*, *20*, 165-176. doi:10.1002/bin.194.

Cohen J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates; Hillsdale, NJ.

Cohen, J. (1977). *Statistical power analysis for behavioral sciences* (revised ed.). New York: Academic Press.

Cohen, J. (1968). Weighted kappa: Nominal scale agreement provision for scaled disagreement or partial credit. *Psychological Bulletin*, *70*, 213-220. doi:10.1037/h0026256.

Colorado University Center for Collaborative Educational Leadership. (1998). *Social skills classroom training packet. LEAP outreach project*. Retrieved from ERIC database.

Cooke, N., Heward, W. L., Test, D. W., Spooner, F., & Courson, F. H. (1991) Student performance data in the classroom: Measurement and evaluation of student progress. *Teacher Education and Special Education, 14*, 155-161. Retrieved from ERIC database

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). Measuring behavior. In *Applied behavior analysis* (2nd ed., pp. 72-101). Upper Saddle River, NJ: Pearson.

Crockett, J. B., & Yell, M. L. (2008). Without data all we have are assumptions: Revisiting the meaning of a free appropriate public education. *Journal of Law & Education, 37*, 381-392.

Culig, K. M., Dickinson, A. M., McGee, H. M, & Austin, J. (2005). An objective comparison of applied behavior analysis and organizational behavior management research. *Journal of Organizational Behavior Management, 25*, 35-72 doi:10.1300/J075v25n01_02.

Cummings, A. R. (2005). *Evaluating progress in behavioral programs for children with pervasive developmental disorders: Continuous versus intermittent data collection*. Unpublished doctoral dissertation. Western Michigan University.

Cummings, A. R., & Carr, J. E. (2009). Evaluating progress in behavioral programs for children with autism spectrum disorders via continuous and discontinuous measurement. *Journal of Applied Behavior Analysis, 42*, 57-71. doi:10.1901/jaba.2009.42-57

Daniels, A. C., & Daniels, J. E. (2004). *Performance management: Changing behavior that drives organizational effectiveness* (4th ed.). Atlanta, GA: Performance Management Publications.

Drasgow, E., Yell, M., & Robinson, T. (2001). Developing legally correct and educationally appropriate IEPs. *Remedial & Special Education*, *22*, 359-373. Retrieved from Education Research Complete database

Ducharme, J. M., & Feldman, M. A. (1992). Comparison of staff training strategies to promote generalized teaching skills. *Journal of Applied Behavior Analysis, 25*, 165-179. doi:10.1901/jaba.1992.25-165

Ducharme, J. M., Williams, L., Cummings, A., Murray, P., & Spencer, T. (2001). General case quasi-pyramidal staff training to promote generalization of teaching skills in supervisory and direct-care staff. *Behavior Modification, 25*, 233-254. doi:10.1177/0145445501252004

Dunst, C. J., Hamby, D. W., & Trivette, C. M. (2004). Guidelines for calculating effect sizes for practice-based research synthesis. *Evidence-based Approaches to Early Childhood Development, 3*, 1-10.

*Farmer, R., Wolery, M., Gast, D. L, & Page, J. L. (1988). Individual staff training to increase the daily mean frequency of data collection in an integrated preschool program. *Education and Treatment of Children, 11*, 127-142. Retrieved from ERIC database.

Fenske, E. C., Zalenski, S., Krantz, P. J., & McClannahan, L. E. (1985). Age at intervention and treatment outcome for autistic children in a comprehensive intervention program. *Analysis and Intervention in Developmental Disabilities, 5*, 49-58. Retrieved from Education Research Complete database.

Frederiksen, L. W., & Lovett, S. B. (1980). Inside organizational behavior management: Perspectives on an emerging field. *Journal of Organizational Behavior Management, 4*, 193-203.

Frederiksen, L. W., & Riley, A. (Eds.). (1984). *Improving staff effectiveness in human service settings: Organizational behavior management approaches.* New York, NY: Hawthorne Press.

Freeman, B. (1997). Guidelines for evaluating intervention programs for children with autism. *Journal of Autism and Developmental Disorders*, *27*, 641-651. Retrieved from E Journals database.

Frick, T., & Semmel, M. I. (1987). Observer agreement and reliabilities of classroom observational measures. *Review of Educational Research, 48*, 157-184. doi: 10.3102/00346543048001157.

Fuchs, L., & Fuchs, D. (1986). Effects of systematic formative evaluation: A meta-analysis. *Exceptional Children*, *53*, 199-208. Retrieved from Education Research Complete database.

Fuchs, L., Fuchs, D, & Warren, L. (1982). Special education practice in evaluating student progress toward goals. *Institute for Research on Leaning Disabilities Research Report, 81*, 1-34. Retrieved from ERIC database.

Gast, D. L. (2010). *Single subject research methodology in behavioral sciences*. New York, NY: Routledge.

Given, H., Kuh, L., LeeKeenan, D., Mardell, B., Redditt, S., & Twombly, S. (2010). Changing school culture: Using documentation to support collaborative inquiry. *Theory Into Practice, 49*(1), 36.

Graff, H. (2007). Technology adoption and usage of a data collection tool in a school setting servicing students with autism: A qualitative look at the process and perspectives. *Dissertation Abstracts International Section A*, 68, Retrieved from PsycINFO database.

Greenwood, C. R., & Maheady, L. (1997). Measurable change in student performance: Forgotten standard in teacher preparation? *Teacher Education and Special Education:*

The Journal of the Teacher Education Division of the Council for Exceptional Children, 20, 265-275. doi:10.1177/088840649702000307

Greenwood, C. R., & Maheady, L. (2001). Are future teachers aware of the gap between research and practice and what should they know? *Teacher Education and Special Education: The Journal of the Teacher Education Division of the Council for Exceptional Children, 24,* 333-347. doi: 10.1177/088840640102400407.

Gresham, F., Gansle, K., & Noell, G. (1993). Treatment integrity in applied behavior analysis with children. *Journal of Applied Behavior Analysis*, *26*, 257-263. doi:10.1901/jaba.1993.26-257.

Grissom, R. J., & Kim, J. J. (2005). *Effect sizes for research: A broad practical approach*. Mahwah, NJ US: Lawrence Erlbaum Associates Publishers.

Gross, A. M., & Ekstrand, M. (1983). Increasing and maintaining rates of teacher praise: A study using public posting and feedback fading. *Behavior Modification, 7,* 126-136.

Gunter, P., Callicott, K., Denny, R., & Gerber, B. (2003). Finding a place for data collection in classrooms for students with emotional/behavioral disorders. *Preventing School Failure*, *48*, 4-8. Retrieved from Academic Search Complete database.

Haberlin, A. T., Beauchamp, K., Agnew, J., & O'Brien, F. (2012). A comparison of pyramidal staff training and direct staff training in community-based day programs. *Journal of Organizational Behavior Management, 32*, 65-74. doi: 10.1080/01608061.2012.646848.

Harris, R., Simons, M., Willis, P., & Carden, P. (2003). Exploring complementarity in on- and off-job training for apprenticeships. *International Journal of Training and Development*, *7*, 82-92. doi:10.1111/1468-2419.00173.

Heritage, M., & Chen, E. (2005). Why data skills matter in school improvement. *Phi Delta Kappan*, *86*, 707-710. Retrieved from MasterFILE Premier database.

Heward, W. L. (2003). Ten faulty notions about teaching and learning that hinder the effectiveness of special education. *Journal of Special Education, 36*, 186-205. doi:10.1177/002246690303600401.

Hojnoski, R. L., Caskie, G. I., Gischlar, K. L., Key, J. M., Barry, A., & Hughes, C. L. (2009). Data display preference, acceptability, and accuracy among urban head start teachers. *Journal of Early Intervention, 32*, 38-53. doi: 10.1177/1053815109355982.

Holvoet, J*.,* O'Neil*, C.,* Chazdon, L., Carr*,* D. & Warner, J*.* (1983). Hey, do we really have to take data? *Journal of the Association for People with Severe Handicaps*, *8*, 56-70. Retrieved from ERIC database.

*Hundert, J. (1982). Training teachers in generalized writing of behavior modification programs for multihandicapped deaf children. *Journal of Applied Behavior Analysis*, *15*, 111 122. Retrieved from PubMed Central.

Individuals with Disabilities Education Act Amendments. (1997). 20 U.S.C. § 1415.

Individuals with Disabilities Education Act. (1990). 20 U.S.C. § 1400 *et seq.*

Individuals with Disabilities Education Improvement Act, (2004). H.R. 1350, 108th Congress.

Iwata, B. A. (1994). Functional analysis methodology: Some closing comments. *Journal of Applied Behavior Analysis*, *27*, 413. doi:10.1901/jaba.1994.27-413.

Iwata, B. A., Dorsey, M. F., Slifer, K. J., & Bauman, K. E. (1994). Toward a functional analysis of self-injury. *Journal of Applied Behavior Analysis*, *27*, 197-209. doi:10.1901/jaba.1994.27-197.

Jahr, E. (1998). Current issues in staff training. *Research in Developmental Disabilities, 19*, 73-87. doi:10.1016/S0891-4222(97)00030-9.

Jones, C., Ratcliff, N., Sheehan, H., & Hunt, G. (2012). An analysis of teachers' and paraeducators' roles and responsibilities with implications for professional development. *Early Childhood Education Journal, 40*, 19-24. doi:10.1007/s10643-011-0487-4

Kissel, R. C., Whitman, T. L., & Reid, D. H. (1983). An institutional staff training and self management program for developing self-care skills in severely/profoundly retarded individuals. *Journal of Applied Behavior Analysis* , *16*, 395-415. Retrieved from PubMed Central.

Kokina, A., & Kern, L. (2010). Social story interventions for students with autism spectrum disorders: A meta-analysis. *Journal of Autism and Developmental Disorders, 40*, 812-826. doi:10.1007/s10803-009-0931-0

Krasch, D., & Carter, D. (2009). Monitoring classroom behavior in early childhood: Using group observation data to make decisions. *Early Childhood Education Journal*, *36*, 475-482. doi:10.1007/s10643-009-0316-1.

Kunz, G. G, Lutzker, J. R., Cuvo, A. J., Eddleman, J., Lutzker, S. Z., Megson, D., & Gulley, B. (1982). Evaluation strategies to improve careprovider performance on health and developmental tasks in an infant care facility. *Journal of Applied Behavior Analysis, 15,* 521-531. Retrieved from PubMed Central.

Lerman, D., Hovanetz, A., Strobel, M., & Tetreault, A. (2009). Accuracy of teacher-collected descriptive analysis data: A comparison of narrative and structured recording formats. *Journal of Behavioral Education*, *18*, 157-172. doi:10.1007/s10864-009-9084-7.

Lovaas, O. I. (1987). Behavioral treatment and normal educational and intellectual functioning in young autistic children. *Journal of Consulting and Clinical Psychology, 55*, 3-9. Retrieved from PsycINFO database.

Lowden, C. (2006). Reality check: Survey highlights the disparity between the ideal and real in professional learning programs. *Journal of Staff Development*, *27*, 61-64. Retrieved from ERIC database.

Mautone, J., Luiselli, J., & Handler, M. (2006). Improving implementation of classroom instruction through teacher-directed behavioral consultation: A single-case demonstration. *International Journal of Behavioral Consultation & Therapy*, *2*, 432-438. Retrieved from Academic Search Complete database.

McAfee, J. (1987). Integrating therapy services in the school: A model for training educators, administrators, and therapists. *Topics in Early Childhood Special Education*, *7*, 116-126. doi:10.1177/027112148700700311.

McEachin, J. J., Smith, T., & Lovaas, O. I. (1993). Long-term outcome for children with autism who received early intensive behavioral treatment. *American Journal of Mental Retardation, 4*, 359-372. Retrieved from Education Research Complete database.

McLaughlin, M. J., & Thurlow, M. (2003). Educational accountability and students with disabilities: Issues and challenges. *Educational Policy, 17*, 431-451. doi: 10.1177/0895904803254962.

McLaughlin, T. (1993). An analysis and evaluation of educator selected data collection procedures in actual school settings. *Child & Family Behavior Therapy*, *15*, 61-64. Retrieved from E-Journals database.

Morrier, M. J., Hess, K. L., & Heflin, L. J. (2011). Teacher training for implementation of teaching strategies for students with autism spectrum disorders. *Teacher Education and Special Education: The Journal of the Teacher Education Division of the Council for Exceptional Children, 34,* 119. doi:10.1177/0888406410376660

Munger, G., & Loyd, B. (1989). Effects of daily mean frequency of data collection and graph characteristics on visual inference. *Assessment For Effective Intervention (AEI)*, *14*, 112-124. Retrieved from E-Journals database.

Munger, G., Snell, M., & Loyd, B. (1989). A study of the effects of daily mean frequency of probe data collection and graph characteristics on teachers' visual analysis. *Research In Developmental Disabilities*, *10*, 109-127. Retrieved from MEDLINE database.

Nadjowski, C. A., Chilingaryan, V., Bergstrom, R., Granpeesheh, D., Blasanyan, S., Aguilar, B., & Tarbox, J. (2009). Comparison of data-collection methods in a behavioral intervention program for children with pervasive developmental disorders: A replication. *Journal of Applied Behavior Analysis. 42*, 827-832.

No Child Left Behind (NCLB) Act of 2001, Pub. L. No. 107-110, § 115, Stat. 1425 (2002).

Noell, G., Witt, J., Slider, N., Connell, J., Gatti, L., Williams, K., Koenig, J. L., Resetar, J. L., & Duhon, G. J. (2005). Treatment implementation following behavioral consultation in schools: A comparison of three follow-up strategies. *School Psychology Review, 34*, 87–106.

Odom, S. L., Brantlinger, E., Gersten, R., Horner, R. H., Thompson, B., & Harris, K. H. (2005). Research in special education: Scientific methods and evidence-based practices. *Exceptional Children, 71*, 137-148.

Ogletree, B., & Oren, T. (2001). Application of ABA principles to general communication instruction. *Focus on Autism and Other Developmental Disabilities*, *16*, 102-109. Retrieved from Education Research Complete database.

Owston, R., Wideman, H., Murphy, J., & Lupshenyuk, D. (2008). Blended teacher professional development: A synthesis of three program evaluations. *Internet and Higher Education*, *11,* 201-210. Retrieved from ERIC database.

Palmen A., Didden R., & Korzilius H. (2010). Effectiveness of behavior skills training on staff performance in a job training setting for high-functioning adolescents with autism spectrum disorders. *Research in Autism Spectrum Disorders. 4*, 731-740.

Panyan, M., Boozer, H., & Morris, N. (1970). Feedback to attendants as a reinforcer for applying operant techniques. *Journal of Applied Behavior Analysis*, *3*, 1-4. Retrieved from PubMed Central.

Parsons, M., & Reid, D. (1995). Training residential supervisors to provide feedback for maintaining staff teaching skills with people who have severe disabilities. *Journal of Applied Behavior Analysis*, *28*, 317-22. Retrieved from ERIC database.

Parsons, M., Reid, D., & Green, C. (1993). Preparing direct service staff to teach people with severe disabilities: A comprehensive evaluation of an acceptable training program. *Behavioral Residential Treatment*, *8*, 163-185. Retrieved from Psychology and Behavioral Sciences Collection database.

*Pellecchia, M., Connell, J. E., Eisenhart, D., Kane, M., Schoener, C., Turkel, K., Riley, M., & Mandell, D. S. (2011). We're all in this together now: Group performance feedback to increase classroom team data collection. *Journal of School Psychology, 49*, 411-431. doi:10.1016/j.jsp.2011.04.003.

Penuel, W. R., Fishman, B. J., Yamaguchi, R., & Gallagher, L. P. (2007). What makes professional development effective? Strategies that foster curriculum implementation. *American Educational Research Journal, 44*, 921-958. doi: 10.3102/0002831207308221.

Pindiprolu, S., Peterson, S., & Berglof, H. (2007). School personnel's professional development needs and skill level with functional behavior assessments in ten midwestern states in the United States: Analysis and issues. *Journal of the International Association of Special Education*, *8*, 31-42. Retrieved from Education Research Complete database.

Quilitch, R. (1975). A comparison of three staff-management procedures. *Journal of Applied Behavior Analysis*, *8*, 59-66. Retrieved from PubMed Central.

Realon, R., Lewallen, J., & Wheeler, A. (1983). Verbal feedback vs. verbal feedback plus praise: The effects on direct care staff's training behaviors. *Mental Retardation*, *21*, 209-212. Retrieved from Education Research Complete database.

Reed, D. D., Fienup, D. M., Luiselli, J. K., & Pace, G. M. (2010). Performance improvement in behavioral health care: Collateral effects of planned treatment integrity observations as an applied example of schedule-induced responding. *Behavior Modification, 34*, 367-385. doi:10.1177/0145445510383524.

Reichow, B. V., Volkmar, F. R., & Cicchetti, D. V. (2008). Development of the evaluative method for evaluating and determining evidence-based practices in autism. *Journal of Autism & Developmental Disorders*, *38*, 1311-1319. doi:10.1007/s10803-007-0517-7

Reichow, B., Doehring, P., Cicchetti, D. V., & Volkmar, F. R. (2011). *Evidence-based practices and treatments for children with autism* (Eds.). New York, NY: Springer Science + Business Media, LLC.

Reid, D. H., & Parsons, M. B. (2006). *Motivating human service staff: Supervisory strategies for maximizing work effort & work enjoyment* (2nd ed.). Morganton, NC: Habilitative Management Consultants, Inc.

Reid, D. H., Rotholz, D. A., Parsons, M. B., Morris, L. A., Braswell, B. A., Green, C. W., & Shell, R. M. (2003). Training human service supervisors in aspects of PBS: Evaluation of a statewide, performance based program. *Journal of Positive Behavior Interventions, 5*, 35-46. doi:10.1177/10983007030050010601

Romancyzk, R. G. (1996). Behavioral analysis and assessment: The cornerstone to effectiveness. In C. Maurice, G. Green, & S. Luce (Eds.) *Behavioral intervention for young children with autism* (pp. 195-220). Austin, TX: Pro-ed.

Sandall, S., Schwartz, I., & Lacroix, B. (2004). Interventionists' perspectives about data collection in integrated early childhood classrooms. *Journal of Early Intervention*, *26*, 161-174. doi:10.1177/105381510402600301.

Saunders, M., Saunders, J., & Saunders, R. (1993). A program evaluation of classroom data collection with bar codes. *Research in Developmental Disabilities*, *14*, 1-18. Retrieved from ERIC database.

Schwartz, I., & Olswang, L. (1996). Evaluating child behavior change in natural settings: Exploring alternative strategies for data collection. *Topics in Early Childhood Special Education*, *16*, 82-101. doi:10.1177/027112149601600108.

Scott, T. M., & Martinek, G. (2006). Coaching positive behavior support in school settings: Tactics and data-based decision making. *Journal of Positive Behavior Interventions, 8*, 165-173.

Shore, B. A., Iwata, B. A., Vollmer, T. R., Lerman, D. C., & Zarcone, J. R. (1995). Pyramidal staff training in the extension of treatment for severe behavior disorders. doi:10.1901/jaba.1995.28-323

Shukla-Mehta, S., Miller, T., & Callahan, K. J. (2010). Evaluating the effectiveness of video instruction on social and communication skills training for children with autism spectrum disorders: A review of the literature. *Focus on Autism and Other Developmental Disabilities, 25*, 23-36, doi:10.1177/1088357609352901

Smith, T., Parker, T., Taubman, M., & Lovaas, O. I. (1992). Transfer of staff training from workshops to group homes: a failure to generalize across settings. *Research In Developmental Disabilities*, *13*(1), 57-71. Retrieved from MEDLINE database

Sopko, K. (2003). *The IEP: A synthesis of current literature since 1997*. Alexandria, VA: National Association of State Directors of Special Education.

Stecker, P. M., & Fuchs, L. S. (2000). Effecting superior achievement using curriculum-based measurement: The importance of individual progress monitoring. *Learning Disabilities Research and Practice, 15*, 128–134.

Stein, T. (1975). Some ethical considerations of short-term workshops in the principles and methods of behavior modification. *Journal of Applied Behavior Analysis*, *8*, 113-115. Retrieved from MEDLINE database.

Suarez, S. (2010). Show me again what I can do: Documentation and self-determination for students with social challenges. *Theory into Practice*, *49*, 21-28. Retrieved from E Journals database.

Suhrheinrich, J. (2011). Examining the effectiveness of a train-the-trainer model: Training teachers to use pivotal response training. *Society For Research On Educational Effectiveness*. Retrieved from ERIC

Tarbox, J., Wilke, A., Findel-Pyles, R., Bergstrom, R., & Granpeesheh, D. (2009). A comparison of electronic to traditional pen-and-paper data collection in discrete trial training for children with autism. *Research in Autism Spectrum Disorders, 4*, 65-75. doi:10.1016/j.rasd.2009.07.008.

Tawney, J. W., & Gast, D. L. (1984). *Single subject research in special education*. New York, NY: Merrill.

Tschannen-Moran, M., & McMaster, P. (2009). Sources of self-efficacy: Four professional development formats and their relationship to self-efficacy and implementation of a new teaching strategy. *Elementary School Journal*, *110*, 228-245. Retrieved from ERIC database.

Utley, B. L., Zigmond, N., & Strain, P. S. (1987). How various forms of data affect teacher analysis of student performance. *Exceptional Children, 53*, 411-422.

Van Acker, R., Grant, S. H., & Getty, J. E. (1991). Observer accuracy under two different methods of data collection: The effect of behavior frequency and predictability. *Journal of Special Education Technology, 11*, 155–166.

Walton, W. T. (1985). Educators' responses to methods of collecting, storing, and analyzing behavioral data. *Journal of Special Education Technology, 7*, 50–55.

Webber, J., & Scheuermann, B. (2008). *Educating Students with autism: A quick start manual.* Pro-ed: Austin, TX.

Wesson, C. L., King, R. P., & Deno, S. L. (1984). Direct and frequent measurement of student performance: If it's good for us, why don't we do it? *Learning Disability Quarterly, 7*, 45–48.

Wolf, F.M. (1986). *Meta-analysis: Quantitative methods for research synthesis*. Beverly Hills, CA: Sage.

Wolf, P. J., & Hassel, B. C. (2001). Effectiveness and accountability (Part 1): The compliance model. In Finn, Rotherham, & Hokanson (Eds.), *Rethinking special education for a new century* (pp. 53-75). Washington, D.C.: Thomas B. Fordham Foundation and the Progressive Policy Institute.

Yell, M., & Stecker, P. (2003). Developing legally correct and educationally meaningful IEPs using curriculum-based measurement. *Assessment for Effective Intervention*, *28,* 73-88. Retrieved from ERIC database.

Yell, M., Deno, S. L., & Marston, D. B. (1992). Barriers to implementing curriculum-based measurement. *Diagnostique*, *18*, 99-112. Retrieved from ERIC database.

Yell, M., Drasgow, E., & Lowrey, K. (2005). No Child Left Behind and students with autism spectrum disorders. *Focus on Autism and Other Developmental Disabilities*, *20*, 130-139. Retrieved from Health Source - Consumer Edition database.

Yell, M., Katsiyannis, A., Drasgow, E., & Herbst, M. (2003). Developing legally correct and educationally appropriate programs for students with autism spectrum disorders. *Focus*

on Autism and Other Developmental Disabilities, *18*, 182-191. Retrieved from Health Source - Consumer Edition database.

Yell, M., Katsiyannis, A., Ryan, J., McDuffie, K., & Mattocks, L. (2008). Ensure compliance with the Individuals With Disabilities Education Improvement Act Of 2004. *Intervention in School and Clinic*, *44*, 45-51. Retrieved from ERIC database.

Yell, M., Shriner, J., & Katsiyannis, A. (2006). Individuals With Disabilities Education Improvement Act of 2004 and IDEA regulations of 2006: Implications for educators, administrators, and teacher trainers. *Focus on Exceptional Children*, *39*, 1-24. Retrieved from Education Research Complete database.

Ysseldyke, J., & Olsen, K. (1999). Putting alternative assessments into practice: What to measure and possible sources of data. *Exceptional Children, 65*, 175-185.