Title

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Journal

Exceptional Children, 86(2)

ISSN

0014-4029

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Publication Date

2020

DOI

10.1177/0014402919881354

Peer reviewed

Exploring Associations Between Inner Context Factors and Implementation Outcomes

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Published in: Exceptional Children. Pp 1-19. Online First, 2019
DOI: 10.1177/0014402919881354

Abstract

Classroom Pivotal Response Teaching (CPRT) is an evidence-based practice adapted for classroom use. A recent effectiveness trial of CPRT involved training 98 special education classrooms in Southern California. The Exploration, Planning, Implementation and Sustainment (EPIS) conceptual framework illustrates the impact of inner and outer context factors on implementation outcomes. This paper evaluates how teacher factors (including attitudes toward evidence-based practice) and organizational factors (implementation climate and district support) influence training outcomes (fidelity of intervention, report of use, sustainment, and satisfaction). Teachers' ratings of training quality were related to higher fidelity during their follow-up year (β=.34, t(78)=2.97, p<.004) and rating of intervention ease of use was related to higher daily CPRT use. Teacher ratings on the appeal scale of the attitudes measure were associated with individual sustainment (β=.35, t(55)=2.76, p<.01). Leader involvement at recruitment meetings (β=.35, t(48)=2.58, p=.01) and provision of CPRT training space (β=.44, t(48)=2.73, p<.01) were significantly related to school sustainment. Teachers overall attitudes toward the intervention were significantly related to satisfaction with CPRT training (β=.41, t(80)=3.96, p<.01). This study makes important preliminary contributions to understanding the impact of inner context implementation determinants of a classroom-based EBP for students with ASD.

Exploring Associations Between Inner-context Factors And Implementation Outcomes

An increase in diagnosis of autism spectrum disorder (ASD) has resulted in increased demand for effective educational services. Current estimates indicate 1 in 59 children have an ASD and 1 in 50 school-age children have autism (Reding, Chorpita, Lau, & Innes-Gomsberg, 2014). Because school districts are required to provide for the educational and any associated needs of children (Individuals with Disabilities Education Act, 2004), the majority of services for children with ASD take place in schools. Nationwide, 617,000 students received educational services for autism during the 2015-16 school year, an increase of 208% from 2007-08 (Digest of Education Statistics, 2017). With such rapid growth, providing appropriate, effective services for children with ASD has become increasingly challenging and expensive. Per pupil additional expenditure for a child with ASD as compared to a typically developing child is an estimated $8610 more annually (Lavelle, et al., 2014) and the total estimated yearly cost for caring for individuals with ASD is $236 billion (Buescher, Ciday, Knapp, & Mandell, 2014).

Evidence-based practices for ASD

Systematic reviews have identified evidence-based practices for children with ASD (National Autism Center, 2015; Odom, Collet-Klingenberg, Rogers, & Hatton, 2010). Although EBPs for children with ASD exist, current methods for selecting, implementing and sustaining these practices in community school settings are not effective. Research demonstrates that teachers and other school-based providers can learn to use evidence-based practices (e.g., Pellechia et al., 2015; Suhrheinrich, Rieth, Dickson, Roesch & Stahmer, 2019). However, multiple studies indicate evidence-based practices for ASD are rarely incorporated into school-based programs (Hess, Morrier, Heflin, & Ivey, 2008; Suhrheinrich, 2011) are implemented with low fidelity (or adherence to the intervention procedures), or make limited use of the intervention

as designed (Suhrheinrich et al., 2013; Suhrheinrich, Stahmer, & Schreibman, 2007). High fidelity is important given identified links between accurate implementation and optimal treatment outcomes (e.g., Pellecchia et al., 2015). These findings align with other studies indicating teachers use practices with and without research support about equally with children of varied disabilities (e.g., Burns & Ysseldyke, 2009). Unfortunately, children with ASD in usual school services make very limited progress compared to children receiving evidence-based practices (Howard, Sparkman, Cohen, Green, & Stanislaw, 2005). Currently, there is limited information indicating what factors support effective implementation of evidence-based practices in the school context (Locke, Kratz, Reisinger, & Mandell, 2014). This critical issue may be addressed more effectively by drawing on the growing field of implementation science.

Implementation Science

Implementation science is the study of methods to promote the adoption and integration of evidence-based practices, interventions, and policies into routine care (Eccles & Mittman, 2006). In contrast to intervention research, which focuses on student outcomes, targets of implementation research include acceptability, adoption, appropriateness, feasibility, fidelity, implementation cost, penetration (spread or access within the organization), and sustainability of the practice (Proctor et al., 2011). Additionally, although intervention trials typically minimize variability so student outcomes can be linked to specific contextual factors, implementation trials attempt to identify the varying conditions in which evidence-based practices can have the maximal impact in the natural school setting (Bauer, Damschroder, Hagedorn, Smith, & Kilbourne, 2015).

As with other scientific pursuits, implementation science involves engaging theoretical hypotheses to guide experimentation. Frameworks provide a set of constructs, or variables, that are organized to illustrate how implementation efforts may be planned or carried out (Eccles &

Mittman, 2006). As an example of one framework, the Exploration, Preparation, Implementation and Sustainment framework of implementation (EPIS; Aarons, Hurlburt, & Horowitz, 2011) is a multi-level, multi-phase, process and determinant framework. This framework both describes the process of translating research into practice, including early stage planning, and allows for identification of factors that influence implementation outcomes, including potential barriers and facilitators. The EPIS framework was developed to align with public sector service systems, such as public education, and is relevant for understanding the process and determinants of service implementation, including school-based services for students with ASD. During the Exploration phase, implementers consider specific evidence-based practices and potential barriers or facilitators to the implementation process. In the Preparation phase, the specific evidence-based practice to implement is selected and support systems are developed. The Implementation phase begins with active training. The Sustainment phase occurs when the intervention is stabilized and supported through methods such as sustainable funding systems and ongoing fidelity monitoring (Walsh, Reutz, & Williams, 2015). The EPIS framework has been used to guide the implementation processes across many service systems, including in child welfare and community mental health service systems (Aarons et al., 2011; Moullin, Dickson, Stadnick, Rabin, & Aarons, 2019) and can also be a useful for considering implementation within the education system (Stahmer, Suhrheinrich, Schetter, McGee Hassrick, 2018). EPIS also specifies the critical role of intervention characteristics, inner context and outer context factors on the implementation process (see Figure 1). The outer context refers to broader system-level factors such as the service sector, inter-organizational environment, and student support/advocacy. The inner context refers to provider and organizational characteristics such as leadership and culture or climate (Aarons et al., 2011). The EPIS framework also highlights linkages as a representation

of the interdependence of the inner and outer contexts along with the importance of intervention fit with both contexts.

Provider Attitudes.

Provider attitudes are one of the most studied factors in implementation research. Provider attitudes towards evidence-based practice have been linked to practice behavior (Casper, 2007; Henggeler et al, 2008) and have been significantly related to use and sustainment of evidence-based practices (Aarons, 2004; Aarons et al., 2011; Reding et al., 2014). Multiple studies have found that provider attitudes before training, especially openness to the use of evidence-based practice and perceptions of the appeal of the practice, are linked to fidelity to the intervention after training (Aarons et al., 2011; Beidas et al., 2014). Furthermore, attitudes toward a specific practice have been linked to reported use of that practice (Reding et al., 2014) and negative beliefs about a practice may be a barrier to adoption (e.g., Harned, Dimeff, Woodcock, & Contreras, 2013). Data indicate that this may be especially true of behavioral interventions for ASD; however, poor attitudes can be improved with education (Allen & Bowles, 2014). In one study of special education teachers, positive attitudes toward behavioral strategies were associated with use of those strategies (McCormick, 2011). These studies indicate that provider attitudes are a promising and important target of implementation interventions aimed to increase uptake, however they are just one of the possible supporting inner context factors.

Implementation leadership.

Recent research highlights the importance of leadership in successful implementation of new practices (Bass & Avolio, 1990; Powell et al., 2012). In contrast to education leadership more generally, implementation leadership focuses on specific behaviors and actions that demonstrate the leader's commitment to, knowledge of, support for, and determination during

evidence-based practice implementation. Positive implementation climate and use of support strategies such as training availability, and ongoing monitoring of performance have been linked to better sustainment of innovation, improved child outcomes and decreased staff burnout and turn over (Novins, Green, Legha, & Aarons, 2013). When leaders provide clear guidance during implementation, facilitate support among co-workers and from administration for effective implementation, trainees report an increased sense of competence and satisfaction (Green, Albanese, Shapiro, & Aarons, 2014). However, most research on leadership in special education has focused on leadership qualities more broadly (e.g., Bon & Bigbee, 2011; Gong, Zimmerli, & Hoffer, 2013), with less attention on how leadership influences implementation efforts. In addition to leader-level factors, organizational climate has been indicated as related to implementation outcomes (Dingfelder & Mandell, 2011; Williams & Glisson, 2014).

Implementation Climate.

Implementation climate refers to employees' perceptions of the extent to which use of the intervention is expected, supported and rewarded by colleagues and supervisors (Weiner, Belden, Bergmire & Johnston, 2011). Historically, evaluation of climate in schools has taken a broad focus, considering organizational functioning generally, rather than perceptions related to implementation specifically. However, more recent models, including EPIS, suggest implementation climate may be directly related to implementation and clinical outcomes because it is more proximal (Ehrhardt, Aarons, & Farahnak, 2014).

Classroom Pivotal Response Teaching

Pivotal Response Training (PRT) has consistently been identified as an evidence-based practice for youth with ASD in multiple systematic reviews (National Standards Project, 2009, 2015; Wong et al., 2015). PRT is a naturalistic behavioral intervention that was designed based on a series of studies identifying important treatment components. With PRT, students with ASD

have demonstrated significant improvements in functional communication skills (e.g., Koegel, Koegel, & Surrat, 1992; Koegel, Camarata, Koegel, Ben-Tall, & Smith, 1998), appropriate play (Stahmer, 1995; Lydon, Healy, & Leader, 2011), and peer social interaction (Koegel, Koegel, Harrower, & Carter; Pierce & Schreibman, 1997). The "pivotal" responses targeted in PRT are *motivation, initiation* and *responsivity to multiple cues* (i.e. increasing breadth of attention). More recently, PRT has been systematically adapted for the school context (Stahmer, Suhrheinrich, & Rieth, 2016). Creswell and Garrett (2008) used a mixed-methods approach toexamine ways to adapt PRT for classroom use that would maintain the integrity of the intervention while increasing feasibility of use for teachers. For detailed information about the studies informing this adaptation, which is known as Classroom Pivotal Response Teaching (CPRT; Stahmer, Suhrheinrich, Reed, Bolduc. & Schreibman, 2011), please see existing published work (Reed, Stahmer, Suhrheinrich, & Schreibman, 2013; Rieth et al., 2014; Rieth, Stahmer, Suhrheinrich, & Schreibman, 2015). CPRT maintains the main components of PRT, but it includes modifications in how some components are delivered to fit within the classroom context and incorporates additional resources to support teacher use. Components include: gaining student attention, providing clear and varied instructions, following student interest and incorporating preferred materials, incorporating opportunities for choice, providing contingent consequences, direct reinforcement and reinforcing goal-directed attempts (See Supplemental Table 2). A recent school-based randomized trial was conducted to examine the efficacy of CPRT and associated implementation outcomes (Suhrheinrich, Rieth, Dickson, Roesch, & Stahmer, 2019). Data for the current study were drawn from this larger trial to examine the relationship between specific factors (implementation climate, leadership, and teacher attitudes) and fidelity and use of CPRT over time. This study employs the EPIS framework to evaluate relationships between inner context factors (provider attitudes toward the intervention,

implementation leadership and implementation climate) and implementation outcomes (satisfaction, fidelity, report of use and sustainment of CPRT) using data from a large school-based efficacy trial.

Method

Design

The larger study employed a waitlist-control design, with random assignment at the teacher level to training across three years. Teachers were randomized to one of three training cohorts: Teachers in Cohort A received CPRT training in year 1. Teachers in Cohort B were observed in year 1 and received CPRT training in year 2. Teachers in Cohort C were observed in year 2 and received CPRT training in year 3. After receiving training, teachers in each cohort participated in a follow-up year (i.e., Cohort A participated in follow-up in year 2, Cohort B participated in follow-up in year 3, and Cohort C participated in follow-up in year 4). Data in the current paper are drawn from the training and follow-up years for all three cohorts. The wait-list control design offers methodological benefits over a standard randomized trial by increasing the sample size of teachers receiving CPRT training. As recommended by Rhoades (2010), an independent consultant randomized participants at the teacher level (instead of the school or district level) to increase efficiency and statistical power. Our previous research found very low interclass correlations in the fidelity scores of teachers at the same school, indicating low risk of contamination across trained and untrained teachers. This study was approved by all appropriate Institutional Review Boards and participating school districts.

Participants

Participants were recruited from public school districts in one Southern California County. The research team recruited all districts in the county who served at least 15 students, ages 3-10, with an educational classification of autism. Of the 35 school districts in the county,

21 districts were eligible; administrators from 19 districts agreed to participation. Individual teachers were recruited from 17 of these districts; teachers from the remaining 2 districts did not respond to recruitment announcements.

Teachers. To be eligible, teachers could not have received prior training in CPRT and must have had at least two students with an educational classification of autism in their class. School district staff shared study information with eligible teachers. Members of the research staff held recruitment meetings for interested teachers to explain the study and training process. We enrolled a total of 106 teachers in 17 districts. Of that total, 98 completed CPRT training across the duration of the study. Participating teachers were 95% female, 82% white and 18% Hispanic, and 53% had an MA degree. Teachers had an average of 9.5 years of experience teaching students with ASD (SD = 6.7). A total of 20% of participants were teaching in inclusive classrooms (n = 20), with the remaining 80% teacher in self-contained special education classrooms (n = 78). After initial enrollment in the study, each teacher was randomly assigned to Cohort A (training in year 1; n = 36), Cohort B (training in year 2, n = 30), or Cohort C (training in year 3, n = 32), such that all teachers were eligible to receive CPRT training by the conclusion of the study. Only one teacher enrolled per classroom. The attrition rate for teachers during training was 0% in year 1, 13% in year 2, and 15% in year 3, for an average of 9.3%. See Supplemental Table 1.

Procedure

CPRT coaches. Trained CPRT coaches were part of the research team, and they facilitated the training process with all teachers, including both group didactic sessions and individual coaching. Coaching staff included seven clinicians with a Masters or Doctoral degree in Psychology or Education and at least 10 years of experience working with children with ASD. Coaches were supervised by a licensed clinical psychologist and received systematic training in

how to deliver the CPRT training protocol. Throughout the project, coaches met as a group with their supervisor at least bi-monthly to review procedures and discuss any coaching or training challenges. Training protocol fidelity for didactic sessions was assessed throughout the project, through both self-report and supervisor ratings. Training fidelity ratings for didactic sessions were consistently high (M = 90%, SD = 17% adherence for self-report ratings; M = 86%, SD = 16% adherence for supervisor ratings), indicating coaches delivered trainings as designed.

CPRT training procedures. The research team developed the CPRT training plan based on current knowledge of adult learning theory, best practices in teacher professional development, feedback from a community advisory board, and data from our pilot project (Darling-Hammond, Hyler & Gardner, 2017; Odom, 2009; Scheuermann, Webber, Boutot, & Goodwin, 2003; Stahmer et al., 2016). Teachers received training with other teachers from their district or those in close proximity in groups of 3-4 teachers (M = 3.37; Range = 2-6). Initial training involved 12 hours of didactic, interactive lecture, typically delivered 2 hours per week over 6 weeks (with some slight variability based on district schedules). Training was scheduled in this manner based on discussions with our CPRT community advisory board to make scheduling easier for teachers and administrators, support gradual introduction of CPRT protocol, and to allow time for individual classroom-based practice and coaching in-between group training sessions (e.g., Stahmer, et al., 2011; 2016). Participating teachers and administrators assisted with development of the training schedule prior to the start of training to ensure teacher availability and commitment. The majority of training groups met after school (n = 20, 67%) or during district supported professional development time on student early-release days (n = 7, 23%), however one district chose to hold trainings during the school day and provided substitute coverage for participant teachers (n = 3, 10%). If a participating teacher could not attend a group training session due to an unpredictable conflict (e.g., illness), they

received a pre-recorded, narrated PowerPoint presentation of the session training content and associated materials for independent study.

After the first six hours of group training (three sessions), teachers began to receive individualized, in-classroom coaching on their use of CPRT. Coaching appointments were scheduled once per week until the teacher met coach-rated mastery criteria (see Teacher Fidelity of CPRT presented subsequently for full description of mastery criteria). During each appointment, coaches evaluated fidelity of CPRT using the CPRT Assessment and provided structured feedback using the CPRT Feedback Form. The research team reviewed and recorded documentation as a measure of coaching fidelity. Upon successfully maintaining mastery criteria over two sequential visits, scheduled coaching faded from once per week, to every other week, and then once a month for the duration of the school year if fidelity was maintained. During the year following CPRT training (follow-up year), teachers received two coaching sessions to promote maintenance of skills, scheduled at their convenience. These follow-up coaching sessions followed the same format, and typically occurred once per semester after an initial fidelity video was collected. Some variation in frequency of coaching occurred based on teacher and school schedules.

Enrollment in the study included the expectation that teachers would attend each of the training sessions, participate in scheduled coaching appointments, and complete the reading materials provided. Coaches recommended that teacher practice using CPRT strategies during their identified activities (see below), however, no specific requirements for frequency of CPRT use was recommended or required for study participation. Please see Suhrheinrich, Rieth, Dickson, Roesch, & Stahmer (2019) for a complete description and outcome data for teacher attendance, participation and use of CPRT.

Data collection procedures. Data were collected for each teacher upon study enrollment and throughout her of his participation. Data from the year teachers participated in training (training year; Years 1, 2 and 3) and the following year (follow up year; Years 2, 3, and 4) are presented in this report. Teacher's received surveys via email with an embedded individualized survey link or had the option to complete measures using printed documents or, if individuals prereffed, by phone interview. Members of the research team administered measures through live observation or video observation of classroom activities. At the beginning of each school year, teachers identified two activities in which they would use CPRT throughout the year; we used these activities as the focus of all in-classroom observations (for fidelity data collection) and coaching appointments. We chose these data collection methods to support consistency in measurement of fidelity and student behavior throughout the school year. We selected the activities on the basis of teacher preference and participating students' individualized learning goals. Activities were categorized as one-on-one, small-group, or large-group interaction and focused on academic, behavioral, communication, or peer-interaction goals. We collected video recordings during these classroom activities four times during the training year and two times during the follow-up year.

Measures

Demographics. We gathered participant demographic information, including personal characteristics, teaching experience, education and professional training. We collected these data using an eight-item questionnaire administered when teachers enrolled in the study.

Outcome measures. We selected outcome measures to address the primary research aims of examining the inner context factors associated with teacher initial fidelity and use of CPRT, teacher satisfaction, and CPRT sustainment. We describe all outcome measures in a subsequent section; please also see Supplemental Table 3.

Teacher satisfaction with CPRT /training. Teachers completed a 25-item Satisfaction Questionnaire at the end of the training year to examine their satisfaction with the training process, the CPRT intervention and its use in their classroom, and perceived effectiveness of CPRT for students. Teachers rated each question on a 5-point Likert scale with 1 indicating very dissatisfied or not at all satisfied, 3 indicating neutral, and 5 indicating very satisfied or satisfied to a great extent. An average across all items was used in these analyses. Alpha was .99 for this measure in the current study, which is considered very good (Cicchetti, 1994).

Teacher fidelity of CPRT. Trained researched assistants used the CPRT Assessment and CPRT fidelity definitions to code teacher fidelity to CPRT (Stahmer et al., 2016; Stahmer, Suhrheinrich, Reed, Schreibman, & Bolduc, 2011). The CPRT fidelity evaluation form included 13 items rated on a five-point Likert scale, with 1 indicating the teacher correctly implements the component less than 30% of the observation, 2 indicating the teacher correctly implements the component approximately 30-49% of the observation, 3 indicating the teacher correctly implements the component 50-79% of the observation, 4 indicating the teacher implements the component correctly 80% of the observation, and 5 indicating the teacher implements the component correctly through the entire observation (100% of opportunities). Please contact the first author for the full CPRT Assessment and fidelity coding definitions.

Research assistants naive about participant training status evaluated fidelity of CPRT from classroom video recordings. Video recordings from the teachers' last observation for their training year (n = 227) and first observation during their follow up year (n = 141) were scored for fidelity to examine use of CPRT immediately after training and sustainment of CPRT prior to any follow up coaching. All coders met a reliability criterion of 80% agreement with coding keys across two separate video recordings prior to beginning independent coding. Ongoing agreement was evaluated throughout the coding process. Coders with two consecutive videos below 80%

agreement received a didactic review of components for which they were having difficulty and were required to code two reliability videos at 80% agreement or above again before further independent coding. Two coders independently evaluated 33% (n=122) of all video samples. Intraclass correlation coefficients (ICCs) ranged from .67 to .89 across individual fidelity items, with a mean of .81. Items with an overall ICC below .7 in the full dataset were not considered reliable and were dropped from further analyses (contingent consequences and varied cues). The remaining codes exhibited fair to good ICCs according to accepted standards (Cicchetti, 1994). When considered separately, training year and follow-up years ICCs ranged from .60 to .91 and .66 to .88 with means of .82 and .77, respectively; these ICCs are considered good to excellent (Cicchetti, 1994.

Teacher report of CPRT use. Teachers completed a six-item on-line survey to report use of CPRT once per month throughout the training and follow-up years. This timing was selected to balance teacher burden with sufficient data to capture variability across the school year. Teachers reported how many days per week they utilized CPRT; they also estimated how many minutes per day they used the procedures. We asked teachers to report these values specific to the prior week. To assess variability in teachers' use of CPRT across the school year, we analyzed the average number of days per week and minutes per day across all teacher reports between the end of didactic training (once a teacher could reasonably be expected to be implementing CPRT) and the end of the follow-up year.

Teacher sustainment of use of CPRT. Eighteen months after completion of training teachers completed a 43-item online survey of sustainment of CPRT use. Teachers indicated agreement on a 5-point Likert scale (1 indicating strongly disagree to 5 indicating strongly agree) to statements related to their individual on-going use of CPRT, as well as their perception of on-going use of CPRT in their school. Average scores of items across the individual and school

domains (n = 4 items related to schools, n = 9 items related to individuals) were used in analyses. Alphas for the individual and school domains were .76 and .82 and considered fair and good, respectively (Cicchetti, 1994).

Inner-context measures. Several measures of inner-context variables were used to examine relationships with primary outcomes. These included measures of teacher attitudes towards evidence-based practices broadly, teacher perceived implementation climate and school district leadership support of CPRT training and CPRT use. Measures are described below and in Supplemental Table 3.

Evidence-based Practice Attitudes Scale (EBPAS;* Aarons, 2004*). The EBPAS is a 15item measure of practitioner attitudes toward adoption of innovation. Teachers completed the EBPAS at the beginning of the year in which they participated in CPRT training. The EBPAS assesses four dimensions of attitudes toward adoption of evidence-based practice including: (a) Intuitive *Appeal* of the practice, (b) Likelihood of adopting the practice given *Requirements* to do so, (c) *Openness* to new practices, and (d) perceived *Divergence* between research-based interventions and current practice. Participants rated their agreement using a 5-point Likert scale, with 0 indicating not at all to 4 indicating to a very great extent. The EBPAS has established reliability and validity with an overall alpha of .77 (range = .59 to .90; Aarons et al., 2010). In the current study, alphas were .78, .96, .83, .52, and .75 for the Appeal, Requirements, Openness, Divergence, and Total Score dimensions, respectively. With the exception of the Divergence scale, these alphas are considered between fair and very good (Cicchetti, 1994). The overall score (average of all items) and dimension scores (average of subscale items) were used in the analyses.

Program Implementation Climate Scale (PICS). The PICS is a 47-item measure that captures teachers' perceptions of the feasibility of CPRT and the extent to which the use of CPRT is expected, supported, and rewarded by colleagues and supervisors. Teachers completed

this measure after they had completed training, because questions were specific to implementation climate about the use of CPRT. We adopted an original measure (Kratz et al., 2019) of implementation climate (Klein, Conn, Smith & Sorra, 2001) to evaluate teachers' perceived implementation in autism support classrooms. The PICS includes six subscales: (a) Ease of Use, (b) Stress of Use; (c) Training Quality and Accessibility; (d) Ongoing User Support; (e) Communication on Use; and (f) Rewards for Use. Teachers rated all items on five-point Likert scales, with 1 indicating not true to 5 indicating true, with some items reverse-coded. To weight each of these domains equally, we averaged scale scores to create an overall perceived implementation climate score (Global Climate). Alphas for the perceived implementation climate scales as rated by teachers were .70, .52, .64, .61, .82, .75, and .89 for the Ease of Use, Stress of Use, Training Quality, User Support, Communication, Rewards and Global Climate scales, respectively. Alphas range from being considered poor to very good (Cichetti, 1994). Average scores on each subscale were used in analyses.

District leadership support measures. We characterized school district leadership support for training through three specific leader behaviors: recruitment support (special education director's or autism coordinator's involvement in teacher recruitment meetings), facilitated training time (provision of CPRT training during paid, work time), and facilitated training space (allocation of district space to hold training meetings). The project coordinator rated each participating school district across all leader support behaviors after the completion of training using a 3-point Likert scale, with 0 indicating not at all, 1 indicating somewhat, sometimes, and 2 indicating often or a lot. Due to the project coordinator's unique communication with district leaders and knowledge of district decisions, no additional raters were available to provide secondary coding. District scores for each scale were used in analyses.

Analytic Plan

To examine the relationship between implementation factors and teacher outcomes of interest, we employed linear regression models using Statistical Package for the Social Sciences 25.0 (SPSS; SPSS Inc., 2018). Specifically, we regressed implementation climate, leadership, and teacher attitudes prior to training on CPRT fidelity and use over time assessed during their training and follow-up years as well as satisfaction with training in separate regression models. Results from the linear regression models are reported. Additionally, the EPIS framework specifies interconnections and linkages among inner context variables that impact the implementation process (see EPIS figure). To examine the interrelationships among inner context variables, bivariate correlations were examined. Additionally, we also examined multiple regression models that included significant univariate predictors for each outcome variable. This method can be useful in selecting variables for multivariate analyses when there is not enough power to enter all variables in the model, and it has been used in prior studies examining child services (Brookman-Frazee, Haine, Gabayan, & Garland, 2008; Garland, Haine, & Lewczyk-Boxmeyer, 2007). Due the large number of statistical tests and resulting increase in Type-1 error, we report results using a Bonferroni adjusted p-value of .004 for linear regressions and .01 for multiple regressions and all other tests, per recommended procedures (Holm, 1979).

Results

Intervention Fidelity

The average CPRT fidelity score across teachers was 3.61 (SD = .54; range = 1.22 – 4.73, n = 92 teachers) at the end of the training year and 3.48 (SD = .4, range = 1.64 – 4.33; n = 74 teachers) at the end of the follow-up year.

Teacher Report of Use

A total of 73 teachers (74% of teachers) completed at least one CPRT Report of Use measure after training was complete. Across all reports, teachers reported using CPRT an

average of 47 min per day (SD = 36; range = 15-240), and 3 days per week (SD = 1.1, range = 1-5).

Satisfaction

The average score on the Satisfaction Questionnaire after training was 4.37 (SD = .45, range = 3-5), indicating high teacher satisfaction with the training experience. Scores were collected from 84% of teachers (n = 82). Teachers indicated they felt confident in their ability to use CPRT with their students (M = 4.2, SD = .57, range = 3-5) as well as their ability to use CPRT in groups effectively (M = 4.18, SD = .74, range = 2-5).

Sustainment of CPRT

Fifty-seven teachers (58% of teachers) completed a sustainment survey 18 months after participating in training. On a 1-5 scale, teachers rated their individual sustainment of CPRT at an average of 3.8 (SD = .58; range = 3-5), and their school's sustainment of CPRT at an average of 1.4 (SD = 0.7, range = 2-5).

Relationships with Inner Context Factors

As stated above, a Bonferroni adjusted p-value of .004 for linear regressions and .01 for multiple regressions was used.

Fidelity. Full results of analyses showing relationships between inner context factors and teacher fidelity are presented in Table 1. There were no significant associations between district involvement or teacher attitudes and teacher fidelity. During the follow-up year, teacher ratings of Training Quality on the PICS were significantly related to teacher fidelity ($\beta = .34$, $t(78) = 2.97$, $p < .004$). No additional multiple regression analyses were conducted as there was only one significant predictor of fidelity.

Satisfaction. Table 2 shows the results of analyses examining relationships between inner context factors and satisfaction. Teachers overall attitudes toward evidence-based practices

as measured by the EBPAS were significantly related to satisfaction with CPRT training (β = .41, t(80) = 3.96, p < .004), as were the three subscales of Requirements (β = .36, t(80) = 3.42, p < .004), Appeal (β = .32, t(80) = 2.99, p < .004) and Openness (β = .32, t(80) = 3.06, p < .004). Teachers' PICS ratings on the Ease of Use (β = .50, t(75) = 4.95, p < .004), Training Quality (β = .52, t(75) = 5.24, p < .004), User Support (β = .35, t(75) = 3.16, p < .004), Communication on Use, (β = .49, t(75) = 4.68, p < .004), Rewards for Use (β = .45, t(75) = 4.36, p < .004), and Global Climate (β = .28, t(75) = 5.83, p < .004) scales were all significantly related to higher satisfaction with CPRT training. No district involvement measures were significantly related to satisfaction. Results from the multiple regression analyses indicated a significant association between EBPAS Appeal (β = .27, t(61) = 2.55, p = .01) and higher teacher satisfaction with training (F(10,61) = 6.86, p < .01).

Report of use. Table 2 also presented results of analyses showing relationships between inner context factors and report of use. The Global Climate scale of the PICS was significantly related to teachers' report of CPRT daily use (β = .47, t(59) = 4.07, p < .004), with higher climate associated with more reported use of CPRT. The Ease of Use (β = .36 t(59) = 2.92, p < .01) and Stress of Use (β = .50, t(59) = 2.61, p = .01) scales were significantly related to teachers' report of CPRT daily use. Teacher attitudes as measured by the EBPAS and district involvement measures were not significantly related to teachers' report of CPRT use. No additional multiple regression analyses were conducted as there was only one significant predictor of report of use.

Sustainment. Table 3 presents the results of analyses showing relationships between inner context factors and sustainment of CPRT. Scores on the Appeal score of the EBPAS were associated with teachers' individual sustainment (β = .35, t(55) = 2.76, p < .01). District Recruitment Support (β = .35, t(48) = 2.58, p = .01) and District Facilitated Training Space (β =

.44, t(48) = 2.73, $p < .01$) were related to school sustainment. Turning to the PICS, teachers' ratings on the Training Quality (β = .38, t(54) = 3.02, $p = .004$), User Support (β = .47, t(54) = 3.91, $p < .004$), Communication on Use (β = .41, t(54) = 3.17, $p < .004$), Ease of Use (β = .38, t(54) = 2.99, $p < .01$) and Global Climate (β = .51, t(75) = 4.33, $p < .004$) scales were all significantly related to higher individual sustainment. PICS User Support (β = .38, t(47) = 2.84, $p < .01$) and Global Climate (β = .43, t(47) = 3.49, $p < .01$) were significantly related to higher individual sustainment in multiple regression analyses (F(4,47) = 9.64, $p < .01$).

Interconnection among inner context variables. Results indicate significant positive associations between EPBAS Requirements and Appeal scales and several PICS subscales. In terms of district-level factors, there was some evidence of a positive association with District Leadership Support and EBPAS Requirements and a negative association between District Facilitated Space and PICS Ease of Use subscale (See Supplemental Table 4).

Discussion

The current study examined the impact of several key inner context factors, including implementation climate, leadership and teacher attitudes, on teachers' use and fidelity of CPRT. In terms of implementation climate and leadership, results suggest that teacher perceptions of training quality (PICS Training Quality subscale) was associated with higher fidelity of CPRT. Higher global program implementation climate was associated with higher levels of reported CPRT daily use, improved individual sustainment of CPRT, and higher teacher satisfaction with CPRT. At the provider level, more positive attitudes towards evidence-based practices, particularly viewing an intervention as intuitively appealing, was associated with higher teacher satisfaction with CPRT and sustainment.

Consistent with the EPIS framework, our findings highlight the importance of considering individual provider characteristics during evidence-based practice implementation.

This study adds to the developing literature on provider attitudes and implementation of evidence-based practices in community settings. Findings from this study did not fully align with existing literature on attitudes toward EBP that indicate a relationship between attitudes and fidelity to the intervention (Aarons et al., 2011; Beidas et al., 2014) or attitudes and intervention use (Reding et al., 2014), and intervention sustainment (Aarons, 2004; Aarons et al., 2011; Reding et al., 2014). Current findings point to some variability in the influence of attitude dimensions on implementation compared to sustainment. For example, it may be that general attitudes towards EBPs affect teachers' willingness to learn an EBP during training but that other factors have more influence on use, fidelity and sustainment. However, work examining the effects of teacher attitudes on EBPs on both implementation and sustainment is limited and warrants further examination.

In addition to provider characteristics, broader organizational characteristics such as implementation climate was associated with teacher fidelity and both implementation climate and leadership involvement were also associated with sustainment of CPRT. Although leadership measurement was constrained by methodological limitations, our results suggest supportive leadership may be related to sustainment of CPRT by individual teachers. This is consistent with existing literature. For example, work by Aarons (2006) indicated that a combination of leadership styles, namely leadership aiming to motivate followers intrinsically through the expression of their values or goals and leadership aiming to motivate extrinsically or concretely through the use of rewards versus just one, was associated with more positive attitudes towards adopting EBP. In special education literature, transformational leadership was related to lower teacher burnout, which may be linked to motivation to adopt new interventions (Gong, Zimmerli, & Hoffer, 2013). Additional examination of implementation leadership in schools using more rigorous methodology will help clarify this growing area of research.

Generally, our findings reveal a willingness among teachers to learn and implement a new practice, but they highlight that inner context factors are associated with more variability in the sustainment of the practice. This builds on other literature that emphasizes links between strong implementation leadership, implementation climate, and positive provider attitudes towards EBPs (Aarons, 2006; Aarons & Sommerfeld, 2012). Additionally, a clear relationship between organizational culture and climate and child level outcomes has been identified in educational settings for children with ASD (Dingfelder & Mandell, 2011).

Results from our multiple regressions underscore some inner context factors that may be especially important to consider within the context of implementation. Whereas multiple factors were associated with implementation outcomes, our findings suggest that when considered in relation to other implementation determinants-which is often the case within real-world implementation-some factors seemed particularly relevant. This includes the role of perceived training quality and global implantation climate as key facilitators. These findings are consistent with prior studies pointing to the value of leadership and organizational factors in supporting implementation (Dingfelder & Mandell, 2011; Glisson, Hemmelgran, Green, & Williams, 2013; Williams & Glisson, 2014). Further, our findings regarding the links between inner context factors as well as their impact on outcomes, such as the joint impact of provider attitudes and perceived climate on CPRT training satisfaction, also support the complex, interrelated nature of inner context factors in predicting outcomes (e.g., Aarons et al., 2014).

Based on these results, the next step is continued rigorous evaluation of inner-context factors and implementation outcomes within current and future intervention research. The specific measures used in the current study add very minimal respondent burden to participants already involved in intensive research-supported training efforts and may provide critical insight to the field.

An additional implication of this work involves future evaluation of implementation interventions to improve student/clinical outcomes. One approach may be to provide additional support to leaders in programs where teachers are learning a new EBP. The large majority of school administrators do not have special education experience and did not receive training in how to evaluate special education teachers, suggesting a lack of expertise in site-level administration of special education services (Rodl, Bonifay, Cruz & Manchanda, 2018). The literature provides evidence that when leaders provide clear guidance during implementation and facilitate support among co-workers and from administration for effective implementation, trainees report an increased sense of competence and satisfaction (Green et al., 2014). H owever, with limited administrator knowledge, this is likely not occurring in ASD-specific implementation efforts. One possible support is the Leadership and Organizational Change for Implementation intervention (LOCI; Aarons, 2015). The model has high utility for leader behavior change and organizational change, as well as provider-reported improvements in clinical team leader support for EBPs (Aarons, 2015) and has been evaluated as feasible and acceptable in mental health settings (Priestland & Hanig, 2005). Researchers are currently testing an adaptation of this model to target implementation leadership in schools and mental health clinics serving children with ASD, including teachers learning CPRT (Brookman-Frazee & Stahmer, 2018).

Some limitations to the current study are important to acknowledge. First, teachers in the current study volunteered to participate in a research study and may not represent the broader population of teachers in districts serving youth with ASD on a number of key variables examined in the current study (e.g., attitudes towards EBP, leadership support). However, the current sample had a full range of teachers and districts that varied in their attitudes towards EBPs and leadership participation and support. Second, examination of the impact of inner

context implementation factors was not the primary focus of the larger study from which these data are drawn, so systematic measurements of leadership, with valid reliability assessment, were not included. Therefore, all outcomes related to leadership should be viewed as provisional. Future implementation studies will need to include more systematic, validated measures of cross-level inner and outer contextual factors, including leadership (e.g., Implementation Leadership Scale; Aarons et al., 2014). Systematic measures of provider characteristics and attitudes were included; however, these responses were self-reported by participating teachers which may introduce bias or other confounds. There are also other elements that impact teacher implementation and sustainment. Additionally, although our decision to remove two components from our fidelity measurement from further analyses due to lower interrater reliability was informed by existing guidelines (e.g., Cicchetti, 1994), the impact of this on the current results is not well understood. Finally, this evaluation focused on only one practice, CPRT, limiting generalizability of these outcomes to other EBP. It is possible that factors associated with implementation of other evidence-based practices will differ, so these outcomes may not be broadly applicable.

Given these outcomes and limitations, there are several implications for future research and potential clinical adaptation. Future inquiry should continue to explore inner and outer context factors and their impact on implementation of evidence-based practices for ASD in school settings. More specifically, barriers and facilitators of CPRT implementation should be explored. As researchers and school leaders consider scale-up, it will be important to consider how these factors impact teacher use and sustainment. For example, with regard to teacher attitudes toward evidence-based practices, what mechanisms can be targeted to increase support and ultimately adoption? Perhaps districts can evaluate teacher openness to specific interventions prior to training. With regard to organizational leadership, what factors are most strongly related

to teacher and student outcomes? Leadership interventions targeting administrators, mid-level leaders and teachers may be beneficial in maximizing the effectiveness and uptake of evidence-based practice. In summary, even with these limitations and clear need for future exploration, this study makes important contributions to understanding the impact of inner context implementation determinants of a classroom-based interventions for students with ASD. More broadly, this work adds to the growing body of literature on implementation frameworks, measurement tools and methodologies, as well as the developing understanding of how this field may inform efforts to advance services for students with special needs.

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Table 1. Factors Related to Fidelity, Regression Coefficients

	Training Year Fidelity			*Follow Up Year Fidelity*		
	B	β	*p*	B	β	*p*
EBPAS Total	-.04	-.04	.75	.06	.05	.71
Requirements	.03	.05	.67	-.02	-.03	.84
Appeal	-.04	-.04	.70	.11	.10	.40
Openness	-.05	-.06	.60	.06	.06	.62
Divergence	-.08	-.08	.47	.02	.02	.89
District Support Measures						
District Recruitment Support	.09	.16	.14	.16	.27	.02
District Training Time	.06	.06	.58	.15	.17	.17
District Training Space	-.003	-.01	.97	.04	.06	.62
Program Implementation Climate Scales						
Ease of Use	.19	.22	.05	.13	.15	.21
Stress of Use (Reversed)	.11	.13	.25	.07	.09	.49
Training Quality	.25	.19	.10	.49	.34	<.004**
User Support	.18	.18	.11	.23	.22	.07
Communication on Use	.11	.19	.10	-.05	-.08	.54
Rewards for Use	.04	.11	.34	-.02	-.06	.67
Global Climate	.04	.07	.54	-.05	-.07	.55

Note: *p≤.01; **p≤.004

Table 2. Factors Related to Satisfaction and Report of Use, Regression Coefficients

	Satisfaction			*Report of Daily Use*		
	B	β	*p*	B	β	*p*
EBPAS Total	.42	.41	<.004**	.17	.06	.61
Requirements[+]	.19	.36	<.004**	.01	.01	.92
Appeal[+]	.24	.32	<.004**	.33	.16.	.19
Openness[+]	.25	.32	<.004**	.01	<.01	.98
Divergence	.04	.04	.70	.01	.01	.96
District Support Measures						
Recruitment Support	.01	.03	.81	.16	.15	.23
Training Time	.02	.03	.81	-.11	-.07	.58
Training Space	<.01	<.01	.98	.06	.05	.69
Program Implementation Climate Scales						
Ease of Use[+#]	.35	.50	<.004**	.57	.36	<.01*
Stress of Use (Reversed)[+#]	.20	.29	.01*	.50	.32	.01*
Training Quality [+]	.59	.52	<.004**	.77	.30	.02
User Support[+]	.29	.35	<.004**	.51	.25	.05
Communication on Use[+]	-.24	.49	<.004**	.27	.24	.07
Rewards for Use[+]	.14	.45	<.004**	.17	.24	.07
Global Climate[+#]	.28	.56	<.004**	.52	.47	<.004**

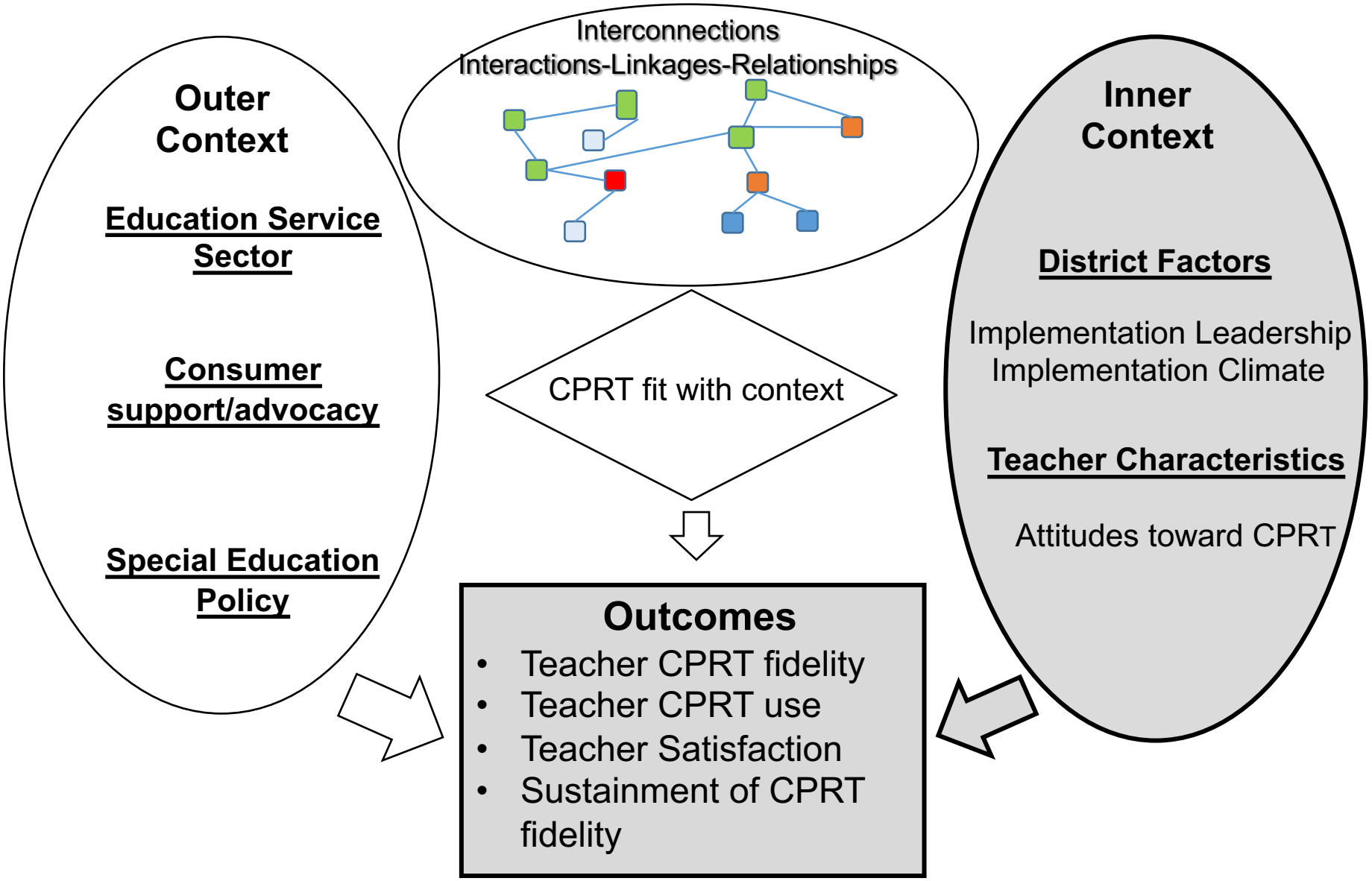
Note: [+]=Factors included in multiple regression analyses with Satisfaction; [#]=Factors included in the multiple regression analyses with Report of Daily Use; *p≤.01; **p≤.004

Table 3. Factors Related to Sustainment, Regression Coefficients

	Individual Sustainment			*School Sustainment*		
	B	β	*p*	B	β	*p*
EBPAS Total	.23	.15	.26	.34	.14	.32
Requirements	.01	.10	.92	.22	.20	.16
Appeal[+]	.39	.35	<.01*	.03	.02	.89
Openness	.18	.16	.24	.19	.11	.45
Divergence	-.12	-.10	.45	-.05	-.03	.85
District Support Measures						
Recruitment Support[#]	.02	.03	.82	.36	.35	.01*
Training Time	.09	.10	.49	.42	.27	.05
Training Space[#]	.25	.13	.37	.44	.37	.01*
Program Implementation Climate Scales						
Ease of Use[+]	.39	.38	<.01*	-.04	-.02	.87
Stress of Use (Reversed) [+]	.33	.35	<.01*	.02	.01	.95
Training Quality [+]	.61	.38	.004**	.12	.04	.79
Ongoing User Support[+]	.57	.47	<.004**	.20	.10	.50
Communication on Use[+]	.29	.41	<.004**	.09	.07	.63
Rewards for Use[+]	.14	.31	.02	.16	.23	.11
Global Climate[+]	.37	.51	<.004**	.24	.20	.16

Note: [+]=Factors included in multiple regression analyses with Individual Sustainment; [#]=Factors included in the multiple regression analyses with School Sustainment; *≤.01; **p≤.004

Applying the Exploration, Preparation, Implementation, Sustainment (EPIS) Conceptual Model of Implementation of CPRT



Adapted from Aarons, G.A., Hurlburt, M. & Horwitz, S.M. (2011).