EXAMINING THE EFFECTS OF SYSTEMS BARRIERS AND IMPLEMENTATION STRATEGIES ON SCHOOL-WIDE POSITIVE BEHAVIORAL INTERVENTIONS AND SUPPORTS TIER 1 IMPLEMENTATION FIDELITY OVER TIME

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DISSERTATION ABSTRACT

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Title: Examining the Effects of Systems Barriers and Implementation Strategies on School-wide Positive Behavioral Interventions and Supports Tier 1 Implementation Fidelity Over Time

It is common for evidence-based practices in schools to be implemented and discontinued before practitioners reach adequate implementing fidelity or achieved meaning educational outcomes. A number of systems barriers have been found to inhibit the successful implementation of evidence-based practices in service organizations. There are also a number of implementation strategies (e.g., Training, Coaching) found to facilitate the successful transfer of evidence-based practices into these service organizations. However, the extent to which these systems barriers and implementation strategies affect the fidelity that evidence-based practices are implemented in educational strategies is understudied.

The purpose of this longitudinal study was to examine the associations between Administrator Turnover, implementation strategies, and Tier 1 Implementation Fidelity using a sample of 563 schools implementing School-Wide Positive Behavioral Interventions and Supports (SWPBIS). In addition, this study also examined whether implementation strategies buffer the negative influences of Administrator Turnover on Tier 1 implementation over time.

Results of this study indicated that implementation strategies were significantly and positively related to Tier 1 implementation fidelity; however, Administrator Turnover was not found to be significantly associated with SWPBIS Tier 1 Implementation Fidelity. Implication of these findings, limitations, and suggestions for future research are discussed.

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CHAPTER I

INTRODUCTION

Statement of Purpose

Schools must overcome many barriers throughout the implementation of effective practices (Forman, Olin, Hoagwood, Crowe, & Saka, 2009; Langley, Nadeem, Kataoka, Stein, & Jaycox, 2010; Pinkelman, McIntosh, Rasplica, Berg, & Strickland-Cohen, 2015). Barriers can greatly impede the fidelity to which these practices are implemented (Elliott & Mihalic, 2004; Russo-Campisi, 2017; Turri et al., 2016). Unfortunately, when these effective practices are not adequately supported and fail to demonstrate meaningful effects, practices are too often abandoned and replaced with newer ones, often without empirical support (Nese et al., 2016). Many researchers and practitioners have learned that simply adopting effective practices in schools is necessary but insufficient to produce long-term desired educational outcomes (B. G. Cook & Odom, 2013; Fixsen, Blase, Metz, & Van Dyke, 2013).

There are abundant examples of the difficulty of sustaining school initiatives. In 2017, the Institute of Education Sciences (IES) released an evaluation of the School Improvement Grants (SIG) program (Dragoset et al., 2017). The SIG program was one of the largest federally-funded educational initiatives to date, providing over $3 billion dollars for states to implement one of four types of SIG-funded universal models in their schools (transformation, turnaround, restart, or closure). Embedded within these models, included comprehensive school reform strategies (e.g., instructional reforms, increasing learning time, creating community-oriented schools, operational flexibility) intended to increase student academic, graduation, and college enrollment outcomes. Unfortunately,

findings from this evaluation indicated that the SIG-models had no overall impact on the intended student outcomes (i.e., math or reading test scores, high school graduation rates, or college enrollment rates; Dragoset et al., 2017).

Reviews of implementation and dissemination research shed light on why effective practices or programs may be ineffective in improving educational outcomes (Elliott & Mihalic, 2004; Gottfredson & Gottfredson, 2002). In their review of violence and drug prevention dissemination efforts, Elliott and Mihalic (2004) found a number of factors that negatively impact dissemination activities. For example, staff turnover was cited as being a critical barrier to dissemination activity of staff training. In addition, other factors, such as lack of resources, were found to impact multiple dissemination processes within organizations (e.g., site selection and training). In a national survey of school-based prevention programs that evaluated over 3,600 implementation activities, Gottfredson and Gottfredson (2002) found that the overall quality to which effective programs were being implemented was low and likely to impact the effectiveness of these programs on student outcomes. Among the factors perceived to impact implementation quality was the extent to which schools integrated implementation activities into typical school operations and had access to implementation strategies, such as training, supervision, and principal support (Gottfredson & Gottfredson, 2002).

Literature Review

Factors Affecting Implementation Fidelity

Implementation fidelity. The extent to which effective programs are implemented as prescribed is defined as implementation fidelity (Carroll et al., 2007). Dane and Schneider (1998) proposed that implementation fidelity (defined as program

integrity) consists of five core components: (a) adherence, (b) exposure, (c) quality of delivery, (d) participant responsiveness, and (e) program differentiation. The authors defined adherence as the exact degree to which all intervention components and procedures are delivered as intended. Exposure refers to the number of sessions, frequency, and duration for which components are intended to be implemented. Quality of delivery describes aspects related to the quality to which implementers deliver the intervention, such as preparedness, enthusiasm, and leadership attitudes. Participant responsiveness relates to participants' receptiveness, participation, and engagement in the program. Also, program differentiation was defined as the extent to which specific components of the programs are distinct from one another (Dane & Schneider, 1998; Mihalic, 2004). Dane and Schneider (1998) then conducted a systematic review to examine the extent to which these components were measured in prevention studies between 1980 to 1994. Of the 162 studies included in their review, only 39 (24%) contained procedures for measuring implementation fidelity. In addition, only 13 of the 162 (8%) measured more than one of the five components of implementation fidelity.

Expanding on Dane and Schneider's (1998) efforts, Carroll and colleagues (2007) proposed a conceptual framework for examining potential variables (e.g., participant responsiveness, quality of delivery) that moderate implementation fidelity (Carroll et al., 2007). In addition to components defined by Dane and Schneider (1998), Carroll and contributors (2007) proposed two additional components: intervention complexity, defined as the extent to which interventions vary in implementation complexity and implementation strategies, which strengthen implementation fidelity (e.g., training, monitoring, feedback). Carroll and colleagues (2007) argued that more complex

interventions require more complex implementation strategies for adherence to implementation fidelity; however, the authors acknowledged that there was no empirical evidence indicating that implementation strategies serve as moderating variables of adherence to implementation fidelity. Figure 1 provides an overview of Carroll and colleagues' (2007) conceptual framework.

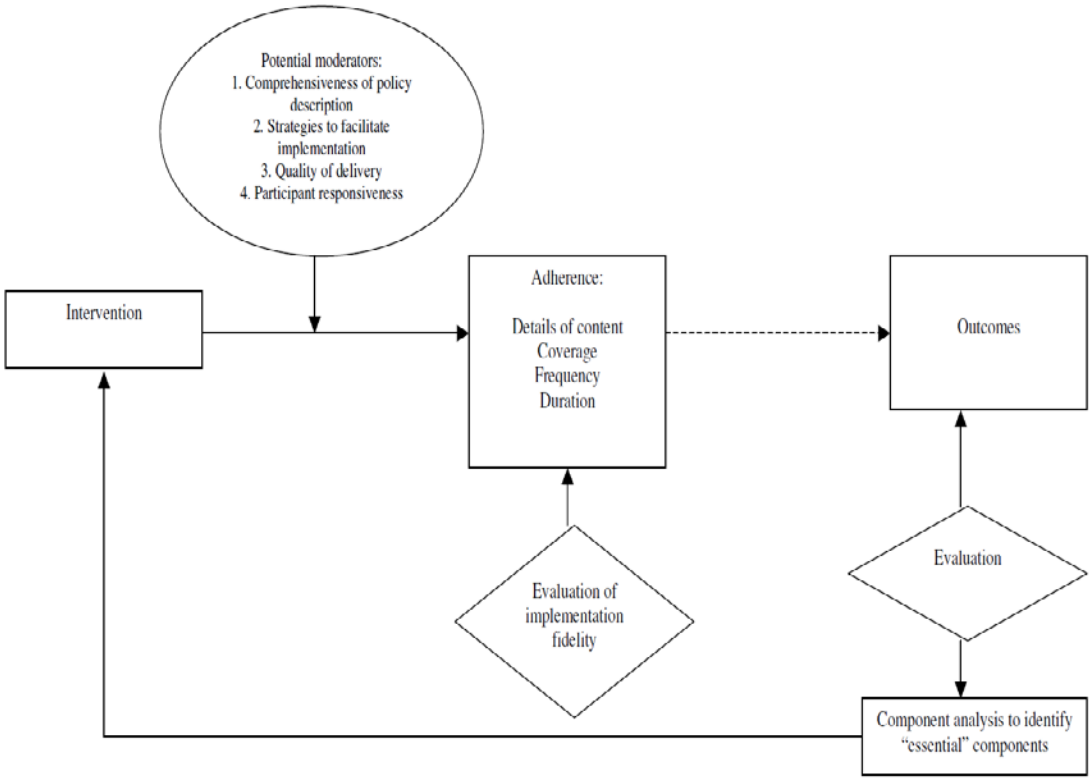

Figure 1. Conceptual framework for measuring adherence to implementation fidelity and potential moderators proposed by Carroll and contributors (2007).

Implementation Science

Although often undervalued in educational research (Horner & Sugai, 2018), the field of implementation science is a discipline dedicated to identifying and understanding factors that facilitate the successful transfer of effective practices into service organizations (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005; Fixsen & Ogden, 2014; Glasgow, Vogt, & Boles, 1999; Metz & Bartley, 2012; Powell, Proctor, & Glass,

2014). Implementation science has taught that effective practices are more likely to be implemented successfully when organizations use implementation strategies (Fixsen, Blase, Naoom, & Wallace, 2009; Fixsen et al., 2005; Fixsen & Ogden, 2014; Horner & Sugai, 2018). In a recent commentary of the field of positive behavior support, Horner and Sugai (2018) offered several recommendations for future directions of research. Included among these was a need for the field of positive behavior support to focus on examining systems and systems variables (e.g., training, coaching, performance feedback) that facilitate the implementation and sustained use of effective practices with high fidelity (Horner & Sugai, 2018). Others, in different disciplines, have recently echoed similar calls for experimental and rigorous research examining implementation strategies and their impact on fidelity of effective practices (Lippold & Jensen, 2017; Powell et al., 2012; Powell et al., 2014).

Implementation stages. Studies have shown certain predictors (e.g., data-based decision and evaluation systems and leadership factors) impact the implementation of effective practices differently within organizations, based on the stage of implementation (McIntosh et al., 2013; McIntosh, Mercer, Nese, Strickland-Cohen, & Hoselton, 2016; Saldana, Chamberlain, Wang, & Brown, 2012). According to Adelman and Taylor (1997), the implementation process moves through a series of four stages in schools. Stage 1 (Creating Readiness) involves establishing a willingness or need for change within schools (e.g., establishing interest, developing a feasible budget, and building an implementation team). Stage 2 is Initial Implementation, during which implementation teams work to adopt and phase in effective practices within their schools. In this stage, many of the implementation strategies are temporarily established to support the

implementation of these practices (e.g., formative evaluation procedures and coaching and mentoring). In Stage 3 (Institutionalization), schools focus more on building the infrastructure and organizational systems to support the ongoing implementation strategies needed to sustain the practices. In the final stage (Ongoing Evolution), practices go through a continuous regeneration process to improve upon the quality and efficacy to which practices are implemented over time (Adelman & Taylor, 1997).

Implementation strategies. Multiple theoretical frameworks in the field of implementation science have been developed to understand, explain, or evaluate implementation processes. Nilsen (2015) described that there are two types of theoretical frameworks in implementation science research: evaluation frameworks and determinant frameworks. Evaluation frameworks, such as RE-AIM (i.e., reach, efficacy, adoption, implementation, and maintenance; Glasgow et al., 1999) are used to evaluate implementation processes and interventions for adoption. Determinant frameworks, such as the active implementation drivers (Fixsen, Blase, Naoom, & Duda, 2015; Fixsen et al., 2005) and consolidated frameworks for implementation research (CFIR; Damschroder et al., 2009), are used to identify, categorize, and explain how specific implementation factors (e.g., implementation strategies, barriers) influence implementation outcomes (Nilsen, 2015).

Prior to the development of the active implementation frameworks (see Figure 2; Fixsen & Blase, 2008), Fixsen and colleagues (2005) published a systematic literature of implementation science research. In their review, the authors identified implementation strategies found to facilitate the successful implementation of effective practices and programs into service organizations (e.g., education, health, business, and social

services). Powell, Proctor, and Glass (2014) defined implementation strategies as "systematic intervention processes" that are used to integrate effective practices into routine organizational operations. With the assistance of colleagues from the National Implementation Research Network (NIRN), Fixsen then organized and categorized these implementation strategies into one of three types of systems-level drivers (Fixsen et al., 2015; Fixsen & Blase, 2008; Fixsen et al., 2005). The three implementation drivers include: leadership drivers, organizational drivers, and competency drivers (Fixsen & Blase, 2008).

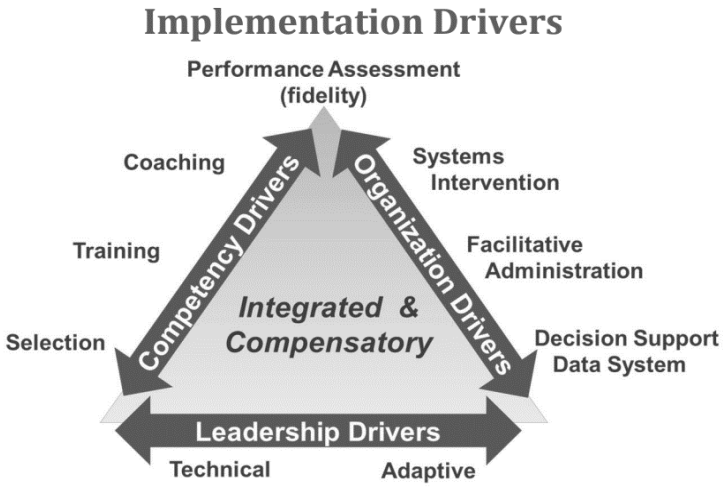

Figure 2. The active implementation frameworks (Fixsen & Blase, 2008).

According to the implementation frameworks (Fixsen & Blase, 2008), leadership drivers are adaptive and technical leadership strategies needed to support the implementation and sustained use of effective practices. Fixsen, Blase, Naoom, and Duda (2015) explained that leadership approaches are likely to change over time, from being adaptive early on during initial implementation, and then shift to being more technical as organizations adjust to sustaining practices. Daily and Chrispeels (2008) explained that

technical leadership is needed for resolving problems that already exist within organizational systems, such as future funding and resources. Organizational drivers consist of (a) systems interventions, (b) facilitative administration systems, and (c) decision support data systems (Fixsen et al., 2015; Metz & Bartley, 2012). These drivers include strategies necessary to build capacity to implement and sustain organizational systems and practices (Metz & Bartley, 2012). Competency drivers are strategies (i.e., selection, training, and coaching) intended to improve practitioners' competence within organizations to implement effective practices (Fixsen et al., 2015; Fixsen et al., 2009; Metz & Bartley, 2012). Drawing on research in the field of implementation science and related disciplines, a number of studies have shown implementation strategies to be integral to the implementation of effective practices in service organizations and differentially impactful based on the stage of implementation (Adelman & Taylor, 1997; Fixsen et al., 2005).

Leadership strategies. Leadership strategies have been found to affect a number of different variables related to the implementation process (Guerrero, Padwa, Fenwick, Harris, & Aarons, 2016; McIntosh, Kelm, & Delabra, 2016; Payne, Gottfredson, & Gottfredson, 2006). For example, Saldana, Chamberlain, Wang, and Brown (2012) conducted one of the first observational studies to examine the influence of system leaders' behaviors on the successful start-up of an evidence-based foster care program, as part of a large randomized implementation trial in two U.S. states. Using an implementation progress tool, the authors found that the proportion of implementation activities completed by system leaders and the amount of time system leaders spent completing these activities in the early stages of implementation (e.g., engagement,

consideration of feasibility, readiness planning) strongly predicted successful start-up. Payne, Gottfredson, and Gottfredson (2006) analyzed data from 544 schools that had implemented delinquency prevention programs in schools. Using structural equation modeling (SEM), the authors found principal support to be a significant predictor of implementation program intensity.

Locke and colleagues (2017) conducted semi-structured interviews with 39 staff members who participated in a randomized controlled trial examining the effects of a universal social engagement intervention for children with autism. Administrator support was found to be essential, both prior to and during implementation. Prior to implementation, administrators were acknowledged as helping to facilitate open communication among school personnel about the intervention and encouraged personnel to seek out further information about the intervention. During implementation, administrators continued to engage in ongoing communications with school personnel and allocated school resources (e.g., time for planning meetings and training) to support the intervention (Locke et al., 2017).

Organization strategies. Fixsen and colleagues defined organizational drivers as system-level processes for continually evaluating, monitoring, and improving upon the overall implementation of practices within organizations (Fixsen et al., 2015). Horner, Sugai, and Fixsen (2017) noted that investing "early and intensely" in organizational systems is critical for achieving high implementation fidelity and sustainability of school practices. There is research to suggest that the use of data for decision making and evaluation by school teams, is a significant predictor of sustained implementation of universal behavior practices (Coffey & Horner, 2012; McIntosh et al., 2013). Using SEM

with a sample of 217 schools implementing School-Wide Positive Behavior Interventions and Supports (SWPBIS), McIntosh and colleagues (2013) found the construct of team use of data to be a significant and independent predictor of sustained implementation of SWPBIS. Also, Mercer, McIntosh, Strickland-Cohen, and Horner (2014) also found team use of data to be rated significantly higher for schools implementing SWPBIS for longer periods of time (five or more years) based on a sample of 860 schools, also using SEM.

In terms of organizational capacity building, there is research to suggest that the number of practitioners working together in a team to implement effective practices is an effective implementation strategy (Klest, 2014; Patras & Klest, 2016). For example, Klest (2014) surveyed 83 therapists implementing a parent training program in social service organizations in Norway. The author found that the number of therapists working within an organization positively correlated with implementation factors, such as (a) therapists' time dedicated to the program, (b) number of families served, and (c) integration of the program within the organizations. In a related study using SEM, Patras and Klest (2016) found significant differences in the therapists' reports of key variables related to implementation (i.e., collective efficacy, collaboration, and teamwork) for therapists implementing the parent training program in groups of three, compared to therapists implementing in groups of two or one.

Competency strategies. Competency strategies are factors related to selecting and providing practitioners with the skills necessary to successfully implement and sustain practices with high fidelity (Fixsen et al., 2005; Metz & Bartley, 2012; Powell et al., 2014). In schools, implementation strategies related to training and coaching are delivered through professional development (e.g., in-services, release time) and ongoing

technical assistance. However, Odom (2009) noted that professional development in schools has often consisted of "stand-alone workshops or presentations without ongoing support" (p. 59). He also acknowledged that these types professional development activities often failed to consider the school organizational systems needed to implement and sustain effective practices (2009).

Prior to providing professional development and technical assistance to implement effective practices, Fixsen and colleagues (2009) argued that it is important to consider the skills, qualifications, and attributes of those that will be responsible for implementing the practices within the service organizations. Fixsen and colleagues (2015) described certain attributes (e.g., basic interpersonal and professional skills) as often "difficult to teach in training sessions" (p. 8) but critical for implementation in terms of identifying internal leaders and selecting team members responsible for providing professional development (Elliott & Mihalic, 2004; Fixsen et al., 2005). As an example, Kittelman, Pinkelman, Strickland-Cohen, and McIntosh (in preparation) found a lack of teaming (e.g., failing to meet and accomplish team goals/objectives) among team members to be a factor for why some schools abandoned the implementation of Tier 1 SWPBIS in their schools. To illustrate, one of the participants reported that their team leader did not want help from other team members in planning implementation activities, which limited the number of these activities completed by the team over the course of the school year. In another study, based on structured interviews with intervention developers of school mental health practices, Forman and colleagues (2009) found school implementers' attributes and behaviors (e.g., strong interpersonal skills, ability to deal

with ambiguity, respecting others) were found to be important facilitators to the successful implementation of these practices.

School personnel primarily receive two types of professional development: preservice training and in-service training (Kratochwill, Volpiansky, Clements, & Ball, 2007). However, the content in professional development provided prior to and after placement in schools is typically much different (Kratochwill et al., 2007). For example, preservice professional development provided to educators mainly involves the mastery course work and practicum experiences. Kratochwill and colleagues (2007) noted that it is common for preservice professional development programs to provide little training on how to implement and sustain effective practices or systems. Alternatively, in-service professional development is focused on training school personnel to acquire knowledge, skills, and resources to implement practices (Sandholtz, 2002). In-services and other ongoing professional development present unique opportunities for school personnel to acquire knowledge about systems processes and implementation strategies needed to implement and sustain practices over time with high fidelity (Fixsen et al., 2015; Fixsen et al., 2005).

Although training is one of the most frequently used implementation strategies (Powell et al., 2012; Powell et al., 2014), training alone without ongoing support is often insufficient for achieving high implementation of effective practices in service organizations (Beidas et al., 2014; Beidas & Kendall, 2010; Joyce & Showers, 1982, 2002). For example, Beidas and Kendall (2010) conducted a systematic literature review of studies between 1990-2008, in which training was provided to therapists (e.g., social workers, secondary school staff, and psychologists) to implement effective practices in

clinical and other service organizations. Findings indicated that trainings were mainly impactful on therapists' perceived behaviors, knowledge, and attitudes; however, the majority of studies indicated that training did not result in significant changes in therapists' actual behaviors such as adherence, competence, and skill, or the newly learned behaviors did not maintain for long after study follow-up (Beidas & Kendall, 2010).

Another implementation strategy that is frequently cited as being highly important to supporting practitioners' ongoing use of effective practices is coaching (B. G. Cook & Odom, 2013; Fixsen et al., 2009; Joyce & Showers, 2002). In Joyce and Showers' (1982) seminal article on coaching, the authors described coaching as a necessary step for the transfer of newly acquired skills from training to practice. The authors also define coaching as process which involves providing technical feedback and opportunities to practice newly acquired skills (Joyce & Showers, 1982). Showers (1985) explained that coaching is an intensive and ongoing type of professional development that needs to be supported at the organizational school levels to ensure that sufficient resources are allocated to this type of professional development. As evidenced by Beidas and Kendall's study (2010), without ongoing support, training was mainly ineffective. As an example, Massar (2017) recently examined the effects of two functions of coaching (i.e., prompting and performance feedback) on general education elementary teachers' use of evidence-based classroom management practices (i.e., opportunities to respond, behavior-specific praise, and precorrection) using a single-case multiple baseline design. Prior to classroom coaching, the researcher provided teachers with an online training on the use of these effective classroom management practices, which did not generate high rates of

teachers' use in their classrooms. However, after weekly coaching sessions were provided, using prompting or performance feedback, and then a combination of both, functional relations were found between classroom coaching and increases in teachers' use of these classroom management practices and decreases in student problem behaviors (Massar, 2017).

A few studies have examined the effects of training and ongoing professional development on implementation fidelity over time. For example, Phillips, Ingrole, Burris, and Tabulda (2017) examined factors that predicted implementation fidelity of a vocabulary/language intervention in 39 preschool classrooms. Implementation fidelity was defined as the adherence to the intervention lessons and the quality to which lessons were implemented. Training provided for preschool teachers and assistants included two and a half days of workshops over the course of 16 weeks and covered topics related to the intervention and effective classroom behavior management practices. Ongoing mentoring sessions were provided throughout the intervention (e.g., modeling, feedback). The authors found that teacher preparation, receptivity, consistency in implementation, and use of classroom management practices were all significantly related to implementation fidelity (Phillips et al., 2017). In another classroom study, Stahmer and colleagues (2014) conducted a two-year investigation, as part of a randomized control trial, examining the effects of intensive training and coaching on teachers' use of a packaged intervention program consisting of three evidence-based strategies (i.e., discrete trail teaching, pivotal response training, functional routines) on implementation fidelity. The study included 57 teachers in kindergarten through second grade autism support classrooms that received intensive training (e.g., didactic teaching, video exemplars, role-

playing) in the first year of the study and ongoing classroom coaching (e.g., in person, phone, emails) every two weeks in the second year. Implementation fidelity was collected and examined at four time points over the course of the two years. The authors found that implementation fidelity improved over time; however, the number of hours spent coaching was not significantly associated with overall implementation fidelity (Stahmer et al., 2014).

Although ongoing training and coaching have been cited as key strategies for the implementation of effective practices with high implementation fidelity in schools (Bambara, Goh, Kern, & Caskie, 2012; Coffey & Horner, 2012), the experimental literature examining the effects of training and coaching on implementation fidelity of universal practices over time in schools is sparse (Horner & Sugai, 2018). In a recent paper, Kittelman, Wagner, Mercer, and McIntosh (2018) examined the extent to which composite scores of days of formal SWPBIS training (i.e., individual team members, teams, building administrators, and all school staff) and hours of coaching in over 500 schools implementing SWPBIS, correlated with a latent construct of district capacity building across three years of implementation. District capacity building has been found to significantly predict sustained implementing of SWPBIS at Tier 1 (McIntosh et al., 2013; Mercer et al., 2014). The authors found training and coaching to be modestly, yet significantly, related to district capacity building (Kittelman et al., 2018); however, the extent to which training and coaching directly affected Tier 1 Implementation Fidelity was not examined.

SWPBIS

SWPBIS (Horner, Sugai, & Anderson, 2010) is an evidence-based, multi-tiered framework implemented in more than 25,000 U.S. schools (Horner et al., 2017). SWPBIS is comprised of three tiers of organizational systems and effective practices intended to support students with varying levels of needs (Horner et al., 2010; Sugai & Horner, 1999). Tier 1 SWPBIS (universal) practices are designed to support all students by defining and teaching appropriate behaviors, establishing universal acknowledgement systems to reinforce appropriate behaviors, developing proactive discipline policies, and using effective screening methods to identify students in need of additional supports (Horner et al., 2010). Tier 2 practices include the use of standardized group-based practices (e.g., Check-In Check-Out; Crone, Horner, & Hawken, 2004) for at-risk students engaging in low frequency and low-level problem behaviors. Tier 3 practices consist of individualized function-based intensive practices for students engaging in chronic high-risk problem behaviors (Horner et al., 2010; T. J. Lewis & Sugai, 1999; McIntosh, Bennett, & Price, 2011; Sugai & Horner, 1999). At each tier, school leadership teams are responsible for implementing and monitoring implementation fidelity.

Implementation of SWPBIS at Tier 1 is associated with a number of positive student and school outcomes, including positive impacts on perceptions of school safety (Horner, Sugai, Smolkowski, Todd, & Nakasato, 2009; McIntosh, Bennett, et al., 2011; Sprague et al., 2002), increases in perceptions of school organizational functioning (Bradshaw, Koth, Thornton, & Leaf, 2009), reductions in student office discipline referrals and suspensions, improvements in students' academic performance (Bradshaw, Mitchell, & Leaf, 2010; McIntosh, Bennett, et al., 2011; Nelson, Martella, & Marchand-

Martella, 2002), improvements in student attendance (Freeman et al., 2015), decreases in peer bullying and peer rejection (Waasdorp, Bradshaw, & Leaf, 2012), increased positive perceptions of teachers' efficacy, and decreased levels of teacher burnout (Ross, Romer, & Horner, 2012).

SWPBIS and implementation science. In an introductory article on implementation science in special education, Cook and Odom (2013) cited SWPBIS as being an exemplar for the field of special education in terms of utilizing implementation science strategies to achieve successful implementation outcomes in school environments. The authors also stated that "such attention to the principles of implementation science has, no doubt, contributed to SWPB[I]S's extensive, sustained, and effective application" (p. 140; B. G. Cook & Odom, 2013). Recent implementation efforts focused on sustaining SWPBIS within schools and scaling up within states, have identified and used a number of implementation strategies, such as creating implementation blueprints, training and coaching, establishing school, district, and state leadership teams, and using data for continuous evaluation and decision making (Coffey & Horner, 2012; Horner et al., 2014; Horner et al., 2017; McIntosh et al., 2013). Through implementation efforts, researchers have also identified a number of barriers perceived to have negative impact on implementation and sustainability of SWPBIS.

Systems barriers to adequate SWPBIS Tier 1 implementation. It is not uncommon for schools to face numerous and reoccurring system barriers that threaten the implementation and sustainability of effective practices (Elliott & Mihalic, 2004; Fixsen et al., 2013; Gottfredson & Gottfredson, 2002; Pinkelman, McIntosh, Rasplica, et al., 2015). Systems barriers, such as turnover, burnout, and lack of resources are common

and reoccurring among service organizations (Fixsen et al., 2013; Lippold & Jensen, 2017; McIntosh et al., 2014). Both the complexity of the organizational systems and practices present challenges for practitioners in terms of implementing with high implementation fidelity (Lippold & Jensen, 2017). In addition, Adelman and Taylor (1997) acknowledged that barriers to the implementation of effective practices (e.g., negative attitudes, institutionalized resistance) are pervasive and can occur throughout the different stages of implementation (i.e., creating readiness, initial implementation, institutionalization, and ongoing evolution). Even when practices are supported within organizations using effective implementation strategies (e.g., training, coaching, and leadership support), systems barriers may impact the consistency to which implementation strategies are used to implement the practices (Lippold & Jensen, 2017).

Although the implementation of Tier 1 SWPBIS with fidelity is associated with positive student and staff outcomes, several large-scale implementation studies have examined systems barriers, perceived to have negatively impact the implementation of SWPBIS. These perceived barriers may occur due to variety of factors including, such as complexity of implementing universal SWPBIS practices and systems, the school environments and organizational factors, or a lack of implementation supports throughout ongoing implementation. Commonly cited perceived systems barriers in the SWPBIS literature include turnover, competing initiatives, and opposition to SWPBIS philosophy.

Turnover. Turnover among general personnel and administrators is a reoccurring obstacle schools must take into account when implementing initiatives. Kincaid, Childs, Blase, and Wallace (2007) conducted a systematic qualitative study to identify perceived barriers and facilitators to Tier 1 SWPBIS implementation among school team members

(n = 70) in 26 Florida schools implementing SWPBIS for a minimum of one year. Teams were identified and categorized as either implementing SWPBIS to high implementation fidelity or low implementation fidelity, based on their schools' SWPBIS Tier 1 Implementation Fidelity scores. The authors found turnover among school personnel and students to be among the top-10 perceived barriers to SWPBIS implementation, among high and low implementers. However, those in the high implementers group perceived staff and student turnover to be more problematic (Kincaid et al., 2007). One possible explanation for this finding is that turnover is less malleable than other barriers, such as a lack of training or coaching, and therefore more difficult to address than other perceived barriers, such as opposition to SWPBIS philosophy (Kincaid et al., 2007).

Responsibilities of school administrators include supporting faculty and student, managing budgets, hiring staff, and supporting the implementation of district or school initiatives. Therefore, turnover among school administrators can have significant implications for schools implementing SWPBIS (Bambara et al., 2012; McIntosh et al., 2014). For example, McIntosh and colleagues (2014) surveyed 257 school team members to identify critical features perceived as most and least important for implementing and sustaining SWPBIS. Administrator support was found to be the most important perceived factor for both implementing and sustaining SWPBIS. Furthermore, turnover among administrators, team members, general staff, and students were identified as among the most significant barriers to sustaining SWPBIS (McIntosh et al., 2014). In addition, Andreou, McIntosh, Ross, and Kahn (2015) conducted semi-structured qualitative interviews with 17 school and district personnel in a school district implementing Tier 1 SWPBIS for more than 15 years. Staff turnover was documented as one of two critical

incidents perceived to have hindered school staff's ability to sustain the implementation of Tier 1 SWPBIS within their district (Andreou et al., 2015).

Opposition to SWPBIS philosophy. Researchers have noted that the implementation of SWPBIS requires a cultural shift to dealing with student discipline problems, which includes moving away from using punitive and zero tolerance approaches, to more proactive and preventative approaches (T. J. Lewis & Garrison-Harrell, 1999; T. J. Lewis & Sugai, 1999). For example, implementing universal acknowledgement systems for encouraging positive behaviors is one of the core Tier 1 SWPBIS features (Horner et al., 2010). School personnel may be opposed to this approach to student discipline if they feel that it is not their responsibility to reinforce positive social behaviors.

Bambara et al. (2012) surveyed 293 school personnel, including behavior support specialists, trainers, school psychologists, administrators and others, in five U.S. states to identify perceived factors that impacted Tier 3 SWPBIS implementation in their schools. Survey items "resistance among school personnel to change their behavior management practices" and "belief among school personnel that problem behaviors should be punished," were found to be the top three highest rated items for the construct of "school culture: practices and beliefs." In addition, "resistance among school personnel to change their behavior management practices" was rated as a top six overall perceived barrier to Tier 3 SWPBIS implementation (Bambara et al., 2012).

Opposition to Tier 1 SWPBIS among leadership has also been cited as perceived barrier to Tier 1 SWPBIS implementation. In an effort to explore factors that influenced school administrators' perceptions of Tier 1 SWPBIS implementation, McIntosh, Kelm,

and Canizal Delabra (2016) conducted in-depth interviews with 10 school administrators. McIntosh and colleagues (2016) found (a) disagreement with philosophy of SWPBIS, (b) witnessing unsupportive staff, and (c) negative reaction to time commitment to hinder school leaders' support of Tier 1 SWPBIS implementation.

Competing initiatives. Implementing multiple school initiatives over the course of a school year is likely to compete for school personnel time and resources. Coffey and Horner (2012) surveyed school personnel from 117 schools in six U.S. states implementing SWPBIS for a minimum of three years. Among the most commonly reported barriers to sustaining SWPBIS were lack of funding and time to carry out implementation activities. Because SWPBIS is a universal practice, there are a number of systems that can put increased demands on school personnel. For example, Pinkelman and colleagues (2015) surveyed 860 participants, each representing a school implementing SWPBIS for varying lengths of time. The authors used a phenomenological coding process to identify factors perceived to be the most influential to the sustained implementation of SWPBIS. The authors identified 13 themes representing barriers and facilitators to SWPBIS implementation. Lack of time and funding were rated as the second and third most significant barriers to sustaining SWPBIS, after staff buy-in (Pinkelman, McIntosh, Rasplica, et al., 2015). In another mixed-methods survey study of 257 school and district team members implementing SWPBIS, McIntosh and colleagues (2014) found inadequate resources as the most commonly reported barrier to SWPBIS implementation. However, this and other perceived barriers (e.g., turnover, SWPBIS philosophy) were considered less impactful

for school team members implementing SWPBIS for longer periods of time (at least five or more years; McIntosh et al., 2014).

Experimental Analysis of Systems Barriers on Tier 1 Fidelity

As previously cited, a majority of the studies examining impact of perceived barriers on the Tier 1 SWPBIS implementation fidelity have been descriptive in nature (e.g., survey, semi-structured interviews, mixed methods) and do not empirically examine how barriers influence actual Tier 1 SWPBIS implementation over time. As a step towards addressing this limitation, Turri and colleagues (2016) developed a brief experimental measure, titled the *Assessment of Barriers to Implementation and Sustainability in Schools* (ABISS) to assess perceived barriers impacting the implementation of SWPBIS. Using multi-group SEM, the authors found barrier scores from 704 U.S. schools (a subsample of schools participating in Year 1 of the current proposal) to be significantly related to their schools' SWPBIS Tier 1 Implementation Fidelity scores. Moreover, Turri and contributors also found that schools that had been implementing Tier 1 SWPBIS for longer periods of time (five or more years) reported significantly fewer barriers compared to schools implementing for shorter periods of time (2016).

Although Turri and colleagues' (2016) study was one of the first to experimentally examine how systems barriers are related to Tier 1 SWPBIS implementation fidelity, further research is needed. For example, there is a need to examine how perceived barriers affect implementation fidelity of SWPBIS at Tier 1 longitudinally. Elliott and Mihalic (2004) noted in their review of dissemination research that a majority of replication failures were attributed to factors in the early

implementation phase; therefore it would be particularly meaningful to know if systems barriers to implementation of SWPBIS at Tier 1 are more detrimental to schools in the early stages of implementation, as opposed to the later ones (Adelman & Taylor, 1997).

Because of the dearth of experimental research examining the impact of implementation strategies (e.g., training and coaching) on systems practices (Powell et al., 2014), there is a need to examine (a) to what extent systems-level implementation strategies provided to schools positively impact SWPBIS Tier 1 Implementation Fidelity over time (Horner & Sugai, 2018) and (b) to what extent these strategies can buffer the negative effects of systems barriers, previously cited in the SWPBIS literature as being negatively impactful to Tier 1 Implementation Fidelity over time (Pinkelman, McIntosh, Rasplica, et al., 2015; Turri et al., 2016). More specifically, there is a need to assess whether there schools that receive more training, coaching, release time for implementation activities, and Team Use of Data for Decision Making are more likely to overcome systems barriers. In terms of resource allocation, it would be especially meaningful to researchers and practitioners in the field of positive behavior support to evaluate whether schools that received more implementation strategies in the earlier implementation stages (Adelman & Taylor, 1997) are better equipped to overcome barriers to SWPBIS implementation over time. Furthermore, recent research has found several non-malleable school factors (e.g., school grade level, stage of implementation, school urbancity) to significantly predict adequate and sustained Tier 1 Implementation Fidelity (McIntosh et al., under review; Nese, Nese, McIntosh, Mercer, & Kittelman, under review). Therefore, it would be relevant to examine whether the impact of systems

barriers and implementation strategies on Tier 1 implementation vary these non-malleable school factors.

Based on the proposed logic model presented in Figure 3, I hypothesize that Administrator Turnover will significantly and negatively affect SWPBIS Tier 1 Implementation Fidelity and implementation strategies will significantly and positively affect Tier 1 Implementation Fidelity in schools. In addition, I also hypothesize that effects of Administrator Turnover and implementation strategies on Tier 1 Implementation Fidelity will vary based on grade level and stage of implementation. Finally, I hypothesize that implementation strategies (i.e., Training, Coaching, and Team Use of Data for Decision Making) will attenuate the negative effects of Administrator Turnover on Tier 1 Implementation Fidelity over time, and therefore result in improved proximal and distal student and staff outcomes.

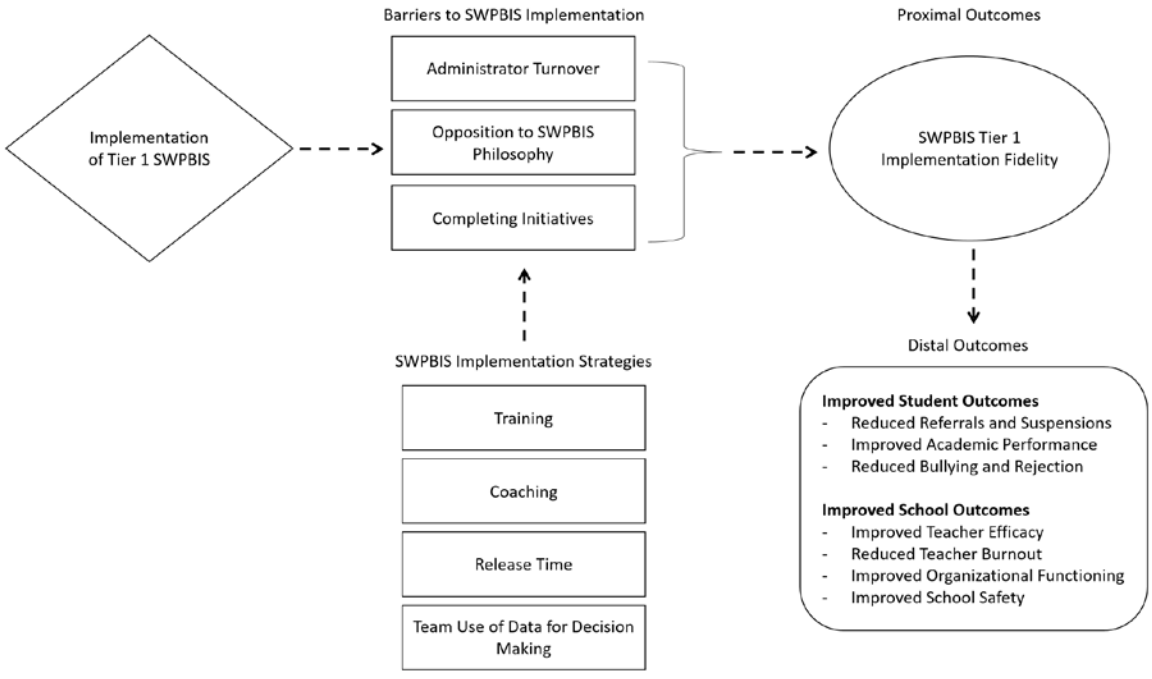

Figure 3. Conceptual model of implementation strategies buffering the negative influences of systems barriers on SWPBIS Tier 1 Implementation Fidelity.

Research Questions

The purpose of this study was to examine (a) the influence of Administrator Turnover and implementation strategies on SWPBIS Tier 1 Implementation Fidelity over time, (b) whether the influence of Administrator Turnover and implementation strategies on Tier 1 Implementation Fidelity varies based on non-malleable school factors, and (c) whether school implementation strategies buffer the negative influences of Administrator Turnover on Tier 1 Implementation Fidelity. Therefore, the following research questions for this study were:

Research Question 1

To what extent are Administrator Turnover, implementation strategies (Training, Coaching, and Team Use of Data for Decision Making), and Tier 1 Implementation Fidelity related over time?

Research question 1.1. To what extent are Administrator Turnover, *Training*, and Tier 1 Implementation Fidelity related over time?

Research question 1.2. To what extent are Administrator Turnover, *Coaching*, and Tier 1 Implementation Fidelity related over time?

Research question 1.3. To what extent are Administrator Turnover, *Team Use of Data for Decision Making*, and Tier 1 Implementation Fidelity related over time?

Research Question 2

To what extent does the influence of Administrator Turnover and implementation strategies on Tier 1 Implementation Fidelity vary over time based on grade level and stage of implementation?

Research Question 3

To what extent do implementation strategies buffer the negative influences of Administrator Turnover on Tier 1 Implementation Fidelity over time?

Research question 3.1. To what extent does Training buffer the negative influences of Administrator Turnover on Tier 1 Implementation Fidelity over time?

Research question 3.2. To what extent does Coaching buffer the negative influences of Administrator Turnover on Tier 1 Implementation Fidelity over time?

Research question 3.3. To what extent does Team Use of Data for Decision Making buffer the negative influences of Administrator Turnover on Tier 1 Implementation Fidelity over time?

CHAPTER II

METHOD

Settings and Participants

This study used an open cohort of 563 U.S. schools in 11 states implementing SWPBIS across five concurrent years. Year 1 was the 2012-13 school year and Year 5 was the 2016-17 school year. For each of the years, one participant from each of the schools, either internal SWPBIS team member or an external district or regional SWPBIS coach, participated in the study. In Year 1, 64.1% of the participants identified as SWPBIS team leaders, 23.3% school administrators, 7.1% school faculty or staff, 4.4% external district or regional coaches, and 1.1% identified as "other." In Year 2, 62.3% identified as SWPBIS team leaders, 22.7% school administrators, 7.6% external district or regional coaches, 6% school faculty or staff, and 1.2% identified as "other." In Year 3, 61.2% identified as SWPBIS team leaders, 21.9% school administrators, 8.8% school faculty or staff, 6.3% external district or regional coaches, and 1.9% identified as "other." In Year 4, 62.5% identified as SWPBIS team leaders, 14.7% school administrators, 12.1% school faculty or staff, 7.8% external district or regional coaches, and 2.6% identified as "other." In Year 5, 59.8% identified as SWPBIS team leaders, 18.5% school administrators, 13.3% school faculty or staff, 7.2% external district or regional coaches, and 0.8% identified as "other."

Of the total number of schools, 123 (21.8%) of the schools had been implementing SWPBIS for 0 to 1 years (initial implementation stage), 273 (48.5%) had been implementing for 2 to 4 years (institutionalization stage), and 167 (29.7%) had been implementing for 5 or more years (ongoing evolution stage; Adelman & Taylor, 1997).

School demographic data were obtained from the National Center for Educational Statistics (NCES) database for 99.5% of the participating schools in Year 1. Of the 563 schools, 380 (67.5%) were elementary schools, 108 (19.2%) were middle schools, 58 (10.3%) were high schools, and 17 (3%) were identified as "other" or unidentified. The average student enrollment was 465.89 (*SD* = 306.49), and the average percent of students receiving free and eligible for reduced-priced lunch was 52% (*SD* = 24.2%) with 17 (2%) unidentified. Of the total number of schools, 372 (66.1%) were Title I eligible, with 3 (0.5%) unidentified. Based on the four federal categories for school urbanicity, 167 (29.7%) were located in cities, 189 (33.6%) were located in suburban areas, 87 (15.5%) were located in towns, and 120 (21.3%) were located in rural areas. Across the 11 states, 5 were from the West region, 4 were from the Midwest region, and 2 were from the South region.

Measures

Malleable variables included: (a) SWPBIS Tier 1 Implementation Fidelity, (b) Administrator Turnover, and (c) SWPBIS implementation strategies. Data on Administrator Turnover were obtained from schools at the beginning of each school year and reflected Administrator Turnover schools encountered the previous year compared to the current year (e.g., Administrator Turnover reported at the beginning Year 2 related to Administrator Turnover encountered in Year 1). Implementation strategies included cumulative counts of (a) Training, (b) Coaching, and (c) Team Use of Data for Decision Making. Data on SWPBIS implementation strategies and SWPBIS Tier 1 Implementation Fidelity were collected at the end of each school year. Measures used to collect data on the malleable school variables and their psychometric properties are described below.

Outcome Variable

SWPBIS Tier 1 implementing fidelity data were collected across each of the years using one of five research-validated SWPBIS fidelity measurement tools. A description of each fidelity tool and their psychometric properties are presented below. In addition, a summary of the percentages of schools using the different SWPBIS fidelity measures across the five years is presented in Table 1.

School-Wide Evaluation Tool (SET). The SET (Sugai, Lewis-Palmer, Todd, & Horner, 2001) is a 28-item Tier 1 Implementation Fidelity measure organized into seven subscales (i.e., expectations defined, behavioral expectations taught, ongoing system for rewarding behavioral expectations, systems for responding to behavioral violations, monitoring and decision-making, management, and district-level support) and is intended to be completed by an external assessor using staff and student interviews. For schools to be considered meeting at-or-above adequate Tier 1 fidelity, schools are expected to score at least 80% on the expectations defined subscale and/or an 80% on overall implementation. Horner and colleagues (2004) found the SET to contain strong psychometric properties, including an overall alpha of .96, a total average mean test-retest reliability score of 97.3% (subscales range from 89.2% - 100%), and mean interobserver reliability of 99% (reliability across SET items ranged from 98.4% - 100%). In addition, Horner and colleagues (2004) found the SET to contain high construct validity (r = .75) when total SET scores were correlated with total scores from another SWPBIS Tier 1 fidelity measure, the Effective Behavior Support: Self-Assessment Survey (EBS 2.0; Sugai, Horner, & Todd, 2000), using a sample of 31 schools.

SWPBIS Tiered Fidelity Inventory (TFI). The TFI (Algozzine et al., 2014) is used as an external or internal self-assessment measure to assess SWPBIS fidelity across each of the three tiers and subscales (Massar, McIntosh, & Mercer, in press). As part of the technical validation of the TFI, Massar, McIntosh, and Mercer (2017) conducted a confirmatory factor analysis and found the TFI to contain a stable factor structure across subscales within individual tiers and across tiers. Using a Likert-type format (i.e., not implemented, partially implemented, or fully implemented), SWPBIS teams rate the extent to which each item is in place in their schools. To reach adequate Tier 1 SWPBIS implementation fidelity, an overall Tier 1 implementation average of 70% or above is expected (McIntosh et al., 2017).

In a series of technical validation studies, McIntosh and colleagues (2017) used an expert panel of reviewers (n = 12) to ascertain the content validity the TFI. The authors found the TFI to contain high expert panel reliability across all three tiers (91% - 95%, overall = 93%), high item validity (96%), factor structure (96%), scoring (89%), with an overall content validity index score across all tiers to be .92 (range = .91 - .95). Using a sample of 15 schools teams and their external coaches, McIntosh and colleagues (2017) also found high interrater reliability of the TFI across raters, tiers, and items (r = .99), and high test-retest reliability (r = .99). Using another sample of 789 schools who completed the TFI, McIntosh and colleagues (2017) found the overall internal consistency (coefficient alpha) of the TFI to be .96, with alphas ranging from .87 to .98 across individual tiers. The authors also found the Tier 1 scale of the TFI to be moderately correlated with the Benchmarks of Quality (BoQ; Kincaid, Childs, & George, 2005), when schools teams completed the TFI without an external coach (r = .42, n = 106), and

moderately-to-strongly correlated and when completed with an external coach (r = .64, n = 215).

Schoolwide Benchmarks of Quality (BoQ). The BoQ (Kincaid et al., 2005) is a 53-item measure, which internal or external school team members can use to assess Tier 1 Implementation Fidelity. Teams are expected to rate the extent to which critical elements (e.g., team has administrative support, faculty are involved in establishing and reviewing goals, problem behaviors are defined) of Tier 1 are in place, based on a 3-point rating scale (i.e., in place, needs improvement, and not in place). An overall implementation total ratio score of 70% is expected for schools to be considered implementing to adequate Tier 1 Implementation Fidelity. The overall internal consistency (α = .96), overall test-retest reliability (r = .94), and overall interrater reliability (r = .87) are all reported to be strong, using a sample of 28 to 42 school staff, in which two individuals completed the BoQ (Cohen, Kincaid, & Childs, 2007). Moreover, when the total BoQ scores were correlated with the total scores on the SET, a moderate correlation of .51 was found, which attests to the concurrent validity of the BoQ (Cohen et al., 2007).

PBIS Self-Assessment Survey (SAS). The SAS (Sugai et al., 2000) is a 43-item Tier 1 measure comprised of four subscales: (1) universal systems (focuses on supporting all students across all school settings), (2) non-classroom systems (focuses on supporting students in settings other than the classroom), (3) classroom systems (focuses on supporting students in the using effective instruction and behavioral strategies), and (4) individual student support systems (focuses supporting students with more intensive and challenging needs). The self-assessment measure is intended to be completed by either a

school SWPBIS team or other school staff. An overall average implementation ratio score of 80% or higher is considered reaching adequate Tier 1 Implementation Fidelity.

Both Hagan-Burke and colleagues (Hagan-Burke et al., 2005) and Safran (2006) found the SAS to contain moderate-to-strong overall internal consistency reliability (αs = .85 - .94), with individual subscale internal consistency reliability estimates ranging from .66 (individual student support system) to .75 (individual student support system; Safran, 2006). In addition, Horner and colleagues (2004) found the SAS and to be moderate-to-strongly correlated with the SET, using a sample of 31 school staff that completed both Tier 1 Implementation Fidelity measures (r = .75; Horner et al., 2004).

Team Implementation Checklist (TIC). The TIC (Sugai, Horner, & Lewis-Palmer, 2001) self-assessment measure is intended to be completed quarterly by school teams to evaluate early and ongoing Tier 1 implementation and progress monitoring. The measure includes a number of subscales including: establish commitment, establish and maintain team, self-assessment, establish universal expectations, establish information systems, and building capacity for function-based support. An overall implementation ratio score of 80% or greater on either version of the 3.1 is considered reaching adequate Tier 1 Implementation Fidelity. The psychometric properties for both versions of the TIC, have been validated using ordinal confirmatory factor analyses (McIntosh, Mercer, et al., 2016). The authors found that internal consistency of subscales and total implementation average scores to be acceptable for both versions of the TIC. Ordinal alphas on the subscales of the TIC 2.0 ranged from .72 to .93, with an overall ordinal alpha of .94. Ordinal alphas on the subscales of the TIC 3.1 ranged between .70 to .91, with an overall ordinal alpha of .94 (McIntosh, Mercer, et al., 2016).

Comparability of Tier 1 SWPBIS Fidelity Measures

To ensure each of the fidelity measures were assessing the same overall construct of Tier 1 SWPBIS implementation, Mercer and colleagues (2017) examined the convergent validity, mean differences, and linking cut scores across all five of the SWPBIS measures. The authors found convergent validity across measures to be moderate-to-high (*r*s .59 - .71; *ns* = 200 - 3,706), with higher convergent validity scores when the SET was compared to the TFI (r = .92; n = 36), and when the TIC was compared to the TFI (r = .96; n =119). Except for the SET, overall differences in scores across measures were found to be trivial in magnitude (d = .04 - .14); however, higher SET scores were more easily attainable by schools, though these scores did not consistently result in more schools reaching adequate Tier 1 Implementation Fidelity (Mercer et al., 2017). When Tier 1 Implementation Fidelity scores on all measures ranged between 70% and 80%, linking cut scores analysis demonstrated that scores were close to equivalent; with the exception of SAS scores, being on average, lower and more sensitive to implementation variations, suggesting higher scores on the SAS may be less obtainable (Mercer et al., 2017).

In Year 1, 487 of the 563 schools (86.5%) completed at least one of the SWPBIS implementation fidelity measures. In Year 2, 464 (82.4%) completed at least one of the fidelity measures. In Year 3, 447 (79.4%) of schools completed at least one of the fidelity measures. In Year 4, 382 (67.7%) of schools completed at least one of the fidelity measure. In Year 5, 351 (62.3%) of schools completed at least one of the fidelity measures.

If schools completed one of Tier 1 Implementation Fidelity measures for each of the years, their fidelity scores were used. If schools completed more than one fidelity measure in the same year, a mean score from the multiple fidelity measures was used. However, if schools did not report fidelity on any of the fidelity measures, missing fidelity data were coded as "0" in order to make use of all available data. The rationale for this was that schools not reporting implementation fidelity on any of the fidelity measures were believed to have discontinued SWPBIS implementation.

The average Tier 1 Implementation Fidelity scores for the 563 schools were found to be decrease steadily over time. The average implementation score in Year 1 was 72.5% (*SD* = 31 %), average implementation score in Year 2 was 70.7% (*SD* = 34.4%), average implementation score in Year 3 was 67.5% (*SD* = 36.2%), average implementation score in Year 4 was 55.1% (*SD* = 40.4%), and the average implementation score in Year 5 was 52.6% (*SD* = 42.4%).

Administrator Turnover

Data on Administrator Turnover was obtained from a single item included on the ABISS survey, an experimental five-item measure with four response options (1 = not true to 4 = very true). There are a total of five perceived barrier items, including: (1) school personnel are opposed to SWPBIS because it goes against their values (e.g., "rewarding" students, teachers "compliance"), (2) other school/district initiatives (e.g., academic, behavior) are present that compete (for time, resources, or content) with SWPBIS, (3) there are high levels of turnover of school administrators (i.e., yearly), (4) there are high levels of turnover of school personnel who served as key leaders, (5) there

Table 1

Summary of SWPBIS Implementation Fidelity Measures With Data Across the Five Years for the 563 Schools

Fidelity measures	Year 1		Year 2		Year 3		Year 4		Year 5	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
SET	306	54.4	245	43.5	143	25.4	19	3.4	19	3.4
TFI					50	8.9	190	33.7	194	34.5
BoQ	257	45.7	298	52.9	292	51.9	174	30.9	133	23.6
SAS	319	56.7	292	51.9	267	47.4	212	37.7	195	34.6
TIC	174	30.9	150	26.6	69	12.3	26	4.6	13	2.3

Note. *n* = sample; SET = school-wide evaluation tool; TFI = tiered fidelity inventory; BoQ = benchmarks of quality; SAS = self-assessment survey.

are high levels of general school personnel turnover (i.e., 50% of staff; Turri et al., 2016). The internal consistency of the ABISS ranges from .75 to .81, based on ordinal alphas from an exploratory factor analysis when comparing across school stage of implementation groups (i.e., initial implementaton, full operation, and sustainability; Turri et al., 2016). Earlier research on the barrier items was reported by McIntosh and colleagues (2011), who found the barrier items to have strong content validity (.95), based on an expert panel of reviewers. Barrier items were reported to have high weighted kappa scores of .83 for interrater reliability and .86 for 3-week test-retest reliability (McIntosh, MacKay, et al., 2011).

The mean score for Administrator Turnover in Year 1 was 1.37 (n = 563, SD = 0.72). In Year 2, mean score was 1.43 (n = 426, SD = 0.77). In Year 3, the mean was 1.54 (n = 230, SD = 0.88). In Year 4, the mean was 1.50 (n = 243, SD = 0.88). Figure 4 and 5 include histograms and boxplots of the Administrator Turnover variable. In addition, Table 2 includes a summary of the intercorrelations between Administrator Turnover in Year 1 and Tier 1 Implementation Fidelity across the five years.

Table 2

Intercorrelations for Administrator Turnover and Tier 1 Implementation Fidelity Across Study Years

Variable	1	2	3	4	5	6
1. Administrator Turnover Year 1	-					
2. Tier 1 Implementation Fidelity Year 1	<.01	-				
3. Tier 1 Implementation Fidelity Year 2	-.05	.75**	-			
4. Tier 1 Implementation Fidelity Year 3	-.02	.49**	.60**	-		
5. Tier 1 Implementation Fidelity Year 4	-.01	.41**	.45**	.52**	-	
6. Tier 1 Implementation Fidelity Year 5	-.03	.40**	.40**	.45**	.69**	-

Note. ** = Significance at $p < .01$; * = Significance at $p < .05$.

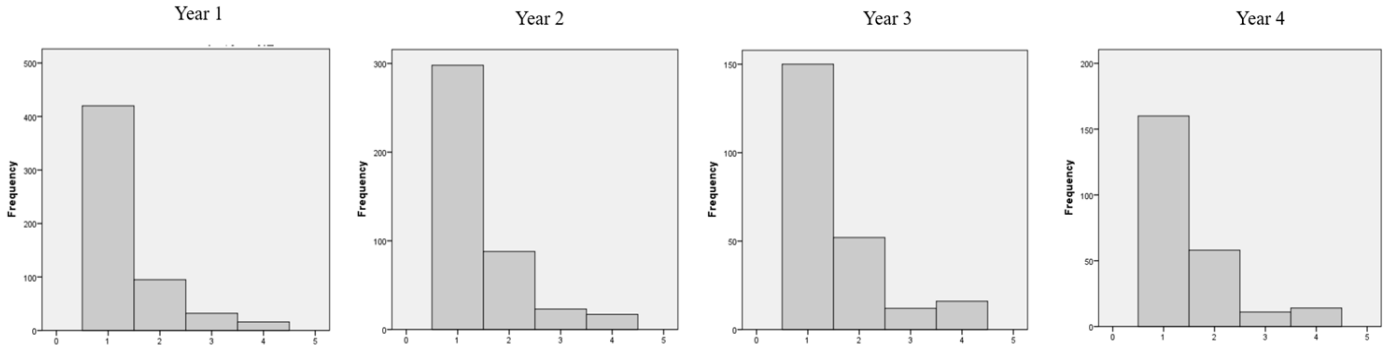

Figure 4. Histograms of Administrator Turnover item with response options ranging from 1 = not true to 4 = very true.

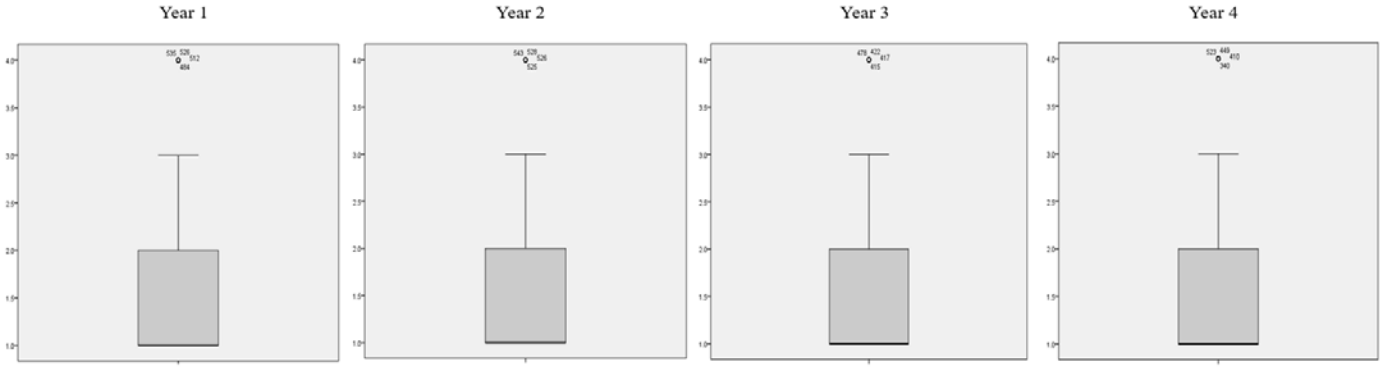

Figure 5. Boxplots of Administrator Turnover item with response options ranging from 1 = not true to 4 = very true.

Training and Coaching

Data for Training and Coaching were collected from the *Access to District Expertise and Professional Training* (ADEPT; McIntosh, Strickland-Cohen, & Horner, 2012) is an online tool used to record the number of days or hours of professional development provided to schools to implement SWPBIS. Teams use the ADEPT to report on receipt of professional development in three categories, including: (1) total number of days of SWPBIS Training (e.g., trainings, workshops, conferences, institutes) attended by a team member, the whole team, an administrator, or the entire school staff, (2) total days of release time for SWPBIS activities (e.g., time for school action planning) attended by whole school staff, and (3) total hours of Coaching (e.g., assistance with data collection and interventions, consults with SWPBIS team members and administrators) that were officially offered to schools.

Technical validation (i.e., test-retest reliability, inter-rater reliability) for formal Training and Coaching was reported by Kittelman and colleagues (2018). Using a sample of school personnel (*ns* = 20 – 28) that completed the ADEPT twice over a two-week latency period, test-retest for Training for combined groups (i.e., one team member, team, administrator, whole staff) was .92. Training was also found to be strong for teams (*r* = .90) and administrators (*r* = .93). In addition, test-retest reliability for Coaching was found to be marginal (*r* = .63). Inter-rater reliability, using a sample of 12 to13 staff members (SWPBIS team members and administrators) from one school, for Training for the combined groups (one team member, team, administrator, whole staff) was .86. Inter-rater reliability was moderate-to-strong for team Training (*r* = .76), administrator (*r* = 87), and Coaching (r = .83; Kittelman et al., 2018).

For the purposes of this study, Training was comprised of a composite score of the four Training items included on the ADEPT measure. Response options were coded into five categories (i.e., none = 0, under 1 half-day to 1 full day = 1, 2 to 3 full days = 2, 4 to 5 full days = 3, and over 5 full days = 4). The mean score for Training in Year 1 was 2.33 (n = 563, SD = 1.15). In Year 2, the mean score for Training was 2.02 (n = 495, SD = 1.12). In Year 3, the mean score for Training was 1.75 (n = 442, SD = 1.12). In Year 4, the mean score for Training was 1.55 (n = 281, SD = 1.04). In Year 5, the mean score for Training was 1.41 (n = 148, SD = 1.05). Figure 6 includes histograms of participants' responses for the five categorical response options for Training across the five years.

Coaching was comprised of the single item on the ADEPT, measuring Coaching offered to schools, and was coded into four categories (i.e., none = 0, less than weekly = 1, 1-2 hours per week = 2, three or more hours per week = 3). The mean score for Coaching in Year 1 was 1.46 (n = 430, SD = 1.10). In Year 2, the mean score for Coaching offered was 0.99 (n = 370, SD = 0.66). In Year 3, the mean score for Coaching offered was 0.91 (n = 293, SD = 0.62). In Year 4, the mean score for Coaching offered was 0.85 (n = 211, SD = 0.65). In Year 5, the mean score for Coaching offered was 0.85 (n = 115, SD = 0.69). Figure 7 includes histograms of participants' responses for the four categorical response options for Coaching offered across the five years.

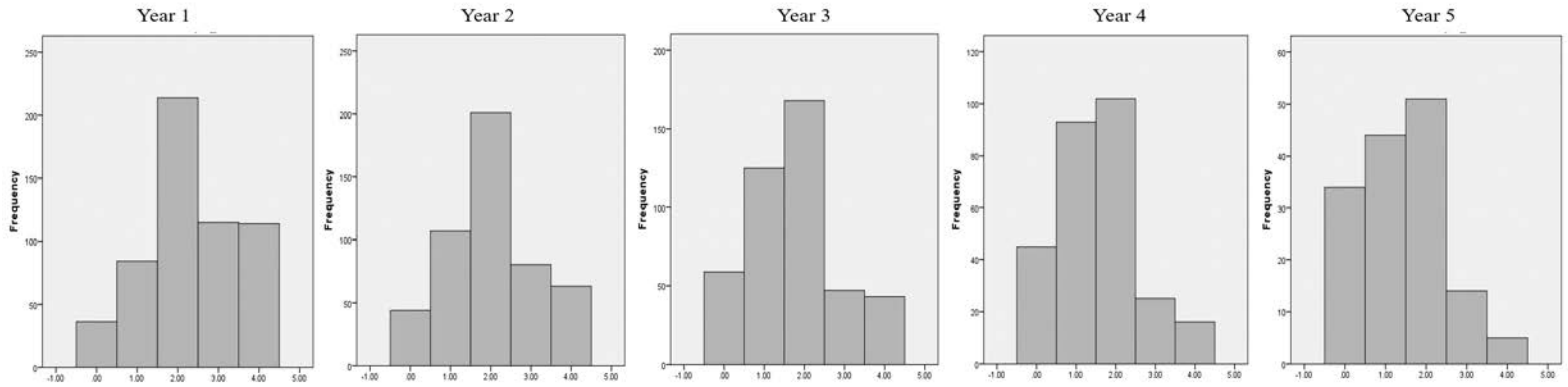

Figure 6. Histograms of Training with categorical response options ranging from 0 = none to 5 = over 5 full days.

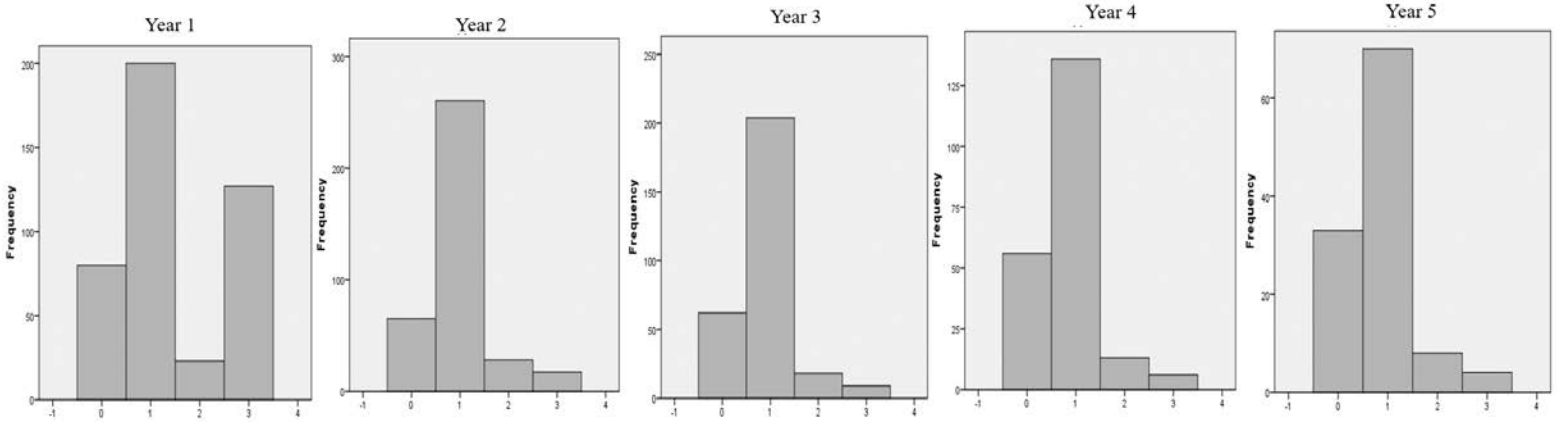

Figure 7. Histograms of Coaching offered with categorical response options ranging from 0 = none to 4 = 3 or more hours weekly.

Team Use of Data for Decision Making

School teams used the *School-wide Information Systems* (SWIS) Suite (May et al., 2013) to gather and summarize student discipline data. SWIS is a web-based software application for school teams to enter student office discipline referral information and generate reports for team problem solving. School teams use these reports for continuous data-based decision making to understand where, when, with who, and why student office discipline referrals have occurred. Teams can then generate and use these reports to make informed and efficient decisions on how to reduce problem behaviors.

To examine the impact of SWPBIS teams' use of data to make decisions on Tier 1 Implementation Fidelity, a proportion variable was created by calculating the number of months (excluding July and August) in which 10 or more reports were generated. The total number of months that 10 reports were generated was then divided by the total possible number of months to create the proportion of reports generated per month variables for each of the five years to examine variability in the number of reports generated by teams over time. If school teams did not generate at least one report per year, but did enter discipline data into SWIS, generation of report data for decision making was treated as 0s. However, if school teams did not generate reports and did not enter discipline data into SWIS, data were treated as missing (i.e., they may have been viewing reports from other applications).

In Year 1, the average proportion of months in which 10 or more reports were generated was 0.56 (n = 322, SD = 0.33). In Year 2, the average proportion was 0.58 (n = 325, SD = .35). In Year 3, the average proportion was 0.51 (n = 307, SD = 0.35). In Year 4, the average proportion was 0.52 (n = 260, SD = 0.37). In Year 5, the average

proportion was 0.49 (n = 239, SD = 0.33). Figure 8 and Figure 9 include histograms and boxplots of the proportion of 10 or more data reports generated by school teams. Also, a summary of the intercorrelations between implementation strategies and Tier 1 Implementation Fidelity in Year 1 is presented in Table 3.

Table 3

Intercorrelations for Implementation Strategies and Tier 1 Implementation Fidelity in Year 1

Variable	1.	2.	3.	4.
1. Team Use of Data for Decision Making Year 1	-			
2. Training Year 1	.07	-		
3. Coaching Year 1	.06	.06	-	
4. Tier 1 Implementation Fidelity Year 1	.05	.09*	.02	-

Note. * = Significance at p <.05.

School Characteristics

Non-malleable school variables included: (a) grade level and (b) stage of implementation. Grade level was coded into three categories (elementary, middle, and high). Also, schools were coded into one of three stages of implementation (0-1 years = initial implementation, 2-4 years = institutionalization, and 5 or more years = ongoing evolution; Adelman & Taylor, 1997).

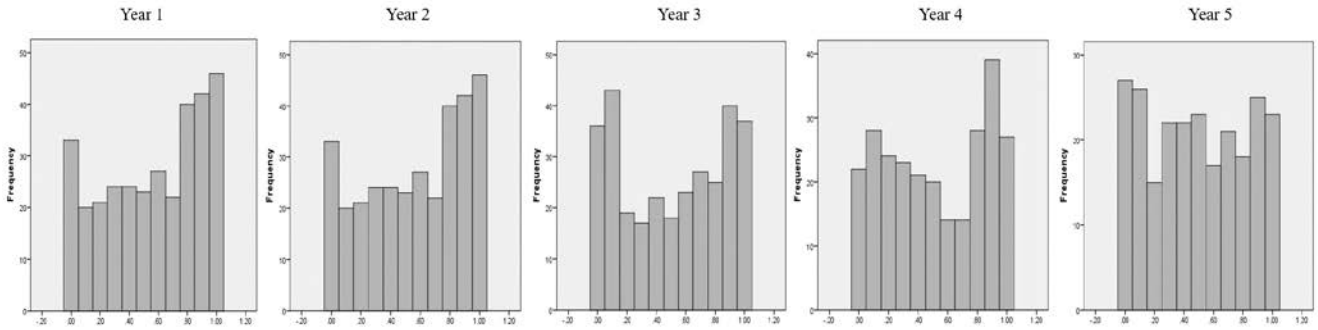

Figure 8. Histograms of the proportion of data reports generated by SWPBIS team members.

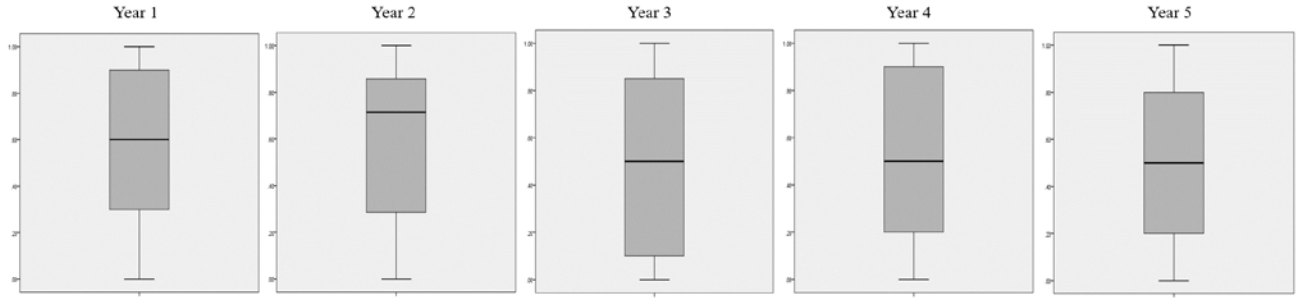

Figure 9. Boxplots of the proportion of data reports generated by SWPBIS team members.

Procedures

Participants were recruited via email invitations gathered from regional SWPBIS network organizations and by distributing contact information at national and state conferences. For each of the years, school staff (a) completed the ABISS survey at the beginning of each year, (b) recorded the number of days/hours that schools provided SWPBIS professional development (i.e., ADEPT survey), (c) generated school discipline data reports using SWIS for decision making purposes (collected as extant data), and (d) entered their SWPBIS implementation fidelity scores into an online extant database (PBIS Assessment; pbisapps.org) at the end of each year.

As part of the data collection process each year, schools' ABISS, ADEPT, generation of discipline report data was electronically linked to schools' SWPBIS Tier 1 Implementation Fidelity data. Fidelity data were obtained from a free online database called PBIS Assessment (http://pbisapps.org). PBIS Assessment is a College of Education University of Oregon managed database, designed for schools implementing SWPBIS to enter and access their year implementation fidelity data for decision making. Use of the free database was contingent upon schools (a) identifying a coordinator to support the data collection process and (b) agreeing to allow access to their fidelity data for research and evaluation purposes.

Data Analyses

Longitudinal SEM was used to address the proposed research questions. SEM is a powerful statistical process that combines factor analysis and multiple regression-based procedures to analyze structural relationships of latent and manifest factors (Bowen & Guo, 2012; Burkholder & Harlow, 2003; Kline, 2005, 2010). M*plus* 7.4 software

(Muthén & Muthén, 1998-2012) was used to conduct SEM analyses and examine the relations between malleable and non-malleable factors and Tier 1 Implementation Fidelity over time. In addition, the mean- and variance-corrected robust weighted least squares (WLSMV) estimator with parameterization in M*plus* was used to account for the ordered categorical predictor variables. To account for nesting of schools within districts, the COMPLEX command was used, which adjusts standard errors for non-independence assumptions (Asparouhov, 2005). In addition, the chi-square difference test in (DIFFTEST) was used to examine whether there were significant group differences between the non-malleable school and practice variables for research question 2. Using this procedure, two nested models were compared (one in which parameters were freed for non-malleable groups and another in which parameters were restricted). A significant chi-square difference estimate indicates that the model with freed parameters for the non-malleable school or practice variables fit the data better, as opposed to the more restricted model with fewer parameters estimated (Bentler & Bonett, 1980; Widaman, Ferrer, & Conger, 2010). For research question 3, moderation analyses using M*plus* were conducted for each of the three implementation strategies using ordinary least squares regression, as the dependent variable (i.e., Tier 1 Implementation Fidelity) was continuous. There were a total of three moderation models created, one for each implementation strategy (Training, Coaching, and Team Use of Data for Decision Making). Two of the moderation models were conducted using categorical moderators (Training and Coaching), and the other was conducted using a continuous moderator (Team Use of Data for Decision Making).

Treatment of Outcome and Predictor Variables

To address the research questions, SWPBIS Tier 1 Implementation Fidelity was treated as a continuous observed outcome variable. If schools completed more than one of the Tier 1 Implementation Fidelity measures for one or more of the years, the mean score of the multiple Tier 1 Implementation Fidelity measures was used. Malleable and non-malleable predictor variables were included into the models as ordered categorical or continuous predictor variables. Grade level and stage of implementation were dummy coded. Dummy coded vectors (0 or 1) were used to compare the non-malleable categorical predictor variables to reference groups (grade level, stage of implementation). For grade level, two dummy coded variables were created to represent middle and high schools, with elementary schools serving as the reference category (i.e., middle vs. elementary and high vs. elementary). For stage of implementation, two dummy coded variables represented institutionalization and ongoing evolution, with initial implementation serving as the reference category (i.e., institutionalization vs. initial implementation and ongoing evolution vs. initial implementation).

For malleable school predictors, the Administrator Turnover barrier was treated as an observed ordered categorical variable. Concerning the four Training variables from the ADEPT measure (one team member, entire team, administrator, and whole staff), a mean composite score was estimated for each of the years. These variables were treated as observed categorical variables. In addition, Coaching offered was treated as an observed ordered categorical variable for each of the years. Team Use of Data for Decision Making was treated as a continuous observed variable.

To answer research question 3, Administrator Turnover (categorical) variable was recoded into a dichotomous variable (0 = “not true” to 1 = “partially true,” “mostly true,” “very true”) in order to ease interpretation (no Administrator Turnover vs Administrator Turnover). In addition, by dichotomizing Administrator Turnover, more cases were retained in the analyses when testing moderation between Administrator Turnover and the two categorical implementation strategies (Training, Coaching) on Tier 1 Implementation Fidelity. In addition, to test moderation among categorical variables, one of the five categories for the Training implementation strategy and one of the four categories for the Coaching implementation strategy served as reference categories. As such, there were four dummy coded variables for Training and three dummy coded variables for Coaching. For both Training and Coaching, reference categories were “none,” so that any Training or Coaching provided or offered to schools was compared to the “none” category.

Model Fit

Model fit was examined by testing the overall fit of the models (Kline, 2005, 2010). Based on the recommendations advanced by Kline (2005), model fit was evaluated using the following model fit indices: chi-square goodness-of-fit x^2 test, the Root Mean Squared Error of Approximation (RMSEA), the comparative fit index (CFI), the Tucker Lewis Index (TLI). In addition, the weighted root-mean-square residual (WRMR) was also selected as an additional indicator to evaluate model fit because it is suitable for estimating non-normal and categorical variables (K. F. Cook, Kallen, & Amtmann, 2009). To be considered sound and well-fitted models, chi-square goodness-of-fit values are expected to be insignificant at a 0.05 threshold, RMSEA values should

be less than 0.05 (0.05 – 0.08 indicates middling fit, values greater than 0.08 indicate poor fit), CFI and TLI values should be greater than 0.95, WRMR values less than 1 are considered a good fit (Hu & Bentler, 1999; Kline, 2005).

Missing data. ML was used to handle missing data. ML is considered a sophisticated and efficient approach for handling missing data and produces less biased parameter estimates, compared to multiple imputation (Yuan, Yang-Wallentin, & Bentler, 2012). ML accounted for missing data in the endogenous variables in this study; however, did not account for missing data in the exogenous variables. Therefore, the number of cases in the cross-lagged panel models ranged from 563 to 331, for research questions 1 and 2, depending on the implementation strategies included in the models. For research question 3, the number of cases ranged from 391 (Training) to 255 (Coaching) depending on the categorical response option interactions between Administrator Turnover and implementation strategies.

SEM longitudinal modeling. Cross-lagged panel modeling was used to address the three research questions. This type of SEM modeling is particularly useful for examining associations and stability between two or more factors over time (Christens, Reterson, & Speer, 2011; Selig & Little, 2012). This approach was used because it (a) uses SEM and can be completed using *M*plus software, (b) is commonly used to addressed longitudinal research questions for correlational or quasi-experimental research, and (c) uses regression-based approaches that are widely used for testing moderation effects (Cheung & Lau, 2017; Little, Card, Bovaird, Preacher, & Crandall, 2007). Specifically, Little, Card, Bovaird, Preacher, and Crandall (2007) explained that predictor variables (moderated and moderating) are added to the SEM models and main

effects are analyzed on the outcome variable of interest. Only then are interaction terms of the moderated and moderating variables added to the regression models and tested. If interaction terms are significant, it indicates that the moderating variables are related to the outcome variable (Little, Card, et al., 2007). Little and colleagues (2007) provided an example of a standard OLS regression equation, which includes the moderated (X) and moderating (W) variables and an interaction term representing both (XW) on the outcome variable (Y): $Y = b_0 + b_1 + b_2W + b_3XW + e$

Cross-lagged panel modeling. Cross-lagged panel modeling (Belsky, Fearon, & Bell, 2007; Little, Preacher, Selig, & Card, 2007; Mayer, 1986; Selig & Little, 2012) is a commonly used approach for measuring change over time within factors in development research (Christens et al., 2011; Kearney, 2017). Selig and Little (2012) noted that cross-lagged modeling is helpful for when there is limited theory about how variables influence one another over time and research questions are focused on examining patterns of change or influence over time. Once an overall measurement model is developed and evaluated, the main effects are tested by examining the cross-lagged direct relationships between factors. For example, the relationship of X variable (predictor) at time 1 on Y variable (outcome) at time 2 and the relationship between Y variable at time 1 on X variable at time 2. Specially, standardized regression estimates across direct predictor and outcome variable paths would be examined in the results output (Burkholder & Harlow, 2003). In addition, within time point correlations among factors and autoregressive effects across similar factors over time would also be examined to assess stability within constructs (Kearney, 2017). Larger autoregressive coefficients imply less variance over time and more stability (Selig & Little, 2012).

To examine invariant relations, Farrell (1994) outlined a process for examining group differences among variables using cross-lagged path models. After models are found to have acceptable fit, group differences are tested by constraining parameters (path coefficients) to be equal among groups and then parameters are estimated separately (freeing parameters) for each group one at a time. This process is then repeated during the development and testing the path models for consistency in factors over time (Farrell, 1994).

In addition to examining direct and autoregressive effects using cross-lagged models, moderation (interaction) effects within path models among factors can also be tested. Selig and Little (2012) highlighted that examining moderation in cross-lagged panel models is straightforward and occurs by testing "the multiplicative product of two variables as a predictor" (p. 268). If the interaction effect between the two variables is significant on the outcome variable, moderation is found (Selig & Little, 2012).

To address research question 1, main effects were examined by developing and testing a series of three three-way cross-lagged panel models to examine significant relations and stability between Administrator Turnover and implementation strategies (i.e., Training, Coaching, Team Use of Data for Decision Making) on the outcome variable (Tier 1 Implementation Fidelity). Each of the three cross-lagged models included Administrator Turnover, one of the implementation strategies, and Tier 1 Implementation Fidelity. Specific hypotheses were then tested to evaluate whether Administrator Turnover and implementation strategies were significant predictors of Tier 1 Implementation Fidelity across each of the four time points. For research question 2, grade level and stage of implementation were then tested and evaluated in relation to

group differences in the malleable predictors and outcome variables using the multi-group process previously outlined by Farrell (1994). Only cross-lagged paths between predictor and outcome variables in Year 1 to Year 2 and Year 4 to Year 5 were examined for the non-malleable stage of implementation and grade level.

Selig and Little (2012) outline several assumptions when using cross-lagged SEM panel modeling. First, there should be no measurement error in the variables included in the analysis (unbiased parameter estimates). Secondly, there is measurement invariance among factors repeatedly assessed over time, and therefore it is important that these factors are measured approximately at the same time for each time point to decrease potential confounds (Selig & Little, 2012). Thirdly, attrition over time in the sample is due to randomness (Selig & Little, 2012). Another assumption Selig and Little (2012) noted is retest effects, which may occur when participants complete the same measure over time and are likely to answer using the same responses.

Cross-sectional moderation. For research question 3, interaction effects using basic moderation for (a) Training and Administrator Turnover, (b) Coaching and Administrator Turnover, and (c) Team Use of Data for Decision Making and Administrator Turnover were examined. For each of the three moderation models, interaction effects were tested for Administrator Turnover in Year 2 moderated by implementation strategies in Year 3 on Tier 1 Implementation Fidelity in Year 3. These paths were selected to address moderation because prior results from research question 1 indicated the paths between implementation strategies in Year 2 and Fidelity in Year 3 were significantly related across all implementation strategies. In addition, autoregressive effects between implementation strategies in Year 2 to 3 were strongly and significantly

related, compared to autoregressive effects from the previous two years. Therefore, theoretically, it was hypothesized that the most significant interaction effects between Administrator Turnover and implementation strategies on Tier 1 fidelity would occur between Years 2 and 3.

CHAPTER III

RESULTS

To examine the associations between Administrator Turnover, implementation strategies, and Tier 1 Implementation Fidelity over time, cross-lagged modeling was used. For research question 1, direct associations between the three variables were assessed, as well as autoregressive associations across similar variables. Research question 2 examined the differences between implementation strategies, Administrator Turnover, and Tier 1 Implementation Fidelity for grade level and stage of implementation). The last research question examined the moderating (indirect) influences of implementation strategies between Administrator Turnover and Tier 1 Implementation Fidelity.

Research Question 1.1. To What Extent Are Administrator Turnover, Training, and Tier 1 Implementation Fidelity Related Over Time?

Measurement Model 1.1

Overall model fit was examined prior to examining the structural relations between Training, Administrator Turnover, and Tier 1 Implementation Fidelity. The measurement model included direct associations between different variables (regression paths) and across similar variables (autoregressive paths), and bidirectional associations (covariances) between variables. Bidirectional correlations among malleable factors were examined only in Years 1 and 5. The overall model was found to be acceptable, x^2 (54, n = 563) = 82.951, p = .007, RMSEA = .031, CFI = .977, TFI = .962, and WRMR = .695, indicating data fit the measurement model.

Structural Relations of Model 1.1

All cross-lagged paths in Figures 10 and 11 are represented as single-headed arrows directed from a variable at one year and pointed toward another variable for the next year. All autoregressive paths are indicated as single-headed arrows directed toward the same variable across years. Figure 10 includes a representation of all cross-lagged and autoregressive paths across the five years between the three variables. Significant paths for model 1.1 are represented in Figure 11. To ease interpretability, all coefficients are standardized, indicating that β refers to number of standard deviations for the outcome variable, based on one standard deviation change in the predictor variables.

All significant cross-lagged parameters are presented in Figure 9 and Table 4. Results indicate that implementation fidelity in Year 1 was significantly and positively associated with Administrator Turnover (β = .683, $p < .001$) and Training (β = .854, $p < .001$) in Year 2. In Year 2, Training was significantly and negatively associated with Administrator Turnover in Year 3 (β = -.353, $p = .035$) and significantly and positively associated with fidelity in Year 3 (β = .283, $p < .001$). In addition, fidelity in Year 2 was also significantly and negatively associated with Administrator Turnover in Year 3 (β = -.249, $p = .006$) and significantly and positively associated with Training in Year 3 (β = .147, $p = .033$). In Year 3, the only significant cross-lagged path included Training in Year 3 and fidelity in Year 4 (β = .268, $p < .001$). The bi-directional correlation between Training and fidelity in Year 5 was found to be significant (0.367, $p < .001$).

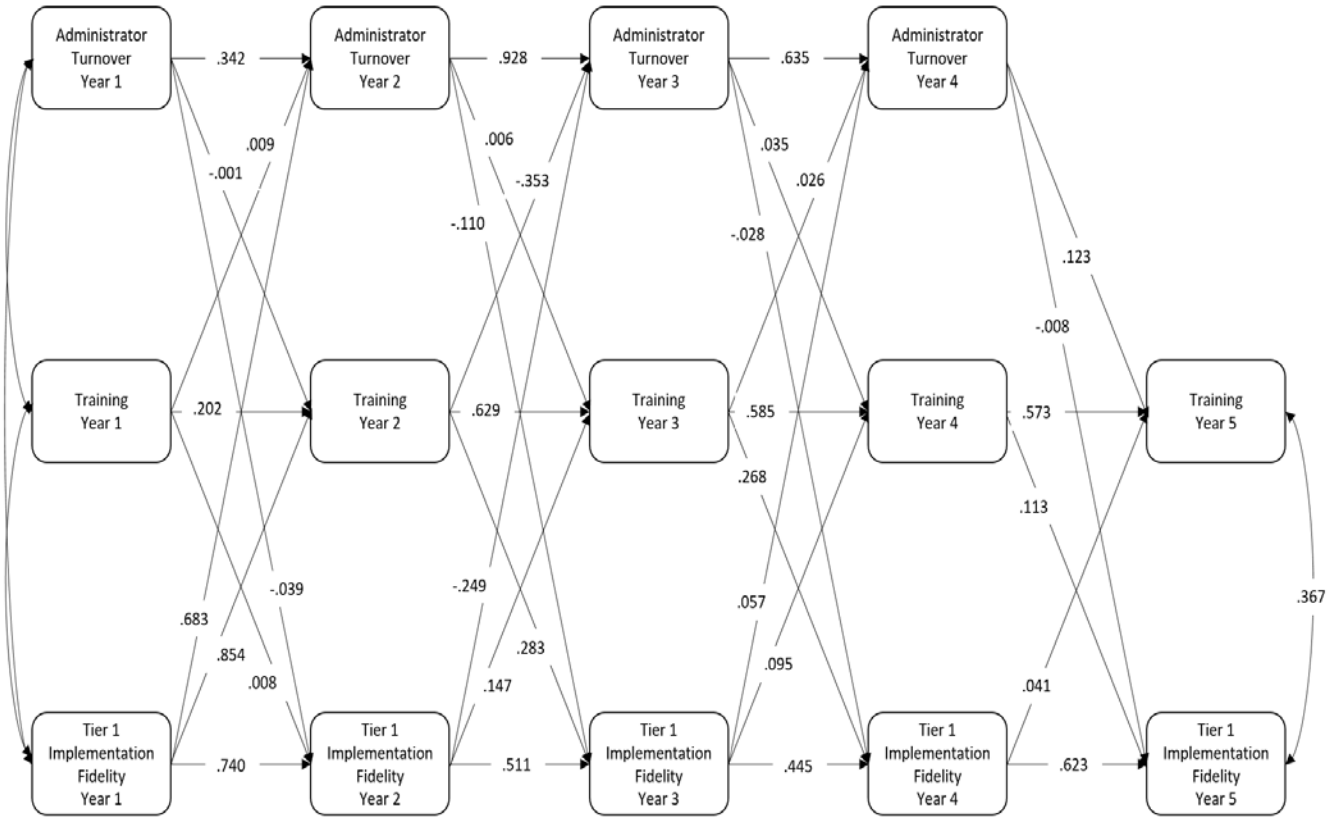

Figure 10. Parameter estimates and autoregressive paths for Administrator Turnover, Training, and Tier 1 Implementation Fidelity.

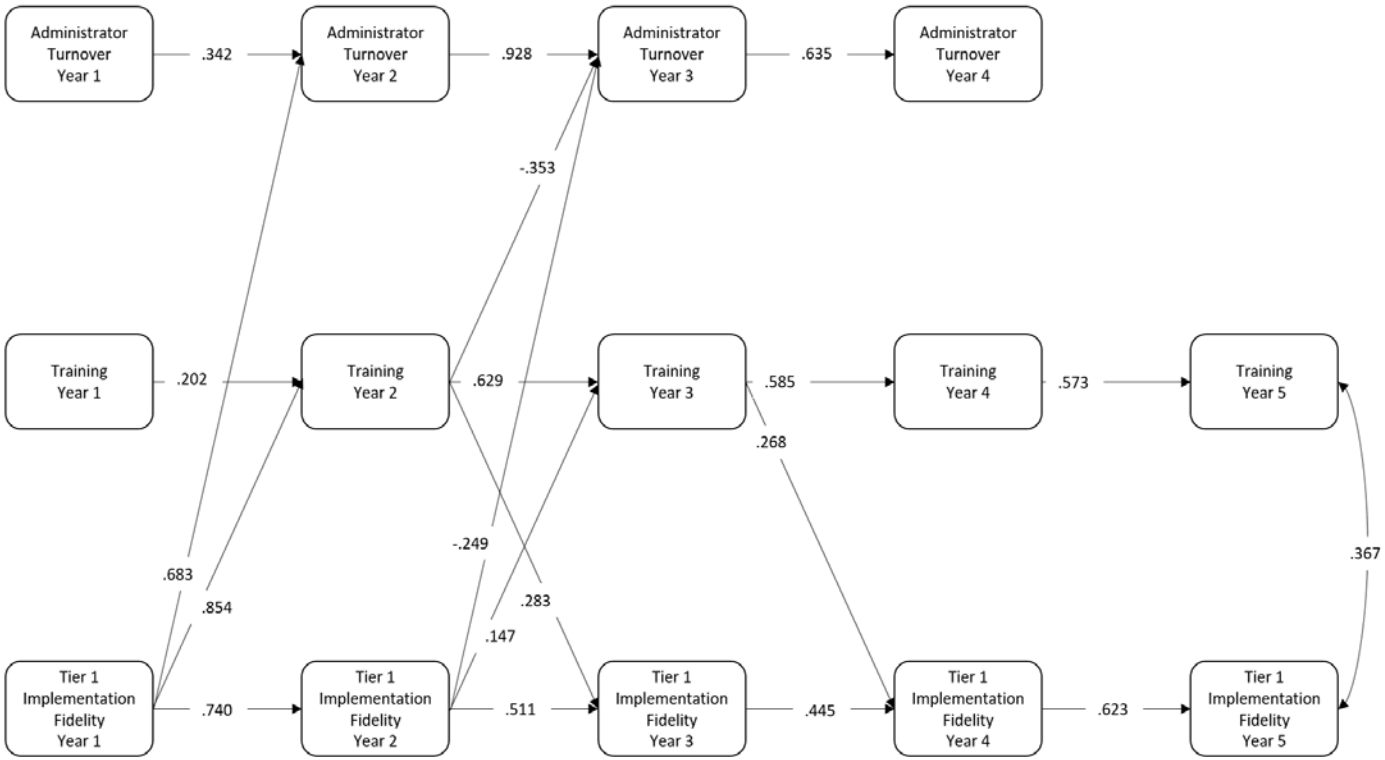

Figure 11. Significant parameter estimates and autoregressive paths for Administrator Turnover, Training, and Tier 1 Implementation Fidelity.

Table 4

Significant Standardized Parameter Estimates, Standard Errors, and p-Values for Model 1.1

Path	Coefficient	*SE*	*p*-value
Tier 1 Implementation Fidelity Year 1 → Administrator Turnover Year 2	.683	.139	<.001
Tier 1 Implementation Fidelity Year 1 → Training Year 2	.854	.099	<.001
Training Year 2 → Administrator Turnover Year 3	-.353	.168	.035
Training Year 2 → Tier 1 Implementation Fidelity Year 3	.283	.075	<.001
Tier 1 Implementation Fidelity Year 2 → Administrator Turnover Year 3	-.249	.090	.006
Tier 1 Implementation Fidelity Year 2 → Training Year 3	.147	.069	.033
Training Year 3 → Tier 1 Implementation Fidelity Year 4	.268	.071	<.001

Note. SE = Standard error.

As indicated in Figure 9 and Table 5, all autoregressive paths between Administrator Turnover from Years 1 to 4 (βs = .343 - .928, *p*s < .001), Training in Years 1 to 5 (βs = .202 - .629, *p*s < .01), and fidelity in Years 1 – 5 (βs = .445 - .740, *p*s < .001) were statistically significant. As larger autoregressive paths imply more stability and less variance over time, fidelity was the most stable, with the two largest autoregressive paths occurring between Year 1 and 2 (β = .740, $p < .001$) and Year 4 and 5 (β = .652, $p < .001$). Largest autoregressive path within the model was between Administrator Turnover in Year 2 and 3 (β = .928, $p < .001$). In addition, the weakest autoregressive path was between Training in Year 1 and 2 (β = .202, $p = .006$); however, autoregressive paths

between the Training variables were considerably larger across Years 3 through 5 (βs = .573 - .629, *p*s < .001).

Table 5

Significant Standardized Autoregressive Parameter Estimates, Standard Errors, and p-Values for Model 1.1

Path	Coefficient	*SE*	*p*-value
Administrator Turnover Year 1 → Administrator Turnover Year 2	.342	.074	<.001
Training Year 1 → Training Year 2	.202	.073	.006
Tier 1 Implementation Fidelity Year 1 → Tier 1 Implementation Fidelity Year 2	.740	.026	<.001
Administrator Turnover Year 2 → Administrator Turnover Year 3	.928	.146	<.001
Training Year 2 → Training Year 3	.629	.117	<.001
Tier 1 Implementation Fidelity Year 2 → Tier 1 Implementation Fidelity Year 3	.511	.067	<.001
Administrator Turnover Year 3 → Administrator Turnover Year 4	.635	.079	<.001
Training Year 3 → Training Year 4	.585	.064	<.001
Tier 1 Implementation Fidelity Year 3 → Tier 1 Implementation Fidelity Year 4	.445	.068	<.001
Training Year 4 → Training Year 5	.573	.061	<.001
Tier 1 Implementation Fidelity Year 4 → Tier 1 Implementation Fidelity Year 5	.652	.067	<.001

Note. SE = Standard error.

Total variance explained (R^2) was calculated for all three variables over time (Table 6). R^2 values for Administrator Turnover from Years 2 to 4 ranged from .405 to

.586 (*p*s < .001), indicating the SEM model accounted for nearly half of the variance among Administrator Turnover in Years 2 to 4. For Training, R^2 values from Years 2 through 5 ranged from .370 to .800 (*p*s < .001) and for implementation fidelity R^2 values ranged from .377 to .550 (*p*s < .001). Residual variances for the composite variable of implementation fidelity in Year 2 was .450 (*SE* = .038), .552 in Year 3 (*SE* = .063), .623 in Year 4 (*SE* = .073), and .515 in Year 5 (*SE* = .083). All residual variances for the composite variable were significant at an alpha of .001.

Table 6

R^2 Estimates, Standard Errors, and p-Values for Model 1.1

Variables	R^2	*SE*	*p*-value
Administrator Turnover Year 2	.586	.149	< .001
Administrator Turnover Year 3	.543	.062	< .001
Administrator Turnover Year 4	.405	.100	< .001
Training Year 2	.800	.135	<.001
Training Year 3	.543	.137	<.001
Training Year 4	.402	.093	<.001
Training Year 5	.370	.085	<.001
Tier 1 Implementation Fidelity Year 2	.550	.038	<.001
Tier 1 Implementation Fidelity Year 3	.448	.063	<.001
Tier 1 Implementation Fidelity Year 4	.377	.073	<.001
Tier 1 Implementation Fidelity Year 5	.485	.083	<.001

Note. SE = Standard error.

Research Question 1.2. To What Extent Are Administrator Turnover, Coaching, and Tier 1 Implementation Fidelity Related Over Time?

Measurement Model 1.2

Prior to examining the structural relations between Coaching, Administrator Turnover, and Tier 1 Implementation Fidelity, measurement model fit was assessed. Based on the fit statistics, model fit between the *a priori* cross-lagged panel model and the sample data was found to be acceptable: x^2 (54, n = 430) = 83.505, p = .006, RMSEA = .036, CFI = .970, TFI = .951, and WRMR = .730. Due to the number of missing cases in the Coaching variable over time, the total number of cases dropped from 563 to 430.

Structural Relations of Model 1.2

Figure 12 includes a representation of cross-lagged, autoregressive, and correlational paths among the three variables (i.e., Coaching, Administrator Turnover, and Tier 1 Implementation Fidelity) over time. Figure 13 includes all standardized cross-lagged and autoregressive paths found to be significant, based on an alpha level of .05. Table 7 also includes the standardized coefficients, standard error estimates, and *p*-values for the significant cross-lagged paths.

Similar to the previous model, fidelity in Year 1 was significantly and positively associated with Administrator Turnover in Year 2 (β = .693, p < .001). Fidelity in Year 1 was also significantly and positively associated with Coaching in Year 2 (β = .844, p < .001). This finding was also similar to the previous model, as fidelity in Year 1 was significantly and positively associated with Training in Year 2. In Year 2, Coaching was significantly and positively associated with fidelity in Year 3 (β = .273, p = .002); however, unlike the previous model, Coaching was not significantly and negatively

associated with Administrator Turnover in Year 3. Fidelity in Year 2 was significantly and negatively associated with Administrator Turnover in Year 3 (β = -.233, *p* = .011).

Interestingly, unlike model 1.1, in which fidelity in Year 2 was significantly and positively associated with Training in Year 3, fidelity in Year 2 was not significantly associated with Coaching in Year 3 (β = .074, *p* = .405). Coaching in Year 3 was also not significantly associated with fidelity in Year 4 (β = .140, *p* = .123), whereas Training in Year 3 was significantly and positively associated with fidelity in Year 4 for model 1.1.

Table 7

Significant Standardized Parameter Estimates, Standard Errors, and p-Values for Model 1.2

Path	Coefficient	*SE*	*p*-value
Tier 1 Implementation Fidelity Year 1 → Administrator Turnover Year 2	.693	.166	<.001
Tier 1 Implementation Fidelity Year 1 → Coaching Year 2	.844	.123	<.001
Coaching Year 2 → Tier 1 Implementation Fidelity in Year 3	.273	.088	.002
Tier 1 Implementation Fidelity Year 2 → Administrator Turnover in Year 3	-.283	.092	.011

Note. SE = Standard error.

Similar to model 1.1, autoregressive paths between Administrator Turnover (βs = .363 - .908, *p*s < .001) and fidelity were significant (βs = .441 - .714, *p*s < .001; Figure 13, Table 8). Interestingly, unlike the Training implementation strategy, there was no significant autoregressive path between Coaching in Year 1 and 2 (β = .055, *p* = .131). Across the three variables, Administrator Turnover had the smallest autoregressive

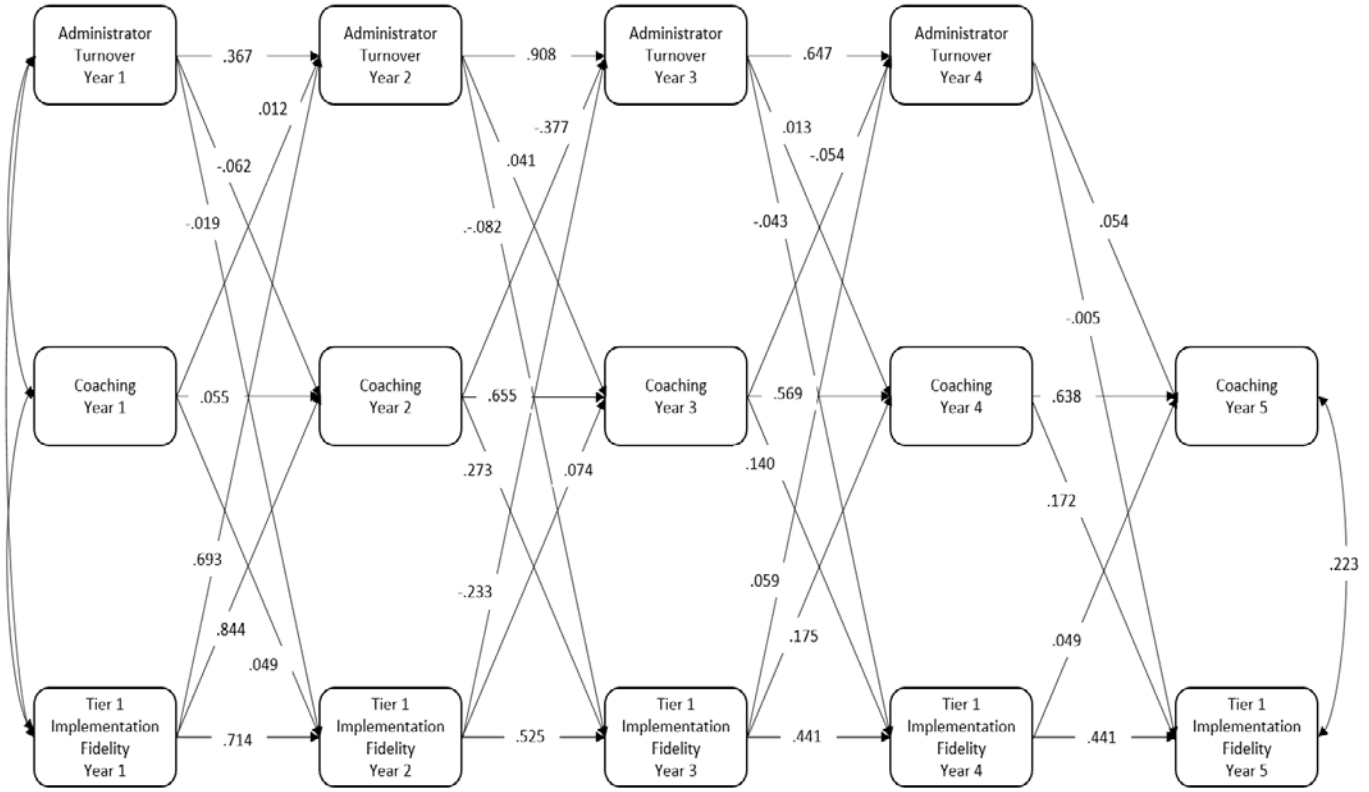

Figure 12. Parameter estimates and autoregressive paths for Administrator Turnover, Coaching, and Tier 1 Implementation Fidelity.

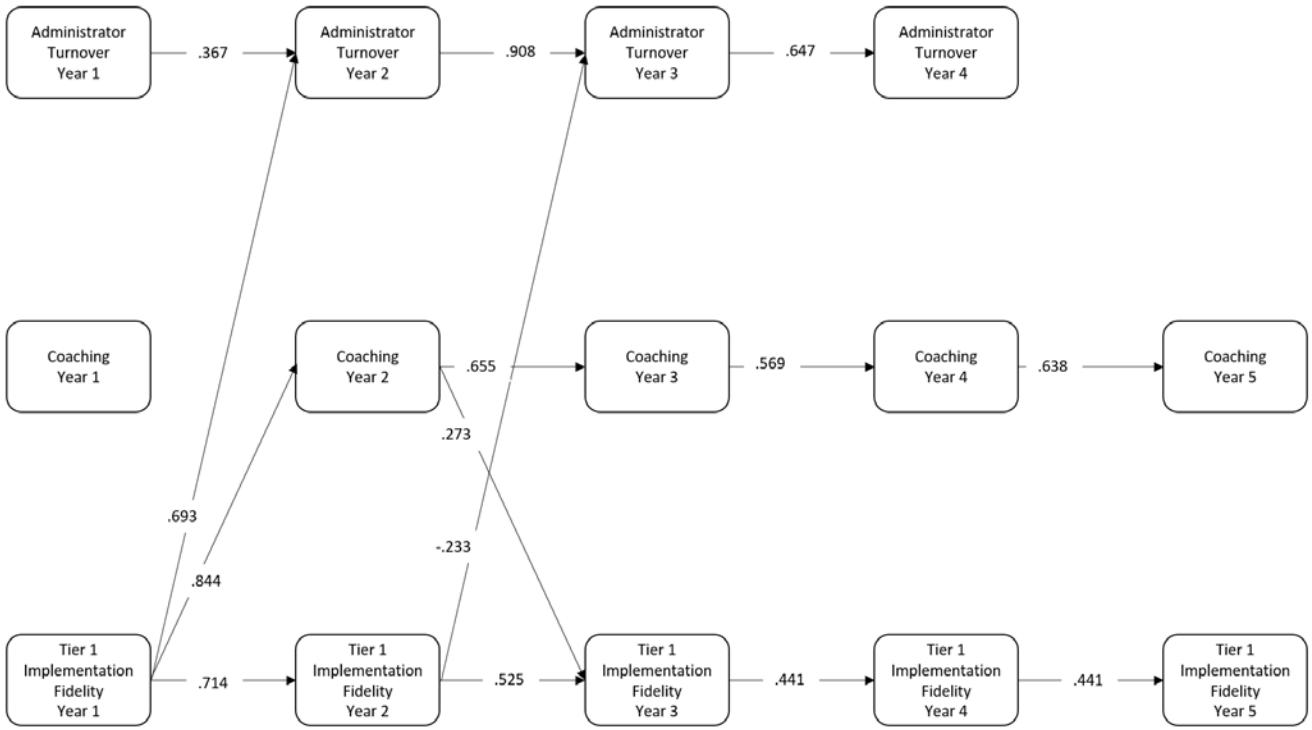

Figure 13. Significant parameter estimates and autoregressive paths for Administrator Turnover, Coaching, and Tier 1 Implementation Fidelity.

coefficients (Year 1 to Year 2 = β = .367, $p < .001$) and the largest autoregressive coefficients (Year 2 to Year 3 = β = .908, $p < .001$), implying large variation across the years.

Table 8

Significant Standardized Autoregressive Parameter Estimates, Standard Errors, and p-Values for Model 1.2

Path	Coefficient	*SE*	*p*-value
Administrator Turnover Year 1 → Administrator Turnover Year 2	.367	.093	<.001
Tier 1 Implementation Fidelity Year 2 → Tier 1 Implementation Fidelity Year 3	.714	.033	<.001
Administrator Turnover Year 3 → Administrator Turnover Year 4	.908	.164	<.001
Coaching Year 2 → Coaching Year 3	.655	.138	<.001
Tier 1 Implementation Fidelity Year 2 → Tier 1 Implementation Fidelity Year 3	.525	.079	<.001
Administrator Turnover Year 3 → Administrator Turnover Year 4	.647	.093	<.001
Coaching Year 3 → Coaching Year 4	.569	.094	<.001
Tier 1 Implementation Fidelity Year 3 → Tier 1 Implementation Fidelity Year 4	.441	.075	<.001
Coaching Year 4 → Coaching Year 5	.638	.074	<.001
Tier 1 Implementation Fidelity Year 4 → Tier 1 Implementation Fidelity Year 5	.664	.068	<.001

Note. SE = Standard error.

For total variance explained among the observed variables, R^2 values for Administrator Turnover ranged between .417 (Year 4) to .608 (Year 2); all were

significant at an alpha of .001 or smaller (Table 9). R^2 values for Coaching ranged from .430 (Year 5) to .722 (Year 2), indicating that the model accounted for nearly half to over two thirds of the variance in Coaching, depending on the year. Finally, R^2 values for fidelity ranged from .270 (Year 4) to .533 (Year 5) and were significant at an alpha of .001. Residual variance for implementation variables in Year 2 was .484 (*SE* = .048), in Year 3 was .536 (*SE* = .057), in Year 4 was .730 (*SE* = .083), and in Year 5 was .467 (*SE* = .088). All residual variances were significant at an alpha of .001.

Table 9

R^2 Estimates, Standard Errors, and p-Values for Model 1.2

Variables	R^2	*SE*	*p*-value
Administrator Turnover Year 2	.608	.172	< .001
Administrator Turnover Year 3	.538	.074	< .001
Administrator Turnover Year 4	.417	.122	.001
Coaching Year 2	.722	.203	<.001
Coaching Year 3	.528	.174	.002
Coaching Year 4	.438	.124	<.001
Coaching Year 5	.430	.083	<.001
Tier 1 Implementation Fidelity Year 2	.515	.048	<.001
Tier 1 Implementation Fidelity Year 3	.464	.067	<.001
Tier 1 Implementation Fidelity Year 4	.270	.083	<.001
Tier 1 Implementation Fidelity Year 5	.533	.088	<.001

Note. SE = Standard error.

Research Question 1.3. To What Extent Are Administrator Turnover, Team Use of Data for Decision Making, and Tier 1 Implementation Fidelity Related Over Time?

Measurement Model 1.3

Similar to the previous measurement models, model fit was evaluated prior to examining the cross-lagged, autoregressive, and correlations. According to fit indices, adequate model fit was obtained: x^2 (54, n = 351) = 70.819, p = .06, RMSEA = .030, CFI = .975, TFI = .959, and WRMR = .654. The number of cases dropped from 430 in the previous measurement model to 351.

Structural Relations of Model 1.3

Standardized cross-lagged, autoregressive, and correlations for model 1.3 are displayed in Figure 14. Moreover, Figure 15 and Table 10 include all cross-lagged and autoregressive paths found to be statistically significant, based on an alpha of .05. Unlike model 1.1. and 1.2, there was no significant positive relation between fidelity in Year 1 and Administrator Turnover in Year 2, which could be due to fewer cases. Fidelity in Year 1 was strongly and significantly associated with Team Use of Data for Decision Making in Year 2 (β = .908, p < .001), similar to how fidelity was significantly associated with Training and Coaching in Year 2.

Interestingly, Administrator Turnover in Year 2 was significantly and negatively associated with fidelity in Year 3 (β = - .208, p = .003). This path between Administrator Turnover in Year 2 and fidelity in Year 3 was not significant in model 1.1. or 1.2, which included the same variables with different sample sizes. Team use of data for decision-making in Year 2 was significantly and positively associated with fidelity in Year 3 (β = .175, p = .013), similar to how Training and Coaching in Year 2 were significantly

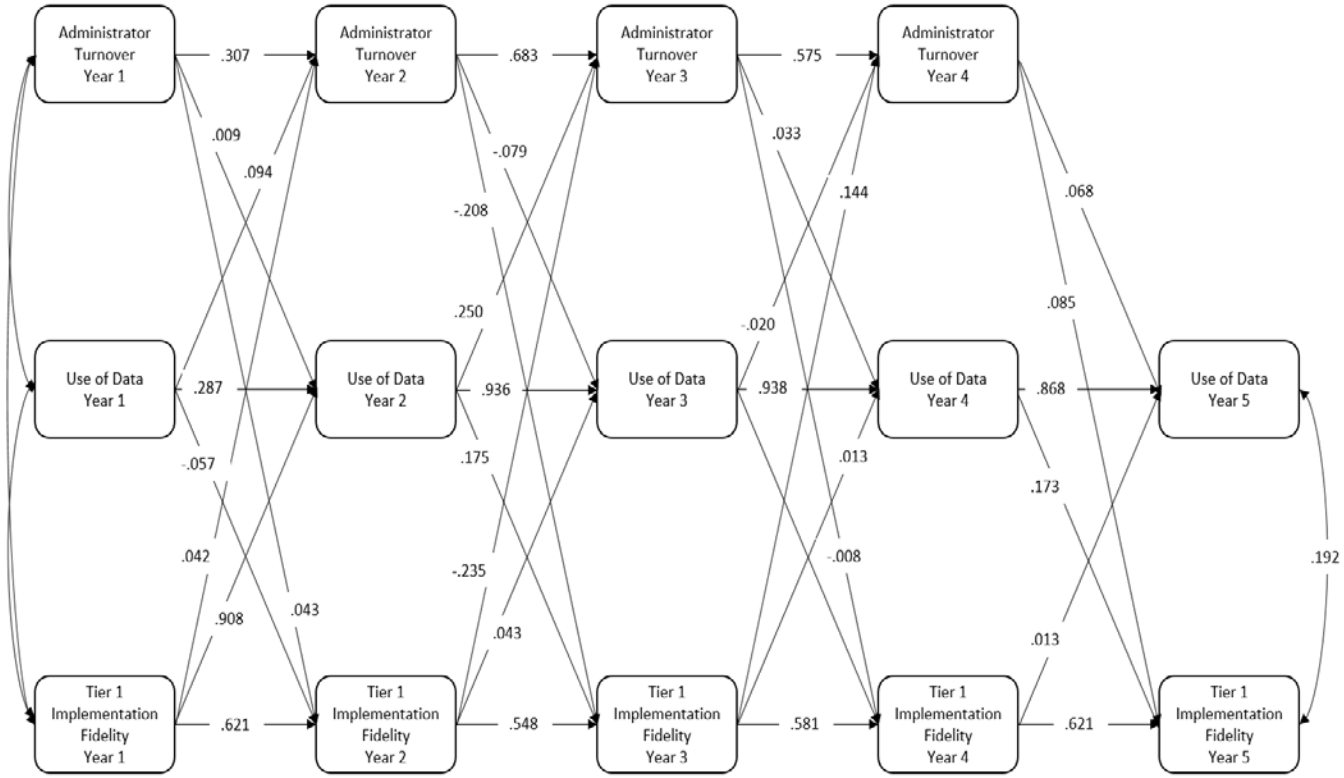

Figure 14. Parameter estimates and autoregressive paths for Administrator Turnover, Team Use of Data for Decision Making, and Tier 1 Implementation Fidelity.

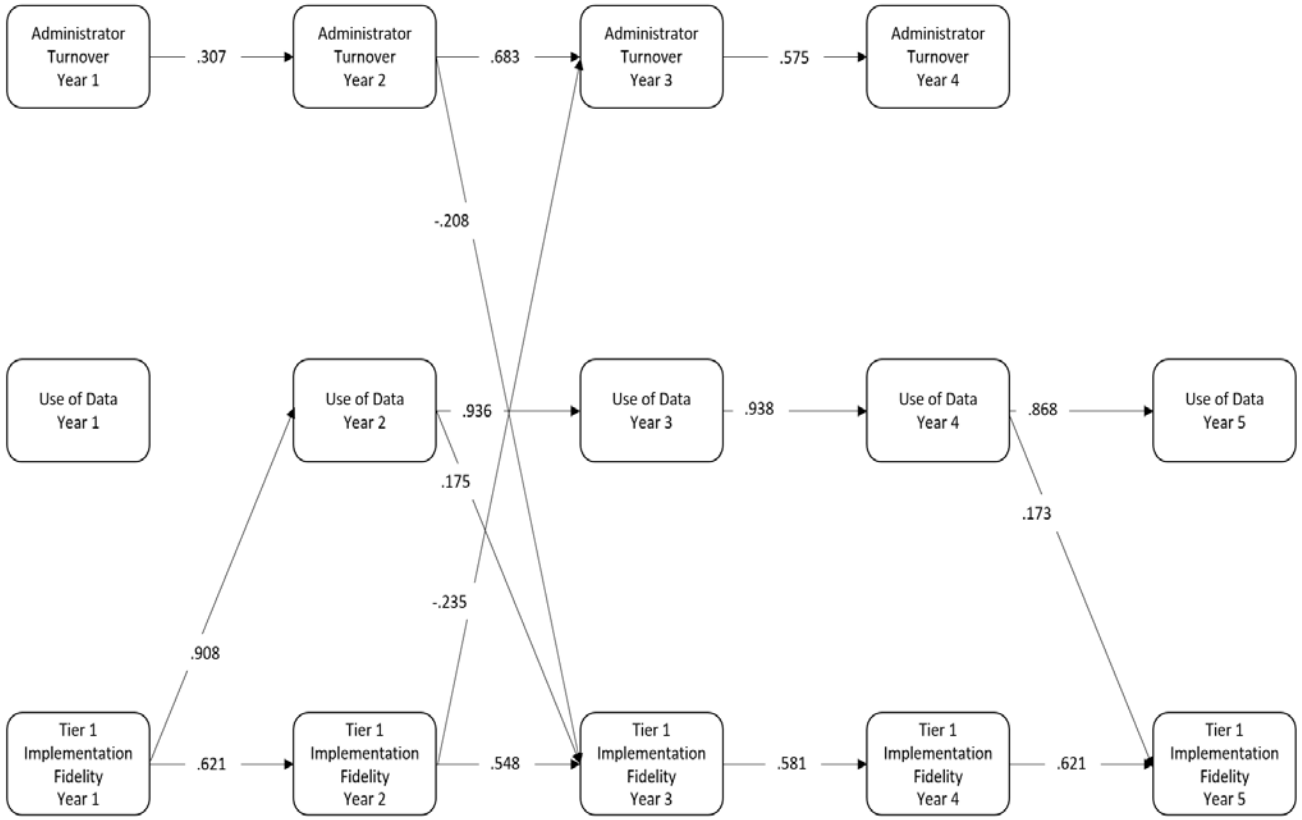

Figure 15. Significant parameter estimates and autoregressive paths for Administrator Turnover, Team Use of Data for Decision Making, and Tier 1 Implementation Fidelity.

associated with fidelity in Year 3. Also in Year 2, fidelity was significantly and negatively associated with Administrator Turnover in Year 3 (β = - .235, *p* = .003). Finally, Team Use of Data for Decision Making in Year 4 was significantly and positively related to fidelity in Year 5 (β = .173, *p* = .018). Interestingly, neither of the previous implementation strategies (i.e., Training or Coaching) in Year 4 was significantly related to fidelity in Year 5.

Table 10

Significant Standardized Parameter Estimates, Standard Errors, and p-Values for Model 1.3

Path	Coefficient	*SE*	*p*-value
Tier 1 Implementation Fidelity Year 1 → Team Use of Data for Decision Making in Year 2	.908	.104	<.001
Administrator Turnover in Year 2 → Tier 1 Implementation Fidelity Year 3	-.208	.070	.003
Team Use of Data for Decision Making in Year 2 → Tier 1 Implementation Fidelity in Year 3	.175	.071	.013
Tier 1 Implementation Fidelity Year 2 → Administrator Turnover in Year 3	-.235	.079	.003
Team Use of Data for Decision Making in Year 4 → Tier 1 Implementation Fidelity Year 5	.173	.073	.018

Note. SE = Standard error.

As evidenced in Figure 15 and Table 11, all autoregressive paths were significant for Administrator Turnover (βs = .307 - .683, *p*s < .001) and fidelity (βs = .548 - .621, *p*s < .001). Similar to model 1.2, there was no significant autoregressive paths between team use of data in Year 1 and 2 (β = .287, *p* = .089). Among the three observed variables (i.e., Team Use of Data for Decision Making, Administrator Turnover, and fidelity), Team Use

of Data for Decision Making contained the largest autoregressive paths over time, implying the most stability.

Table 11

Significant Standardized Autoregressive Parameter Estimates, Standard Errors, and p-Values for Model 1.3

Path	Coefficient	*SE*	*p*-value
Administrator Turnover Year 1 → Administrator Turnover Year 2	.307	.080	<.001
Tier 1 Implementation Fidelity Year 1 → Tier 1 Implementation Fidelity Year 2	.621	.041	<.001
Administrator Turnover Year 2 → Administrator Turnover Year 3	.683	.054	<.001
Team Use of Data for Decision Making Year 2 → Team Use of Data for Decision Making Year 3	.936	.065	<.001
Tier 1 Implementation Fidelity Year 2 → Tier 1 Implementation Fidelity Year 3	.548	.074	<.001
Administrator Turnover Year 3 → Administrator Turnover Year 4	.575	.128	<.001
Team Use of Data for Decision Making Year 3 → Team Use of Data for Decision Making Year 4	.938	.067	<.001
Tier 1 Implementation Fidelity Year 3 → Tier 1 Implementation Fidelity Year 4	.581	.106	<.001
Team Use of Data for Decision Making Year 4 → Team Use of Data for Decision Making Year 5	.868	.103	<.001
Tier 1 Implementation Fidelity Year 4 → Tier 1 Implementation Fidelity Year 5	.621	.076	<.001

Note. SE = Standard error.

For Administrator Turnover, R^2 values ranged from .104 (Year 2) to .532 (Year 3), implying that the model accounted for a small amount of variance in Year 2 and

approximately half of the variance in Year 3 (see Table 12). R^2 values for Team Use of Data for Decision Making ranged from .778 (Year 5) to .937 (Year 2), indicating the model accounted for the majority of the variance in the Team Use of Data for Decision Making variables from Years 2 through 5. Finally, R^2 values for fidelity ranged from .346 to (Year 4) to .488 (Year 5). Residual variance for fidelity in Year 2 was .615 (*SE* = .050), .531 in Year 3 (*SE* = .093), .654 in Year 4 (*SE* = .106), and .512 in Year 5 (*SE* = .091). Residual variances for fidelity were significant at an alpha of .001. Residual variance was also obtained for the continuous Team Use of Data for Decision Making variables; however, all residual variances were insignificant at an alpha of .05.

Table 12

R^2 Estimates, Standard Errors, and p-Values for Model 1.3

Variables	R^2	*SE*	*p*-Value
Administrator Turnover Year 2	.104	.053	.051
Administrator Turnover Year 3	.532	.065	<.001
Administrator Turnover Year 4	.321	.122	.009
Team Use of Data for Decision Making Year 2	.937	.076	<.001
Team Use of Data for Decision Making Year 3	.918	.092	<.001
Team Use of Data for Decision Making Year 4	.899	.096	<.001
Team Use of Data for Decision Making Year 5	.778	.172	<.001
Tier 1 Implementation Fidelity Year 2	.385	.050	<.001
Tier 1 Implementation Fidelity Year 3	.469	.093	<.001
Tier 1 Implementation Fidelity Year 4	.346	.106	.001
Tier 1 Implementation Fidelity Year 5	.488	.091	<.001

Note. SE = Standard error.

Research Question 2. To What Extent Does the Influence of Administrator Turnover and Implementation Strategies on Tier 1 Implementation Fidelity Vary Over Time Based on Grade Level and Stage of Implementation?

To examine the associations between Administrator Turnover, implementation strategies, and fidelity over time (research question 1), it was assumed these variables were invariant across grade level and stage of implementation. To test these assumptions, research question 2 examined whether these groups significantly differed across the Administrator Turnover, implementation strategies, and fidelity, specifically for cross-lagged paths from Year 1 to 2 and Year 4 to 5. Using 1 degree of freedom tests, individual paths were tested by comparing a less restrictive model, where paths were freed and estimated for each non-malleable group, to a more restrictive model, where paths were constrained across groups. Significant chi-square difference tests ($p < .05$) indicated that the least restricted models fit the data better than the restricted paths, and paths were allowed to vary for non-malleable groups. Due to lack of data for specific categorical response options (i.e., zero observations for middle schools that received four or five days of Training), several invariance tests among the grade levels and implementation strategy groups could not be examined. These included testing differences for the Coaching implementation strategy and high schools.

Differences by Grade Level for Model 1.1

As indicated in Table 13, based on the chi-square difference tests, the path between Administrator Turnover in Year 1 and Training in Year 2 was significant ($x^2 = 5.918$, $p = .015$). This finding indicated that the less restrictive model fit the data better than the more restrictive model. Therefore, separate parameter estimates were examined

for elementary schools and middle schools. Although either parameter estimate was significant for elementary schools (β = -.032, p = .594) or middle schools (β = .142, p = .203), for elementary schools the parameter estimate was negative and for middle schools it was positive. The chi-square difference test was also significant for the path between Administrator Turnover in Year 1 to fidelity in Year 2 (x^2 = 4.545, p = .033); however, neither parameter estimate was significant for elementary schools (β = .036, p = .330) or middle schools (β = -.049, p = .289).

There were also significant chi-square differences for paths between Training in Year 1 to fidelity in Year 2 (x^2 = 4.775, p = .029), fidelity in Year 1 to Administrator Turnover in Year 2 (x^2 = 8.028, p = .005), and fidelity in Year 1 to Training in Year 2 (x^2 = 4.313, p = .038); therefore these paths were also estimated separately for elementary and middle schools. As indicated in Table 13, elementary schools significantly varied from middle school for the path between Tier 1 Implementation Fidelity in Year 1 and Administrator Turnover in Year 2 (β = -.984, p < .001) and Tier 1 Implementation Fidelity in Year 1 and Training in Year 2 (β = .576, p = .035). The only paths between Year 4 and 5 allowed to vary at random were between Administrator Turnover in Year 4 to Training in Year 5 (x^2 = 4.545, p = .033); however, neither path was significant for elementary schools (β = .184, p = .077) or middle schools (β = -.204, p = .538).

Model fit was re-examined after all significant paths for the two grade levels between Year 1 to 2 and Year 4 to 5 were freed. Model fit statistics were compared to those obtained for model 1.1, prior to having individual paths freed. Overall model fit was found to be improved: x^2 (135) = 153.186, p = .136, RMSEA = .022, CFI = .984, TFI = .979, and WRMR = 1.051.

In summary, model fit was improved once several individual paths for elementary and middle schools were allowed to be freely estimated across the two grade levels. Findings indicated that fidelity in Year 1 was significantly and negatively related to Administrator Turnover in Year 2 and positively related to Training in Year 2, but only for elementary schools. However, the majority of paths tested for invariance among the two grade levels did not significantly vary from Year 1 to 2. Furthermore, none of the paths tested in Year 4 to 5 significantly varied. Overall, these findings indicated strong invariance across elementary and middle schools related to the influence of Administrator Turnover and implementation strategies on Tier 1 Implementation Fidelity.

Differences by Stage of Implementation for Model 1.1

Chi-square difference tests were also conducted to examine whether individual parameters should be freely estimated for initial implementation and institutionalization groups. As indicated in Table 14, chi-square values for paths Administrator Turnover, Training, and fidelity from Year 1 to 2 were insignificant, indicating there were no significant differences for stage of implementation. Therefore, individual parameters for the two groups were not analyzed.

Between years 4 and 5, only one path (Administrator Turnover in Year 4 to Training in Year 5) was allowed to freely vary. Based on the chi-square difference test (x^2 = 4.293, p = .038), parameters were freed for the initial implementation and institutionalization groups, and individual parameters were estimated. The path between Administrator Turnover in Year 4 to Training in Year 5 was found to be significant only for schools in the initial implementation stage (β = .302, p = .007). Once this path was

Table 13

Chi-Square Difference Tests Between Administrator Turnover, Training, and Tier 1 Implementation Fidelity for Grade Level Groups for Model 1.1

Path	Restricted		χ^2 difference test		Elementary		Middle	
	Coef.	*p*-value	χ^2	*p*-value	Coef.	*p*-value	Coef.	*p*-value
Year 1 to Year 2								
Administrator Turnover Year 1 → Training Year 2	-.001	.965	5.918	.015	-.032	.594	.142	.203
Administrator Turnover Year 1 → Tier 1 Implementation Fidelity Year 2	-.039	.153	4.545	.033	-.036	.330	-.049	.289
Training Year 1 → Administrator Turnover Year 2	.009	.816	3.307	.069				
Training Year 1 → Tier 1 Implementation Fidelity Year 2	.008	.769	4.775	.029	.024	.501	-.025	.582
Tier 1 Implementation Fidelity Year 1 → Administrator Turnover Year 2	.683	<.001	8.028	.005	-.984	<.001	.145	.486
Tier 1 Implementation Fidelity Year 1 → Training Year 2	.854	<.001	4.313	.038	.576	.035	.042	.908
Year 4 to Year 5								
Administrator Turnover Year 4 → Training Year 5	.123	.230	3.958	.047	.184	.077	-.204	.538
Administrator Turnover Year 4 → Tier 1 Implementation Fidelity Year 5	-.008	.868	3.429	.064				
Training Year 4 → Tier 1 Implementation Fidelity Year 5	.113	.183	1.094	.296				
Tier 1 Implementation Fidelity Year 4 → Training Year 5	.014	.706	3.623	.057				

Note. Coef = coefficient

allowed to be freely estimated for the two stage of implementation groups, overall model fit was improved: x^2 (140) = 168.971, p = .044, RMSEA = .028, CFI = .976, TFI = .970, and WRMR = 1.146.

Chi-square difference tests were conducted to examine whether the paths between Administrator Turnover, Training, and fidelity were allowed to freely vary for the initial implementation and ongoing evolution groups. Results indicated that there were no significant differences, therefore parameters between the Administrator Turnover, Training, and fidelity were not allowed to freely varying or be tested for the two implementation groups (see Table 15).

In conclusion, invariance was found across the three implementation groups. Findings suggest that the influence of Administrator Turnover and implementation strategies on Tier 1 Implementation Fidelity were equivalent across the different stage of implementation groups.

Differences by Grade Level for Model 1.3

Similar to model 1.1, individual paths between Administrator Turnover, Team Use of Data for Decision Making, and fidelity were examined to determine whether these paths varied for elementary and middle school levels. Table 16 includes all chi-square difference test values for the paths examined. All chi-square values were found to be insignificant, indicating that models with the freed parameters for the two grade levels did not significantly fit the data better than the model with constrained parameters. These findings indicate that there was strong measurement invariance between elementary and middle schools across the three malleable variables. Similar to the Training

Table 14

Chi-Square Difference Tests Between Administrator Turnover, Training, and Tier 1 Implementation Fidelity for Initial Implementation and Institutionalization Groups for Model 1.1

Path	Restricted		χ^2 difference test		Initial Implem.		Institutionalization	
	Coef.	*p*-value	χ^2	*p*-value	Coef.	*p*-value	Coef.	*p*-value
Year 1 to Year 2								
Administrator Turnover Year 1 → Training Year 2	-.001	.965	.070	.792				
Administrator Turnover Year 1 → Tier 1 Implementation Fidelity Year 2	-.039	.153	.100	.752				
Training Year 1 → Administrator Turnover Year 2	.009	.816	.003	.960				
Training Year 1 → Tier 1 Implementation Fidelity Year 2	.008	.769	.725	.394				
Tier 1 Implementation Fidelity Year 1 → Administrator Turnover Year 2	.683	<.001	.025	.887				
Tier 1 Implementation Fidelity Year 1 → Training Year 2	.854	<.001	.005	.946				
Year 4 to Year 5								
Administrator Turnover Year 4 → Training Year 5	.123	.230	4.293	.038	.302	.007	-.175	.347
Administrator Turnover Year 4 → Tier 1 Implementation Fidelity Year 5	-.008	.868	0.199	.656				
Training Year 4 → Tier 1 Implementation Fidelity Year 5	.113	.183	2.880	.100				
Tier 1 Implementation Fidelity Year 4 → Training Year 5	.014	.706	0.256	.613				

Note. Coef. = coefficient, Implem. = implementation.

Table 15

Chi-Square Difference Tests Between Administrator Turnover, Training, and Tier 1 Implementation Fidelity for Initial Implementation and Ongoing Evolution Groups for Model 1.1

	Restricted		χ^2 difference test		Initial Implem		Ongoing Evolution	
Path	Coef.	*p*-value	χ^2	*p*-value	Coef.	*p*-value	Coef.	*p*-value
Year 1 to Year 2								
Administrator Turnover Year 1 → Training Year 2	-.001	.965	.199	.731				
Administrator Turnover Year 1 → Tier 1 Implementation Fidelity Year 2	-.039	.153	.050	.820				
Training Year 1 → Administrator Turnover Year 2	.009	.816	.670	.413				
Training Year 1 → Tier 1 Implementation Fidelity Year 2	.008	.769	.178	.673				
Tier 1 Implementation Fidelity Year 1 → Administrator Turnover Year 2	.683	<.001	.1429	.232				
Tier 1 Implementation Fidelity Year 1 → Training Year 2	.854	<.001	.454	.500				
Year 4 to Year 5								
Administrator Turnover Year 4 → Training Year 5	.123	.230	1.633	.201				
Administrator Turnover Year 4 → Tier 1 Implementation Fidelity Year 5	-.008	.868	.252	.615				
Training Year 4 → Tier 1 Implementation Fidelity Year 5	.113	.183	.021	.886				
Tier 1 Implementation Fidelity Year 4 → Training Year 5	.014	.706	.151	.698				

Note. Coef. = coefficient, Implem. = implementation.

implementation strategy in model 1.1, findings indicated that there were not substantial differences for the teams using data for decision making implementation strategy on Tier 1 Implementation Fidelity for elementary or middle schools.

Differences by Stage of Implementation for Model 1.3

Chi-square difference tests were then conducted for paths between Administrator Turnover, Team Use of Data for Decision Making, and fidelity for the initial implementation and institutionalization groups (see Table 17). The only path that improved once parameters were freed was between Administrator Turnover in Year 1 and Team Use of Data for Decision Making in Year 2 was ($x^2 = 5.108$, $p = .023$). Therefore, individual parameter estimates for the implementation groups were allowed to be estimated. Neither parameter estimate for initial implementation ($\beta = .040$, $p = .209$) or institutionalization ($\beta = -.042$, $p = .280$) groups were found to be significant. However, freeing the parameter between the two groups did result in improved model fit: $x^2 (140) = 161.333$, $p = .104$, RMSEA = .029, CFI = .974, TFI = .967, and WRMR = 1.132.

Chi-square difference tests were conducted to determine whether individual parameters for the initial implementation and ongoing evolution groups were allowed to freely vary for model 1.3. Table 18 includes all individual paths tested. Since all difference values were insignificant, parameters remained constrained across groups and individual parameters were not examined.

In summary, there were no significant differences for two stage of implementation groups for the three malleable variables over time. These results suggest that schools in

Table 16

Chi-Square Difference Tests Between Administrator Turnover, Team Use of Data for Decision Making, and Tier 1 Implementation Fidelity for Grade Level for Model 1.3

Path	Restricted		χ^2 difference test		Elementary		Middle	
	Coef.	*p*-value	χ^2	*p*-value	Coef.	*p*-value	Coef.	*p*-value
Year 1 to Year 2								
Administrator Turnover Year 1 → team use of data Year 2	.009	.620	3.555	.059				
Administrator Turnover Year 1 → Tier 1 Implementation Fidelity Year 2	.043	.375	2.122	.144				
Team use of data Year 1 → Administrator Turnover Year 2	.094	.267	2.229	.135				
Team Use of Data Year 1 → Tier 1 Implementation Fidelity Year 2	-.057	.397	.990	.350				
Tier 1 Implementation Fidelity Year 1 → Administrator Turnover Year 2	.042	.710	.402	.526				
Tier 1 Implementation Fidelity Year 1 → Team Use of Data Year 2	.908	<.001	2.106	.147				
Year 4 to Year 5								
Administrator Turnover Year 4 → Team Use of Data Year 5	.068	.367	2.679	.102				
Administrator Turnover Year 4 → Tier 1 Implementation Fidelity Year 5	.085	.241	.459	.550				
Team Use of Data Year 4 → Tier 1 Implementation Fidelity Year 5	.173	.018	.180	.671				
Tier 1 Implementation Fidelity Year 4 → Team Use of Data Year 5	.013	.774	1.618	.203				

Note. Coef = coefficient.

the different stages of implementation (i.e., institutionalization and ongoing evolution) did not significantly vary in their associations between Administrator Turnover, Team Use of Data for Decision Making, and fidelity.

Research Question 3.1. To What Extent Does Training Buffer the Negative Influences of Administrator Turnover on Tier 1 Implementation Fidelity Over Time?

To address whether Training in Year 3 moderated the relation between Administrator Turnover in Year 2 and Tier 1 Implementation Fidelity in Year 3, cross-sectional moderated regression was conducted. The moderation model included a total of 391 cases. Cases were excluded from the analyses if data were missing for the Administrator Turnover variable.

Moderation was conducted by examining interaction effects between the dichotomized Administrator Turnover variable and the categorical Training variable on implementation fidelity. The five categories of the Training moderator included: (a) none, (b) under 1 half-day to 1 full day of Training, (c) 2 to 3 days of Training, (d) 4 to 5 days of Training, and (e) over 5 days of Training, with "none" serving as the reference group. Simple interaction slopes for the four categories of the moderating variable (Training) were then computed and compared to the reference category. Based on the results of the interaction effects (simple slopes), there were no significant interaction effects for Administrator Turnover and under 1 half-day to 1 full day of Training ($\beta = -7.259$, $SE = 14.645$, $p = .620$), 2 to 3 days of Training ($\beta = -12.630$, $SE = 14.273$, $p = .376$), 4 to 5 days of

Table 17

Chi-Square Difference Tests Between Administrator Turnover, Team Use of Data for Decision Making, and Tier 1 Implementation Fidelity for Initial Implementation and Institutionalization Groups for Model 1.3

Path	Restricted		χ^2 difference test		Initial implem		Institutionalization	
	Coef.	*p*-value	χ^2	*p*-value	Coef.	*p*-value	Coef.	*p*-value
Year 1 to Year 2								
Administrator Turnover Year 1 → Team use of data Year 2	.009	.620	5.108	.023	.040	.209	-.042	.280
Administrator Turnover Year 1 → Tier 1 Implementation Fidelity Year 2	.043	.375	.010	.921				
Team use of data Year 1 → Administrator Turnover Year 2	.094	.267	.222	.638				
Team use of data Year 1 → Tier 1 Implementation Fidelity Year 2	-.057	.397	.136	.712				
Tier 1 Implementation Fidelity Year 1 → Administrator Turnover Year 2	.042	.710	.032	.859				
Tier 1 Implementation Fidelity Year 1 → team use of data Year 2	.908	<.001	1.072	.301				
Year 4 to Year 5								
Administrator Turnover Year 4 → team use of data Year 5	.068	.367	.052	.821				
Administrator Turnover Year 4 → Tier 1 Implementation Fidelity Year 5	.085	.241	.444	.505				
team use of data Year 4 → Tier 1 Implementation Fidelity Year 5	.173	.018	.148	.701				
Tier 1 Implementation Fidelity Year 4 → team use of data Year 5	.013	.774	.531	.466				

Note. Coef = coefficient, implem = implementation.

Table 18

Chi-Square Difference Tests Between Administrator Turnover, Team Use of Data for Decision Making, and Tier 1 Implementation Fidelity for Initial Implementation and Ongoing Evolution Groups for Model 1.3

Path	Restricted		χ^2 difference test		Initial implem		Ongoing evolution	
	Coef.	*p*-value	χ^2	*p*-value	Coef.	*p*-value	Coef.	*p*-value
Year 1 to Year 2								
Administrator Turnover Year 1 → Team use of data Year 2	.009	.620	3.181	.075				
Administrator Turnover Year 1 → Tier 1 Implementation Fidelity Year 2	.043	.375	.016	.901				
Team use of data Year 1 → Administrator Turnover Year 2	.094	.267	.221	.638				
Team use of data Year 1 → Tier 1 Implementation Fidelity Year 2	-.057	.397	.367	.546				
Tier 1 Implementation Fidelity Year 1 → Administrator Turnover Year 2	.042	.710	.012	.913				
Tier 1 Implementation Fidelity Year 1 → team use of data Year 2	.908	<.001	.726	.394				
Year 4 to Year 5								
Administrator Turnover Year 4 → team use of data Year 5	.068	.367	.179	.672				
Administrator Turnover Year 4 → Tier 1 Implementation Fidelity Year 5	.085	.241	.414	.520				
team use of data Year 4 → Tier 1 Implementation Fidelity Year 5	.173	.018	.990	.320				
Tier 1 Implementation Fidelity Year 4 → team use of data Year 5	.013	.774	1.790	.181				

Note. Coef = coefficient, implem = implementation.

Training (β = -7.969, *SE* = 16.100, *p* = .621), or over 5 full days of Training (β = -8.495, *SE* = 14.043, *p* = .545) on implementation fidelity. In sum, there were no significant interaction effects for schools that received varying amounts of Training compared to schools that receive no Training or Administrator Turnover on Tier 1 fidelity. Figure 16 provides a visual representation of the estimated fidelity scores testing moderation of the different levels of Training and Administrator Turnover on implementation fidelity. Although the estimated fidelity scores were higher for schools that reported no Administrator Turnover and received more Training, these scores were not significantly different.

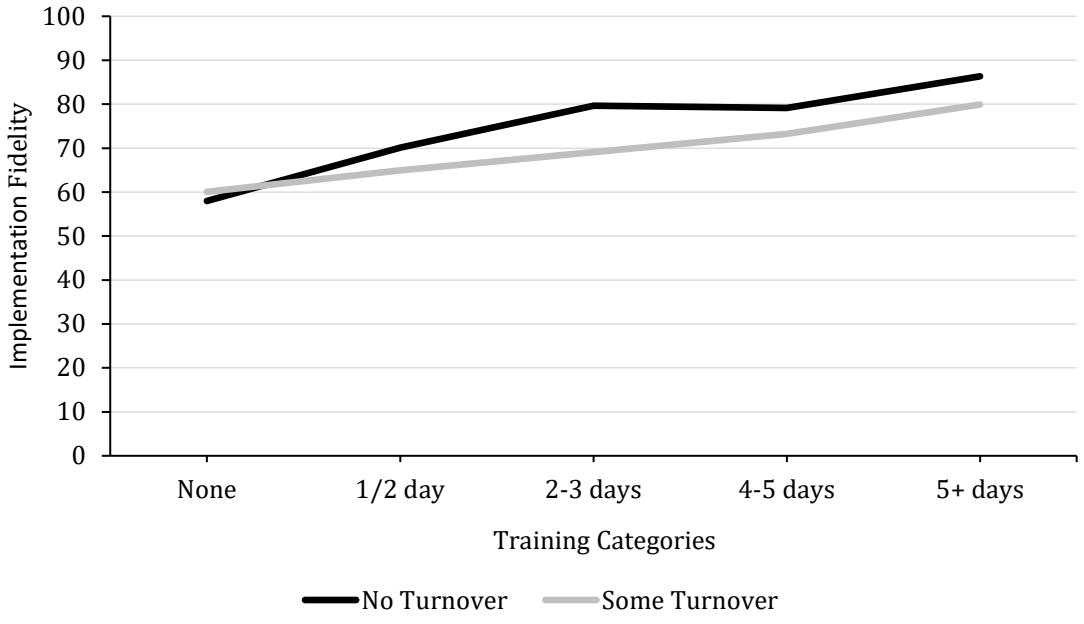

Figure 16. Estimated fidelity scores between Training and Administrator Turnover predicting Tier 1 Implementation Fidelity. Positive slopes correspond with more Training.

Research Question 3.2. To What Extent Does Coaching Buffer the Negative Influences of Administrator Turnover on Tier 1 Implementation Fidelity Over Time?

Moderation regression was then conducted to assess whether Coaching in Year 3 moderated the negative associations between Administrator Turnover in Year 2 on in Year 3. The second moderation model included a total of 255 cases. The categorical Coaching variable included a total of four categories (i.e., none = 0, less than weekly = 1, 1-2 hours per week = 2, and 3 or more hours per week = 3) with "no" Coaching serving as the reference group. Similar to Training moderating variables, there were no significant interaction effects (simple slopes) for Administrator Turnover and the three Coaching categories: less than weekly Coaching (β =. -8.219, *SE* = 14.565, *p* = .573), 1 to 2 hours per week of Coaching (β = -14.571, *SE* = 27.284, *p* = .593), and 3 or more hours per week of Coaching (β = 12.295, *SE* = 42.848, *p* = .774), as compared to schools that received no Coaching. These findings indicate that Coaching did not moderate the relation between Administrator Turnover and Tier 1 fidelity at any of the three levels of Coaching provided to schools, compared to schools that received no Coaching. However, schools that were provided with Coaching and reported that no Administrator Turnover occurred, had higher estimated fidelity scores, based on estimates from the simple slopes (see Figure 17). Lower estimated fidelity scores for schools that received 3 or more hours of Coaching could imply that schools that needed more Coaching were indeed receiving it.

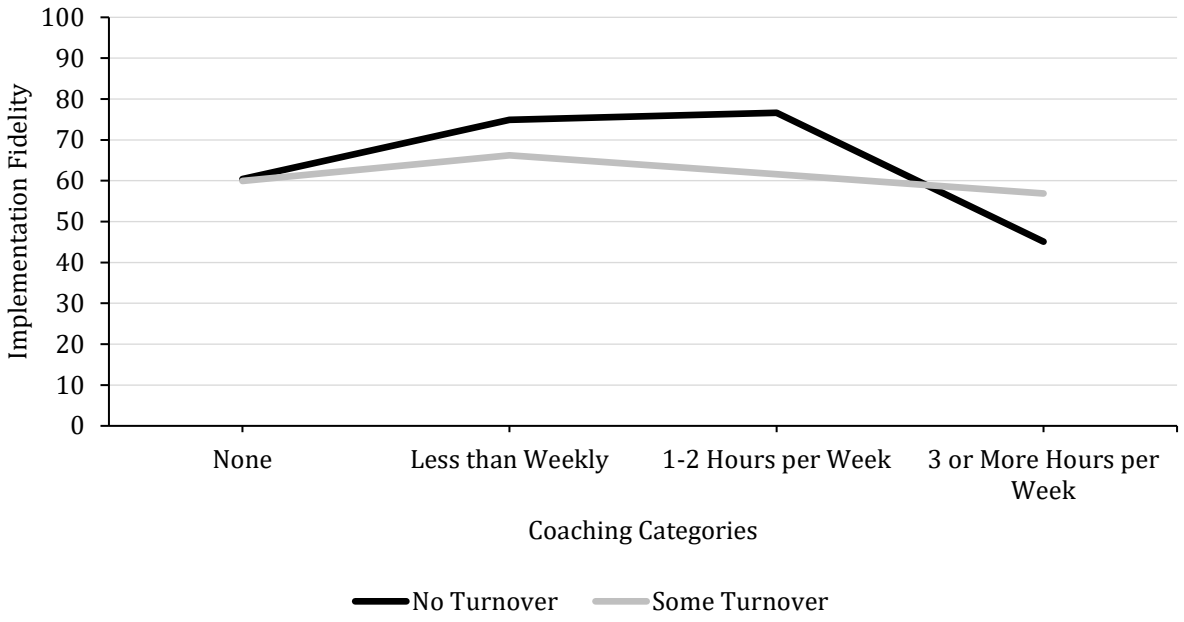

Figure 17. Estimated fidelity scores between Coaching and Administrator Turnover predicting Tier 1 Implementation Fidelity.

Research Question 3.3. To What Extent Does Team Use of Data for Decision Making Buffer the Negative Influences of Administrator Turnover on Tier 1 Implementation Fidelity Over Time?

Single effect moderation analyses were then conducted to examine the interactions between Administrator Turnover and Team Use of Data for Decision Making on Tier 1 Implementation Fidelity. The continuous moderating variable (Team Use of Data for Decision Making) included 374 cases used in the cross-sectional analysis. Results from the one interaction effect (simple slope) between Administrator Turnover and Team Use of Data for Decision Making for Tier 1 fidelity was also found to be insignificant (β = -21.023, *SE* = 16.522, *p* = .203). Using plotting procedures outlined by Aiken and West (1991), estimated fidelity scores one standard deviation below and above the mean were plotted to examine simple slopes testing moderation of Team Use of Data

for Decision Making on the relationship between Administrator Turnover predicting Tier fidelity (see Figure 18). Figure 18 shows that the relation between Tier 1 fidelity and Team Use of Data for Decision Making was positive, but not statistically significant for schools that reported no Administrator Turnover one standard deviation above the mean. For schools that reported some Administrator Turnover, the relation between Tier 1 Implementation Fidelity and Team Use of Data for Decision Making was stable, but not statistically significant.

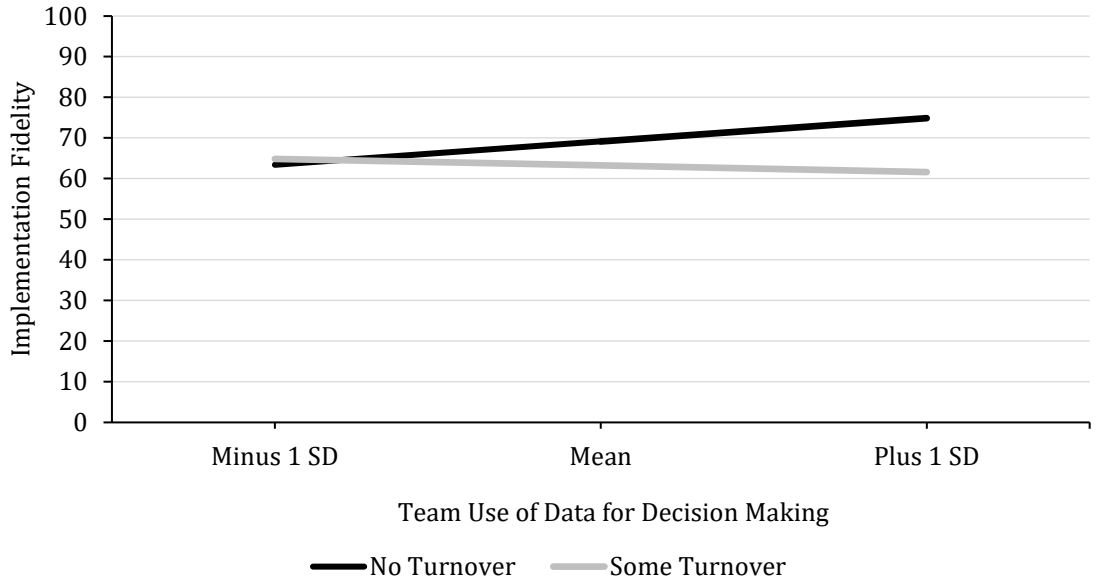

Figure 18. Estimated fidelity scores illustrating the interaction of Administrator Turnover and Team Use of Data for Decision Making on Tier 1 Implementation Fidelity. Positive slope corresponds with no Administrator Turnover.

CHAPTER IV

DISCUSSION

This study aimed to answer three primary research questions. The first research question focused on examining the associations between Administrator Turnover, implementation strategies, and Tier 1 Implementation Fidelity over time. The second research question examined whether associations between Administrator Turnover, implementation strategies, and Tier 1 implementation varied, based on grade level and stage of implementation. Finally, the third research question examined whether implementation strategies buffered the negative effects between Administrator Turnover and Tier 1 implementation over time.

Turnover among administrators has been documented as a critical systems barrier, perceived to hinder the implementation of SWPBIS (Andreou et al., 2015; Kincaid et al., 2007; McIntosh et al., 2014). For example, turnover among staff has been linked to a number of adverse factors, including decreased student learning and academic achievement, depletion of school and district resources, and abandonment of educational initiatives (Boe, Sunderland, & Cook, 2008; Gates et al., 2006; Ronfeldt, Loeb, & Wyckoff, 2013). Specifically, turnover among school administrators, has been cited as one of the strongest perceived barriers to implementing and sustaining SWPBIS (Bambara et al., 2012; McIntosh et al., 2014).

The impetus for the current research study was to examine (a) the degree to which Administrator Turnover was significantly related to the implementation fidelity of SWPBIS over time and (b) whether district and school implementation strategies buffer threats to implementation fidelity resulting from Administrator Turnover. To my

knowledge, this is the first study to longitudinally examine the relations between Administrator Turnover, implementation strategies, and implementation fidelity for schools implementing SWPBIS across multiple years. It is also likely the first study to test whether schools that receive more implementation strategies are able to overcome threats to implementation fidelity, due to Administrator Turnover.

The key hypotheses of this study were: (a) Administrator Turnover and implementation strategies would be significantly related to Tier 1 Implementation Fidelity, (b) relations between Administrator Turnover and implementation strategies would vary by school grade type and stage of implementation, and (c) implementation strategies would attenuate the relations between Administrator Turnover and Tier 1 Implementation Fidelity.

Summary of Findings

First, it should be noted that the majority of autoregressive associations between Administrator Turnover, implementation strategies, and Tier 1 Implementation Fidelity for the three models used to address research question 1 were consistently strong and significantly related over time. Therefore, these autoregressive paths left limited room for the predictive power for other variables included within the models. Moreover, the autoregressive paths for Team Use of Data for Decision Making and Tier 1 implementation were the largest and most stable, indicating that change in these variables was relatively small over time. Interestingly, the autoregressive paths from Year 1 to 2 for Coaching and Team Use of Data for Decision Making were small and insignificant, implying that considerable change within these implementation strategies occurred during the first two years.

The first hypothesis was that Administrator Turnover and implementation strategies would be related to implementation fidelity. Results from the cross-lagged models (1.1, 1.2, and 1.3) for research question 1 showed only one significant and negative cross-lagged (i.e., hypothesized) path between Administrator Turnover in Year 2 and Tier 1 Implementation Fidelity in Year 3. It is possible this relationship was significant related to the implementation strategy assessed. For example, the relation between Administrator Turnover and Tier 1 Implementation Fidelity could have been more dependent on school teams' ability to use data for decision making. However, as this was the only significant path between the two variables, the hypothesis that Administrator Turnover would be negatively and significantly associated with Tier 1 Implementation Fidelity over time was not supported. These results are surprising, given that prior studies have documented the absence of administrator support to be a critical barrier to implementing and sustaining SWPBIS (Kincaid et al., 2007; Pinkelman, McIntosh, Raspica, Berg, & Strickland-Cohen, 2015). It is possible that Administrator Turnover may or may not be related to Tier 1 Implementation Fidelity for many of the schools included within the sample. For example, turnover in administrators does not mean that Tier 1 Implementation Fidelity suffered. Strickland-Cohen, McIntosh, and Horner (2014) note that it is common for administrators to be relocated within schools districts, as part of district policies, or that experienced administrators are often relocated to work in more vulnerable schools. To avoid implementation setbacks, school teams are encouraged to develop proactive strategies for sustaining SWPBIS (Strickland-Cohen et al., 2014). Strategies may include meeting with new administrators and identifying mutually valued goals related to SWPBIS implementation or working with district

personnel to establish strong district policies to help sustain SWPBIS implementation efforts when Administrator Turnover occurs (e.g., funding, technical assistance; Strickland-Cohen et al., 2014).

Results of this study does support the hypothesis that implementation strategies would be significantly related to Tier 1 Implementation Fidelity. For example, Training, Coaching, and Team Use of Data for Decision Making in Year 2 were significantly and positively associated with fidelity in Year 3. These paths suggested that higher levels of implementation strategies in Year 2 were associated with higher levels of fidelity in Year 3. Moreover, Training in Year 3 was significantly and positively associated with fidelity in Year 4 and Team Use of Data for Decision Making in Year 4 was significantly and positively associated with fidelity in Year 5. Therefore, the hypothesis that implementation strategies would be significantly related to Tier 1 Implementation Fidelity was supported. These results relate to prior studies examining the associations of implementation strategies (i.e., ongoing Training and other professional development opportunities) on the implementation and sustainability of SWPBIS systems (Bambara, Nonnemacher, & Kern, 2009; Coffey & Horner, 2012). For example, both McIntosh and colleagues (2013) and Horner and colleagues (2014) found teams using data for decision making to be a significant and positive predictor of sustained implementation of SWPBIS. This study adds to the literature because associations between implementation strategies and Tier 1 Implementation Fidelity were examined across multiple years. By using this longitudinal approach, I was able to examine: (a) in what years implementation strategies were significantly associated with Tier 1 Implementation Fidelity and (b) which implementation strategies were the most stable in schools over time.

Perhaps surprising, and not a hypothesis for this study, there were several significant paths in which Tier 1 Implementation Fidelity was significantly related to implementation strategies in the following year. For example, Tier 1 Implementation Fidelity in Year 1 was positively associated with Training, Coaching, and Team Use of Data for Decision Making in Year 2. Similarly, fidelity in Year 2 was positively and significantly associated with Training schools received in Year 3. These results provide some indication that increased fidelity may be related to increased use of implementation strategies in the following year. Also not a focus for this study, there were several significant paths from Tier 1 Implementation Fidelity to Administrator Turnover. However, because some of these paths were positive, and some were negative, it is possible these significant associations were spurious.

The second hypothesis was that the influences of Administrator Turnover and implementation strategies on fidelity would vary based on grade level and stage of implementation. Interestingly, there were no significant differences between the two groups for Administrator Turnover or implementation strategies, as they related to fidelity. Therefore, the second hypothesis was not supported. These results contrast with Turri and colleagues' (2016) findings, which found systems barriers to be modestly but significantly associated with Tier 1 Implementation Fidelity, but only for schools implementing SWPBIS in the initial implementation and full operation groups. It is also surprising that the association between implementation strategies and Tier 1 Implementation Fidelity did not significantly differ for elementary schools compared to middle schools. For example, Nese and colleagues (2018) found that after initial Training, elementary schools were significantly more likely to reach adequate Tier 1

Implementation Fidelity, than middle schools or high schools. One potential explanation for why there were no significant differences in associations between the implementation strategies and Tier 1 Implementation Fidelity is that the level of implementation strategies elementary and middle schools received was comparable.

Although not a primary focus of research question 2, there were several paths between Administrator Turnover, implementation strategies, and Tier 1 Implementation Fidelity that did significantly differ for elementary and middle schools. For example, Tier 1 Implementation Fidelity in Year 1 for model 1.1 was strongly and negatively related to Administrator Turnover in Year 2 for elementary schools only. Similarly, Tier 1 Implementation Fidelity in Year 1 was significantly and positively related Training in Year 2 for elementary schools only. Also, Administrator Turnover in Year 4 was significantly and positively related to Training in Year 5 for schools in the initial implementation stage compared to schools in the institutionalization stage; however, these findings should be interpreted with caution, due to possible spurious relations.

The third hypothesis was that implementation strategies would buffer the negative influences of Administrator Turnover on Tier 1 Implementation Fidelity over time. Specifically, research question 3 aimed to address whether Training, Coaching, and Team Use of Data for Decision Making moderated the relations between Administrator Turnover and Tier 1 Implementation Fidelity. Findings revealed that none of the implementation strategies had a moderating effect on Administrator Turnover. However, schools that reported not having Administrator Turnover had higher predicted fidelity scores across all three implementation strategies, even though these findings were not statistically significant. Interestingly, schools that were offered more Coaching (3 or

more hours per week), and reported that no Administrator Turnover occurred, had lower predicted Tier 1 Implementation Fidelity scores, compared to schools that reported Administrator Turnover had occurred. Furthermore, both schools with and without Administrator Turnover, that received more Coaching had lower predicted Tier 1 Implementation Fidelity scores. One explanation for this finding is that schools that were implementing with lower fidelity were offered more Coaching by their districts (i.e., low fidelity is the cause of assignment of more Coaching from the district). Alternatively, Coaching could have been ineffective, and therefore was not associated with higher implementation fidelity (Mathews, McIntosh, Frank, & May, 2014). For example, interview findings from Bambara and colleagues (2009) showed that close to half of the participants engaged in implementing Tier 3 support systems reported that poor technical assistance to teams was a barrier in terms of implementing the advanced tiers of support.

Limitations

There are a number of important limitations to this longitudinal study worthy of discussion. These limitations, to some degree, affected the results of this study. Limitations were primarily related to: (a) SEM models selected to answer the research questions, (b) participant attrition and missing data, and (c) predictor and outcome variables used in the study.

Modeling

Cross-lagged panel SEM modeling was used to address research question 1 (Burkholder & Harlow, 2003; Christens et al., 2011; Selig & Little, 2012). Selig and Little (2012) outlined several assumptions that need to be met when using cross-lagged panel modeling. Several of these model assumptions were likely violated in this study to

some extent, which may have affected the results. For example, it is assumed that there is no measurement error within variables used in the cross-lagged panel models. For this reason, Selig and Little (2012) recommend using latent constructs with multiple indicators to reduce measurement error. However, this study examined only observed variables within the cross-lagged panel models. Therefore, it is likely that measurement error biased the results to some degree. For example, Tier 1 Implementation Fidelity was treated as an observed variable, and scores on the Tier 1 fidelity measures ranged from 0 (not implementing any critical features of Tier 1 SWPBIS) to 1 (fully implementing all critical features of Tier 1 SWPBIS). For schools that completed multiple Tier 1 Implementation Fidelity measures (e.g., TFI and BoQ), a mean score from the measures was used. Although all five Tier 1 fidelity measures used in the current analyses were on the same scale (0 – 1), and there is evidence of strong convergent validity between these measures (Mercer et al., 2017), items across the measures vary, and therefore measurement error across the fidelity measures is expected.

Additional measurement error for this study is also potentially related to (a) when measures (i.e., Tier 1 Implementation Fidelity measures, ADEPT, ABISS) were completed and (b) who was completing the measures across the study years. Selig and Little (2012) highlighted the importance of measuring all variables at the same time across each of the time points (e.g., Year 1 to Year 2 to Year 3) to decrease measurement error. Unfortunately, this was not feasible for the current study because data collected on barriers, implementation strategies, and Tier 1 Implementation Fidelity were completed at different time points over time. Respondents from schools completed the ABISS survey at the beginning of each year and Tier 1 Implementation Fidelity measures and ADEPT

surveys at the end of each year. Therefore, time between when each measure was completed is likely a source of measurement error. Moreover, because respondents completed each of the measures for each of the five years, it is likely that the respondents completing each of the measures varied over time, possibly due to changing positions within the schools or turnover. In addition, schools completing the implementation fidelity measures may or may not have completed them each year with the assistance of school or district coach who is responsible for guiding schools through the measurement process. McIntosh and colleagues (2017) recently showed evidence that schools teams completing the Tier 1 scale of the TFI were more reliable and consistent with other Tier 1 fidelity measures, compared to school teams who completed the TFI without the guidance of coach. Therefore, respondents from schools in this study, who likely completed one or more of the fidelity measures without an external coach, would have also created potential sources of measurement error within the data.

Finally, cross-sectional moderation was used to examine the interactions between Administrator Turnover in Year 2 and implementation strategies in Year 3 on Tier 1 Implementation Fidelity also in Year 3 (research question 3). Moderation was not able to be tested using the cross-lagged models to address research question 1, due to limited sample sizes for some of the categorical moderating variables. Therefore, the cross-sectional moderation model was not able to control for autoregressive effects, which could have inflated the results. In addition, Cole and Maxwell (2003) noted that it can be problematic to examine moderation effects when testing two variables (Administrator Turnover and implementation strategies) that occurred at different points in time. For example, due to the amount of time that elapsed between collecting data on the predictor

variable (beginning of the year) and moderator variable (end of the year), it is likely this resulted in obtaining additional measurement error.

Participant Attrition and Missing Data

Sample size for this study and attrition of schools over time limited SEM modeling complexity and certain analyses. Selig and Little (2012) noted that missing data, especially data not missing at random, is likely to bias results. For this study, it is reasonable to assume that missing data, particularly in the outcome variable, is most likely not due to random missingness, but rather schools abandoning the implementation of Tier 1 SWPBIS. As more schools dropped out or abandoned the implementation of Tier 1 SWPBIS over time during the study, it is plausible that the missing data could have biased results, and decreased the power to detect significant positive or negative relations (Kang, 2013).

The amount of missing data was problematic in terms of running more complex SEM cross-lagged models, which include using latent factors. For example, Tier 1 Implementation Fidelity was originally intended to be treated as a latent factor consisting of the five fidelity measures (SET, TFI, BoQ, SAS, and TIC). Although a fidelity latent factor fit the data well in Year 1 (RMSEA =.041, CFI = .999, and SRMR = .001), model fit substantially degraded by Year 5 (RMSEA = 1.70, CFI = .455, SRMS = .006), due to missing data among fidelity measures over time.

Moreover, it is important to note that the amount of missing data for each of three cross-lagged models used to answer the research questions varied, based on the amount of missing participant data for each implementation strategy included in the cross-lagged path models (Training, Coaching, and Team Use of Data for Decision Making). Although

ML accounted for missing data in the Tier 1 Implementation Fidelity over time, it did not account for missing data in the implementation strategies. For these reasons, cross-lagged panel model 1.1 (Training implementation strategy) consisted of 563 cases, cross-lagged panel model 1.2 (Coaching implementation strategy) consisted of 430 cases, and cross-lagged panel modeling 1.3 (Team Use of Data for Decision Making implementation strategy) consisted of 351 cases. Although there were significant associations across the three implementations strategies for research question 1, these significant associations are not equal, making comparisons of strength of association between the implementation strategies difficult. For example, although Training ($\beta = .283$, $p < .001$) and Coaching ($\beta = .273$, $p = .002$) in Year 2 were more strongly associated with fidelity in Year 3, compared to Team Use of Data for Decision Making ($\beta = .175$, $p = .031$), there were fewer cases for the Team Use of Data for Decision Making implementation strategy.

Missing data also limited the number of invariance tests that could be conducted for research question 2, which tested differences in grade level and stage of implementation for cross-lagged paths analyzed for research question 1. Even after the number of categories for the implementation strategies (Training and Coaching) were reduced by combining specific categorical response options into fewer categories to decrease the number of responses within each response option, there continued to be a lack of data for specific invariance tests. For example, comparisons between Training and Coaching were unable to be computed because there were little to no data for categorical response options among implementation strategies and enough data between school types, such as elementary compared to high schools.

Predictor and Outcome Variables

This study examined only the influences of one systems barrier and three implementation strategies on Tier 1 implementing fidelity over time. As previously described in the literature review, there are other systems barriers known to negatively affect SWPBIS implementation. For example, lack of staff buy-in, resources (e.g., money, time), competing initiatives, and consistency in implementing SWPBIS have all been documented as barriers affecting Tier 1 SWPBIS implementation (Kincaid et al., 2007; Pinkelman, McIntosh, Raspica, et al., 2015). Likewise, the implementation strategies examined for this study were limited to (a) Training, (b) Coaching, and (c) Team Use of Data for Decision Making. Regrettably, data were not collected to determine what kinds of Training and Coaching activities were provided or offered to schools. Therefore, I was unable to evaluate whether specific Training and Coaching activities were more significant to fidelity than others.

In addition, it is highly possible that schools in this study were receiving other implementation strategies that were not collected from the ADEPT measure, which could have positively affected the results of this study. For example, Kincaid and colleagues (2007) found parent and community support, team membership, communication among staff, and district support to all be important and routinely used implementation strategies for implementing SWPBIS. Moreover, Pinkelman et al. (2015) found that resources, demonstrating effectiveness, and consistency of implementation efforts were also described as important facilitators to sustaining SWPBIS efforts.

Implications for Future Research

Based on the results and limitations of this study, there are a number of implications and directions for future research. These directions include (a) developing and validating a more thorough measure of systems barriers and implementation strategies for SWPBIS implementation research, (b) closely examining the influences of systems barriers and implementation strategies of SWPBIS implementation fidelity across all three tiers of support, and (c) examining whether implementation strategies can buffer the harmful influences on systems barriers on SWPBIS implementation over time. To investigate these future research directions, a program or research is described in the following section and presented in Figure 19.

Developing and Validating Measures

In this study, data on systems barriers and implementation strategies were gathered from the ABISS and ADEPT survey measures. Both measures are relatively short. For example, the ABISS is limited to five items, with three items strong weighted towards turnover (i.e., Administrator Turnover, implementation team turnover, and general staff turnover; Turri et al., 2016). In addition, the ADEPT only includes four items related to the number of days or hours of professional development provided or offered to schools to implement SWPBIS (i.e., school events, training, release time, and coaching provided and offered; McIntosh et al., 2012). It is expected that there are other systems barriers and implementation strategies that routinely affect SWPBIS implementation, which are not assessed within these two measures. Unfortunately, implementation strategies are often not examined to the degree necessary to make

inferences about what types and functions of implementation strategies are most beneficial for implementers of SWPBIS (Massar, 2017).

The first phase of a potential program of research should focus on developing and validating a comprehensive survey measure of systems barriers and implementation strategies, known to affect the implementation and scalability of SWPBIS. To create this future research should consider an iterative process consisting of (a) developing items related to systems barriers and implementation strategies, (b) refining survey items, and (c) validating them. One approach would be to use a modified Delphi technique (Powell et al., 2015), where consensus regarding implementation strategies and systems barriers affecting SWPBIS implementation may be gathered through experts in the fields of SWPBIS using an expert panel. First, a structured literature review of published and gray literature could be conducted to obtained information related the different types of systems barriers and implementation strategies documented to affect SWPBIS implementation. Through this structured review, items could be developed for an initial implementation survey of systems barriers and implementation strategies. Second, once initial items are developed, items could be sent to an expert panel comprised of researchers, practitioners, policy makers, in the fields of SWPBIS to gathering feedback (e.g., edit, revise, propose new items) and obtain content and face validity (Considine & Martin, 2005). Once feedback is obtained, items could then be revised and re-distributed to the panel for final feedback and approval. The revised survey could then be administered to a sample of several hundred schools to obtain data, for the purposes of conducting an exploratory analysis. This would allow future researchers to (a) identify specific survey items that belong together (i.e. structural validity), (b) eliminate

redundant items, and (c) establish the internal consistently of the measure (Considine & Martin, 2005; C. C. Lewis, Weiner, Stanick, & Fischer, 2015).

During this measurement refinement process, future research could also test whether response options for the individual items of the measure should include continuous semantic differential rating scales (Albaum, Best, & Hawkins, 1981). For example, for the systems barrier items, a semantic differential rating scale may include anchors on each end ranging from "significant" to "insignificant," with a central line where participants can move from left to right to indicate their ratings of how specific systems barriers affected SWPBIS implementation efforts in their schools. As noted in the limitations, some categorical responses for the ABISS and ADEPT measures contained very few participant responses, making invariance tests problematic for certain malleable and non-malleable school groups (i.e., high schools, Coaching implementation strategy). Another potential option for measuring individual barriers and implementation strategies would be to use more event-based measurement methods. For example, instead of measuring perceptions of barriers and implementation strategies used, survey items could also be ask respondents to record whether specific barriers occurred during each school year. For example, "how many school-wide initiates were being implemented between last year and this one?"

Differential Associations Across Tiers

Although there were a number of studies described in the literature review examining the perceived impact of specific systems barriers and implementation on implementation and sustainability of SWPBIS (Andreou et al., 2015; Coffey & Horner, 2012; Kincaid et al., 2007), very few studies have examined the associations of specific

systems barriers and implementation strategies on the implementation fidelity of individual SWPBIS tiers. Future research is needed to understand whether specific implementation strategies and systems affect implementation fidelity at a higher degree for specific tiers (e.g., Tier 2 vs. Tier 3). For example, is Coaching (in person or telecommunication) more critical for overcoming systems barriers related to school teams struggling to efficiently and effectively use data for decision making at Tier 2 compared to Tier 1?

For these reasons, the second phase of this future research should focus on examining the influences of different systems barriers and implementation strategies on SWPBIS implementation fidelity across all three tiers. One approach would be to administer the new implementation survey to a large sample of schools implementing SWPBIS across all three tiers and using the TFI (Algozzine et al., 2014) as their fidelity tool. By including only schools completing the TFI, researchers would (a) remove some of the variance across the fidelity measures and (b) be able to gather implementation fidelity data at Tiers 2 and 3. Researchers could then use data collected from the new implementation survey and the TFI to examine the group differences in implementation strategies and systems barriers for implementation fidelity across all three tiers. One approach would be conduct multi-group SEM predictive modeling. Using this approach, a multi-factor solution of systems barriers and implementation strategies predicting implementation fidelity across individual or all tiers could be identified (Closs & Bryar, 2001). Through this multi-factor model, research could test whether there is structural invariance between the impact of specific implementation strategies and systems barriers on implementation fidelity at individual tiers, based on grade level (e.g., elementary vs.

middle school) and stage of implementation (e.g., initial implementation vs. institutionalization; C. C. Lewis et al., 2015). For example, does using a blueprint to guide SWPBIS implementation (implementation strategy) predict Tier 1 Implementation Fidelity across both elementary and high schools?

Buffering Harmful Influences

Knowing which systems barriers and implementation strategies are more influential at specific tiers of implementation, could inform practitioners to select and implement specific implementation strategies to buffer the negative influences of specific systems barriers during implementing on specific SWPBIS tiers. Therefore, in phase 3, future research would use the same large scale sample of schools collected in phase 2 to examine and test moderating influences of implementation strategies between systems barriers and implementation fidelity, across individual tiers of support. A primary goal of phase 3 would be to identify which implementation strategies practitioners should use to buffer the harmful influences of specific systems barriers at specific tiers. This would give practitioners evidence-based solutions (e.g., action plans, implementer guides) to overcome systems barriers. SEM cross-lagged panel or predictive modeling could be two potential methodological approaches for testing moderating and mediating influences to address the research aims for phase 3 (Little, Card, et al., 2007).

Implications for Practice

Results of this study provide several important implications for implementing and sustaining SWPBIS. First, although findings did not demonstrate significant associations between Administrator Turnover and Tier 1 Implementation Fidelity over time, it does not necessarily mean Administrator Turnover is not an important barrier for schools

implementing SWPBIS. For example, Administrator Turnover can cause staff to shift priorities, decrease morale and buy-in, and deplete school resources (Garner, Hunter, Modisette, Ihnes, & Godley, 2012; Strickland-Cohen et al., 2014). All of these consequences can, in turn, negatively affect the fidelity to which SWPBIS is implemented.

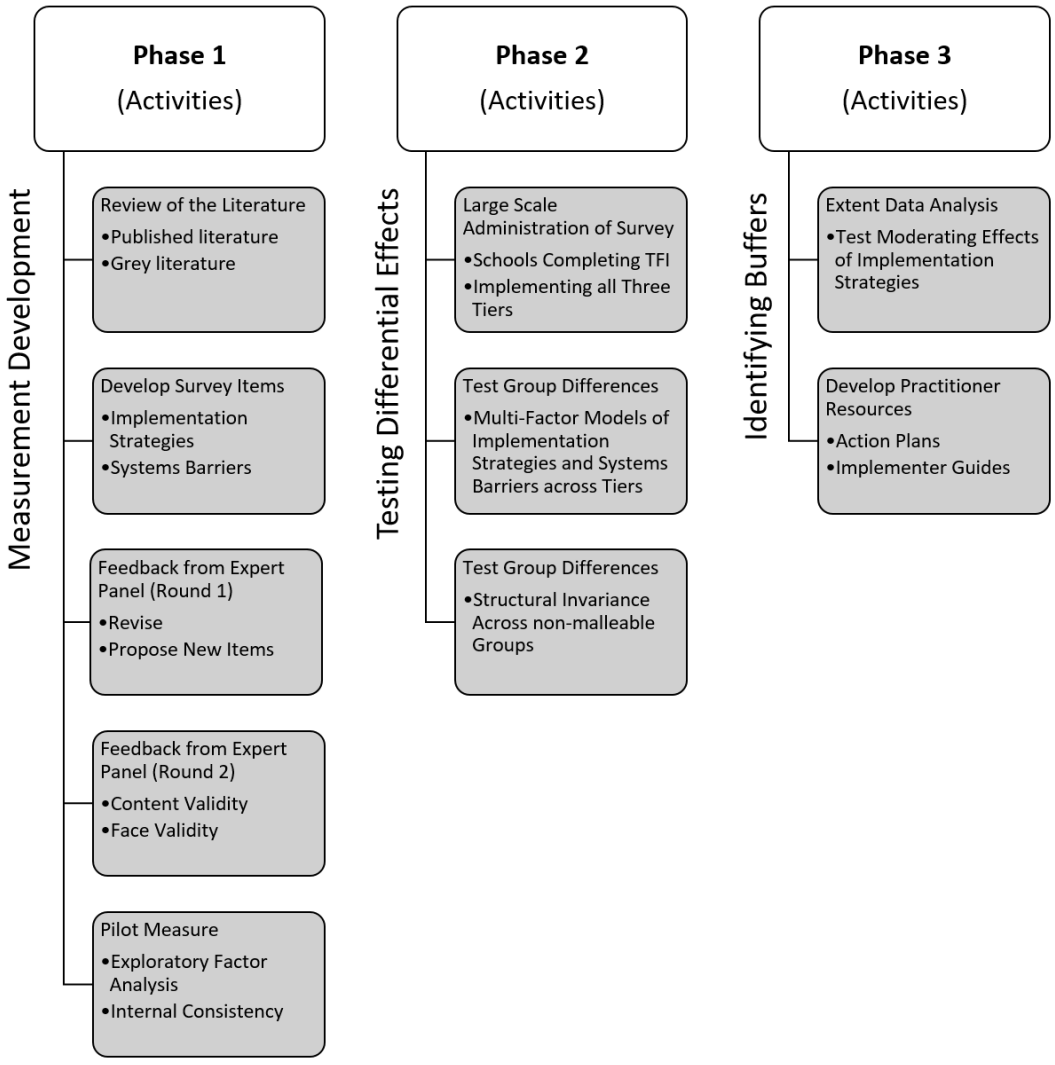

Figure 19. A program of research for assessing implementation strategies and systems barriers.

As Administrator Turnover is a reoccurring and costly barrier, leadership teams implementing SWPBIS need to consider ways to protect against these types of risk factors. Prior to Administrator Turnover occurring, during the installation and initial implementation phases, school teams should anticipate that turnover in school leadership will occur. School teams need to be prepared for the possibility that incoming administrators may not share the same views about SWPBIS or be unfamiliar with SWPBIS. Therefore, staff should consider using proactive strategies to address potential concerns regarding SWPBIS that administrators may have. These strategies may include (a) identifying ways to integrate SWPBIS with other initiatives that incoming administrators see as competing with SWPBIS and (b) explaining how SWPBIS addresses important and meaningful school and student outcomes (Flannery, Frank, Kato, Doren, & Fenning, 2013; Strickland-Cohen et al., 2014).

Districts also play a significant role in creating the protective factors necessary to prevent these types of systems barriers from occurring (Horner et al., 2018). For example, Horner and colleagues (2018) recently noted that district policies can be developed for "selecting new staff with a focus on multitiered systems, redefining the role and opportunities for building administrators, and supporting school teams (e.g., protection of team meeting time, training in team problem solving, ensuring team access to fidelity and student outcome data)."

District leadership teams should also consider efficient ways to measure Administrator Turnover and other systems barriers, in order to address implementation challenges as they occur. By documenting when and where systems barriers are occurring, district leadership teams will be able to target and provide specific

implementation strategies (e.g., Training and Coaching) to vulnerable school teams needing support. For example, if district teams identify a particular school struggling to implement multiple or competing initiatives, district personnel could help schools to prioritize implementation efforts, so that all schools within districts are implementing the same initiative.

Findings did indicated that district and school implementation strategies were positively related to SWPBIS implementation over time. Interestingly, the most significant associations between implementation strategies and fidelity were found in Year 3. This could mean that some implementation strategies were less frequently or inconsistently used during the first few years of implementation. For example, there was a significant change for Coaching and Team Use of Data for Decision Making from Years 1 to 2. Recent findings from Nese and colleagues (2018) provide some support by showing that only 30% out of 708 schools reached high Tier 1 Implementation Fidelity a year after initial training. Therefore, it is important that district and school teams invest heavily in the use of these implementation strategies during the early years of implementation (McIntosh et al., 2018). As a result, staff experiencing early success with SWPBIS implementation efforts may gain momentum and have positive carryover effects, resulting in increased use of these implementation strategies in the following year.

Also, district leadership teams should consider the function that each implementation strategy serves, when providing support (targeted or intensive) to schools struggling to overcome barriers. As district resources are limited, leadership teams need to identify ways to invest wisely in their use of implementation strategies. For example,

instead of conducting expensive school-wide trainings at the beginning of each school year when there is turnover, district leadership teams may consider using other, less expensive support strategies (Horner & Sugai, 2018) to achieve the desired results. District leadership teams may want to have new administrators meet with model demonstration schools to gain knowledge and input regarding implementing SWPBIS. These leadership teams may also choose to focus more in low-cost coaching systems to support continued implementation after initial training, instead of re-training staff each year (Massar, 2017).

Finally, findings from the present study suggest that the influence of systems barriers and implementation strategies on Tier 1 Implementation Fidelity were similar over time, across the different stages of implementation and grade levels, which has several important implications for practice. For example, it appears that even during the early stages implementation, schools avoided potential threats to implementation due to Administrator Turnover. This could imply that many of the districts were proactive in addressing Administrator Turnover, thereby safeguarding against threats to SWPBIS. Second, findings suggest that implementation strategies provided to elementary and middle schools had similar implications for Tier 1 Implementation Fidelity. These results provide some indications that districts may not need to invest more heavily in resources to support middle schools in achieving similar positive outcomes, related to SWPBIS implementation, as elementary schools.

Conclusion

This longitudinal study assessed the stability and associations of critical variables known to influence the implementation and sustainability of SWPBIS. Training,

Coaching, and Team Use of Data for Decision Making were all found to significantly and positively affect Tier 1 Implementation Fidelity over time. Future research is needed to extend the current findings and explore other systems variables that may enhance or inhibit SWPBIS implementation.

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