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The Effects of a Video Self-Analysis Package on Pre-Service Teachers' Use of Behavior-Specific Praise

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This study used a single-subject, multiple baseline across participants research design to explore the effects of a multi-component intervention on pre-service teachers' use of behavior-specific praise (BSP). The intervention consisted of explicit instruction and modeling of the skill, followed by on-going video self-analysis, self-monitoring, and performance feedback. Participants *(n*=4*)* were undergraduate senior teacher education students who were completing their student teaching semester. Results indicate improvements in BSP rates across all four student teachers, and participants found the intervention to be socially valid. Implications for future research and practice are discussed.

Keywords: classroom management, pre-service, single-subject research, teacher preparation, video analysis

A clear connection exists between effective classroom management and positive outcomes for teachers and students (Oliver & Reschly, 2007; Ross et al., 2012). Teachers who are effective classroom managers report higher job satisfaction and lower stress (Caprara et al., 2006). Students who are in well-managed classrooms that promote positive behavior experience academic benefits (Sutherland & Wehby, 2001). Given the importance of classroom management, preparing pre-service teachers to use evidence-based classroom management strategies is crucial, and can potentially prevent the negative outcomes for teachers and students that are associated with poor classroom management (Klassen & Chui, 2010). All teachers need to have the skills necessary to support students in more inclusive, diverse classrooms. This requires the implementation of empirically supported practices within preparation programs, to ensure the success of their teacher education graduates and their future students.

Researchers have outlined evidence-based classroom management practices, including the following: (a) maximize structure in your classroom; (b) post, teach, monitor, review, and reinforce a small number of positively stated expectations; (c) actively engage students in observable ways; (d) establish a continuum of strategies to acknowledge appropriate behavior; and (e) establish a continuum of strategies to respond to inappropriate behavior (Simonsen et al., 2008). Supporting pre-service teachers' development of specific evidence-based teaching behaviors that lead to the successful implementation of these five critical features will likely increase their ability to effectively manage their classrooms in the future. This study will focus on increasing pre-service teachers' use of behavior-specific praise (BSP), which is a discrete skill that can be used across instructional settings to aid in positive classroom management. Given the demands and difficulty of student teaching, we chose to focus on only one classroom management strategy. We chose BSP because it is one of the most effective classroom management strategies yet is often used infrequently (Cavanaugh, 2013).

Teacher praise is an affirmative statement delivered from a teacher to a student immediately following a desirable academic or social behavior (Musti-Rao & Haydon, 2011). Specific praise is a reinforcement strategy in that contingent use of BSP can increase the likelihood that a student will display the same behavior in the future (Thompson et al., 2012).

Research has demonstrated that increased use of BSP can reduce disruptive student behaviors (Royer et al., 2019). Additionally, BSP statements correlate with increases in student engagement with academic tasks (Fullerton et al., 2009).

Jenkins and colleagues (2015) conducted a review of the literature on praise rates and types. While the existing literature base is somewhat limited and dated, their findings indicate that mean praise rates appear to vary, from a low of 1.75 to a high of 8.8 BSP per hour in general education, and 5.2 BSP statements per hour in special education (Jenkins et al., 2015). A recent study examining general education teachers' praise rates found that the frequency of BSP rates is relatively low, with mean rates of 5.9 BSP statements per hour (Floress et al., 2018). Instead of using positive strategies such as BSP, teachers leading classrooms that have high rates of undesirable student behavior tend to rely on reactionary, coercive tactics such as reprimands, threats, and exclusion (Haydon & Hunter, 2011). One of the reasons teachers resort to these practices is that they can be immediately effective in stopping aversive behaviors (Alber & Heward, 2000). Over time, relying on these negative, reactionary practices can amplify behavioral problems by inadvertently reinforcing unwanted behavior and alienating students in need of support (Biglan, 2015).

Perhaps BSP is used infrequently because many teachers report receiving little or no instruction in effective classroom management practices in their teacher preparation programs (Begeny & Martens, 2006; Darling-Hammond et al., 2009). Given the lack of consistent training in evidence-based classroom management practices, it is not a surprise that many educators do not use BSP with frequency to encourage positive behavior in their classrooms. Implementing empirically-supported practices within teacher preparation programs could potentially support the development of good teaching habits early on and prevent teachers from resorting to ineffective, reactionary discipline practices in response to undesirable student behavior.

A recent review of praise research trends found that many effective interventions include multiple components (e.g., didactic training, feedback) within a single intervention package to improve teacher praise rates. The authors recommend that more research is needed to understand less frequently studied training methods, such as self-monitoring (Floress et al., 2017). Existing research indicates that interventions incorporating self-monitoring to

improve BSP rates are effective (Reinke et al., 2008; Simonsen et al., 2013). Video self-analysis (VSA) is one method teachers can use to self-monitor, yet researchers have not incorporated it into multi-component interventions intended to improve BSP.

Studies have shown that interventions supported by technology can improve pre-service teachers' classroom management practices. For example, Dawson and Kraft (2017) used virtual simulation via a mixed reality environment to improve teacher candidates' use of BSP, and visual analysis of results supported a functional relation. Despite their effectiveness, virtual simulation and mixed reality environments can be costly for teacher preparation programs, and teacher preparation programs would benefit from having less expensive alternatives (Dawson & Kraft, 2017).

Researchers have identified VSA as an intervention that supports teacher development (Osmanoglu, 2016). VSA involves having teachers view videos of their teaching. Research has demonstrated that this is an effective strategy and can be beneficial for both in-service (Kennedy et al., 2017) and pre-service teachers (Wu & Kao, 2008). A recent evaluation of the evidence base of video analysis found significant findings across experimental research studies, and the authors concluded that it is a promising practice for teacher training (Nagro & Cornelius, 2013). VSA has primarily been used in teacher preparation as a tool to help pre-service teachers reflect on aspects of their teaching. One study examined the effects of guided video analysis on pre-service teachers' reflective and instructional abilities during student teaching and found significant growth when video analysis was paired with directed guidance and feedback (Nagro et al., 2017). Participants watched videos that were 12-20 minutes in length four times during their student teaching semester.

Recording and analyzing teaching is becoming a common practice within teacher preparation and credentialing (Nagro & Cornelius, 2013). Although there is some evidence that VSA is an encouraging practice, researchers have not used an experimental research design to test the effects of VSA as part of a multi-component intervention on pre-service teachers' use of evidence-based classroom management skills, as measured by direct observation in a classroom setting (VanLone et al., 2020).

Pre-service teachers will be bestTablww prepared to use evidence-based classroom management strategies if they have had opportunities to practice and analyze their behaviors during their student teaching semester. Providing opportunities for student teachers to directly observe and analyze their teaching behaviors could be useful in supporting their development as effective, proactive classroom managers. Teachers at this stage of their development are beginning to acquire knowledge and skills, and therefore, a multi-component intervention may be needed to assist pre-service teachers in becoming fluent in using evidence-based classroom management practices.

The purpose of this study is to determine whether a multi-component intervention that combines explicit instruction, modeling, self-monitoring using VSA, and performance feedback is an effective intervention for increasing pre-service teachers' use of BSP. While studies have examined the effects of multi-component interventions that include technology on pre-service teachers' classroom management practices, the outcome of interest is often an indirect measurement, such as increased knowledge or efficacy in classroom management. Also, research is needed on the effectiveness of self-monitoring interventions on improving BSP. This study contributes to the literature by examining the effects of a multi-component intervention that incorporates technology and self-monitoring on directly observed and measured pre-service teacher behavior change during student teaching. Explicit instruction and modeling components were included to ensure participants' initial understanding of BSP. Performance feedback was included as a component because it is an evidence-based teacher training strategy that can provide reinforcement for use of BSP. This reinforcement will increase the likelihood that the participant will continue to use BSP (Reinke et al., 2007).

This intervention was purposefully designed to be practical and easy to implement in existing teacher preparation programs and utilizes evidence-based strategies to support a high-quality student teaching experience. In practice, it would be unlikely that any component occurs in isolation. Therefore, the researchers intended to test the multi-component intervention as a package. While components of this intervention have been previously experimentally tested, this study is unique because it includes VSA as part of the package.

This research study will address the following experimentally-tested research question: Is there a functional relation between the multi-component intervention and pre-service teachers' increased use of behavior-specific praise?

Method

Participants and Settings

Participants in this study were all senior undergraduate students enrolled in an integrated Bachelors/Masters (IBM) teacher certification program at a large public university in the northeast. Participants were recruited to be in this study through an e-mail that was sent to all senior undergraduate teacher education students. Students who responded with interest were asked to attend a meeting with the lead researcher. During this meeting, the researcher reviewed the rationale, purpose, and study procedures. Students were given the option to sign a consent or opt-out of participation. All participants previously completed a required semester of coursework in evidence-based classroom management practices and were randomly assigned to intervention order (Kazdin, 2011). Pseudonyms were used to maintain confidentiality.

Participant 1. Maria was a 21-year-old, Asian-American senior working toward teacher certification in the IBM Elementary Education program. She was completing her student teaching in a second-grade inclusive classroom. Several students in the class had an Individualized Education Program (IEP) or 504 Plan. The school, located in a rural area, served a student body of 380 students in grades K-2. Ninety-one percent of students were white, 4% of students were Hispanic/Latino, and the remaining 6% of students were Black/African American or Multi-Racial. Fourteen percent of the school population qualified for free or reduced lunch.

Participant 2. Karly was a 21-year-old, Caucasian senior working toward teacher certification in the IBM Music Education program. She was completing her student teaching at a middle school, and she taught inclusive chorus to all students in the building, including those with IEPs and 504 plans. The school was located in a suburban area. Forty-eight percent of students were Black/African American, 28% of students were white, 16% of students were Hispanic/Latino, 4% of students were Asian, and 4% of students are Multi-Racial. Thirty-seven percent of students qualified for free or reduced lunch.

Participant 3. Joe was a 22-year-old, Caucasian senior working toward teacher certification in the IBM Music Education program. Joe taught grades 9-12 elective chorus, and his classes included students with IEPs and 504 plans. He was placed in a regional public high school that served 1,225 students in a rural/suburban area. Eighty-seven percent of students were white, 6% of students were Asian, 4% of students were Hispanic/Latino, and 2% of students were Black/African American. Thirteen percent of students qualified for free or reduced lunch.

Participant 4. Gabrielle was a 22-year-old, Caucasian senior working towards teacher certification in the IBM Special Education program. She was placed in an urban school that served 509 students. Twenty-nine percent of students were white, 38% of students were Hispanic/Latino, and 28.5% of students were Black/African American. Fifty-eight percent of students qualified for free or reduced lunch. Gabrielle was completing her student teaching in a fourth-grade special education classroom, where all students had an IEP. She provided individualized and small group instruction during resource periods, and also supported her students when they were included with peers in general education classrooms.

Dependent Variables

The experimentally-tested dependent variable (DV) for this study was the rate of one specific classroom management skill, BSP. BSP was defined as a statement given to a student that provides specific, affirmative feedback indicating approval of academic or social behavior (example: Thank you for raising a quiet hand; I like the way the back table is taking turns; non-example: nice job!).

Measures and Tool

Data collection tool. Data collectors used a data observation tool to tally instances of BSP. To begin, data collectors reviewed the definition of BSP. The tool tracked total counts within each one-minute interval and a total number of BSP statements per 15-minute session, which data collectors converted to rate by dividing the total number of BSP statements recorded by the number of minutes observed.

Observer training. Doctoral students with extensive experience coding video observations for classroom management skills served as data collectors. For reliability, data

collectors participated in training with the lead researcher. This included instruction in the operational definitions of DV, an overview of the data collection tool, and two direct observations using videos of classroom instruction with 90% inter-observer agreement (IOA) with the lead researcher. Across participants, IOA was calculated for 30.85% of phase A observations, 31.24% of phase B observations, and 31.94% of phase B1observations. IOA was calculated for DVs by calculating the number of intervals with agreement, defined as an interval having the same number recorded by both observers, divided by the total number of intervals for each observation. Agreement across phase A averaged 97.08% for participant rate of BSP. Agreement during phase B was 88.33% for participant rate of BSP. Finally, agreement during phase B1 was 89.99% for participant rate of BSP.

Measure of fidelity. Fidelity data were collected for each of the trainings by using a checklist, which was based on the intervention procedures. The checklist was filled out by an independent observer who was present at the training sessions. Thirteen questions were developed to track the fidelity of implementation of the training. Observers marked that each area was fully covered, partially covered, or not covered during the intervention. Participants' adherence to the thirteen study procedures was measured by collecting completed data collection tools and self-monitoring spreadsheets. This was scored by calculating a percentage of observed procedures over the total number of procedures.

Measure of social validity. The purpose of this measure was to assess the intervention's usability, acceptability, and feasibility. Social validity data was gathered by using the Teacher Preparation Intervention Questionnaire (TPIQ), which was adapted for this study based on the Intervention Rating Profile-15 (IRP-15). The psychometric properties of the IRP-15 indicate that it is a reliable measure of the social validity (Witt & Elliot, 1985). Participants responded to six questions using a 1 through 5 scale, by recording a 1 (strongly disagreed with the statement), 2 (slightly disagreed), 3 (neither agreed or disagreed), 4 (slightly agreed), or 5 (strongly agreed). A higher score indicated higher social validity for each question except for question 5, which was reverse scored.

Measure of BSP knowledge. As part of the training sessions, participants completed a pretest and posttest. Both tests assessed knowledge of BSP. Participants were asked to provide

a definition of BSP and describe an example and non-example. To be considered correct, responses needed to define BSP as a positive statement that specifically described the academic or social being praised. Examples could include a student-specific statement describing a desired behavior, such as "Thank you to the front row for putting your work away," and non-examples could describe an error correction or general praise statement. The posttest also asked participants to describe study procedures.

Measures and tools used in this study are available upon request from the first author, including the data collection tool, the fidelity checklist, the TPIQ, and the knowledge measure.

Design and Procedures

Researchers used a concurrent, single-case, multiple-baseline across participants design to examine the effects of the multi-component intervention on the DV. Single case design is an experimental research approach able to examine whether there is an observable change in a DV, if the observed change is the result of the application of an independent variable, and if the change is something that generalizes across skills or individuals (Riley-Tillman & Burns, 2007). Across all phases of the study, participants used an iPad to record themselves teaching and then upload recordings to a secured, shared folder. To maintain consistency, we asked participants to record themselves using direct instruction with the same class and content daily. Maria recorded whole-class English Language Arts instruction, Karly recorded chorus instruction, Joe recorded chorus instruction, and Gabrielle recorded small group reading instruction. Gabrielle did not teach small group reading each day due to her schedule; therefore, she was not able to record each day.

Baseline phase A. The first phase of this study involved the collection of baseline data on participants' use of BSP. Data were collected through video-recorded lessons and coded by data collectors. Each observation was 15 minutes. Baseline data for all participants were collected for at least 5-7 observations or until stable. Participants did not watch the recordings.

Intervention phase B (VSA). Each participant individually attended a one hour training session with the lead researcher, which consisted of (a) explicit instruction in BSP; (b) initial video analysis (researcher and participant watched 15 minutes of participant teaching and calculated a rate of BSP); (c) performance feedback; and (d) training in video self-analysis and additional

self-monitoring procedures (recording BSP rate, graphing performance). Participants continued to record and upload teaching videos daily. These recordings were coded by data collectors and were also used by the participant for completing ongoing VSA. During each VSA observation, the participant watched fifteen minutes of themselves delivering instruction and completed the data collection tool. Participants monitored progress by entering each VSA BSP total into a shared Excel spreadsheet and then graphing their performance. All participants completed VSA and self-monitoring twice weekly and shared their completed VSA data collection tools with the lead researcher.

Intervention phase B1 (VSA+PF). This was the second phase of the intervention and included follow-up data-based performance feedback. This was provided to participants from the researcher through an e-mail. The decision to move a participant to the second intervention phase (B1) was based on (a) the variability of data collected in intervention phase (VSA); (b) a decreasing trend in the data; or (c) no or minimal increase in level of data between baseline and intervention phase (B). E-mails to participants included 1-2 positive statements about their BSP performance, a specific suggestion for increasing BSP, and an expression of gratitude. For example, “Thank you for your continued participation in this study. I noticed some great BSP statements in your last video. You thanked a student for raising his hand, and you thanked a pair of students for taking turns while working together. That’s fantastic! Here’s one suggestion: you often prompt students to look at you when you want to give a direction. Follow that up with a BSP statement thanking a student for quickly giving you their attention.” VSA and self-monitoring procedures remained throughout both intervention phases.

Data Analysis

Visual analysis was used to determine the effectiveness of this intervention. Following the collection of all data and completion of all phases, data were graphed across participants. The behavioral changes within each participant were analyzed by examining the variability, trend, and level of data points within and between phases. Next, researchers analyzed data across all participants by noting changes between phases and participants. Changes in means across behaviors and participants were analyzed, and effect sizes were calculated using Tau-U. To calculate the effect size, Tau-U analyzes both non-overlap in data and trends within baseline

and intervention phases collectively (Parker, Vannest, Davis, & Sauber, 2011). Fidelity and social validity data were analyzed through descriptive statistics (e.g., mean frequency of adherence to implementation plan).

Results

Implementation Fidelity

During training sessions with participants, an independent observer collected data on fidelity. Across the four training sessions, 91.7% of areas were fully covered, 8.33% of areas were covered partially, and no areas were not covered during interventions.

Researchers also tracked participants' adherence to study procedures. All participants (100%) attended their entire training session. All participants (100%) completed VSA two times per week during the intervention phases. Participants were not required to complete VSA over their spring breaks and there were occasional changes to the two per week requirement due to specific circumstances, such as reduced recordings due to planned or unplanned events (e.g., participant illness, weather-related school closings). Fidelity of VSA was tracked by collecting completed VSA data collection tools from participants. Maria, who remained in intervention for a total of seven weeks completed ten VSA sessions. She did not complete VSA over her spring break or during her last week of student teaching when she only recorded one observation. Karly was in intervention for four weeks and five days and in total Karly completed nine VSA sessions. Joe was in intervention for two weeks and six days. He completed four VSA sessions. Finally, Gabrielle was in intervention for one week and five days, and because her recordings were less frequent, she completed two VSA sessions. Finally, participants were asked to track their performance of BSP following VSA by recording and graphing their rate for each VSA session. Maria and Karly fully met this requirement without any prompting. Barbara recorded performance 88.9% of the time and Joe recorded 100% of the time with no prompting. Both Barbara and Joe did need ongoing support with graphing performance using Excel.

Participant Knowledge

To assess knowledge of BSP and understanding of study procedures, participants complete pre and post knowledge tests. The test asked students to define BSP and to provide one example and one non-example of BSP. On the pretest, three of four participants correctly

defined BSP and provided acceptable examples and non-examples of BSP. One participant's responses were partially acceptable, as the response did describe BSP, but also included error corrections as part of the definition and example. On the posttest, all participants provided acceptable definitions for BSP and included appropriate examples and non-examples. Also, all participants correctly described all study procedures.

Visual Analysis

To determine the presence of a functional relation between the multi-component intervention and pre-service teachers' use of BSP, the researchers analyzed the level, trend, and variability of data within and across participants and phases (Kazdin, 2011). Additionally, descriptive statistics (i.e. median, range) and Tau-U were used to analyze changes in data and measure effect size. Figure 1 presents the graphed results.

Participant 1. Maria did not use BSP during baseline observations. (Mdn = 0.00; Range = 0.00). Across the intervention phases, Maria's median rate of BSP increased to .27 with an overall range of 0 - .667. The initial intervention phase showed an increase followed by a decreasing trend (Mdn = .133; Range = 0 - 0.33). The performance feedback phase showed an immediate increase in BSP rates, followed by a decrease in trend and then stabilized data (Mdn = .267; Range = .067- .667). Tau-U contrast between baseline and intervention phases for Maria was .952 (p = .000).

Participant 2. Karly also did not use BSP during the baseline phase (Mdn = 0.00; Range = 0.00). During the intervention phases, Karly's median rate of BSP increased to 0.53, and the increase was immediate. The rates were variable (Range = 0.067 – 1.27), and visual analysis indicates a slight increase in trend and variability. During the initial intervention phase, Karly's median BSP rates were slightly lower than the performance feedback phase (initial Mdn = 0.47; performance feedback Mdn = 0.63), and the performance feedback phase had higher variability (initial Range = 0.27 - 0.60; performance feedback range = 0.07 – 1.27). Tau-U contrast between baseline and intervention phases for Karly was 1.0 (p = .000).

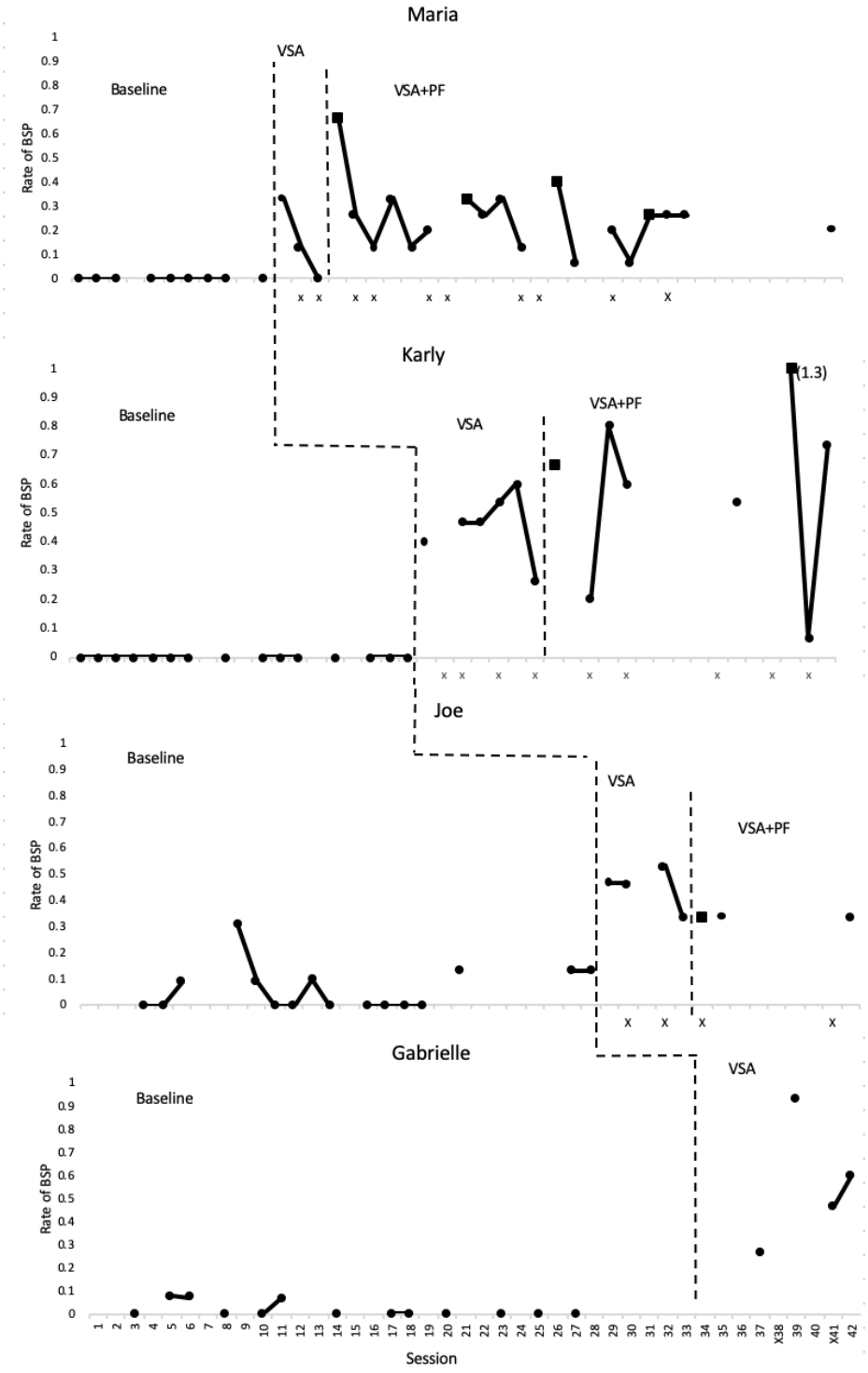

Figure 1. Rate of BSP per minute for participating pre-service teachers across phases.
Note. X mark on X axis corresponds with date participant completed a VSA session; Square marker indicates observation following performance feedback (PF).

Participant 3. Joe's baseline rate of BSP per minute was also low (Mdn = 0.00) and showed some variability (Range = 0.00 - 0.31). His rates stabilized in the 3 observations prior to intervention. Joe's rate of BSP increased during the intervention phases (Mdn = .33; Range = .33 - .53), and visual analysis indicates a slight decrease in trend and increase in stability. Performance feedback phase rates were lower (initial Mdn = 0.47; performance feedback Mdn = 0.33) and more stable (initial Range = 0.33 - 0.53; performance feedback range = 0.33 - 0.33) than initial intervention rates. Tau-U contrast between baseline and intervention phases was 1.0 (p = .000).

Participant 4. Gabrielle's baseline rate of BSP statements per minute was low (Mdn = 0.00), and stable (Range = 0.00 - 0.08). Visual analysis indicates a slight decrease in trend in the baseline phase. In the first 4 weeks of data collection, Gabrielle demonstrated use of the skill during some observations. However, she did not use any BSP during the second four weeks of baseline data collection. Gabrielle's rate of BSP increased immediately after the intervention (Mdn = .533), and visual analysis indicates some variability in the data (Range = 0.27 - 0.93). Gabrielle did not enter the performance feedback phase due to time constraints. Tau-U contrast between baseline and intervention phases for Gabrielle was 1.0 (p = .003).

Table 1
Social Validity Results

Question	Mean	Range	Standard Deviation
This intervention improved my ability to use evidence-based classroom management skills.	5	5.00-5.00	0
This intervention increased appropriate behavior in my students.	4	4.00-4.00	0
This intervention decreased inappropriate behavior in my students.	4	4.00-4.00	0
This intervention was easy to use	5	5.00-5.00	0
This intervention took more effort than it was worth	1	1.00-1.00	0
This intervention should be recommended to teacher preparation programs to aid in the development of pre-service teachers' classroom management skills	5	5.00-5.00	0

Across participants. A visual analysis of the data across all participants indicates that there was a change in the level from baseline to intervention phases. While baseline rates of BSP are stable across participants, the data are variable and unstable during the intervention phases.

Social Validity

Social validity data were gathered by using the TPIQ. Upon the conclusion of data collection, participants were asked to complete the questionnaire and return it via email. All participants completed and returned the questionnaire. Table 1 presents the results, which indicate that participants felt the intervention improved their ability to use evidence-based classroom management practices, impacted student behavior positively, was worthwhile and easy to use, and should be recommended to teacher preparation programs.

Discussion

Discussion of Results

This study provides support for the use of multi-component interventions for increasing pre-service teachers' use of one evidence-based classroom management skill, BSP. By using an experimental single-subject, multiple baseline across participants design, this study extends the research to direct observation of measurable skills during the student teaching semester. Although previous research has examined effective practices for improving pre-service teachers' classroom management skills, the majority of studies used indirect measurements, such as classroom management knowledge or self-efficacy, to determine intervention effects. This study fills a gap in the literature by examining the effects of an intervention on pre-service teachers' classroom management skills by using direct observation of behavior during the student teaching semester. Furthermore, all participants strongly agreed that the intervention was an acceptable use of their time.

The experimentally-tested research question examined the effects of the multi-component intervention on participants' use of BSP. Prior to the training session, participants completed a knowledge test. Three of the four participants demonstrated a full understanding of BSP by correctly defining it and providing appropriate examples and non-examples. One participant's responses were partially acceptable. Despite having demonstrated knowledge and understanding of the skill, baseline data indicated that overall rates of BSP were very low, with

two participants never using the skill. This suggests that without further intentional support beyond coursework instruction, pre-service teachers may not generalize knowledge to practice and develop the habit of using BSP effectively during student teaching. This supports previous research findings regarding effective practices for supporting pre-service teachers' classroom management, which suggest that a cyclical approach, interweaving instruction, interactive, guided practice opportunities, and performance feedback throughout coursework and fieldwork is most effective (Auld et al., 2010; Hazareesingh & Bielawski, 1991; O'Reilly et al., 1992; Sharpe et al., 1997).

Visual analysis and effect size calculations across participants indicated the presence of a functional relation between the baseline and intervention phases, with variances across participants for the initial intervention and performance feedback phases (Tau-U = .987, p = 0.000). While all participants made some improvements of performance as a result of the overall intervention, the responses were extremely variable and not sustained across all participants. For this reason, caution should be used when considering the strength of the overall functional relation. All participants benefitted from ongoing VSA supports, and three needed performance feedback due to a decreasing trend or lack of stability in their initial responses. These results suggest that pre-service teachers require multiple supports beyond instruction in evidence-based classroom management to apply knowledge to practice and to develop fluency with using BSP. Similarly to previous research in effective practices to improve the classroom management skills of pre-service teachers, this study provides further support for the use of multi-component interventions to improve student teachers' use of evidence-based classroom management skills that include the use of explicit instruction (O'Reilly et al., 1994), modeling (Hazareesingh & Bielawski, 1991), and technology (Gorrell & Downing, 1989), specifically when incorporating video self-analysis (Noell et al., 1997; Osmanoglu, 2016).

Additionally, the results indicate that the intensity of support needed to increase use of BSP varied across participants. For example, participant 4 did respond to the initial intervention, and her data did not indicate a need for performance feedback. Unlike the other participants who benefitted from performance feedback, perhaps VSA supports alone would have been enough for her to maintain increased rates of BSP. Similar to findings from previous research,

this indicates that not all pre-service teachers require the same level of support to become fluent with their use of evidence-based classroom management skills and that pre-service teachers' need for and responses to supports such as performance feedback can vary (Auld et al., 2010). Researchers have suggested that using a multi-tiered system within a teacher preparation program can be useful for organizing and providing appropriate, targeted, intensified supports for pre-service teachers (Sobel & Gutierrez, 2009), including tier 1 (universal support for all pre-service teachers), tier 2 (intensified supports for some pre-service teachers), and tier 3 (individualized, intensive support for some pre-service teachers). While some pre-service teachers may be able to apply classroom management knowledge to practice with tier 1 universal supports provided to all teacher education students, others will require more intensified support to develop fluency with skills. A multi-tiered system would ensure that appropriate supports are available to all pre-service teachers.

Limitations and Areas for Future Research

This study has several limitations. Although an effort was made to recruit a similar participant population, there was variability in terms of the content and level of student teaching placements. A more similar participant population would have strengthened the results. Also, the time limit of the student teaching semester, along with numerous planned and unplanned events (e.g., spring break, weather-related school closings, participant illness, technology failure), resulted in gaps and inconsistencies in data collection. Additionally, because the multi-component intervention was tested as a package, caution should be used when drawing conclusions about the effect of any single component.

Given the absence of a follow-up phase additional research is needed to determine if pre-service teachers are able to maintain using BSP and generalize the use of it beyond student teaching into their early career. Additionally, research is needed to determine if technology-supported multi-component interventions would be useful in improving other classroom management skills, such as the use of prompts, opportunities to respond, and active supervision, and with other participant populations, such as in-service teachers.

Video analysis is becoming an increasingly common practice in teacher preparation programs and credentialing. It's versatility and ease of use makes video analysis an attractive

and potentially valuable tool for supporting application of specific skills to practice. Given it's growing popularity, additional research is needed to better understand the most effective, efficient ways to incorporate video analysis into pre-service teacher training programs.

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