International Journal of Professional Development, Learners and Learning
2026, 8(1), e2601
ISSN 2754-0618 (Online)
https://www.ijpdll.com/

Research Article

OPEN ACCESS

Immersive video within virtual reality and performance feedback coaching to improve novice teacher classroom practices

Adam Carreon [1]*, Caitlin Criss [1], Sarah Kelley [1]

[1]Georgia Southern University, Statesboro, GA, USA
***Corresponding Author:** acarreon@georgiasouthern.edu

Citation: Carreon, A., Criss, C., & Kelley, S. (2026). Immersive video within virtual reality and performance feedback coaching to improve novice teacher classroom practices. *International Journal of Professional Development, Learners and Learning*, 8(1), e2601. https://doi.org/10.30935/ijpdll/17677

ABSTRACT

Teacher shortages are a major issue in education as schools across the nation are struggling to recruit and retain teachers in the buildings. New teachers often struggle with classroom management due to a lack of training, which can lead to stress and burnout. This can negatively affect both teachers and students. This study explores how immersive video in virtual reality (IVVR) and performance feedback (PF) can improve teachers' use of behavior-specific praise (BSP), an evidence-based classroom management practice. Six early-career teachers used IVVR with self-reflection and PF coaching to improve their BSP teaching skills. The results showed that both IVVR and PF helped teachers increase their use of BSP, with PF being slightly more effective. Interestingly, when teachers got better at BSP, they used less general praise. Teachers had positive experiences with both methods, but they preferred getting feedback directly rather than self-reflecting. This study highlights the potential of IVVR as a professional development tool and emphasizes the need for ongoing support and training for teachers to improve classroom management and reduce stress. Further implications and directions for the field are presented.

Keywords: virtual reality, 360-cameras, teacher coaching, performance feedback, professional development, behavior-specific praise

Received: 21 Feb. 2025 ◆ Accepted: 05 Dec. 2025

INTRODUCTION

Teacher retention is one of the greatest challenges in education today. In fact, over 50% of public schools across the county report being understaffed, and nearly 45% of schools have at least one teaching vacancy (US Department of Education, Institute of Education Sciences, 2023). Teacher shortages can have a negative impact on the school culture, teacher retention, organizational stability, and student achievement (Henry & Redding, 2020). Often, the schools with the highest needs and diverse student populations are the most impacted. Teachers more frequently leave high-needs schools than those in more affluent communities. Ingersoll and Tran (2023) analyzed national data and found that teachers are twice as likely to leave rural schools than teachers in urban or suburban schools. Further, challenges with understaffing within schools can lead to larger class sizes and less support for complex behaviors. Teachers report complex behaviors, and the social and emotional well-being of students is one of the highest needs in elementary classrooms (Alter et al., 2013). Student disruptions and non-compliance are among the most frequent daily behaviors teachers face (Gage et al., 2018).

Since COVID-19, there has been an increased need for social-emotional support for students and teachers (Verlenden et al., 2021). Unfortunately, there is a correlation between students with complex behaviors, poor academic performance, and social-emotional delays (Algozzine et al., 2011). Managing complex behaviors can be stressful and lead to teacher burnout in both general education and special educators (Johnson et al., 2021; Robinson et al., 2019). Researchers recently found that early childhood special educators often reported higher job demands such as managing complex behavior. Additionally, they reported more psychological stress and job burnout (Jeon et al., 2022).

Younger students often struggle with adapting to the school environment and are at the greatest risk for retention (Bettencourt et al., 2018). If intervention does not occur during early elementary, complex behaviors can progress through late elementary, middle, and even high school. Thus, it is important to ensure that elementary teachers, specifically novice teachers, receive adequate training and professional development in classroom management strategies.

Classroom Management

Classroom management can be a challenge for teachers, specifically novice teachers (McGuire & Meadan, 2024). Unfortunately, teachers receive very little training on classroom management during their pre-service training (Freeman et al., 2014) and often lack the skills to manage complex behavior. Researchers have extensively evaluated effective classroom management practices such as teacher praise (Ennis

et al., 2020; Criss et al., 2023) and high rates of opportunities to respond (Common et al., 2020). Simonsen et al. (2008) identified 20 classroom management practices with evidence of effectiveness, including actively engaging students, maximizing structure and predictability, teaching and reinforcing expectations, and using a continuum of strategies to acknowledge and respond to appropriate and inappropriate behaviors. Despite the effectiveness and extensive research, both novice and experienced educators struggle with managing complex behavior and report the lack of using evidence-based practices in the classroom (Moore et al., 2017). Further, effective classroom management practices can increase time on-task and student achievement.

Behavior-specific praise (BSP) is a widely researched evidence-based practice that effectively improves student on-task behavior (Criss, 2025; Simonsen et al., 2017). Praise is a valuable and effective strategy to promote positive student behavior in the classroom. In a review of classroom management strategies, Epstein et al. (2008) identified teacher praise as one of five effective strategies to promote positive student behavior. Despite its effectiveness, the use of praise is far below the recommended rate (3-5 BSP per 10 min or 18-30 BSP per hour; Floress & Jenkins, 2015; Floress et al., 2018). Teachers often resort to using non-specific or general praise (Markelz et al., 2022). While general praise can be beneficial to signal teacher approval, the lack of specificity to the student behavior being praised may not effectively strengthen the appropriate student behavior. Moreover, a teacher can grasp the attention of a student and be more effective when the praise is more varied and specific (Markelz et al., 2020).

Moore et al. (2019) recently reviewed the evidence base of teacher praise for students without disabilities in the k-12 setting. They found that there is very little research on the effectiveness of praise with students without disabilities. Despite the depth of research on teacher praise to students with disabilities (i.e., Criss et al., 2023; Briere et al., 2015), little is known about the impact of praise on students without disabilities. Although it is widely known that the effectiveness of evidence-based practices such as BSP, both pre-service and in-service teachers often report a need for more training in effective classroom management practices (McGuire et al., 2023).

In a review of effective methods for increasing praise with teachers, Floress et al. (2018) found most studies used a variety of methods for increasing teacher's use of praise in the classroom. Specifically, researchers found the studies with the most positive outcomes were those that used didactic training in combination with other practices such as self-monitoring, goal-setting, or feedback, indicating that using a variety of coaching methods can be most effective for increasing teachers' use of praise (Floress et al., 2018). Further, results found that no studies had exclusively manipulated the use of BSP versus general praise, indicating a need to understand better how the impact of general praise and BSP on positive student behavior.

Coaching Teachers

Novice teachers often begin their first year in the classroom with only a few semesters of practical experience during their educator preparation programs. Novice teachers report the need for more practical application of skills learned in their educator preparation programs (Goodson et al., 2019), which puts the burden on school districts to close the gap in teaching evidence-based practices. Performance feedback (PF) offers a potential solution to improving teacher's use of evidence-based practices in the classroom, specifically classroom management practices. PF has proven to be an effective form of coaching to improve teacher performance in the classroom (Ennis et al., 2020; Schles & Robertson, 2019). While it is effective, traditional coaching used in PF can have some drawbacks. For example, to deliver PF to teachers, an additional person such as a teacher coach, content specialist, or administrator must be present to observe and deliver the feedback. This can be time-consuming and has the potential to overextend building administrators who might have several novice teachers in need of coaching.

The use of technology could provide a potential solution with practices like bug-in-ear technology. Researchers have found that bug-in-ear coaching can be effective (Schaefer & Ottley, 2018; Sinclair et al., 2020), but it also has its limitations and can be difficult to implement as a coach is still needed to deliver real-time feedback from an in-person or remote location. Additionally, with bug-in-ear coaching, the teacher does not have the opportunity to reflect on their behavior as they are given real-time feedback.

Advancements in technology may offer a potential solution to the challenges of real-time feedback and traditional PF. Three hundred sixty-degree cameras (360-degree) have become both accessible and affordable, offering new possibilities for enhancing teacher behaviors. These cameras capture comprehensive video footage, enabling immersive experiences that have been leveraged in educational research. For instance, Ferdig et al. (2023) used 360-degree videos on static displays to study teacher attention, finding increased focus, though not always on relevant areas. Similarly, Gold and Windscheid (2020) noted that while 360-degree videos enhanced the sense of presence, they did not significantly improve classroom observation, prompting further exploration of immersive video's impact on learning.

The use of video is not novel and has been used to enhance teacher practice (Christ et al., 2017). This study enhances video with 360-degree video and increased its utility by integrating it with virtual reality (VR) headsets, allowing teachers dynamic interaction with the natural classroom environment. While 360-degree videos can be viewed on standard screens, their full potential is unlocked through VR headsets, enabling teachers to navigate and observe their classroom from any angle, including the ability to zoom and turn in real-time. This immersive video in virtual reality (IVVR) technology, though common in surgical training (Huber et al., 2017; Pulijala et al., 2018), is gradually making its way into K-12 education. In teacher professional development, Kosko et al. (2021) identified IVVR as an effective tool for facilitating teacher awareness. For reflection, Walshe and Driver (2019) explored IVVR's role in helping pre-service teachers revisit and reflect on their teaching. They found that IVVR could simulate real classroom experiences, although their study was limited to a single video. They recommended further research into multiple IVVR opportunities to enhance effectiveness in educational settings.

Self-Reflection with Immersive Technology

Self-reflection is a cornerstone of effective teaching, particularly for early career educators. It enables teachers to delve deeper into their instructional practices, identify areas for growth, and make informed adjustments to their teaching strategies. This reflective process is commonly integrated into pre-service but not in-service teacher training programs to foster professional development (Nagro et al., 2017). By examining their teaching through video recordings or other reflective tools, teachers can gain valuable insights into their classroom dynamics, student engagement, and overall instructional effectiveness.

Table 1. Teacher participant characteristics

Name	Gender	Experience	Degree	Degree type	Classroom population
Kendall	Female	0 years	Bachelor's degree	Elementary education	1st grade
Kasey	Female	2 years	Master's degree	Sociology and art of teaching	3rd grade
Lily	Female	4 years	Master's degree	Elementary education and instructional technology	2nd grade
Monica	Female	0 years	Bachelor's degree	Elementary education	4th grade
Shaunna	Female	5 years	Bachelor's degree	Health education	1st grade
Vicki	Female	0 years	Bachelor's degree	Elementary education	2nd grade

This process allows them to connect their experiences to learned skills, leading to more understanding of the classroom environment

For novice teachers, who often lack the classroom experience necessary to analyze and adjust their instruction effectively, self-reflection may be an essential element capable of improving teacher practice. Nagro et al. (2017) conducted a study to investigate the impact of guided video analysis and self-reflection on pre-service teachers' classroom skills. They found that pre-service teachers who received guided video analysis and self-reflection demonstrated significant improvements in their teaching abilities compared to those who watched their videos and reflected independently. Furthermore, pre-service teachers who received ongoing feedback and coaching exhibited the greatest growth in their teaching performance.

Video-based self-reflection has emerged as a powerful tool for teachers to analyze their instructional practices and gain valuable insights. By capturing classroom interactions on video, teachers can review their lessons, identify areas for improvement, and gain a more objective perspective on their teaching. Research has consistently demonstrated the effectiveness of video-based self-reflection in improving pre-service teachers' instructional skills and fostering deeper reflective thinking (Nagro et al., 2017; Robinson & Kelley, 2007). Teacher preparation programs have increasingly incorporated video and reflection into their curricula to prepare and enhance teacher skill sets (Xiao & Tobin, 2018). While video-based self-reflection offers numerous benefits, it is important to acknowledge the limitations of traditional cameras. The limited field of vision of traditional cameras can restrict the perspective captured and limit the ability to observe all aspects of the classroom, depending on camera placement. Consequently, teachers may need to place the camera close to themselves, sacrificing the whole classroom view. To address these limitations, more advanced technologies, such as 360-degree cameras or multiple camera setups and the use of VR to view the video recording immersively, can be employed to capture a more comprehensive view of the classroom. These technologies can provide teachers with a more holistic and natural perspective of their instructional interactions and facilitate a deeper level of interaction while self-reflecting.

Purpose

Recognizing the difficulties facing teachers, schools, and districts and the limitations of traditional professional development models, this research explores the effectiveness of IVVR coupled with self-reflection and PF. Further, while there is extensive research on the impact of BSP (Criss et al., 2023; Ennis et al., 2020; Simonsen et al., 2017), little is known about the impact of effects of coaching teachers and self-reflection to improve BSP and the impact on general praise. This pilot study explored the use of two different forms of professional development (i.e., written PF and self-reflection with VR) on teacher's use of evidence-based practices that are known to improve student attention and on-task behavior. Therefore, we sought to investigate the following questions:

1. What are the comparative effects of written PF and IVVR with self-reflection, with visual data on early career teacher's use of BSP?
2. What are the comparative effects of written PF and IVVR with self-reflection, with visual data on early career teacher's use of general praise?
3. What are early career teacher's perceptions of receiving written PF and IVVR with self-reflection with visual data?

METHODS

Participants

Participants were recruited in person via a meeting set up by the building principal. Authors one and two presented the research objectives to all early career teachers in the elementary school building that attended the meeting. Consent forms were provided for any teacher who indicated interest in participating. A total of six teachers, within their first five years of teaching, completed the consent forms and agreed to the study. Teachers were considered eligible if they:

(a) were early career teachers (teaching experience less than five years),

(b) were interested in receiving PF and coaching to improve their classroom teaching environment, and

(c) held a current teaching certificate in the southeastern state where the research was conducted.

The participants were not compensated for their participation in the research study, and all participants understood that they could stop their participation at any time. Additionally, the building principal was aware of the research study but was unaware of the participants in the study. This was to ensure anonymity and to encourage a more natural teaching experience. Participant demographics can be seen in **Table 1**.

Setting

All sessions took place at a rural title 1 elementary (K-5th grade) in a Southeastern state in the USA. The school district is located in a rural community and has an enrollment of 647 students. Of the 647 students, 628 received free or reduced lunch. The school district has a diverse population with 56% African American/non-Hispanic, 19% White, 17% Hispanic, and 8% reported two or more races. Within the school structure there are 48 teachers, two counselors, three assistant principals, and one principal. Furthermore, the school had a small thirteen-to-one student-to-teacher ratio. The entire study was completed during the 2022-2023 school year and classroom observations took place during the spring semester between the months of January and May. All study procedures, including deception, were

approved by the Institutional Review Board at the first author's university.

Experimental Design

An ABAB multiple treatments single-subject research design with a baseline was to evaluate and compare the effects of IVVR and PF on teachers' use of the evidence-based practice BSP. Participants were randomly assigned sequences of conditions to counterbalance the effects. All participants started at baseline. Following baseline, three teacher participants started in the IVVR condition (ABAB), and three started in the PF with email condition (BABA). Condition A consisted of a 360-degree video recording watched via VR headset and teacher self-reflection. Condition B consisted of direct observations by the first author, with the reading of PF directly after the lesson.

Prior to intervention, all participants started the baseline, business-as-usual condition. All participants had a minimum of 5 baseline sessions. Once stable baseline sessions were established for participants, all participants moved into their selected first intervention session. Participants remained in their first intervention session until a minimum of four sessions were completed. Participants then moved into their second intervention condition and completed another minimum of four sessions. This was repeated until all participants completed two replications of a minimum of four sessions in both intervention conditions. Upon completion, participants had a minimum of eight intervention sessions with each intervention condition.

Procedures

Baseline

All six teachers participated in baseline data collection. Authors one and two observed participants deliver regular direct instruction for 10 minutes, 2-3 times a week, during times the teachers choose. Observers sat unobtrusively in the back and recorded the teacher's BSP and general praise usage on researcher-created data observation forms. Observers entered the classroom and exited as quietly and unnoticed as possible to not interrupt normal activity.

Training

Following baseline, all teachers received one-on-one training on BSP. This included learning about the study's purpose, watching a video (https://vimeo.com/673374070) on effective BSP delivery, and reviewing the BSP definition. This video outlines the definition, benefits, examples, and strategies to implement BSP and feedback to students. Teacher participants were also provided with examples specific to their baseline observations. If a teacher lacked sufficient examples, alternative examples were provided. Teachers practiced delivering BSP through role-playing and confirmed they could identify three correct BSP examples. Finally, researchers answered any questions, informed teachers about their starting intervention condition, and explained what to expect during the study. General praise was not discussed during the training other than to differentiate the difference between BSP and general praise and the benefits of using BSP over general praise statements.

Intervention

This study employed two intervention conditions. During the IVVR condition, teachers did not receive feedback on their performance in the classroom, rather they self-reflected after watching their own teaching. Teachers did receive written feedback in the PF condition via email.

IVVR condition

In the IVVR condition, teachers continued with their usual instruction as in baseline while a 360-degree camera recorded 10 minutes of their instruction. Afterward, researchers transferred the video to the VR headset. With the VR headset, teachers can turn their heads and bodies to see their natural 360 degree teaching environment. The researcher and the teacher met after school the day of the observation to allow for the teacher to watch their recording. Before and after watching, they answered questions about their BSP use, including their perceived BSP rate, variation in their BSP statements, and missed opportunities for BSP use. These questions mirrored the feedback the teachers received in the PF condition. Following the completion of watching their teaching recording and answering the self-reflection questions, teacher participants were told their rates of BSP. The total rates of BSP were calculated by researchers who watched the recording and used the data collection form to identify BSP statements.

PF condition

The other intervention was written PF. Teachers continued with their usual instruction while being observed in person for 10 minutes. Observers noted instances of BSP and missed opportunities, then created and sent an email with personalized feedback after each observation. The email included the teacher's BSP rate compared to the previous observation, examples of well-used BSP, strategies to increase BSP use, address missed opportunities, and a reminder of the BSP definition. These emails aligned to the procedures from Criss et al. (2023) and teachers received this email the day of the observation. The teacher participant's only directive was to read over the email prior to the next instructional observation. For the duration of the manuscript, PF will refer to PF via email coaching.

Post-intervention

Following the completion of all sessions, teacher participants were provided a social validity questionnaire via a Google Forms online survey. This survey was adapted from the intervention rating profile-15 (Martens et al., 1985) and was designed to glean opinions about the procedures, outcomes, feasibility, and applicability of the study intervention. The survey included 17 questions pertaining to the use of BSP, opinions on BSP in the classroom, the importance of receiving coaching feedback, perceptions of using IVVR for self-reflection, and the comparative opinions of using IVVR and PF. A four-item Likert scale was used for teacher participant responses to 14 questions, and open-ended questions were used for the remaining three questions.

Interventionists

The authors were the interventionists for this study. Both authors are assistant professors in Special Education with backgrounds in teaching in the k-12 setting and coaching teachers. To maintain consistency across participants, the first author provided all feedback to teachers in the PF condition and the second author was present for all IVVR condition self-monitoring sessions.

Materials

All data collected during baseline and sessions were collected through a researcher-created data collection form that included spaces

for tallying and notes on performance. Each time a teacher used a BSP statement or a general praise statement, observers placed one tally in the correct section. At the end of the observation, the tallies were totaled and divided by 10 to get the overall rate of BSP. All graphs were created using Microsoft Excel.

IVVR condition

All sessions in the IVVR condition were recorded using an Insta360™ X2 camera attached to a tripod. The camera was typically placed around the center of the room on a table, shelf, or desk. After the recording, author one transferred the file to a Windows™ laptop. The file was then converted using Insta360™ Studio 2023 to a compatible file for the VR headset. After file conversion, the file was transferred to a 128-gigabyte Meta™ Quest 2 VR headset. The file was then accessed for viewing by participants through the Meta™ TV application with the 360 two-dimensional setting activated. Participants only had to place the headset on their head to watch and take it off when they finished viewing. The researchers autoloaded it to play once the VR headset was placed on the participant's head.

Prior to and after completion of watching the video in the VR headset, participants were directed to complete four questions on BSP usage in a Google™ Forms online survey. Two questions were to be answered prior to watching, and two questions were to be answered after watching. These questions asked questions related to information provided in the PF conditions such as BSP use, missed opportunities, the total number of BSP, and the participant's understanding of what BSP is.

PF condition

Following the 10-minute observation, a PF email was created using the researchers' University Google™ GMail email software. All information was typed into the email software, and a graph from Microsoft™ Excel was copied and pasted into the email document. The email was sent within one to three hours after observation and sent to the teacher's work email account. All teachers were directed to read the email fully before teaching their next lesson. While we have no way of knowing how much time was spent reading the emails, the emails were written with the intent of taking less than five minutes to read.

Measures

The study's primary dependent variable is the rate of teachers' use of BSP in the classroom. The rate was calculated using event recording divided by the total time spent in the observation or recordings. The definition of BSP adopted in this study emphasized specific recognition of student behavior or performance. It required the praise to meet the following criteria:

(a) praised behavior is explicitly stated,

(b) provided to individuals or groups of students,

(c) provided immediately after the behavior observed, and

(d) incorporated similar language to that of language used in the classroom (Criss et al., 2023).

An example of a BSP statement is, "excellent job switching to the next task quickly."

Data was also collected on participants' use of general praise statements. General praise is the use of praise statements that are not followed by specific content or behavior. Observers used the data collection form for both types of praise, but the focus of IVVR with self-reflection and the PF was on BSP. Examples of general praise included "awesome" or "fantastic."

Interobserver Agreement and Procedural Fidelity

Interobserver agreement (IOA) was collected for 26% across all sessions of the research study. A graduate research assistant (GRA) in a clinical psychology program was trained on BSP through the same video the teacher participants watched. Additionally, the GRA was trained in data collection and participated in three training observations. Following observations, 85% IOA was attained. The variation was discussed amongst the researchers and the GRA until a 100% consensus was reached. IOA across all participants and sessions was calculated using the total count (number of agreements divided by the number of agreements plus disagreements multiplied by 100). Total IOA across all sessions was calculated at 91%, with a range of 60% to 100%.

Furthermore, to ensure procedural fidelity of the intervention, a checklist was created to align with each step of every session. The GRA was trained in observing and completing each checklist (baseline, training, intervention session A & intervention session B). The GRA was present in person for all sessions and was copied on a random 50% of the PF emails for all participants. Overall, 100% procedural fidelity was calculated across all sessions.

RESULTS

Below, we present the overall findings of the study examining the impact of IVVR with self-reflection and PF on the use of BSP among early-career elementary teachers. The results are presented visually in **Figure 1** illustrating the changes in BSP frequency from baseline to intervention phases for each participant. The following sections are organized by research questions.

Q1. Comparative Effects of IVVR With Self-Reflection and PF

Shaunna

During baseline, Shaunna's mean rate of BSP was 0.33 (range: 0.0-0.10; slope: 0.0). Visual analysis of the baseline shows low and stable rates of BSP. After training, Shaunna began the first intervention in the email condition, and her mean rate of BSP increased to 1.13 (range: 0.1-1.5; slope: 0.39). Next, Shaunna entered the IVVR condition, and her overall rate increased to 1.26 (range: 1.1-1.5; slope 0.03). When Shaunna returned to the email condition, her mean rate of BSP increased to 2.8 (range: 2.5-3.3; slope: 0.05), which was her highest rate during all intervention phases. Upon returning to the IVVR condition, her mean rate of BSP was 2.17 (range: 1.8-3.3; slope: 0.14). Her overall rate of BSP across all intervention conditions was 1.75 (range 0.1-3.30; slope: 0.14), indicating a functional relation between both intervention conditions and her rate of BSP. Visual analysis during intervention indicates higher variability during both email conditions and less variability during IVVR conditions, with an overall increasing trend throughout the interventions.

Monica

Monica's mean rate of BSP during baseline was 0.20 (range: 0.00-0.60; slope 0.04), indicating a low and stable response. Monica entered the email condition after training, and her BSP rate increased to 0.60 (range: 0.40-1.00; slope: 0.12). During the next condition, IVVR, Monica's rate of BSP decreased to 0.53 (range: 0.40-0.60; slope: -0.01).

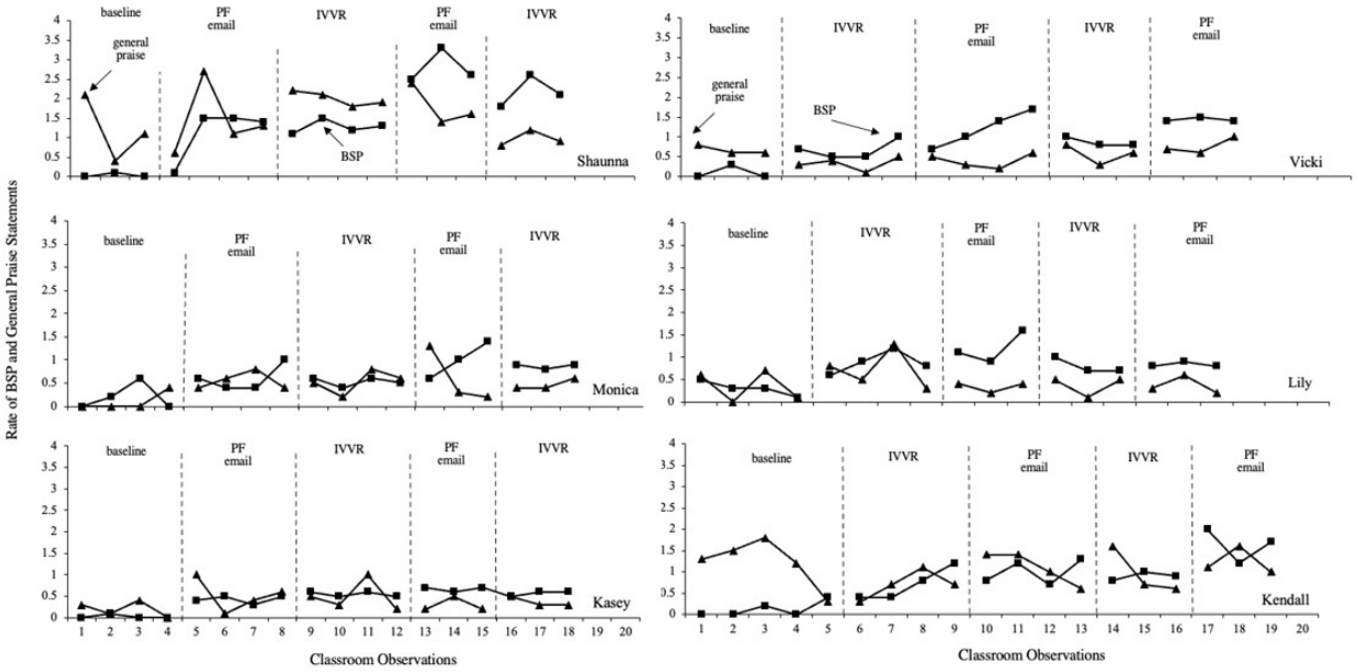

Figure 1. Novice teacher rate of BSP and general praise during performance feedback by email and IVVR (triangles represent rate of general praise & squares represent rate of general BSP) (Figure created by the authors)

When Monica returned to the email, her rate of BSP increased to 1.0- (range: 0.60-1.4; slope: 0.40), indicating her highest rate of BSP during intervention. When Monica returned to IVVR for her phase of intervention, her rate of BSP was 0.87 (range: 0.80-0.90; slope: 0.00). Overall, her mean rate during intervention was 0.72 (range: 0.4-1.4; slope: 0.04) and visual inspection during intervention indicate a steady rate of responding and increased trend across all intervention conditions.

Vicki

Vicki's mean rate of BSP during baseline was 0.10 (range: 0.00-0.10; slope -0.10). Visual analysis indicates a low and stable rate of responding during baseline. Immediately after training, Vicki entered the IVVR condition, and her rate of BSP increased to 0.68 (range: 0.50-1.00; slope 0.09). During the next intervention condition (i.e., email), Vicki's mean rate of BSP increased to 1.20 (range: 0.70-1.70; slope: 0.34), and upon returning to IVVR, Vicki's rate decreased to 0.87 (range: 0.80-1.00; slope -0.10). Vickie's final condition during intervention was email, and her rate of BSP increased to 1.43 (range: 1.40-1.50; slope: 0.00), indicating her highest rate during the interventions. Her overall mean rate of BSP during intervention was 1.03 (range: 0.50-1.70; slope 0.06), indicating a functional relation between the combination of IVVR and email feedback on Vicki's rate of BSP. Visual inspection of Vicki's mean rate of BSP during intervention indicates an increase in the rate of responding with some variability when switching conditions, specifically when leaving the email condition and beginning the IVVR condition.

Lily

During baseline, Lily's mean rate of BSP was 0.30 (range: 0.1-0.5; slope -0.12), and visual inspection indicated a low and decreasing rate of responding. After training, Lily entered the IVVR condition, and her BSP rate increased to 0.88 (range: 0.60-1.20; slope 0.09). Next, Lily entered the email condition, and her rate of BSP increased to 1.20 (range: 0.90-1.60; slope 0.25), which was her highest rate during the intervention. Upon returning to the IVVR condition, Lily's rate of BSP decreased to 0.80 (range: 0.70-1.00; slope: -0.15), and during her final email condition during intervention, her rate of BSP was 0.83 (range: 0.80- 0.90; slope 0.00) indicating a similar rate of responding. Across intervention, her rate of BSP was 0.92 (range: 0.60-1.60; slope: -0.01). Visual inspection indicates an initial increase in BSP after starting intervention for the first two conditions, then showed a decreasing trend for the last two conditions.

Kendall

Kendall's rate of BSP during baseline was 0.12 (range: 0.00-0.40; slope 0.08). Visual inspection indicates a stable rate of responding during baseline, with a very slight increase immediately prior to intervention. Kendall's first condition during intervention was IVVR, and her mean rate of BSP was 0.70 (range: 0.40-1.20; slope: 0.28). Next, Kendall entered the email condition, and her mean rate of BSP increased to 1.00 (range: 0.70-1.30; slope: 0.10), and upon returning to the IVVR condition, her rate of BSP decreased slightly to a mean rate of 0.90 (range: 0.80-1.00; slope 0.05). During her final condition of the interventions, her rate of BSP increased to 1.63 (range: 1.20-2.00; slope -0.15), which was her highest rate during intervention. Across all intervention conditions, her mean rate of BSP was 1.03 (range 0.40-2.00; slope: 0.08). Visual inspection indicates a steady increase in responding across all intervention conditions, with some variability when switching between conditions. See **Figure 1** for visual data.

Q2. Comparative Effects on General Praise

Results for general praise rates for each teacher are reported in **Table 2**. Overall, five of the six teachers had a decreasing trend of general praise during intervention. Vicki was the only teacher who had a slight increase in general praise during the intervention (slope = 0.4). These results indicate that as teachers increased their rate of BSP, their rates of general praise decreased.

Table 2. Descriptive statistics of teachers' behavior-specific and general praise rates across conditions

Participant		BSP			General praise		
		M	Range	Slope	M	Range	Slope
Shaunna	Baseline	0.330	0.0-0.1	0.00	1.20	0.4-2.1	-0.50
	PF by email 1	1.130	0.1-1.5	0.39	1.425	0.6-2.7	0.05
	IVVR 1	1.260	1.1-1.5	0.03	2.000	1.8-2.2	-0.12
	PF by email 2	2.800	2.5-3.3	0.05	1.800	1.4-2.2	-0.40
	IVVR 2	2.170	1.8-2.6	0.15	0.970	0.8-1.2	0.05
	Overall intervention	1.840	0.1-3.3	0.14	1.550	0.6-2.4	-0.04
Monica	Baseline	0.200	0.0-0.6	0.04	0.100	0.0-0.4	0.12
	PF by email 1	0.600	0.4-1.0	0.12	0.550	0.4-0.8	0.02
	IVVR 1	0.530	0.4-0.6	-0.01	0.480	0.2-0.8	0.02
	PF by email 2	1.000	0.6-1.4	0.40	0.600	0.2-1.3	-0.55
	IVVR 2	0.870	0.8-0.9	0.00	0.470	0.4-0.6	0.10
	Overall intervention	0.750	0.4-1.4	0.04	0.530	0.2-1.3	-0.01
Kasey	Baseline	0.025	0.0-0.1	-0.10	0.200	0.0-0.4	-0.06
	PF by email 1	0.430	0.3-0.5	0.01	0.530	0.1-1.0	-0.09
	IVVR 1	0.550	0.5-0.6	-0.02	0.500	0.2-1.0	-0.02
	PF by email 2	0.670	0.6-0.7	0.00	0.300	0.2-0.5	0.00
	IVVR 2	0.570	0.5-0.6	0.05	0.370	0.3-0.5	-0.10
	Overall intervention	0.550	0.3-0.7	0.02	0.420	0.1-1.0	-0.02
Vicki	Baseline	0.100	0.0-0.3	0.00	0.667	0.6-0.8	-0.10
	IVVR 1	0.680	0.5-1.0	0.09	0.330	0.1-0.5	0.03
	PF by email 1	1.200	0.7-1.7	0.34	0.400	0.2-0.6	0.02
	IVVR 2	0.870	0.8-1.0	-0.10	0.570	0.3-0.8	-0.10
	PF by email 2	1.430	1.4-1.5	0.00	0.770	0.6-1.0	0.15
	Overall intervention	1.050	0.5-1.7	0.06	0.520	0.1-1.0	0.04
Lily	Baseline	0.300	0.1-0.5	-0.12	0.350	0.0-0.7	-0.08
	IVVR 1	0.880	0.6-1.2	0.09	0.730	0.3-1.3	-0.07
	PF by email 1	1.200	0.9-1.6	0.25	0.300	0.2-0.4	0.00
	IVVR 2	0.800	0.7-1.0	-0.15	0.370	0.1-0.5	0.00
	PF by email 2	0.830	0.8-0.9	0.00	0.370	0.2-0.6	-0.05
	Overall intervention	0.930	0.6-1.6	-0.01	0.440	0.1-1.3	-0.04
Kendall	Baseline	0.120	0.0-0.4	0.08	1.220	0.3-1.8	-0.23
	IVVR 1	0.700	0.4-1.2	0.28	0.700	0.3-1.1	0.16
	PF by email 1	1.000	0.7-1.3	0.10	1.100	0.6-1.6	-0.28
	IVVR 2	0.900	0.8-1.0	0.05	0.970	0.0-1.6	-0.50
	PF by email 2	1.630	1.2-2.0	-0.15	1.230	1.0-1.6	-0.05
	Overall intervention	1.060	0.4-2.0	0.08	1.000	0.3-1.6	0.03
	Overall IVVR	0.900	0.4-2.6		0.710	0.0-2.2	
	Overall PF by email	1.160	0.1-3.3		0.780	0.01-2.7	

During baseline, five of six teachers had higher rates of general praise than BSP. As teachers participated in training and began intervention, the rate of general praise decreased for most teachers. This may be because teachers shifted their general praise statements to more specific praise. The higher rates of general praise before intervention are consistent with other researchers' findings that teachers use more general praise than BSP (Floress et al., 2018). Further, researchers found that teachers were significantly more likely to use general praise over BSP (Floress & Jenkins, 2015; Floress et al., 2018). Despite the effectiveness of BSP on students' on-task behavior, delivering BSP takes more effort from teachers. Therefore, general praise may be more automatic and feel more natural for teachers, resulting in higher rates prior to intervention.

Teachers of younger students (first and second grade; Shaunna, Vicki, Lily, and Kendall) had higher rates of general praise during baseline (mean [M] = 0.86) than teachers of older students (third and fourth grade; M = 0.15). These results are consistent in that as the grade levels increase, the rate of praise decreases (Floress et al., 2018). Further, the two first-grade teachers (Shaunna and Kendall) had the highest rates of general praise during baseline (M = 1.21), indicating that teachers of the youngest students naturally have a higher rate of praise.

Q3. Early Career Teacher Perceptions

Overall, novice teachers' perceptions of the importance and effectiveness of the intervention were positive. All teachers that responded (five of six teachers completed the survey) to the survey indicated they either agree or strongly agree (M = 3.6) that it is important for teachers to receive feedback to improve their teaching and that BSP is an effective classroom management practice and that teachers should use (M = 3.8). Interestingly, teachers generally agreed that their rates of BSP were low before intervention began. When asked about the specific intervention procedures, four of the five teachers agreed that watching a video was an effective method for teaching a new skill, whereas one teacher disagreed (M = 2.8). All teachers agreed or strongly agreed (M = 3.2) that the email feedback they received on their rate of BSP was effective and most teachers agreed or strongly agreed that they would like their school to use email feedback in future professional development (M = 3.0). Teachers also agreed that IVVR is

effective in increasing their rate of BSP (M = 3.0) and would recommend the use of IVVR for their future professional development and other teachers (M = 3.2). When asked about their preference for email feedback over IVVR, teachers had mixed opinions about whether they would like their school to use IVVR in future professional development (three teachers disagreed, and two teachers agreed). When asked if they would prefer using IVVR over email feedback, four of five teachers disagreed (M = 2.2). These results may indicate that novice teachers still prefer to receive feedback on their performance rather than watching themselves teach and reflect on their practice. Finally, teachers agreed or strongly agreed that their increased rate of BSP in the classroom improved student achievement (M = 3.2).

DISCUSSION

The purpose of this study was to investigate the effectiveness of professional development mediums to improve teacher behavior. Researchers specifically examined and compared the effect of IVVR with self-reflection and PF on its effect on the use of BSP for early career elementary teachers. There are three primary findings associated with this study:

(a) IVVR with self-reflection and PF contributed to an increase in BSP,

(b) general praise can be affected by the implementation of both conditions, and

(c) teachers had positive perceptions of both conditions they received but had specific hesitations moving forward.

RQ1

IVVR with self-reflection and PF successfully increased the delivery of BSP for participants from baseline to intervention. A majority of participants had minimal BSP statements during baseline and increased their use of BSP with varying levels of success. While visual analysis indicates the PF condition produced minimally higher results than the IVVR condition, both provided significant improvements in BSP compared to baseline for most participants. This suggests the potential of IVVR with self-reflection and its ability to provide significant results without the need for another observer. With this potential, IVVR could help alleviate some of the barriers to professional development for teachers, including time, resources, and overall opportunities to practice. It is important to note that we do not suggest that IVVR can be used in isolation as there is research to support the use of direct coaching via mediums such as email or using multiple methods for increasing teacher behaviors (Floress et al., 2018; Criss et al., 2023). However, the results of this study suggest merit in having additional avenues to increase the teacher skill set of evidence-based practices such as BSP.

While all teachers increased their overall use of BSP from baseline, every participant dropped when switching conditions. For example, if a participant increased with IVVR in the first session, they immediately dropped in the resultant PF condition initially. While there is no definitive reason for why the dip in the second session, we speculate that comfort with the initial intervention and discomfort with the second intervention may contribute to the drop. Additionally, this may be a model of what is currently used in schools where a variety of initiatives are introduced without any suggestions from teachers (Brady & Wilson, 2021). This may suggest that professional development should seek the preferences of participants prior to the introduction of new interventions. Furthermore, consistent with current research on professional development, this may suggest the need to stay consistent for longer sessions when implementing professional development interventions, as compared to one-time sit and get professional development (Darling-Hammond et al., 2017). This study saw increases in teacher performance over short periods of sessions (4-5 sessions) and may benefit from future studies seeking more accurate time frames.

Additionally, three teachers who started the PF condition, when they returned to email, continued to grow regardless of condition. On the contrary, the other three participants who started in the IVVR condition did not always continue throughout all sessions with an upward trend. Similar to Thompson et al. (2012), this may suggest the need for a tiered approach, such as direct coaching followed by self-reflection. For example, Reinke et al. (2008) suggest that self-monitoring is more effective in increasing evidence-based practices with teachers when paired with visual PF. However, our research suggests that regardless of condition, skills can be gleaned from teachers who focus on a specific skill set. Furthermore, it is crucial to understand the purpose of the skill being learned and the time necessary to grasp and implement the skill in the classroom.

RQ2

General praise is a common occurrence in the classroom, particularly in early elementary classrooms (Markelz et al., 2022). While general praise is common, it is not as effective in shaping classroom culture and student behavior (Markelz et al., 2020). BSP is an established evidence-based practice for the classroom for the improvement of the classroom environment (Simonsen et al., 2017). Research has indicated that BSP may require more effort to implement because it requires the teacher to identify a specific behavior rather than simply provide an affirmative general praise statement (Floress et al., 2018). However, as teachers increase their specific feedback to students through BSP, the frequency of general praise statements would likely decrease because teachers are replacing general feedback with more targeted feedback. However, our research seems to vary from prior research as two participants increased their use of general praise from baseline, one participant stayed the same, and three minimally decreased. Two participants (Shaunna and Kendall) had the highest general praise rates and the highest BSP rates while both teaching first grade. While both made significant increases, their increases may be due to more reinforcement, which is seen as a positive in lower elementary regardless of the type of reinforcement. Furthermore, the lack of reduction in general praise and increase in BSP suggests that more reinforcement can be built into the same amount of time. For example, in their research, Floress et al. (2018) and Floress and Jenkins (2015) recommend the goal for BSP reinforcement is (3-5 BSP per 10 min or 18-30 BSP per hour) and often, teachers fall well-below this recommendation.

RQ3

Both technologies produced nearly similar results to each other even with drastic changes in the intervention modality. One condition utilized a familiar method of teacher coaching to many current teachers where a third-party observer entered the classroom, observed teaching, and sent coaching information via email. This is similar to the evaluation process of teaching and is a well-known evidence-based practice for teacher professional development (Simonsen et al., 2017).

In the other condition, teachers utilized innovative technology, such as 360-degree cameras and VR headsets, in an attempt to intervene in the same teacher behaviors. While teachers were trained in both modalities, they were much more comfortable and familiar with the PF condition. This is unsurprising as email and in-person observations are much more common in the school systems. Additionally, many teachers are often averse to new technology implementation if there is a lack of training, resources, and time to use (Francom et al., 2020). However, all teachers generally agreed that both conditions were important to improve their teaching using BSP. Interestingly, four of the five teachers indicated that watching the IVVR video and self-reflection was an effective method for teaching a new skill. This suggests that the IVVR condition could be a viable option for improving teachers' use of evidence-based practices, particularly when improving BSP.

Furthermore, all teachers agreed that the use of IVVR was effective and should be considered in future professional development for other teachers. This suggests that schools could benefit from a small investment in technology that schoolwide stakeholders could use. However, in a question of which condition they preferred, four of five teachers stated they preferred the PF condition. Interestingly, participants stated they would prefer email with an outside observer and not a person of power within the school. For example, one participant stated that they preferred the researchers doing the coaching versus an administrator or coach from the district, suggesting that the power dynamic of schools may play a part in the preference for professional development. Understanding the dynamic power and its effect on professional development may be beneficial in future studies when deciding on modalities and personnel.

Participants deemed both conditions successful, but preferring the PF condition could be expected for a variety of reasons. For one, the email had direct coaching, including examples, non-examples, and other information. Additionally, teachers found watching themselves in VR as, anecdotally, odd and did not always enjoy it. Finally, teachers' time is sacred, and they have so many responsibilities that adding the additional time to watching the IVVR and self-reflecting was another duty they needed to accomplish. Further research needs to investigate the effectiveness and efficiency of the design.

Implications for Practice

Schools are constantly looking for impactful professional development so that teachers can improve their classroom teaching without overloading an already overloaded teacher task list (Brady & Wilson, 2021). The results of the current study suggest that the use of IVVR with self-reflection may provide an option for teachers to implement it with minimal change to their daily schedule. Furthermore, it reduces the need for another person to observe and coach. However, the results also indicate the likely need for teachers to be taught a specific skill directly, coached on the specific skill, and then have the opportunity to practice alone with the IVVR. This suggests the need for targeted well-planned professional development that encapsulates a wide stakeholder buy in while also giving teachers more autonomy to improve their practices.

Traditional PF relies on administrator or coach time and teacher time. As well known, teachers, particularly novice teachers and administrators, are overwhelmed much of the time and lack additional capacity for more initiatives (Brady & Wilson, 2021). Some districts are investing heavily in collaborative approaches to improving teacher practice, including innovative professional learning communities (PLC). Within these PLCs, teachers can share innovation and improve learning. With the use of IVVR, teachers would have access to another modality for improving and sharing at PLCs to reduce the need and focus on outside coaching. Moreover, the technology needed for IVVR is falling in price and is more affordable than it has ever been (Alsop, 2024). Therefore, adopting the tools of this research is within reach for many districts. Furthermore, the technology can be shared amongst groups of teachers, including the teacher PLCs. While this research study focused on the use of self-reflection, teachers can self-reflect and utilize their innovative PLCs for further knowledge of their current teacher practices.

Limitations

The current study required every teacher to read an email independently or watch a video. While the researcher sat with the participant during intervention, no data was collected on how participants watched and experienced their lesson in the IVVR condition. This may affect final data and determinations of success. Future studies need to investigate the motivations of teachers to improve their teaching. In addition, participants completed the self-reflection without any governance of accuracy or correctness. In this manner, participants were supposed to reflect through the questions but never received direct training or coaching on their performance, which could affect the outcome. However, one of the purposes of this research is to investigate the effectiveness of technology alone. Third, making clear comparisons among participants is difficult because they were randomly assigned to start in one of two conditions. These varying conditions could have influenced their performance based on which they began and finished. Similarly, the study's alternating interventions complicate comparisons with the baseline and individual conditions. Nonetheless, we focused on comparing the effects of both intervention types, and most participants showed their best performance in their final assigned condition, highlighting the interventions' effectiveness. Furthermore, participants did not continue at a linear positive slope which suggests the need for each intervention independently. Finally, we did not coach or intervene on general praise as the intent was to improve the evidence-based practice of BSP. General praise was used more as an indicator based on the effectiveness of improving BSP. According to foundational research in BSP, BSP should be employed at a higher rate than general praise (Brophy, 1981).

Implications for Future Research

Technology continues to permeate the educational environment at a high rate. This rapid movement is mirrored in educational research, particularly in the areas of 360-degree cameras, VR, and other immersive technology. However, a majority of studies focus on short-term sessions and their effect on skill acquisition. Teaching, though, is a lifeline profession where the skills learned are more effective in the long term. Therefore, while our study shows promising results, future studies need to focus on long-term longitudinal effects along with short-term effects. This dosage of intervention is important to understand the true effects of a professional development intervention.

Second, the current research study focused on the two conditions that can improve teachers' use of BSP in the classroom. However, teachers need more skills to improve the classroom environment, including opportunities to respond, transition, social/emotional, and student outcomes. The results of this study indicate a positive increase

in BSP and may offer an avenue to address the above skills in addition to BSP. Further research needs to not only replicate results with BSP but also continue to investigate the usefulness and effectiveness of the technology across a vast array of teacher skills and student outcomes. Additionally, the features of the intervention and the technology need to be investigated to see the best fit for utilizing the technology to address the vast skillset every teacher needs.

Research in PD often suggests that learning a skill and then practicing a skill is effective (Darling-Hammond et al., 2017). In this study, we similarly suggest that the PF condition first may be more effective due to direct coaching prior to self-reflection. However, further research is needed on when and where specific interventions take place. This includes whether coaching should take place before teaching a lesson or directly after, like the current study. During the PF condition, participants were able to have a physical and specific coaching email that outlined specifics for their lesson.

CONCLUSION

This study provides valuable insights into the effectiveness of professional development mediums for enhancing teacher behavior, particularly in the use of BSP among early-career elementary teachers. The findings demonstrate that both IVVR with self-reflection results and PF positively improved BSP from baseline levels. While the PF condition showed slightly higher effectiveness, IVVR offers a promising alternative that alleviates some barriers to traditional professional development, such as time and resource constraints. The integration of IVVR and PF conditions presents a viable strategy for improving teacher practices, with implications for broader educational settings. By addressing both effectiveness and teacher preferences, schools can develop more impactful professional development programs that support teachers in their critical role in shaping classroom environments.

Author contributions: All authors were involved in the concept, design, collection of data, interpretation, writing, and critically revising the article. All authors approved the final version of the article.

Funding: The authors received no financial support for the research and/or authorship of this article.

Ethics declaration: This study was approved by the Georgia Southern University Institutional Review Board with approval number #H22397. All participants signed informed consent forms prior to research activities. Participants could withdraw without penalty at any time. Personal data was anonymized with pseudonyms.

AI statement: AI was not used to write this manuscript.

Declaration of interest: The authors declare no competing interest.

Data availability: Data generated or analyzed during this study are available from the authors on request.

REFERENCES

Algozzine, B., Wang, C., & Violette, A. S. (2011). Reexamining the relationship between academic achievement and social behavior. *Journal of Positive Behavior Interventions, 13*(1), 3-16. https://doi.org/10.1177/1098300709359084

Alsop, T. (2024). VR headset average price in the United States from 2018 to 2030. *Statista.* https://www.statista.com/forecasts/1338404/vr-headset-average-price-united-states/

Alter, P., Walker, J., & Landers, E. (2013). Teachers' perceptions of students' challenging behavior and the impact of teacher demographics. *Education and Treatment of Children, 36*(4), 51-69. https://doi.org/10.1353/etc.2013.0040

Bettencourt, A. F., Gross, D., Ho, G., & Perrin, N. (2018). The costly consequences of not being socially and behaviorally read to learn by kindergarten in Baltimore City. *Journal of Urban Health, 95*, 36-50. https://doi.org/10.1007/s11524-017-0214-6

Brady, J., & Wilson, E. (2021). Teacher wellbeing in England: Teacher responses to school-level initiatives. *Cambridge Journal of Education, 51*(1), 45-63. https://doi.org/10.1080/0305764X.2020.1775789

Briere, D. E., Simonsen, B., Sugai, G., & Myers, D. (2015). Increasing new teacher's specific praise using a within-school consultation intervention. *Journal of Positive Behavior Interventions, 17*(1), 50-60. https://doi.org/10.1177/1098300713497098

Brophy, J. (1981). Teacher praise: A functional analysis. *Review of Educational Research, 51*, 5-32. https://doi.org/10.3102/00346543051001005

Christ, T., Arya, P., & Chiu, M. M. (2017). Video use in teacher education: An international survey of practices. *Teaching and Teacher Education, 63*, 22-35. https://doi.org/10.1016/j.tate.2016.12.005

Common, E. A., Lane, K. L., Cantwell, E. D., Brunsting, N. C., Oakes, W. P., Germer, K. A., & Bross, L. A. (2020). Teacher-delivered strategies to increase students' opportunities to respond: A systematic methodological review. *Behavioral Disorders, 45*(2), 67-84. https://doi.org/10.1177/0198742919828310

Criss C. J. (2025). The effects of temporal timing of performance feedback on novice teachers' use of behavior-specific praise. *Education and Treatment of Children, 48*, 107-124. https://doi.org/10.1007/s43494-024-00135-y

Criss, C. J., Konrad, M., Alber-Morgan, S. R., Brock, M. E., & Harris, A. B. (2023). Using performance feedback with and without goal setting on teachers' classroom management skills. *Behavioral Disorders, 49*(2), 91-105. https://doi.org/10.1177/01987429231201096

Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). *Effective teacher professional development.* Learning Policy Institute. https://doi.org/10.54300/122.311

Ennis, R. P., Royer, D. J., Lane, K. L., & Dunlap, K. (2020). The impact of coaching on teacher-delivered behavior-specific praise in pre-k-12 settings: A systematic review. *Behavioral Disorders, 45*, 148-156. https://doi.org/10.1177/0198742919839221

Epstein, M., Atkins, M., Cullinan, D., Kutash, K., & Weaver, R. (2008). *Reducing behavior problems in the elementary school classroom: A practice guide (NCEE No. 2008-012).* National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. https://doi.org/10.1037/e602222011-001

Ferdig, R. E., Kosko, K. W., & Gandolfi, E. (2023). Exploring the relationships between teacher noticing, ambisonic audio, and variance in focus when viewing 360 video. *Educational Technology Research and Development, 71*(3), 881-899. https://doi.org/10.1007/s11423-023-10215-2

Floress, M. T., & Jenkins, L. N. (2015). A preliminary investigation of kindergarten teachers' use of praise in general education classrooms. *Preventing School Failure: Alternative Education for Children and Youth, 59*, 253-262. https://doi.org/10.1080/1045988X.2014.942834

Floress, M. T., Jenkins, L. N., Reinke, W. M., & McKown, L. (2018). General education teachers' natural rates of praise: A preliminary investigation. *Behavioral Disorders, 43*(4), 411-422. https://doi.org/10.1177/0198742917709472

Francom, G. M. (2020). Barriers to technology integration: A time-series survey study. *Journal of Research on Technology in Education, 52*(1), 1-16. https://doi.org/10.1080/15391523.2019.1679055

Freeman, J., Simonsen, B., Briere, D. E., & MacSuga-Gage, A. S. (2014). Pre-service teacher training in classroom management: A review of state accreditation policy and teacher preparation programs. *Teacher Education and Special Education, 37*(2), 106-120. https://doi.org/10.1177/0888406413507002

Gage, N. A., Scott, T., Hirn, R., & MacSuga-Gage, A. S. (2018). The relationship between teachers' implementation of classroom management practices and student behavior in elementary school. *Behavioral Disorders, 43*(2), 302-315. https://doi.org/10.1177/0198742917714809

Gold, B., & Windscheid, J. (2020). Observing 360-degree classroom videos–Effects of video type on presence, emotions, workload, classroom observations, and ratings of teaching quality. *Computers & Education, 156*, 1-13. https://doi.org/10.1016/j.compedu.2020.103960

Goodson, B., Caswell, L., Price, C., Litwok, D., Dynarski, M., Crowe, E., Meyer, R., & Rice, A. (2019). *Teacher preparation experiences and early teaching effectiveness. Appendices. NCEE 2019-4007*. National Center for Education Evaluation and Regional Assistance.

Henry, G. T., & Redding, C. (2020). The consequences of leaving school early: The effects of within-year and end-of-year teacher turnover. *Education Finance and Policy, 15*(2), 332-356. https://doi.org/10.1162/edfp_a_00274

Huber, T., Paschold, M., Hansen, C., Wunderling, T., Lang, H., & Kneist, W. (2017). New dimensions in surgical training: Immersive virtual reality laparoscopic simulation exhilarates surgical staff. *Surgical Endoscopy, 31*, 4472-4477. https://doi.org/10.1007/s00464-017-5500-6

Ingersoll, R. M., & Tran, H. (2023). Teacher shortages and turnover in rural schools in the US: An organizational analysis. *Educational Administration Quarterly, 59*(2), 396-431. https://doi.org/10.1177/0013161X231159922

Jeon, H. J., Diamond, L., McCartney, C., & Kwon, K. A. (2022). Early childhood special education teachers' job burnout and psychological stress. *Early Education and Development, 33*(8), 1364-1382. https://doi.org/10.1080/10409289.2021.1965395

Johnson, A. D., Phillips, D. A., Schochet, O. N., Martin, A., Castle, S., & Tulsa SEED Study Team. (2021). To whom little is given, much is expected: ECE teacher stressors and supports as determinants of classroom quality. *Early Childhood Research Quarterly, 54*(1), 13-30. https://doi.org/10.1016/j.ecresq.2020.07.002

Kosko, K. W., Ferdig, R. E., & Zolfaghari, M. (2021). Preservice teachers' professional noticing when viewing standard and 360 video. *Journal of Teacher Education, 72*(3), 284-297. https://doi.org/10.1177/0022487120939544

Markelz, A. M., Riden, B. S., Zoder-Martell, K., Miller, J. E., & Bolinger, S. J. (2020). Reliability assessment of an observation tool to measure praise characteristics. *Journal of Positive Behavior Interventions, 23*(1), 17-29. https://doi.org/10.1177/1098300720907988

Markelz, A., Riden, B., Floress, M. T., Balint-Langel, K., Heath, J., & Pavelka, S. (2022). Teachers' use of specific, contingent, and varied praise. *Journal of Positive Behavior Interventions, 24*(2), 110-121. https://doi.org/10.1177/1098300720988250

Martens, B. K., Witt, J. C., Elliott, S. N., & Darveaux, D. X. (1985). Teacher judgments concerning the acceptability of school-based interventions. *Professional Psychology: Research and Practice, 16*(2), Article 191. https://doi.org/10.1037//0735-7028.16.2.191

McGuire, S. N., & Meadan, H. (2024). Preservice teachers' perspectives and use of behavior management strategies. *Psychology in the Schools, 61*(2), 475-495. https://doi.org/10.1002/pits.23062

McGuire, S. N., Meadan, H., & Xia, Y. (2023). Behavior management training for newly graduated teachers: A randomized-controlled trial. *Behavioral Disorders, 49*(1), 3-16. https://doi.org/10.1177/01987429231179890

Moore, T. C., Maggin, D. M., Thompson, K. M., Gordon, J. R., Daniels, S., & Lang, L. E. (2019). Evidence review for teacher praise to improve students' classroom behavior. *Journal of Positive Behavior Interventions, 21*(1), 3-18. https://doi.org/10.1177/1098300718766657

Moore, T. C., Wehby, J. H., Oliver, R. M., Chow, J. C., Gordon, J. R., & Mahany, L. A. (2017). Teachers' reported knowledge and implementation of research-based classroom and behavior management strategies. *Remedial and Special Education, 38*(4), 222-232. https://doi.org/10.1177/0741932516683631

Nagro, S. A., DeBettencourt, L. U., Rosenberg, M. S., Carran, D. T., & Weiss, M. P. (2017). The effects of guided video analysis on teacher candidates' reflective ability and instructional skills. *Teacher Education and Special Education, 40*(1), 7-25. https://doi.org/10.1177/0888406416680469

Pulijala, Y., Ma, M., Pears, M., Peebles, D., & Ayoub, A. (2018). Effectiveness of immersive virtual reality in surgical training–A randomized control trial. *Journal of Oral and Maxillofacial Surgery, 76*(5), 1065-1072. https://doi.org/10.1016/j.joms.2017.10.002

Reinke, W. M., Lewis-Palmer, T., & Merrell, K. (2008). The classroom check-up: A classwide teacher consultation model for increasing praise and decreasing disruptive behavior. *School Psychology Review, 37*(3), 315-332. https://doi.org/10.1080/02796015.2008.12087879

Robinson, L., & Kelley, B. (2007). Developing reflective thought in preservice educators: Utilizing role-plays and digital video. *Journal of Special Education Technology, 22*(2), 31-43. https://doi.org/10.1177/016264340702200203

Robinson, O. P., Bridges, S. A., Rollins, L. H., & Schumacker, R. E. (2019). A study of the relation between special education burnout and job satisfaction. *Journal of Research in Special Educational Needs, 19*(4), 295-303. https://doi.org/10.1111/1471-3802.12448

Schaefer, J. M., & Ottley, J. R. (2018). Evaluating immediate feedback via bug-in-ear as an evidence-based practice for professional development. *Journal of Special Education Technology, 33*(4), 247-258. https://doi.org/10.1177/0162643418766870

Schles, R. A., & Robertson, R. E. (2019). The role of performance feedback and implementation of evidence-based practices for pre-service special education teachers and student outcomes: A review of the literature. *Teacher Education and Special Education, 42*, 36-48. https://doi.org/10.1177/0888406417736571

Simonsen, B., Fairbanks, S., Briesch, A., Myers, D., & Sugai, G. (2008). Evidence-based practices in classroom management: Considerations for research to practice. *Education and Treatment of Children, 31*, 351-380. https://doi.org/10.1353/etc.0.0007

Simonsen, B., Freeman, J., Dooley, K., Maddock, E., Kern, L., & Myers, D. (2017). Effects of targeted professional development on teachers' specific praise rates. *Journal of Positive Behavior Interventions, 19*(1), 37-47. https://doi.org/10.1177/1098300716637192

Sinclair, A. C., Gesel, S. A., LeJeune, L. M., & Lemons, C. J. (2020). A review of the evidence for real-time performance feedback to improve instructional practice. *The Journal of Special Education, 54*(2), 90-100. https://doi.org/10.1177/0022466919878470

Thompson, N., & Pascal, J. (2012). Developing critically reflective practice. *Reflective Practice, 13*(2), 311-325. https://doi.org/10.1080/14623943.2012.657795

US Department of Education, Institute of Education Sciences. (2023). National Center for Education Statistics, School Pulse Panel 2021-22 and 2022-23. *IES*. https://ies.ed.gov/schoolsurvey/spp/

Verlenden, J. V. (2021). Association of children's mode of school instruction with child and parent experiences and well-being during the COVID-19 pandemic–COVID experiences survey, United States, October 8-November 13, 2020. *MMWR Morbidity and Mortality Weekly Report, 70*(11), 369-376. https://doi.org/10.15585/mmwr.mm7011a1

Walshe, N., & Driver, P. (2019). Developing reflective trainee teacher practice with 360-degree video. *Teaching and Teacher Education, 78*, 97-105. https://doi.org/10.1016/j.tate.2018.11.009

Xiao, B., & Tobin, J. (2018). The use of video as a tool for reflection with preservice teachers. *Journal of Early Childhood Teacher Education, 39*(4), 328-345. https://doi.org/10.1080/10901027.2018.1516705