INTERNATIONAL JOURNAL OF MODERN EDUCATION STUDIES

| Volume 8 - No 2 - December 2024 - ISSN 2618-6209 |

Research

Enhancing Critical Reflection in Preservice Teacher Internships: Examining the Impact of 360-Degree Video and Virtual Reality Technology

Heather Stefanski[1] **Mohamed Ibrahim**[2]

Article Type
Original Research

International Journal of Modern Education Studies
2024
Volume 8, No 2
Pages: 319-340
http://www.ijonmes.net

Article Info:

Received 06.10.2024
Revision 24.11.2024
Accepted 18.12.2024

Abstract:

Preservice teachers (PSTs) frequently face challenges with classroom management, a key aspect of effective teaching. Reflective practice is crucial for PSTs to enhance their skills, but their reflections tend to be superficial. This mixed-methods study explores whether integrating 360-degree video and virtual reality (VR) technology with a modified Gibbs Reflective Cycle can improve PSTs' critical reflection on their classroom management practices. Twelve PSTs, engaged in full-time internships at middle schools, recorded their lessons using 360-degree cameras and reviewed the footage via VR headsets. Reflections were completed at three stages for each of two observed lessons: immediately after teaching, following a review of 2D video, and after viewing the 360-degree VR video. Paired samples t-tests revealed significant improvements in PSTs' self-assessments of classroom management after reviewing the 360 VR video compared to memory and 2D video. Despite technical issues, the results indicate that immersive 360 VR video, combined with structured reflection, can enhance PSTs' objective self-assessment, inform their pedagogical decision-making, and foster actionable insights to improve classroom management skills. This study contributes to research on immersive technologies in teacher education and underscores the value of structured reflection in supporting PSTs' professional development.

Keywords: Critical reflection, Preservice teacher education, 360-degree video, Virtual reality headsets, Classroom management.

Citation:

Stefanski, H. & Ibrahim, M.(2024). Enhancing Critical Reflection in Preservice Teacher Internships: Examining the Impact of 360-Degree Video and Virtual Reality Technology *International Journal of Modern Education Studies, 8*(2), 319-340. https://doi.org/10.51383/ijonmes.2024.379

[1] Assistant Professor of Teaching & Educational Leadership, Arkansas Tech University, College of Education and Health, Russellville, U.S.A. hstefanski@atu.edu, https://orcid.org/0009-0001-0808-9690

[2] Professor of Teaching & Educational Leadership, Arkansas Tech University, College of Education and Health, Russellville, U.S.A. mibrahim1@atu.edu, https://orcid.org/0000-0003-4618-2463

INTRODUCTION

During an informal conversation with pre-service teachers (PSTs) just before their full internship experience, the overwhelming majority expressed significant concerns about classroom management. For many of these PSTs, classroom management seemed synonymous with controlling student behavior. They voiced worries about maintaining student attention and ensuring students "do what they are told." Additionally, PSTs revealed anxieties about how they might react in the face of a disruptive or explosive situation and how such events could be prevented. Research has well-documented that classroom management is a prominent concern among PSTs and is often cited as a key reason why some graduates never pursue a teaching career (Theelen, et al., 2018).

In Arkansas, teachers are evaluated using the Teacher Excellence and Support System (TESS) rubric, which is grounded in Charlotte Danielson's Framework for Teaching (Arkansas Department of Education). The development of the TESS rubric can be traced back to the 2002 No Child Left Behind Act, which aimed to improve schools and increase accountability, ultimately becoming the catalyst for the overhaul of teacher evaluation systems across the country. In 2011, Arkansas responded to state legislation by creating the TESS evaluation system, which was revised in 2013 to incorporate Danielson's framework (Byford, 2018). Danielson's framework was chosen due to its research backing and comprehensive approach to evaluating all aspects of teaching, providing principals with a structured method to determine teachers' support needs.

By 2014, 20 states had adopted Danielson's framework or a modified version to qualify for Race to the Top funds, an initiative led by the Obama administration aimed at reforming teacher evaluation systems (Dodson, 2017). The TESS rubric consists of four domains: Planning and Preparation, The Classroom Environment, Instruction, and Professional Responsibilities. PSTs are evaluated using the Aspiring Teacher Rubric, which closely aligns with TESS. Of particular relevance to PST concerns is Domain 2: The Classroom Environment, which encompasses classroom management, the area that many PSTs find most challenging. This domain covers key elements such as establishing respect and rapport, fostering a culture of learning, managing procedures and student behavior, and organizing the physical space. Effective classroom management is crucial because it directly impacts student learning; disruptive behavior can significantly derail lessons, resulting in lost instructional time as teachers are forced to address behavior issues.

Adeyemo (2012) identified common disruptive behaviors faced by teachers, including bullying, hitting, name-calling, sleeping in class, excessive chatting, lateness, unexcused exits, and verbal or physical threats. These behaviors can persistently interfere with academic learning, making it difficult for both students and teachers to maintain a functional and productive classroom environment. To address these challenges, it is essential for PSTs to focus on building relationships, understanding child development, planning effectively, and monitoring classroom dynamics (Emmer & Evertson, 2017).

For PSTs, critical reflection on their teaching practice is key to improving classroom management. Critical reflection involves objectively examining lesson content and teaching processes, then applying these insights to enhance future practice. This is particularly important for PSTs because, as Liu (2015) notes, "the ultimate goal of critical reflection is producing actions for enhanced student learning" (p. 144).

To develop the capacity for critical reflection, PSTs must first learn to assess their own teaching accurately, identifying both strengths and areas for improvement. A common approach to facilitating reflection is having PSTs review video recordings of their lessons. These 2D video recordings provide a concrete representation of what occurred in the classroom, helping PSTs differentiate between their perceptions and the actual events (Walshe & Driver, 2019). Recorded lessons offer a valuable tool for reflection by anchoring the PST's self-assessment in objective evidence rather than memory (Liu, 2015).

Additionally, traditional video recordings, emerging technologies such as 360-degree cameras and virtual reality (VR) headsets offer new opportunities for enhancing reflective practice. Unlike standard fixed-camera recordings, 360-degree cameras capture the entire classroom environment, allowing for a more immersive and comprehensive review of classroom interactions. When paired with VR headsets like the Oculus Quest 2, PSTs can virtually "walk" around the classroom, observing student behavior and classroom dynamics from multiple perspectives (Kosko et al., 2021). This immersive technology has the potential to deepen PSTs' reflections and provide more detailed insights into their classroom management strategies.

Thus, this study seeks to investigate the impact of using 360-degree cameras and VR headsets on PSTs' ability to reflect on their practice more objectively and critically. By exploring how these technologies influence self-assessment and reflective practice, this research aims to enhance the tools available for developing effective classroom management skills among PSTs.

Literature review

Many educator preparation programs incorporate reflective practices throughout their coursework, but the types and processes of reflection vary significantly (Beauchamp, 2015). Reflection is considered essential for PSTs as it bridges their experiences with problem-solving and decision-making. All teachers need to justify their teaching strategies, showing how they guide students toward proficiency and how learning events are sequenced for optimal understanding.

Course instructors in teacher preparation programs often require PSTs to write reflections as a way to externalize their thought processes (Mulryan-Kyne, 2021). However, literature suggests that PST reflections frequently remain at a surface level and are unproductive. Common criticisms highlight that PSTs tend to describe what they did in the classroom without connecting their actions to a clear rationale, emphasizing their strengths

while downplaying weaknesses to influence grades, and writing reflections filled with clichés and educational jargon (Beauchamp, 2015).

Walshe and Driver (2019) recommend scaffolding the reflective process and teaching deliberate methods to help PSTs engage in deeper self-analysis that supports professional growth. Mulryan-Kyne (2021) noted that frameworks such as Ward and McCotter's (2004) outline three essential elements for reflection: reflection as situated practice, cyclic reflection, and incorporating multiple perspectives. This study used a modified version of Gibbs' Reflective Cycle, which includes these three elements, to guide participants. Gibbs' model provides a systematic approach for PSTs to reflect on their teaching, which is particularly helpful for novices until reflection becomes an intuitive practice. The cycle consists of describing the event, acknowledging feelings during or after the event, evaluating and analyzing what happened, drawing conclusions, and determining future actions (Gibbs, 1988).

To promote objectivity in reflection, many educator preparation programs require PSTs to video record their lessons using 2-dimensional video recorders. Video recordings help PSTs capture more detail and provide concrete evidence for their reflections (Rosaen et al., 2008). While video recordings support recall, they offer a limited perspective due to the fixed camera angle, often capturing only a portion of the classroom and interactions—a limitation referred to as the "keyhole effect" (Atal et al., 2023). Additionally, 2D video recordings often suffer from poor sound quality due to the camera's distance from the action, further hindering the reflective process.

In recent years, 360-degree video technology has become more accessible and user-friendly, leading to its increased use in internships and educational settings. Unlike traditional recordings, 360-degree video offers a comprehensive view of the classroom, enabling viewers to observe interactions from multiple perspectives simultaneously. When placed strategically in the center of the room, these cameras also improve sound quality, capturing a more holistic classroom experience. However, while 360-degree video and virtual reality (VR) headsets offer immersive experiences, they do have limitations. Viewers can explore the recorded space but cannot interact with the content directly. Moreover, learning to operate 360-degree cameras and VR headsets can present a steep learning curve, requiring both training for optimal use and some adaptation to the technology (Roche, Kittel, et al., 2021). In addition, VR headsets may cause overstimulation, dizziness, or discomfort, particularly for individuals who wear glasses or are sensitive to wearing devices on their faces (Fransson et al., 2020). Despite these challenges, with practice, the advantages of immersive 360-degree video may outweigh the potential discomforts, transforming how PSTs reflect on their teaching (Roche, Cunningham, et al, 2021).

Schon's (1987) theory of reflective practice distinguishes between two types: reflection-on-action and reflection-in-action. Reflection-on-action occurs after an event, allowing teachers to analyze their past decisions, while reflection-in-action happens in the

moment, requiring teachers to think on their feet and make immediate adjustments (Third, 2022). For PSTs, who have limited teaching experience, opportunities to practice reflection-in-action are scarce. Yet during their internships, PSTs are expected to reflect-on-action in ways that simulate reflection-in-action. This can be challenging, but 360-degree video and VR technology can help PSTs better develop these skills. The immersive nature of technology allows PSTs to mentally revisit their teaching moments, offering enhanced recall of their in-the-moment thinking. Although the video is viewed post-lesson, it can create links to the reflective processes that occur during the lesson itself.

Teacher evaluation systems, such as TESS, assess classroom management and "on-the-spot" decision-making, require PSTs to reflect on their in-the-moment actions, analyze situations, and plan for future improvements. Combining immersive technologies like 360-degree video with structured reflective models such as Gibbs Reflective Cycle offers a promising avenue for developing critical reflection skills that mirror authentic classroom experiences.

This study required PSTs to focus on Domain 2: The Classroom Environment of the TESS rubric (Appendix A) during lessons and under three reflective conditions: memory, 2D video, and 360-degree VR. Domain 2, which addresses classroom management, was chosen because it reflects the concerns frequently expressed by PSTs. The study sought to explore how 360-degree cameras and VR headsets could impact PSTs' ability to objectively reflect on this domain. Gibbs' Reflective Cycle was selected as the reflective framework, as PSTs often reflect superficially, and this model prompts deeper thinking about classroom management, analyzing actions, and decision-making. The immersive nature of 360-degree VR technology offers a realistic setting conducive to objective self-assessment, aligning with the stages of Gibbs' Cycle, which begins with evidence-based description and analysis.

Research Question

Thus, this study's research question was: Can a modified Gibbs' Reflective Cycle, combined with 360-degree video and VR headsets, increase PSTs' ability to objectively self-assess Domain 2: The Classroom Environment?

Theoretical Framework

This study is grounded in constructivist learning theory, with a particular emphasis on active learning. Constructivism asserts that learners actively construct their own knowledge by integrating new information with their existing cognitive frameworks (Fernando & Marikar, 2017). Within this approach, learning is seen as a dynamic process where individuals are not passive recipients of information but active participants in creating meaning from their experiences. Active learning, a key aspect of constructivism, requires students to engage deeply with content by doing something and then reflecting on those actions (Vanhorn et al., 2019).

Active learning encourages students to participate in higher-order thinking tasks, such as analyzing, synthesizing, and evaluating (Bonwell & Eison, 1991). This study adopts this approach through the use of Gibbs' Reflective Cycle, which provides a structured framework for reflection. PSTs in this study taught lessons and then actively engaged in the reflective process by analyzing their classroom management practices using Domain 2: The Classroom Environment from the Aspiring Teacher Rubric. This reflection involved synthesizing insights from their teaching experiences, identifying best practices, and evaluating their classroom management strategies to identify areas for improvement.

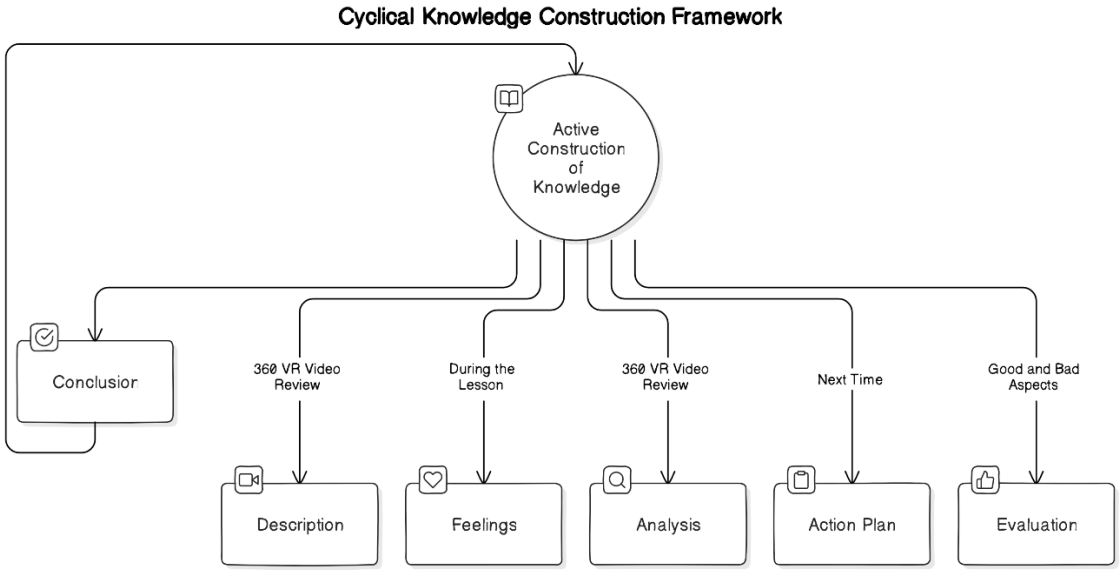

Figure 1. Research Cyclical Knowledge Construction Framework

The use of authentic, real-time scenarios during the PSTs' full internships provided a rich context for reflection and knowledge construction. As PSTs progressed through the semester, they built on their reflections by incorporating feedback from mentors and supervisors, engaging in professional development opportunities, and utilizing recommended resources. These iterative cycles of reflection and feedback allowed PSTs to continuously refine their classroom management skills, aligning with the principles of constructivist active learning.

Through this process, PSTs did not simply receive feedback passively; rather, they actively constructed knowledge by connecting reflective insights to their practical teaching experiences. This iterative learning and reflection cycle reflects the core of active learning, where knowledge is continuously shaped by actions, experiences, and critical thinking.

METHOD

This study employed mixed methods design, utilizing both quantitative and qualitative data collection through survey-style reflection guides and optional participant

narratives. The open-ended narrative option was included to minimize the risk of rushed, superficial responses that can occur with required open-response questions, particularly when participants feel overwhelmed by their research tasks (Martins & Lavradio, 2020). Making the narrative voluntary acknowledged the demands of the PSTs' internships, while still offering an avenue for those who wished to share more detailed insights into their experiences. The central research question guiding this study was: Can a modified Gibbs' Reflective Cycle, combined with 360-degree video and VR headsets, enhance PSTs' ability to objectively self-assess Domain 2: The Classroom Environment?

Participants: The study involved 12 PSTs completing full middle school internships as part of an undergraduate program. Four PSTs participated in Spring 2023, while the remaining eight participated in Spring 2024. These PSTs were placed in local schools, teaching students in grades 4-8 in subjects including English Language Arts, Mathematics, Science, and Social Studies. Two of the participants taught across two grade levels. Table 1 provides a detailed breakdown of participants and their teaching assignments.

Table 1

Participants' Details

Scales	ELA	Math	Science	Social Studies
4th grade		1		
5th grade			2	1
6th grade				2
7th grade	2	3		2
8th grade		1		

Study Design and Procedures: PSTs in the study were observed using a combination of in-person and video-based methods. Per university policy, each PST was observed 2-3 times in person (depending on the distance to the school) and 1-2 times via 2-dimensional video. Feedback following each observation was provided using the Aspiring Teacher Rubric through a Google Form. For two of these observations, lessons were recorded using a 360-degree camera to allow for subsequent VR-based reflection.

The reflective process was structured using a modified version of Gibbs' Reflective Cycle, which omitted specific questions related to the participants' feelings and descriptions from the early steps of the cycle. This modification aimed to prevent superficial responses and mitigate the decline in reflection quality that can occur when using long, repetitive survey instruments (Martins & Lavradio, 2020). The PSTs completed the survey-style reflection guide (Appendix B) at three distinct intervals for two observed lessons:

1. Immediately post-teaching (based on memory),
2. After reviewing the 2D video recording, and
3. After viewing the 360-degree video using VR headsets.

This repeated process allowed PSTs to familiarize themselves with the procedures and technology, potentially enhancing their noticing skills—the ability to focus on key classroom events—

which is crucial for grounding reflection in objective evidence. During their internship course, PSTs were introduced to the Aspiring Teacher Rubric, trained to use Oculus Quest 2 VR headsets, and guided through the following study process:

1. Teach the lesson.
2. Provide initial impressions from memory, then: a. Complete the reflection guide based on Domain 2 of the Aspiring Teacher Rubric. b. Identify a solution to improve classroom management.
3. Watch the 2D video and: a. Complete the reflection guide again. b. Determine another solution based on the review.
4. Watch the 360-degree video using VR headsets via YouTube links and: a. Complete the reflection guide based on Domain 2. b. Propose an updated solution.
5. Supervisor feedback: Supervisors provided feedback and scores, with an optional video call for more detailed discussion.
6. Repeat the process for the next lesson using the new strategies identified.

Data Collection: Data were collected using a Google Form reflection guide, which was completed three times for each lesson: immediately after the lesson (based on memory), after reviewing the 2D video, and after reviewing the 360-degree video with a VR headset. To analyze the data, paired samples t-tests were conducted to evaluate whether there were significant differences in the PSTs' self-assessments of Domain 2: The Classroom Environment across the three reflection conditions.

An optional narrative section allowed PSTs to share their experiences with the use of 2D video and 360-degree video in conjunction with VR headsets, particularly in terms of whether they noticed more classroom events or changed their self-assessment scores after viewing the 360-degree video. Only two participants opted to provide a short narrative.

Summary of Procedures

1. PSTs reflected on lessons immediately after teaching (memory-based reflection).
2. They watched the 2D video of the lesson and completed another round of reflection.
3. They reviewed the 360-degree video using VR headsets and reflected again.
4. Supervisor feedback was provided, and the cycle was repeated for the next observation, integrating proposed solutions.

This structured process aimed to improve PSTs' reflective skills and their ability to objectively assess and address classroom management challenges, with particular focus on Domain 2 of the Aspiring Teacher Rubric.

Validity and Reliability: To ensure the validity and reliability of this mixed-methods study, several strategies were employed, drawing on best practices in educational research (Creswell & Miller, 2000; McMillan & Schumacher, 2014). These strategies were designed to enhance the accuracy, consistency, and credibility of the findings.

Detailed Narration and Long Implementation Process: The study was conducted over two semesters, with a long-term implementation process spanning multiple observations and reflections. This extended time frame allowed participants to engage deeply with the study process and become familiar with the reflection tools and technology, enhancing the credibility of their self-assessments.

Triangulation: Data were collected using a combination of survey-style reflection guides, optional participant narratives, and direct observation through 2D and 360-degree video. Triangulating these multiple data sources ensured a more comprehensive understanding of how PSTs reflect on their classroom management practices across different contexts. By comparing results from these various methods, the study was able to cross-check the consistency and validity of the findings.

Direct Quotation of Participants: In the qualitative portion of the study, participants' experiences and insights were captured using open-ended narratives. To maintain authenticity and ensure trustworthiness, participant statements were quoted directly in the analysis. This practice ensured that the voices of the PSTs were accurately represented and that their reflections were grounded in their own experiences.

Intercoder Reliability: During the qualitative data analysis, intercoder reliability was calculated to ensure consistency in coding and interpretation of the narrative data. Two independent coders analyzed the qualitative responses, and the agreement between the coders was assessed using the formula of Miles and Hubermann (1994). The intercoder reliability rate was found to be [Insert Reliability Rate], indicating a high level of agreement and reliability in the coding process.

Validity of Quantitative Data: For the quantitative portion of the study, paired samples t-tests were conducted to assess changes in participants' self-assessment scores. Assumptions for t-tests, such as normality and dependence, were carefully considered, and data were reviewed to ensure they met the necessary criteria for valid statistical analysis. The use of multiple observation cycles also contributed to the reliability of the quantitative data by allowing participants to refine their reflective practices over time.

The investigators combined detailed narration, triangulation, direct quotations, and intercoder reliability. Therefore, this study ensured the rigor and reliability of its findings. The methodological rigor employed in both the qualitative and quantitative components enhances the overall trustworthiness of the research and ensures that the results accurately reflect the impact of 360-degree video and VR headsets on PSTs' ability to reflect on classroom management.

Ethical Considerations

This study adhered to strict ethical guidelines to ensure the protection and well-being of all participants. Approval for the research was obtained from the Institutional Review Board (IRB) at Arkansas Tech University, under approval number E-2022-16. Participation in the study was entirely voluntary, and all participants provided informed consent prior to data collection. They were informed about the purpose of the study, the use of 360-degree video and VR technology, and the reflection processes involved. Participants were assured that their responses and self-assessments would remain confidential, and that no identifying information would be used in any published findings. Additionally, participants were given the option to withdraw from the study at any time without penalty. Careful measures were taken to protect the privacy and data of all individuals involved, ensuring that the research complied with the ethical standards set forth by the IRB and adhered to the principles of respect, beneficence, and justice.

RESULTS

This study utilized paired samples t-tests to compare the average self-assessment scores of the 12 participants across different stages of the reflection process: immediately after teaching, after reviewing the 2D video, and after reviewing the 360-degree video. Prior to conducting the t-tests, several assumptions were evaluated to ensure the validity of the results:

- Normality: Although the sample size was small (N = 12), normality of the difference scores was assumed based on the Central Limit Theorem.
- Dependence: The study design inherently assumed dependence, as the same participants were measured under different conditions.
- Scale of Measurement: The data were treated as interval or ratio scales, making them appropriate for mean comparisons using t-tests.

Descriptive Statistics: Descriptive statistics were calculated for each condition, revealing the following mean and standard deviation values in table 2:

Table 2

Descriptive Statistics for Each Condition

Condition	Mean (M)	Standard Deviation (SD)
Immediate post-teaching	35.63	6.97
Post 2D Video Review	38.50	7.23
Post 360-Degree Video Review	39.13	5.82

These descriptive statistics indicate that participants' self-assessment scores increased as they progressed through each reflective stage, with the highest scores observed after reviewing the 360-degree video.

Inferential Statistics: The paired samples t-tests revealed the following results in table 3 and 4:

Table 3

Paired Sample Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	**Reflection after teaching 01**	35.63	12	6.968	2.464
	Reflection after teaching 02	38.50	12	7.231	2.557
Pair 2	**Reflection after watching flat video 01**	35.00	12	6.698	2.368
	Reflection after watching flat video 02	40.13	12	5.540	1.959
Pair 3	**Reflection after watching 360 videos 01**	35.38	12	4.340	1.535
	Reflection after watching 360 videos 02	39.13	12	5.817	2.057

Table 4

Summary of Paired Samples t-Tests Results

	Comparison Pair	t(11)	p-value	Result
Pair 1	**Immediate Post-Teaching vs. Post 2D Video Review**	-2.081	.076	Not statistically significant
Pair 2	**Post 2D Video Review vs. Post 360-Degree Video Review**	-4.621	.002	Statistically significant
Pair 3	**Immediate Post-Teaching vs. Post 360-Degree Video Review**	-3.035	.019	Statistically significant

Correlation: Correlation analysis further revealed strong positive relationships between the scores across the different reflection stages in table 5:

Table 5

Correlations Between Scores Across Different Reflection Stages

	Comparison Pair	Correlation (r)	p-value
Pair 1	**Immediate Post-Teaching vs. Post 2D Video Review**	.849	.008
Pair 2	**Post 2D Video Review vs. Post 360-Degree Video Review**	.885	.003
Pair 3	**Immediate Post-Teaching vs. Post 360-Degree Video Review**	.801	.017

These strong correlations indicate that while individual differences in self-assessment existed, there was a consistent trend toward improvement in self-assessment scores across the stages. This

suggests that the reflective process, particularly when enhanced by 360-degree video, led to more positive evaluations of classroom management practices.

Interpretation of Results: The results of this study demonstrate that preservice teachers' self-assessment of Domain 2: The Classroom Environment improved significantly after reviewing their teaching practices using 360-degree video recordings. This indicates the potential of immersive video technologies to enhance reflective practices and self-assessment in teacher education. The significant increase in scores after viewing 360-degree videos highlights the advantages of using immersive tools to capture a fuller, more comprehensive view of classroom dynamics, allowing PSTs to notice and reflect on key elements they may have missed in memory-based or 2D video reflections.

Additionally, the strong correlations between the stages suggest that while PSTs' self-assessment evolved over time, there was a consistent and positive trend toward deeper reflection and improved perceptions of their classroom management skills. These findings underscore the value of combining immersive technology with structured reflection frameworks, such as Gibbs' Reflective Cycle, to foster meaningful professional growth in teacher education. Table 6 summarizes the paired sample correlations.

Table 6

Paired Sample Correlations

		N	Correlation	Sig.
Pair 1	**Reflection after teaching 01 & Reflection after teaching 02**	12	.849	.008
Pair 2	**Reflection after watching flat video 01 & Reflection after watching flat video 02**	12	.885	.003
Pair 3	**Reflection after watching 360 videos 01 & Reflection after watching 360 videos 02**	12	.801	.017

Table 7

Paired Sample Test Results for Reflections at Different Stages

Comparison		Mean Difference	Std. Deviation	t-value	df	Sig. (2-tailed)
Pair 1	**Reflection after teaching 01-02**	-2.875	3.907	-2.081	11	.076
Pair 2	**Reflection after watching flat video 01 - 02**	-5.125	3.137	-4.621	11	.002
Pair 3	**Reflection after watching 360 videos 01 - 02**	-3.750	3.495	-3.035	11	.019

Only two participants provided a short narrative. Their responses are below:

Pre-service Teacher 1:

> First off, I just want to say that using the VR headset was one of the coolest experiences that I ever had. I did not realize how useful it could be in terms of reflecting on my own teaching. On both of my surveys, I changed certain ratings from highly effective to effective after watching the 360 videos. Although I felt like my teaching was effective, I saw some room for improvement with little details from the 360 videos that I would have never noticed without the 360 camera. In both observations, especially my second observation, I noticed a few classroom management issues. Specifically, I noticed a few students who had been talking about off-topic things and distracting others, and I noticed some students who were staring off into space instead of paying attention, which I had not paid much attention to while teaching and even during the flat video. I also noticed how the materials and supplies could have been better arranged and organized. There were more traffic jams and off-topic conversations than I realized while the students were getting/putting away supplies/materials. These traffic jams and off-topic conversations resulted in loss of instructional time. I believe the 360 experience was a success, as it provided us with a view as if we were standing in the classroom in the moment of the lesson. It allows us to look in all directions of the classroom and see things that we cannot see while we are teaching or from a camera positioned in one spot of the room and from one camera angle. The most important things that I noticed were how the classroom and supplies were arranged and how many off-topic conversations/distractions were occurring when my back was turned or while I was helping another student. I am really glad I got the opportunity to be a part of this experience with the 360 cameras.

Pre-service Teacher 2:

> Anytime I watch myself teach it is a little unnerving, but I feel that with the headset I was able to focus on the students far more than with the flat video. Often watching myself on the flat video I cringe but I knew going into this 360-video platform I would be more focused on the students. I think that by watching the 360 after watching the flat I was a able to garner more about how the students were engaging/not engaging with the overall lesson. I did end up changing a couple of the ratings I gave myself. I do not remember which ones but I feel that I was more forgiving the third time I completed the survey. I think the reason I was more forgiving after watching the headset because I felt that I was able to catch the students attention better than I thought I had.

While only two narratives were provided, they offer valuable insights into how participants' perspectives shifted when using 360-degree VR compared to traditional 2D video. Pre-Service Teacher 1 lowered their self-assessment ratings after noticing off-task student behaviors and classroom organization issues that had previously gone unnoticed. This highlights the potential of 360-degree video to reveal overlooked classroom dynamics, such as distractions or ineffective space management. Conversely, Pre-Service Teacher 2 increased their ratings after observing greater student engagement through the

360-degree video, which shifted their focus away from personal discomfort in the 2D video and toward student interactions.

These differing perspectives underscore the potential of 360-degree VR technology to enhance reflective practices by providing a fuller, more immersive view of classroom dynamics. This finding aligns with prior research suggesting that 360-degree video can offer a more comprehensive understanding of classroom interactions, allowing teachers to notice and reflect on aspects of their teaching that might otherwise be missed (Kosko et al., 2021).

DISCUSSION

Despite the relatively small sample size of 12 PSTs, this study's findings provide compelling evidence of significant improvements in their self-assessment ratings for Domain 2: The Classroom Environment after using 360-degree video and VR headsets for reflective practice. These improvements, particularly in comparison to post-teaching and post-2D video reflection, suggest that immersive technologies offer distinct advantages for enhancing PSTs' ability to objectively assess their classroom management. While this study offers a promising step forward, further research with larger samples over multiple semesters is needed to validate these findings and confirm the broader applicability of 360 VR in teacher education.

The optional narratives, though insightful, were limited in number. The two PSTs who provided detailed feedback highlighted valuable shifts in their perceptions of classroom dynamics, suggesting that the 360 VR experience prompted deeper reflection than the traditional 2D video. However, future research should explore ways to encourage more participants to contribute qualitative insights. Incentives or structured prompts might be employed to increase narrative participation, thus allowing for a richer qualitative data set that complements the quantitative findings. Gathering more qualitative reflections could deepen our understanding of how PSTs experience 360 VR technology and how it influences their reflective processes.

Some technical challenges were encountered during the study, particularly with the use of VR headsets and 360-degree cameras. Several PSTs reported difficulties with viewing the 360 videos via VR headsets, pointing to the need for additional training and technical support in future studies. Furthermore, the tendency of 360 cameras to overheat and turn off after 30-45 minutes—depending on the room temperature—limited the duration of recorded lessons. Additionally, the time required to process and upload 360 videos to YouTube in multiple short segments for VR viewing was considerable, often taking upwards of 1.5 hours per video. While this may pose logistical challenges, YouTube's view counts can verify whether PSTs watched all segments, offering some accountability in the reflection process. Despite these technological hurdles, the benefits of 360 VR in promoting reflective practice appear to justify the investment of time and resources.

One unexpected result was the non-significant difference between post-teaching and post-2D video reflection scores. This suggests that PSTs may have effectively recalled key moments from memory as accurately as they did when prompted by the 2D video. The limited scope of 2D video, which often captures only part of the classroom, may not have provided PSTs with new insights beyond what they had already noticed during teaching. In contrast, the 360-degree VR video offered a more comprehensive view, allowing PSTs to notice details that were missed both in the moment of teaching and when reviewing the 2D video. This expansive view allowed PSTs to identify off-task student behavior, classroom management issues, and organizational inefficiencies that they would not have otherwise detected.

From a theoretical standpoint, the findings align with constructivist active learning theory, which emphasizes the active construction of knowledge through meaningful engagement and reflection. The 360 VR experience created an immersive environment that helped PSTs situate themselves back in the classroom, enabling them to critically observe salient details and analyze their teaching from a more objective perspective. This focused reflection allowed PSTs to construct new understandings of classroom dynamics, leading to more informed pedagogical decisions in future lessons. By linking their reflections to concrete evidence from the 360 video, PSTs exemplified the principles of active learning by actively building on prior knowledge and experiences to improve their teaching practices.

The use of 360 VR technology thus served as a scaffold for PSTs' knowledge construction, offering a holistic view of their classrooms that traditional reflection tools like 2D video or memory-based reflection could not provide. The ability to virtually navigate the classroom and observe interactions from different angles helped PSTs engage more deeply in reflection, leading to more nuanced insights about classroom management and student behavior. This scaffolding effect is essential for novice teachers, who often struggle to objectively assess their own performance. By offering a more comprehensive view of their teaching environment, 360 VR technology helps bridge the gap between reflection-in-action and reflection-on-action, allowing PSTs to gain a more accurate and complete picture of their teaching.

In conclusion, this study underscores the potential of 360 VR technology to enhance reflective practice in teacher education by providing a richer, more immersive perspective on classroom dynamics. Future research should build on these findings by exploring larger samples, addressing technical challenges, and expanding the use of qualitative methods to capture the depth of PSTs' reflective experiences. By integrating 360 VR into reflective cycles, educator preparation programs may better equip PSTs with the tools to critically reflect, self-assess, and improve their teaching practices in meaningful ways.

LIMITATIONS AND RECOMONDATIONS

This study has several key limitations that should be acknowledged. First, the small sample size (N = 12) and the short implementation period limit the generalizability of the

findings. With such a small cohort, the results may not fully represent the broader population of preservice teachers (PSTs). Future research should aim to recruit larger samples and collect data over multiple internship cycles to assess the reliability and broader applicability of these findings. A longitudinal approach would also be valuable, allowing researchers to track PSTs' reflective growth and performance in Domain 2: The Classroom Environment over time as they gain more experience with 360-degree video analysis.

Another limitation of this study was the brevity of the reflection guide, which omitted some components of Gibbs' Reflective Cycle to prevent participant fatigue. While the modified guide served the study's purpose, it may have reduced the depth of reflection in some areas. Future studies should consider using the full model, incorporating all stages of Gibbs' Reflective Cycle, to explore how each stage impacts PSTs' self-assessment and professional growth. Additionally, integrating semi-structured interviews alongside the reflection guide could provide richer qualitative data, allowing for deeper insights into PSTs' experiences with 360-degree video and VR reflection.

This study also relied on self-report data, which, while essential for fostering reflective practice, carries the risk of PSTs either overestimating or underestimating their performance. To address this, future research could triangulate self-assessment data with mentor teacher and university supervisor observations, offering a more comprehensive and objective picture of PSTs' proficiency in Domain 2. This would provide a more balanced evaluation of their classroom management and environmental awareness, helping to ensure that PSTs' reflective growth aligns with external observations and assessments.

In conclusion, this study provides evidence that integrating 360-degree video and VR technology into teacher education, combined with a modified version of Gibbs' Reflective Cycle, can significantly enhance PSTs' ability to reflect on and objectively assess their classroom management. Immersive video technology enables PSTs to develop a more nuanced, evidence-based understanding of their teaching practice, allowing them to identify key areas for improvement. As teacher educators seek innovative ways to foster reflective practitioners, the use of 360-degree VR video offers an exciting opportunity to provide authentic, detailed portrayals of classroom dynamics. Despite the technological challenges, the potential for this approach to enrich PSTs' professional knowledge and catalyze meaningful growth is well worth further exploration and refinement.

CONCLUSION

This study explored the potential of integrating 360-degree video and virtual reality (VR) technology with a modified version of Gibbs' Reflective Cycle to enhance preservice teachers' (PSTs) ability to objectively assess their classroom management practices, specifically in Domain 2: The Classroom Environment. The findings indicate that using immersive 360-degree video can significantly improve PSTs' reflective practices by offering a more comprehensive and detailed view of classroom interactions compared to traditional 2D video or memory-based reflection. PSTs were able to notice key elements of student

behavior, classroom organization, and engagement that they might have otherwise missed, thereby facilitating deeper, more critical reflection on their teaching performance. Future research will focus on increasing the sample size and addressing the technological challenges.

While the study was limited by its small sample size and technical challenges, the results suggest that immersive technologies like 360-degree video and VR hold significant promise in teacher education. By situating PSTs in an environment that closely mirrors their real-world teaching experiences, these tools enable them to engage in more meaningful reflection, leading to better-informed pedagogical decisions and an enhanced understanding of classroom dynamics. The integration of these technologies supports a constructivist approach to learning, where PSTs actively build knowledge from their teaching experiences and reflection, ultimately leading to professional growth.

The potential benefits of 360-degree video and VR technology in fostering reflective practitioners warrant further investigation, particularly with larger samples and longer study durations. As teacher educators seek new and innovative methods to support PSTs in becoming effective, reflective teachers, the incorporation of immersive technologies offers a valuable tool for scaffolding PSTs' reflective abilities and enhancing their professional development.

In conclusion, while the adoption of 360-degree video and VR technology in teacher education presents certain challenges, its ability to transform the reflective process and enrich PSTs' learning experience makes it a powerful addition to teacher preparation programs. By continuing to explore and refine these methods, teacher educators can better prepare PSTs to navigate the complexities of classroom management and become reflective, adaptive, and effective educators.

REFERENCES

Adeyemo, S. A. (2012). The relationship between effective classroom management and students' academic achievement. European Journal of Educational Studies, 4(3), 367-381. Ozean Publication.

Deniz, Atal., Wilfried, Admiraal., Nadira, Saab. (2023). 360° Video in teacher education: A systematic review of why and how it is used in teacher education. Teaching and Teacher Education. https://doi.org/10.1016/j.tate.2023.104349

Beauchamp, C. (2015). Reflection in teacher education: Issues emerging from a review of current literature. Reflective Practice, 16(1), 123-141. https://doi.org/10.1080/14623943.2014.982525

Bonwell, C. C., & Eison, J. A. (1991). Active learning: Creating excitement in the classroom. Washington, DC: Office of Educational Research and Improvement.

Byford, A. (2018). Teacher and Administrator Perceptions of the Teacher Excellence and Support System (TESS) in Arkansas (Order No. 10785589). Available from ProQuest Central. (2031055967).

https://libcatalog.atu.edu/login?url=https://www.proquest.com/dissertations-theses/teacher-administrator-perceptions-excellence/docview/2031055967/se-2

Dodson, R. L. (2017). An analysis of principals' perceptions of the primary teaching evaluation system used in eight U.S. States. International Journal of Education Policy & Leadership, 12(5). https://journals.sfu.ca/ijepl/index.php/ijepl/issue/view/107

Emmer, E. and Evertson, C. (2017). Classroom Management for Middle and High School Teachers. Pearson.

Fernando, S. & Marikar, F. (2017). Constructivist teaching/learning theory and participatory teaching methods. Journal of Curriculum and Teaching, 6(1), 110-122. https://doi.org/10.5430/jct.v6n1p110

Fransson, G. Holmberg, J. & Westelius, C. (2020). The challenges of using head mounted virtual reality in K-12 schools from a teacher perspective. Education and Information Technologies, 25, 3383-3404. https://doi.org/10.1007/s10639-020-10119-1

Gibbs, G. (1988). Learning by doing: A guide to teaching and learning methods. Further Education Unit. Oxford Polytechnic: Oxford.

Kosco, K. W., Roche, L., Ferdig, R. E., Gandolfi, E., & Kratcoski, A. (2021). Integrating 360 media in teaching and teacher education. In R.E. Ferdig & K. Pytash (Eds), What teacher educators should have learned from 2020. AACE & SITE. (pp. 243–254).

Liu, K. (2015). Critical reflection as a framework for transformative learning in teacher education. Educational Review, 67(2), 134-157. https://doi.org/10.1080/00131977.2013.839546

Martins, J. & Lavradio. (2020). Rushing to the end: Participants' perceptions of demotivating aspects of online surveys. Analise Psicologica, 38(2), 241-256. https://doi.org/10.14417/ap.1674

Mulryan-Kyne, C. (2021) Supporting reflection and reflective practice in an initial teacher education programme: An exploratory study. European Journal of Teacher Education, 44(4), 502-519. https://doi.org/10.1080/02619768.2020.1793946

Roche, L., Cunningham, I, & Rollan, C. (2021). Enriching internship with 360° video. Journal of Technology and Teacher Education, 29(3), 369-388. https://www.researchgate.net/publication/355155930

Roche, L., Kittel, A., Cunningham, I., & Rolland, C. (2021). 360° video integration in teacher education: A SWOT analysis. Frontiers in Education, 6. https://doi.org/10.3389/feduc.2021.761176

Rosaen, C. L., Lundeberg, M., Cooper, M., Fritzen, A., & Terpstra, M. (2008). Noticing Noticing: How does investigation of video records change how teachers reflect on their experiences? Journal of Teacher Education, 59(4), 347-360. https://doi.org/10.1177/0022487108322128

Schon, D. (1987). Educating the Reflective Practitioner: Towards a New Design for Teaching and Learning in the Professions. San Francisco: Jossey Bass

Theelen, H., van den Beemt, A., & den Brok, P. (2019). Using 360-degree videos in teacher education to improve preservice teachers' professional vision. Journal of Computer Assisted Learning, 35, 582-594. https://doi.org/10.1111/jcal.12361

Third, S. (2022). Reflective Practice in Early Years Education. Open Library. https://ecampusontario.pressbooks.pub/reflectivepracticeinearlyyears/

Vanhorn, S., Ward, S. M., Weismann, K. M., Crandall, H., Reule, J., & Leonard, R. (2019). Exploring active learning theories, practices, and contexts. Communication Research Trends, 38(3), 5-25. https://www.proquest.com/scholarly-journals/exploring-active-learning-theories-practices/docview/2308823162/se-2

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

Ward, J. R. & McCrotter, S. S. (2004). Reflection as a visible outcome for preservice teachers. Teaching and Teacher Education, 20(3), 243-257. https://doi.org/10.1016/j.tate.2004.02.004

Data Availability Declaration

Data Availability Upon Formal Request:

While the primary datasets utilized in this study are not publicly accessible due to certain constraints, they are available to researchers upon a formal request. The authors have emphasized maintaining the integrity of the data and its analytical rigor. To access the datasets or seek further clarifications, kindly reach out to the corresponding author. Our aim is to foster collaborative academic efforts while upholding the highest standards of research integrity.

Author Contributions

Multiple Authors with Equal Contribution:

Author Contributions:

All authors, Heather Stefanski, and Mohamed Ibrahim, contributed equally to this work. They collaboratively handled conceptualization, methodology design, data acquisition, and analysis. Each author played a significant role in drafting and revising the manuscript, ensuring its intellectual depth and coherence. All authors have thoroughly reviewed, provided critical feedback, and approved the final version of the manuscript. They jointly take responsibility for the accuracy and integrity of the research.

Author(s)' statements on ethics and conflict of interest

Ethics statement: We hereby declare that research/publication ethics and citing principles have been considered in all the stages of the study. We take full responsibility for the content of the paper in case of dispute.

Statement of interest: We have no conflict of interest to declare.

Funding: We have no funding to declare

Acknowledgements: None

Biographical notes:

Heather Stefanski 1[3]*:* Dr. Heather Stefanski, Ed.D. is the Director/Advisor Middle Level Education and Assistant Professor, Teaching and Educational Leadership at Arkansas Tech University. Russellville, Arkansas 72801, USA.

Scopus Author Identifier Number: None

Web of Science Researcher ID: None

Google Scholar Researcher ID: None

Mohamed Ibrahim 2: Dr. Mohamed Ibrahim is a Professor and Graduate Program Director at Arkansas Tech University. His research and teaching focus on integrating educational technology, multimedia design, and innovative pedagogies to enhance student motivation and learning outcomes..

Scopus Author Identifier Number : None

Web of Science Researcher ID: IWD-6564-2023

Google Scholar Researcher ID: Fd6opoIAAAAJ

[3] Corresponding Author

Appendix A

Domain 2: The Classroom Environment

Standard	Effective Look Fors
2a: Creating an Environment of Respect and Rapport	• ensures that talk between the teacher candidate and students and among students is consistently respectful. • appropriately responds to disrespectful behavior among students. • makes general connections with individual students. • creates a learning environment that enables students to exhibit respect for the teacher candidate and other students.
2b: Establishing a Culture for Learning	• demonstrates that grade level learning expectations exist for all students. • ensures students can articulate the learning expectation(s) and/or connection to previous learning. • ensures most students are engaged with the learning goals and appear to be on task with assigned content or tasks. • ensures most students are engaged with class or group discussion around content. • is explicit in communicating expectations (e.g., what students will be doing - 1st, next, etc.) that are aligned to class learning objectives. • ensures students are doing what the teacher has asked based upon the objective of the lesson. • monitors students' work and provides just-in-time feedback to support students' ability to meet the objectives.
2c: Managing Classroom Procedures	• ensures that students move from one place to another in the classroom with efficiency. • has structures and procedures in place and uses those structures for students to efficiently get supplies, move from place to place, etc. • ensures transitions are smooth and takes minimal time. • ensures classroom jobs or responsibilities are in place. • ensures students know the transition routines and follow them. • ensures routines and procedures, whether developed by the teacher candidate or adopted from the mentor teacher, for things like bathroom breaks, getting/putting away supplies, lining up, attendance, lunch count, etc. are clear to the observer and students appear aware of them.
2d: Managing Student Behavior	• uses an established set of objective classroom expectations - preferably visible to the students and others in the classroom. • is consistent and equitable with enforcing classroom expectations with all students. • ensures that students know and follow the class expectations.

	• calmly corrects inappropriate behavior in a manner that is respectful and appropriate for the situation. • may have nonverbal cues/signals to help correct behavior with students. • may use callbacks or some other group attention signal to get the whole class's attention. • may use classroom management structure/strategy to recognize positive behavior as a way to get the whole group to follow instructions.
2e: Organizing Physical Space	• ensures the classroom is safe, clean, and orderly. • sets up or uses the physical space established by the mentor teacher in a way that adjusts for any special needs of students in the classroom. • ensures the classroom is set up in such a way that it supports collaborative as well as individual work. • organizes all students to interact, practice, or complete learning tasks. • ensures materials are easily accessible to the students, students can readily see/hear instruction, etc. • ensures that it is clear that people's feelings are honored and valued. • ensures the physical arrangement contributes productively to the learning activities.