RedFame

International Journal of Contemporary Education
Vol. 9, No. 1; April 2026
ISSN 2575-3177 E-ISSN 2575-3185
Published by Redfame Publishing
URL: http://ijce.redfame.com

Exploring the Influence of Contextual Factors on Students During an Active Shooter Simulation: A Thematic Analysis

Stephanie F. Dailey[1], Beth Hosek[1], Heather Walter[1]

[1]College of Education and Human Development, Counseling Program, George Mason University, USA.

Correspondence: Stephanie F. Dailey, College of Education and Human Development, Counseling Program, George Mason University, USA.

Received: May 30, 2025 Accepted: July 25, 2025 Online Published: August 5, 2025

doi:10.11114/ijce.v9i1.7732 URL: https://doi.org/10.11114/ijce.v9i1.7732

Abstract

School shootings present complex challenges for student safety, yet ethical constraints limit opportunities to examine students' real-time responses during such crises. This study used live, immersive virtual reality simulations to explore how individual, relational, and contextual factors shape perceived safety and emotional coping during a simulated school shooter lockdown. Nineteen university students participated in 36 fully interactive VR lockdown scenarios set in a realistic virtual high school environment. A qualitative phenomenological design guided the collection of post-scenario surveys and focus group data. Thematic analysis revealed three key findings: (1) dynamic internal states and environmental cues shape student safety decisions, (2) ambiguous communication elevates stress and fear, and (3) relational support from school staff and peers fosters collective resilience. Results highlight the value of VR as a research tool for school safety and emphasize the importance of developmentally appropriate, and inclusive emergency preparedness protocols that integrate clear communication and relational trust alongside physical safety measures.

Keywords: school shootings, school safety, phenomenology, thematic analysis, resilience, lockdown drills

1. Introduction

In the wake of high-profile school shootings, safety has become a top U.S. priority. These events impact students, teachers, and communities—disrupting physical safety, mental health, and academic performance. Exposure to school violence elevates risk for traumatic stress, depression, anxiety, and socioemotional issues (Schildkraut & Nickerson, 2022). Even perceived threats can affect memory, cognition, and students' ability to maintain secure relationships (Beland & Kim, 2016). To mitigate risk, schools use preparedness strategies such as lockdown drills and, at times, options-based simulations. While intended to promote safety, such measures may evoke stress responses, especially in younger students (Huskey & Connell, 2021). Though often used interchangeably, "active shooter exercises" and "lockdown drills" differ (see Schildkraut & Nickerson, 2022 for a detailed description of each protocol). Research suggests developmentally appropriate lockdown drills can enhance safety perceptions and procedural knowledge without increasing anxiety (Schildkraut et al., 2023; Zhe & Nickerson, 2007).

Dickson and Vargo (2017) found that lockdown drills increased emergency preparedness, emphasizing trauma-informed implementation. Preparedness is most effective within supportive environments, underscoring the importance of school climate and relational safety (NASP et al., 2021; Yablon, 2019). While many students show resilience after school violence (Lowe & Galea, 2017), little is known about what supports resilience during the crisis itself. This study addresses that gap by examining student experiences in a simulated active shooter event.

1.1 Resilience as a Socioecological Process

Contrary to Western models of trauma that focus on individual pathology, resilience is increasingly understood as a socioecological process involving broader cultural and relational supports (Masson & Smith, 2019). While pathology is a possible outcome, resilience—defined as the capacity to recover or adapt following adversity—is the more common response (Bonanno, 2005; Hobfoll et al., 2015). A persistent misconception is that resilience is an individual trait (Galatzer-Levy et al., 2018), when in reality, resilience is shaped by access to social, material, and emotional resources (Hobfoll et al., 2015).

Bronfenbrenner's Ecological Systems Theory (EST; Bronfenbrenner & Morris, 2006) provides a useful lens for

understanding how individuals develop within nested environmental systems, from microsystems (e.g., peer and teacher relationships) to macrosystems (e.g., policies and cultural norms). Hobfoll's Conservation of Resources (COR) theory complements EST by highlighting the importance of protecting and replenishing resources (emotional, physical, and interpersonal) in times of stress (Hobfoll et al., 2015; Raghavan & Sandanapitchai, 2020). Both frameworks support a contextualized view of resilience: it is not only about bouncing back but about having the necessary resources and supports to do so.

1.2 School Contextual Factors

Within K–12 schools, contextual factors such as school climate and social connectedness shape how students respond to and recover from crises. A positive school climate—marked by supportive relationships, consistent expectations, and psychological safety—is strongly linked to student well-being and resilience (Lenzi et al., 2017). School connectedness, or a student's sense of belonging within their school community, may reduce the psychological toll of violence and enhance recovery, particularly in high-threat environments (Yablon, 2019). These patterns align with EST, which emphasizes how individual development is embedded in social and institutional contexts (Bronfenbrenner & Morris, 2006).

Resource availability, adult-student relationships, and environmental design (e.g., classroom layout, visibility, access to exits) can buffer or exacerbate students' responses during emergencies (Curran et al., 2019; Gaias et al., 2019). However, most research on school climate and connectedness focuses on recovery after the crisis has ended. Few studies have examined how these protective factors operate in real time during an acute event such as a school lockdown. This omission is notable, especially given the rise of lockdown drills and options-based preparedness practices across U.S. schools. Understanding how students interpret environmental and relational cues during the crisis itself is essential for developing trauma-informed emergency procedures. This study explores this space using simulated lockdown scenarios.

1.3 Integrated Conceptual Model

Collectively, EST and COR provide a framework for understanding student responses during lockdown scenarios. EST highlights the role of environmental systems and interactions, while COR emphasizes the depletion or protection of resources during crises. Figure 1 illustrates how individual (e.g., emotional regulation), relational (e.g., peer and staff support), and school-level (e.g., communication systems) factors interact to shape perceived threat and resilience. This model integrates key components from Bronfenbrenner's EST, Hobfoll's COR theory, and simulation-based studies on crisis decision-making and environmental cues.

Figure 1. Conceptual model of contextual influences on students' perceived safety and psychological resilience during a school crisis

Description: This model depicts how individual, relational, and school-level factors shape students' perceptions of safety and threat during a school crisis. These perceptions, in turn, influence psychological resilience.

1.4 Simulation-Based Methods to Study School Safety

School violence impacts entire communities, and contextual factors like climate and connectedness are critical to understanding student responses. Yet studying real-time crisis reactions poses ethical and methodological challenges. Immersive simulation methods—such as virtual reality (VR)—offer a promising alternative by allowing researchers to safely examine responses to high-stress scenarios (Awada et al., 2021; citation blinded for peer review, 2023). Despite widespread use in higher education and emergency response, VR remains underutilized in K–12 safety education. Recent research demonstrates its potential: Chiu and Tsuei (2022) found that VR-based training improved students' hazard recognition and response behaviors, and Rajabi et al. (2022) reported improved earthquake preparedness and decision-making under stress.

Despite these encouraging findings, the use of VR to simulate school-specific emergencies remains underexplored. This study addresses that gap by employing immersive VR technology to simulate a school lockdown during an active shooter event using a qualitative phenomenological approach to examine how individual, relational, and school-level contextual factors influence perceived safety, threat appraisal, and emotional coping in students.

1.5 Current Study

Building on this emerging body of work, the current study employed VR technology to examine participant experiences across 36 simulated school shooting scenarios set in a virtual high school environment. University students served as developmentally appropriate proxies for older high school students, as individuals aged 18–22 demonstrate cognitive and emotional characteristics akin to those in late adolescence, especially in decision-making during high-stress situations (Blimling, 2010; Feitelson, 2015).

High schools were selected as the simulation setting because they are more likely than elementary or middle schools to implement complex emergency response protocols, including options-based drills, layered communication systems, and the presence of school resource officers (Schildkraut & Nickerson, 2022). Late adolescence is also a critical developmental period during which perceptions of safety, autonomy, and peer relationships are especially influential (Juvonen et al., 2018).

Against this backdrop, the current study explored how participants perceived and made meaning of their simulated lockdown experiences, with particular attention to individual, relational, and school-level contextual factors that shaped their responses. Specifically, how do individual, relational, and school-level contextual factors influence students' perceived safety, threat appraisal, and emotional coping during a simulated school lockdown using virtual reality?

2. Method

This study used live-action VR technology to examine students' lived experiences during an active school shooter event. This investigation was part of a larger study exploring the efficacy of specific safety interventions, including automatic versus manual classroom door locks, school administrator- versus teacher-initiated lockdown notifications, and the role of a school resource officer (SRO) in mitigating fatalities (see [citation blinded for peer review]). For the present analysis, we utilized a phenomenological approach to explore student experiences within the context of a series of VR simulated school shootings (Cresswell & Poth, 2018). Data were analyzed using thematic analysis (Braun & Clarke, 2006).

2.1 Participants and Screening

Participants were university students recruited from a mid-Atlantic institution. They were selected as developmentally appropriate proxies for high school students to allow for ethical, high-fidelity simulation of lockdown procedures (Blimling, 2010). Institutional Review Board (IRB) approval was obtained from a local university. Undergraduate students from the mid-Atlantic region of the United States were recruited through faculty teaching freshman-level courses at a local university. Faculty members were asked to send an email invitation to their students, and researchers provided brief classroom presentations to introduce the study. Students were compensated for their participation. To ensure a diverse sample, participants represented a range of demographic characteristics, including race, gender, and age (See Table 1). The mean age for participants was 18.79 years old, and all participants had completed at least one semester of college. Most participants identified as White/European American (n = 8, 42.11%), with a slight majority identifying as male (n = 10, 52.63%).

Consented participants volunteered to engage in 36 active school shooter scenarios (referred to as "runs") in a simulated high school environment as part of a two-week, in-person VR study. These scenarios, conducted using high-fidelity VR technology, were designed to replicate various aspects of lockdown procedures and emergency responses during an active shooter event. Each run presented a combination of situational variables, including different physical locations, levels of perceived threat, and interactions with teachers, peers, and SROs. A detailed alignment of simulation-based contextual variables and the theoretical constructs presented in Figure 1 is available in Supplemental Table S1.

Table 1. Participant Demographics (N = 19)

	n	*%*
Gender		
Female	10	52.63%
Male	9	47.37%
Racial Identity		
White/Euro American	8	42.11%
Middle Eastern/Middle Eastern American	4	21.05%
Asian/Asian American	4	21.05%
Hispanic/Latinx	2	10.53%
Black/African American	1	5.26%
Age		
18	8	42.11%
19	7	36.84%
20	4	21.05%
Lockdown Drill Experience (per year)[a]		

[a]: Reflects the number and percentage of participants answering "yes" to having experienced lockdown drills in high school (9th -12th grade) and the estimated number of drills conducted yearly.

Description: This table summarizes the demographic characteristics of participants, including gender, racial identity, age, and reported frequency of lockdown drill experiences during high school. Percentages are based on the total sample (N = 19).

A three-phase screening process was employed to ensure participants' psychological and physical readiness for the VR scenarios. First, participants completed general physical and mental health assessments to evaluate emotional and physiological fitness, including the *DSM-5 Self-Rated Level 1 Cross-Cutting Symptom Measure – Adult* (Mahoney et al., 2020). Second, participants participated in a virtual interview conducted via Zoom, where study protocols were reviewed and participants' understanding of potential risks was confirmed. Finally, participants underwent a 30-minute VR suitability assessment, during which they interacted with the VR equipment to ensure physical compatibility and screen for issues such as motion sickness or sensory discomfort. This was especially important given known risks of cybersickness in immersive VR (citation blinded for peer review). Exclusion criteria included untreated or active mental health conditions, a history of VR-related discomfort, and neurological conditions such as epilepsy, which could be exacerbated by the simulation. Individuals with prior exposure to active shooter events were excluded to reduce the risk of psychological distress and to maintain a controlled sample suitable for analysis. Four individuals were excluded for mental health history (n = 1), prior exposure to school violence (n = 1), and VR-induced discomfort (n = 2). Selected participants (n = 19) were given pseudonyms and numeric identifiers to safeguard confidentiality. Each scenario included teachers (n = 11), two SROs, and an administrator to support ecological validity; however, these individuals were not included in the present analysis.

2.2 Procedures

The simulation was developed using the Unity game engine and delivered through Oculus Quest 2 headsets to create a realistic, first-person virtual high school environment. This high-fidelity platform featured spatially accurate school settings (e.g., classrooms, hallways, cafeteria), real-time sound and visual effects (e.g., lockdown alarms, gunshots), and dynamic interactive elements. These features enabled immersive scenario-based decision-making, allowing researchers to simulate crisis situations while controlling for environmental variables, building on VR safety training architecture described by (citation blinded for peer review).

The in-person simulated experiment was conducted over two weeks (10 business days) during the summer of 2020. The first two days included participant training on the VR equipment, general rules of engagement (i.e., lockdown protocols), and familiarization with the layout of the virtual school environment. Following training, student participants—university students serving as developmentally appropriate proxies for older high school students—engaged in 36 VR runs, in which an active school shooter event prompted the need for lockdown procedures (see Appendix A for participant training protocols and screening criteria).

Each scenario—referred to as a "run"—included 10 virtual classrooms populated by human-operated student avatars (n = 19), as well as teacher avatars (n = 11), an armed active assailant, and an SRO, all operated live by research participants. Student participants began the simulation by engaging in routine morning activities (e.g., entering homerooms, visiting the cafeteria, transitioning through hallways) and could communicate via proximity-based voice chat. Scenarios varied across conditions, including whether an SRO was present, how lockdowns were initiated (teacher vs. centralized announcement), and whether door locking was automatic or manual. In 24 of the 36 scenarios, a

human-operated active assailant initiated a shooting, while 12 runs included no shots fired to mitigate anticipatory responses. Communication realism was emphasized: only those in physical proximity could speak directly to one another, while a simulated public announcement (PA) system was used to issue lockdown alerts. This high-fidelity structure was designed to replicate the uncertainty and variability present during real-world school crises.

These runs were systematically designed to reflect varied situational dynamics within a simulated school environment. Key contextual details, such as locked doors, lockdown announcements, and visual and auditory cues (e.g., gunshot sounds, movement of the shooter), were carefully designed and programmed into the VR scenarios to ensure authenticity. Elements in the VR scenarios were modeled based on real-world lockdown protocols and reviewed by school safety experts and law enforcement consultants to enhance the realism and relevance of the simulation. These scenarios were evenly distributed across three conditions: the presence or absence of an SRO, automatic versus manual door-locking mechanisms, and centralized (i.e., over a public announcement system) versus teacher-initiated (i.e., call to the front office) lockdown notifications. To mitigate anticipatory effects, some runs excluded an active shooter, ensuring participants encountered a range of situational contexts while maintaining consistency of scenario conditions.

This intentionally designed data collection process supports in-depth exploration of participants' lived experiences. After each run, participants completed open-ended survey questions capturing their immediate reactions and then participated in follow-up focus groups. While phenomenological research traditionally relies on in-depth interviews, open-ended surveys were used here to elicit rich, first-person accounts directly following emotionally intense VR scenarios, thereby reducing recall bias. This approach aligns with phenomenological aims by prioritizing immediate meaning-making and minimizing retrospective reinterpretation (Bevan, 2014; Gill, 2020). When designed to reflect lived experience and analyzed through iterative, reflexive thematic analysis, survey methods can yield valid phenomenological insights (Neergaard et al., 2009).

2.3 Data Collection and Analysis

Data collection consisted of two components: a post-run survey administered immediately after each of the 36 simulation runs to capture participants' immediate reactions, and two focus group sessions—one conducted immediately following the final simulation to explore initial reflections, and a second follow-up session held within 7 to 10 days to support deeper processing and allow for member checking using preliminary themes (Seidman, 2006). Post-simulation surveys and focus groups were selected to ethically capture participants' reflections without disrupting realism or psychological safety of the high-intensity VR scenarios, consistent with best practices in high-stress, immersive VR research (Eppich & Cheng, 2015).

The post-run survey included open-ended questions such as: "What did you observe during the experiment run?", "What actions did you take?", and "Briefly describe what happened from your perspective?" These questions were designed to elicit participants' perceptions of context, decision-making, and emotional responses in real time. The follow-up focus group used semi-structured prompts including: "Was there a particular moment that stood out to you?", "How did your interactions with teachers or staff affect your experience?", and "Did you notice any recurring patterns in how you or others responded?" These instruments were piloted with a small group of graduate students to ensure clarity and alignment with the study's phenomenological focus. Full survey and focus group protocols are included in Appendix B.

Focus groups served a dual purpose by providing additional qualitative data and supporting the trustworthiness of findings through member checking. The first focus group was conducted immediately following the final simulation to allow participants to reflect on their experiences across all scenarios. After initial coding of the post-run surveys, the research team developed a set of preliminary themes and descriptive summaries, which were introduced during a follow-up focus group held 7 to 10 days later. Participants were invited to discuss whether the themes resonated with their lived experience, suggest refinements, or offer alternative interpretations. This interactive process allowed participants to validate, challenge, or expand the thematic findings, consistent with best practices in member checking (Birt et al., 2016; Ravitch & Carl, 2021). Open-ended prompts such as, "Looking back on all the scenarios, was there a particular moment that stood out to you as especially impactful? Why?" and "Did you notice any recurring patterns in how you or others responded?" encouraged deeper reflection, while reactions to the proposed themes helped clarify and strengthen the analytic framework.

Survey questions and focus group prompts were piloted with a small group of graduate students in counseling and education disciplines to ensure clarity, sensitivity, and relevance to the study's objectives. These individuals were selected for their expertise in crisis response and qualitative research methodologies, which allowed for valuable feedback on the appropriateness of the questions and their alignment with the study goals. Experienced qualitative researchers moderated focus groups trained in trauma-informed practices to create an environment that encouraged honest, comprehensive, and thoughtful responses. Moderators used active listening and neutral facilitation techniques to ensure participants felt safe and supported.

Thematic analysis was conducted following Braun and Clarke's (2006) six-step process: (1) immersing in the data, accompanied by reflexive notetaking to identify and address potential biases, (2) generating initial codes using in vivo and descriptive coding techniques, (3) grouping similar codes into overarching themes, (4) reviewing themes to ensure they holistically represented the dataset, (5) refining and defining theme names, and (6) producing the final report. Themes were defined based on conceptual coherence and prevalence across participants, not by frequency alone, in line with Braun and Clarke's (2006) recommendation that a theme captures something meaningful about the data in relation to the research question.

The analysis was collaboratively conducted by two researchers, ensuring rigor and alignment with the phenomenological approach's focus on shared interpretation and deep engagement with participants' lived experience. A third researcher reviewed and refined the emergent themes during the final stages of analysis, further enhancing the credibility and robustness of the findings. Reflexive notes were maintained throughout to promote transparency and rigor in the analytical process (Ravitch & Carl, 2021).

Using open-ended survey questions and focus group discussions facilitated a deeper exploration of participants' emotional and relational experiences during the simulations. These methods captured nuanced perspectives, enabling the study to move beyond surface-level observations and align with its phenomenological framework (Seidman, 2006). Engaging participants in iterative discussions ensured that the thematic analysis was firmly rooted in participants' narratives, enriching the study's understanding of individual and collective dynamics (Braun & Clarke, 2006; Birt et al., 2016).

2.4 Trustworthiness and Reflexivity

The trustworthiness of the study was established through rigorous qualitative methods, including reflexive notetaking, researcher agreement on coding, triangulation of data sources, and member checking procedures (Ravitch & Carl, 2021). Reflexive notes documented researchers' thoughts and potential biases throughout the analysis process, promoting transparency and rigor. Data were analyzed using MAXQDA qualitative software (VERBI Software, 2019), and any divergences in coding were resolved through iterative discussions until consensus was reached. Triangulation was achieved by cross-referencing survey responses and focus group transcripts to validate the emergent themes. Focus groups served as the member checking mechanism, allowing participants to review and refine preliminary themes. This iterative process ensured that the findings accurately represented their lived experiences and reinforced the credibility of the analysis (Birt et al., 2016).

The research team brought diverse perspectives and experiences to the study, helping to enrich the analysis and minimize researcher bias. The first author's expertise in disaster behavioral health and school lockdown informed the study design and thematic interpretation. The second author contributed expertise in self-regulated learning, adolescent mental health, and crisis response, while the third author provided insights into child development and trauma-informed practices in educational settings.

3. Findings

Thematic analysis of student survey and focus group data revealed three primary themes: (1) Dynamic Cues and Internal States Shape Student Safety Decisions, (2) Ambiguity Elicits Stress and Fear, and (3) Collective Resilience and the Role of School Staff in Student Coping. These findings are framed by EST, which considers the influence of immediate (microsystem) and institutional (exosystem) contexts on student experiences, and by COR theory, which explains how perceived loss or protection of emotional, physical, and relational resources shapes stress responses. The emergent themes reflect how sensory cues, peer and adult interactions, and situational ambiguity contributed to students' appraisals of safety and their emotional coping during the simulation.

3.1 Dynamic Cues and Internal States Shape Student Safety Decisions

The first theme, Dynamic Cues and Internal States Shape Student Safety Decisions, explores how students' perceptions of safety during the simulation were influenced by the interplay of environmental stimuli, emotional responses, and available information. Rather than relying on any single indicator, participants described actively interpreting multiple cues—including sounds, physical barriers, and communication from adults—to guide their decisions about whether to remain in place or seek safety elsewhere.

Both external cues, such as locked doors, announcements, and physical surroundings, and internal responses, such as fear or calmness, shaped students' decisions to remain in place or seek safer locations. One student described, "*The sounds from the hallway made me think it wasn't safe to stay, so I wanted to move to another room*," while another noted, "*Seeing that the door was closed and locked made me feel like we were less visible and that it was safe to stay put.*" These quotes illustrate how students relied on sensory and contextual information to navigate perceptions of safety and associated responses.

Students' experiences were shaped by the information they received from their surroundings, including auditory cues like gunshots or reports of the shooter's location. One student recalled hearing, "*A shooter in the blue hallways headed around room 216, which was very close,*" emphasizing how proximity heightened feelings of vulnerability. Those in secure settings, such as locked classrooms with teachers, reported feeling safer, while students in unsecured areas, like open spaces, expressed heightened fear. One student highlighted the dual role of locked doors and teacher presence in providing reassurance: "*I stayed hidden in the bathroom until I heard a long silence without any gunshots. I then managed to run and tell a teacher in the closest classroom … [I] remained safe in her locked classroom.*"

Information from school staff also played a critical role in shaping students' perceptions of safety and guiding their decisions. One student shared, "*I heard the announcement that the shooter was in the blue hallway. So I safely ran out the front doors,*" underscoring how clear, authoritative communication informed immediate actions. Conversely, students outside locked classrooms or in less secure areas described feeling unsafe, even when accompanied by teachers. For instance, one participant stated, "*I had no choice but to hide in the breakroom with a teacher and some other students, but we felt very unsafe because the door couldn't lock.*" These accounts demonstrate how physical barriers, particularly locked doors, often outweighed the perceived safety of adult presence in students' evaluations of risk.

External stimuli, such as gunshots, proximity to the shooter, or visual exposure to violence, were key factors in shaping students' emotional and behavioral responses. One student described witnessing their teacher being shot: "*Before my teacher could close the door, she was shot out of nowhere. I was shocked when I saw the teacher get shot and confused, but I knew I needed to get out.*" This response illustrates how exposure to acute violence triggered confusion, urgency, and immediate action, often overriding established protocols or expectations.

Students often had to weigh pre-established lockdown procedures against real-time information from staff. For instance, one student said, "*The SRO came to check in on us… hearing the SRO and then the admin [over the PA] say the hallway was clear made me want to try and escape.*" Locked doors and teacher presence were pivotal in creating a sense of safety, prompting students to actively seek these protective measures. One student explained, "*I was in a lockdown classroom safe and sound,*" highlighting the emotional relief provided by physical security measures. However, when access to a locked room was unavailable, anxiety and fear often increased. For example, a student shared, "*I was alone and didn't know what I should do, so I went to find another teacher and the others...I headed towards the hallway towards the classrooms, having no idea whether or not I was heading straight towards the shooter.*"

Without clear safety cues, such as an 'all clear' from the SRO or admin, students sometimes made risky decisions in search of information or reassurance. One student recounted, "*My teacher was not in my homeroom, so I ran down the hall to a room with a teacher,*" emphasizing how the presence of an adult reinforced a sense of safety. Another described their confusion, stating, "*I didn't know where the shooter was, but I didn't feel safe staying where I was, so I decided to move towards the hallway to find out if I could escape.*" These decisions reveal how contextual ambiguity, emotional discomfort, and a desire for agency shaped real-time coping strategies—even when such strategies might increase risk.

3.2 Ambiguity Elicits Stress and Fear

The second theme captures the heightened emotional responses students experienced when situational awareness was limited or unclear. In contrast to the first theme's emphasis on actionable cues, this theme highlights how ambiguity amplified anxiety, confusion, and fear—reactions supported by cognitive appraisal theory (Lazarus, 1991) and crisis response research (Lowe & Galea, 2017). This theme reflects the study's conceptual framework: under COR theory, ambiguity strains coping resources, while EST highlights how disrupted communication and safety cues in students' immediate environment weaken perceived support and resilience.

Ambiguity was often more distressing than confirmed danger. As one student put it, "*The silence is what's really scary…. gunshots make it clear on what I should do.*" Another shared, "*It's when we have no updates or information that make me the most afraid.*" These experiences align with research showing that unclear threat information undermines coping and increases psychological stress (Blascovich & Mendes, 2010). Moreover, lack of information disrupted students' ability to act decisively. "*My mind went blank because I did not know what to do,*" one student noted. Another said, "*I did not know if it was a real lockdown or a drill because not a lot of info was provided.*" Even efforts to clarify were sometimes unsuccessful: "*I was worried because he [the teacher] wasn't responding to me asking him if he had locked the door.*" In some cases, students took action in the face of uncertainty. "*We are like sitting ducks…I have no idea what is going on,*" one participant remarked. Another recalled preparing to close the door if a teacher was shot. These moments reflect patterns seen in high-stakes disasters wherein unclear conditions prompt risky, adaptive behaviors (Bonanno et al., 2010).

Conversely, clear communication—even when no new information was available—helped reduce distress. "*The SRO came around asking for info and checking in which was comforting,*" one student shared. Another explained, "*We could not hear anything coming from the radio, so [the teacher] had to relay the messages…no new info but made me feel*

better." These responses are consistent with crisis communication theory, which emphasizes the stabilizing role of trusted messengers and ongoing updates during emergencies (Sellnow & Seeger, 2013). Taken together, these findings demonstrate that ambiguity—not just the threat itself—triggers acute distress, and that clear, timely communication is central to students' sense of safety and emotional regulation.

3.3 Collective Resilience and the Role of School Staff in Student Coping

The third theme, Collective Resilience and the Role of School Staff in Student Coping, highlights the interpersonal and community-based dynamics that support student adaptation during high-stress events. Unlike the first theme's emphasis on environmental cues or the second theme's focus on ambiguity, this theme explores how teachers, staff, and peers serve as protective agents—modeling calm, sharing information, and promoting cohesion. These behaviors foster emotional stability and reinforce a sense of shared control during a lockdown.

A consistent pattern across responses was the stabilizing role of staff. Participants emphasized that the calm demeanor and clear communication from teachers and SROs helped alleviate fear. One student recalled, "*Our teacher whispered to us to stay calm and kept reminding us everything would be okay,*" while another shared, "*Seeing the teacher stay calm made me feel like I didn't need to panic—it felt like she had control of the situation.*" These reflections underscore the power of modeled regulation in emotionally charged settings.

Staff were also key conduits for trusted information, reinforcing structure amidst chaos. One participant explained, "*Our teacher relayed everything she heard on the radio, and it helped us feel like the adults had everything under control.*" This type of relational communication—grounded in trust, clarity, and empathy—fostered both a sense of safety and a belief that the situation was being managed.

Peers similarly played a role in buffering stress. One student shared, "*When I got to my homeroom, there wasn't a teacher, but we closed the door, and I tried to keep everyone quiet.*" Another said, "*I sat next to her, and we sang together until it was over.*" These examples illustrate how students actively drew on each other for emotional regulation and cohesion. However, when others failed to follow lockdown procedures, it had the opposite effect: "*There were kids roaming the halls not listening, and the teacher was trying to get them inside. I kept telling her, 'Close the door! Close the door!' because we were going to get shot.*" The absence of collective adherence to safety protocols increased perceived vulnerability.

From a COR lens, support from staff and peers represents a critical resource that helps buffer psychological distress (Hobfoll et al., 2015). When these resources are accessible—through verbal reassurance, shared information, or acts of protection—they contribute to resilience by replenishing students' sense of control. EST (Bronfenbrenner & Morris, 2006) further emphasizes how microsystem interactions, like those with teachers and peers, and mesosystem coordination (e.g., between administrators and classroom teachers) shape a student's adaptive response.

This theme also builds on research identifying school communities as resilience systems. As Marshall and Clark (2023) argue, schools are not only instructional spaces but also relational systems where adults' coordinated actions during crisis signal safety and belonging. Resilience, in this framing, is a shared process—not merely individual—but co-constructed through communication, leadership, and emotional support (Norris et al., 2008). One student's quote captured this integration of structure and care:

> *The teacher kept checking on us and communicated everything being said over the radio. Even though there wasn't much new information, they showed they cared and stayed engaged. That made me feel like they had everything under control and we were safe.*

Such examples illustrate how emotional presence and consistent communication, even absent novel updates, foster trust and coping. Collectively, this theme emphasizes that student resilience during lockdowns is not self-contained—it emerges through interpersonal interactions and community coherence. In line with the study's conceptual model, relational and organizational supports serve as key resources that mitigate fear, promote meaning-making, and reinforce adaptive behaviors in moments of acute stress.

4. Discussion

This study highlights critical contextual and relational factors shaping student experiences during school lockdowns, addressing significant gaps in school safety and resilience literature. By analyzing students' lived experiences through 36 simulated school shooting scenarios, the findings emphasize how environmental and relational dynamics—captured in the three themes— Dynamic Cues and Internal States Shape Student Safety Decisions, Ambiguity Elicits Stress and Fear, and Collective Resilience and the Role of School Staff in Student Coping—can support students during lockdowns. Aligned with COR theory and EST, the role of resources and relationships in shaping adaptive responses is highlighted (Bronfenbrenner & Morris, 2006; Hobfoll et al., 2015).

4.1 Contextual and Relational Factors in Resilience

Findings from this study reaffirm the critical importance of fostering strong, supportive relationships within the school community, a concept rooted in theoretical and empirical literature. While the notion of social connectedness as a resilience factor is well-established (citation blinded for peer review; Yablon, 2019), this study offers new evidence demonstrating its acute impact during a school lockdown, particularly in shaping adaptive responses in real time. Relational networks within schools, characterized by trust and belonging, function at both the individual and community level, serving as critical resources for mitigating fear and enhancing resilience (Aldrich & Meyer, 2015). By leveraging these networks, schools can create a sense of safety that reduces stress and improves decision-making (Lenzi et al., 2017).

4.2 Dynamic Cues and Internal States Shape Student Safety Decisions

The findings from this study emphasize how external contextual cues, such as locked doors, teacher presence, and clear communication, significantly influence students' perceptions of safety during a lockdown. Participants consistently described feeling more secure in environments where these physical and situational factors were present, highlighting the importance of intentionally incorporating such safety cues into school protocols to enhance preparedness and reduce student anxiety during crises (Perkins, 2018). Findings also emphasize bidirectional interactions between individuals and their environments. Within the EST framework, contextual safety measures, such as secure physical environments and consistent communication protocols, are critical resources that shape student resilience. COR complements this perspective by highlighting the role of resource management in reducing stress. For instance, clear expectations and protocols give students a sense of control and safety, an essential resource for fostering resilience in high-stress situations. However, prior researchers have cautioned that structured protocols may overlook the diverse needs of students with disabilities or trauma (Eckhoff & Goodman-Scott, 2021). For example, protocols involving alarms may overstimulate students with sensory disabilities, highlighting the need for flexible approaches that mitigate vulnerability without exacerbating distress. Thus, implementation of safety protocols must account for the diverse needs of students, including those with physical and emotional disabilities.

This connection is further supported by studies highlighting the importance of safety cues in reducing fear and promoting adaptive responses during high-stress situations. Cues such as secure physical barriers and calm relational interactions have been shown to inhibit fear responses (Meyer et al., 2019) and activate neural pathways associated with threat modulation (Christianson et al., 2012). It follows that school safety researchers have consistently found that visible security measures, such as security cameras, metal detectors, and the presence of security personnel, may adversely affect students' perceptions of safety (Perumean-Chaney & Sutton, 2012). Importantly, this literature primarily focuses on preventative measures implemented during non-crisis periods. In contrast, during a lockdown, relational cues such as teacher presence, clear communication, and visible leadership may serve a different function by providing reassurance and fostering a sense of safety and connection, particularly when in alignment with best practices for trauma mitigation (see NASP et al., 2021 for best practice information).

4.3 Ambiguity Elicits Stress and Fear

Ambiguity during lockdowns emerged as a major source of fear and stress, with students describing increased anxiety when information was delayed, unclear, or inconsistent. As one participant noted, prolonged silence intensified uncertainty, underscoring the urgent need for timely and accurate updates during crises. These findings align with Eckhoff and Goodman-Scott (2021), who found that transparent communication during drills fosters trust and preparedness. Similarly, Schildkraut and Nickerson (2022) demonstrated that drills aligned with best practices—especially those that clearly teach safety strategies—do not heighten anxiety and may enhance students' sense of control. NASP (2015) echoes this, emphasizing that clear, age-appropriate communication reduces fear, supports decision-making, and improves emotional safety during emergencies. Relatedly, a lack of information can be destabilizing – not only for students but for staff. Bradshaw et al. (2022) found that the absence of visible, well-communicated crisis procedures eroded perceptions of safety in secondary schools. Best understood through COR theory, when critical psychological resources—such as clear expectations and actionable information—are absent, coping is diminished, distress increases, and effective decision-making is impaired.

Schildkraut and Nickerson (2022) emphasize drills that reinforce clear communication, procedural familiarity, and psychological safety and NASP (2015) outlines best practices for lockdown procedures, including age-appropriate language, procedural transparency, and opportunities for staff and student feedback. Such practices balance realism with reassurance, reducing emotional harm while enhancing preparedness. From a training perspective, these systems can be reinforced through structured professional development, including scenario-based drills, trauma-informed de-escalation, and inclusive communication strategies. This equips staff to respond with clarity and care, reducing the psychological burden on students across a range of emergencies (NASP, 2015; Nickerson et al., 2022).

4.4 Collective Resilience and the Role of School Staff in Student Coping

The third theme highlights the critical role of relational dynamics in fostering resilience during crises, with participants consistently identifying teachers, administrators, and peers as sources of reassurance and emotional stability. Teachers and staff were seen as protectors whose calm behavior mitigated fear and modeled emotional regulation during the lockdown. One participant said, "*Seeing the teacher stay calm made me feel like I didn't need to panic—it felt like they had control of the situation.*" This aligns with research highlighting how adult behavior influences students' emotions and coping during crises (Jennings et al., 2017).

The findings underscore the importance of both peer and staff relational efforts in fostering resilience. Peer support played a vital role, as students turned to one another for reassurance and assistance. One participant described peers collaborating to secure a classroom and maintain quiet, while another noted comforting a distressed peer by singing together. These interactions reflect the relational nature of resilience, where mutual support mitigates fear and enhances adaptability (Gaias et al., 2019). Similarly, staff relational communication was key to building trust and emotional stability. Consistent staff engagement and expressions of care helped students feel that "*the teachers had everything under control.*" Even when new information was unavailable, participants valued the staff's relational connection, which fostered safety and stability. This aligns with Lenzi et al.'s (2017) multilevel analysis, which found that a strong sense of community—fostered by peer and student-staff relationships—promoted collective resilience and reduced feelings of unsafety through shared support and connectedness. Research on relational trust further emphasizes the role of communication and care in reducing anxiety during high-stress situations (Jennings et al., 2017).

Finally, instances of non-compliance with lockdown protocols were described as sources of heightened anxiety among participants. For example, one student recounted their fear when peers roamed the hallways during the lockdown, emphasizing the critical need for clear leadership and adherence to established protocols to maintain collective safety. These findings align with Curran et al. (2019) and Schildkraut et al. (2023) who found that lockdown drills adhering to well-established and widely understood protocols enhanced students' preparedness and reduced anxiety by promoting familiarity and a sense of control. Huskey and Connell (2021) echoed these findings, noting that students feel more secure when drills follow consistent routines, highlighting the psychological benefits of familiarity and clear expectations.

Collectively, these findings illustrate that relational dynamics, peer support, and communication are essential for resilience and emotional stability but function within larger systems. Several studies have documented that scenario-based training, trauma-informed communication strategies, and inclusive de-escalation protocols improve staff confidence, emotional regulation, and responsiveness to diverse student needs (Nickerson et al., 2022; NASP, 2015). These programs help educators maintain composure, model calm behavior, and deliver consistent information—core elements of relational safety—in varied situations and circumstances.

4.5 Critical Examination of Security Measures

While prior research has raised concerns that heightened security measures can negatively affect students' perceived safety—particularly among students of color and those with trauma histories (Schildkraut et al., 2020; Perumean-Chaney & Sutton, 2012)—our findings suggest a more nuanced reality. In the context of a lockdown drill, some students in this study reported that visible safety measures, such as locked doors or SRO presence, provided emotional reassurance. This contrast may reflect differences in how students interpret preventative versus responsive security. That is, what feels intrusive or stigmatizing during day-to-day school life may feel stabilizing in a crisis, especially when those measures are enacted by trusted adults in calm, coordinated ways. Thus, rather than contradicting prior findings, our results highlight the importance of context, established relational trust, and implementation fidelity in shaping how security measures are perceived.

Relatedly, participants often found comfort in structured drills or the visible presence of SROs. However, these protocols can have mixed effects. For some students—especially those with trauma histories, disabilities, or from marginalized groups—visible security measures may heighten, rather than reduce, fear (Schildkraut et al., 2020). Safety efforts that overlook student diversity can unintentionally erode perceptions of safety and disrupt the emotional support provided by staff (Marshall & Clark, 2023). While hardening measures dominate national investments, they often fail to address the relational and emotional aspects of crisis response. Research suggests that school climate, staff behavior, and community trust are more predictive of student resilience than surveillance tools or armed personnel (Jennings et al., 2017; Marshall & Clark, 2023).

Balancing physical security with relational supports requires thoughtful implementation to reduce fear without increasing vulnerability (Ungar, 2012). This includes offering visual supports, individualized accommodations, and sensory-friendly alternatives when needed. Staff should be trained in de-escalation techniques and trauma-informed responses during both drills and real incidents. Culturally responsive training for school security personnel should emphasize trust-building, collaboration, and awareness of systemic influences on school communities.

5. Implications for Practice and Policy

Findings from this study offer several implications for educators, school leaders, and policymakers aiming to strengthen emergency preparedness while supporting both physical safety and psychological well-being. Clear and consistent communication emerged as a vital protective factor. Participants reported heightened anxiety in the absence of updates, whereas regular verbal check-ins—regardless of content—fostered trust and emotional stability. These results align with NASP (2015) recommendations emphasizing consistent messaging and adult composure during crises. Embedding communication protocols into drills may reduce ambiguity and build student confidence. Physical security features like working door locks and access to secure spaces also contributed to perceived safety, when paired with calm adult behavior and clear explanations. Modeling their use during drills, addressing concerns, and framing them within a shared safety plan can reinforce autonomy and psychological safety (NASP, 2015).

Relational support—particularly from teachers—played a central role in students' ability to manage fear. Calm, communicative adults helped students interpret the situation as manageable, reinforcing prior findings on adult regulation during high-stress events. Trauma-informed training is recommended to equip staff to provide this reassurance through verbal support, consistent presence, and active monitoring. Lastly, peer connections, though less frequently mentioned, also served as sources of comfort. Reliance on peers suggests the potential value of incorporating peer-led preparedness initiatives or team-based drills. Together, these findings highlight the need for safety protocols that integrate physical measures with relational and emotional supports.

6. Limitations and Future Research

This study offers valuable insights into student experiences during simulated lockdowns, yet several limitations must be noted. First, although qualitative research is not intended to be generalizable, future studies should include more diverse participants—particularly those from marginalized backgrounds or with trauma histories—to better capture variation in perceived safety. To deepen understanding of contextual factors, future samples should represent a range of socioeconomic statuses, racial and ethnic backgrounds, gender identities, and trauma exposures. Employing intersectional frameworks will enable examination of how overlapping dimensions of diversity shape student responses to crisis interventions. Longitudinal designs could also clarify the lasting psychological effects of drills and the role of relational dynamics in crisis response. Although this study did not incorporate longitudinal follow-up, the potential for lasting psychological effects following participation in school crisis simulations warrants further investigation. Future research should employ longitudinal designs to assess long-term outcomes and identify any unintended adverse impacts. Second, while VR is a promising tool for studying crisis behavior, its realism is limited. The "device gap" (Slater et al., 2020) may reduce immersion, impacting participant engagement. Continued refinement of VR methods—especially for high-stakes simulations—will improve validity (Birt et al., 2018). Third, although clear communication was essential, relational communication—marked by trust and emotional reassurance—also played a pivotal role. Future studies should examine how behaviors such as calm modeling and empathetic messaging promote resilience. Mixed-methods approaches may further clarify how communication and relational cues shape safety perceptions across school contexts. While this study was designed to foreground participant voices through qualitative methods, we acknowledge the absence of integrated quantitative measures, such as physiological stress indicators or pre/post anxiety scales, as a limitation. Although survey data from the broader project were analyzed and disseminated in a separate publication, future research should incorporate quantitative tools (e.g., standardized surveys, biometric data) alongside qualitative inquiry to support a fully mixed-methods design and deepen understanding of participant responses. Finally, this study highlights the importance of collective resilience. Future work should explore how trauma-informed, culturally responsive, and peer-based strategies can strengthen school communities and foster equitable, inclusive safety practices.

7. Conclusion

This study explores students' experiences during lockdown procedures in simulated active shooter scenarios, highlighting environmental, communicative, and relational factors that shape responses and resilience. Utilizing VR technology, the findings emphasize the importance of clear communication, relational trust, and supportive school climates in fostering safety and mitigating fear. The themes underscore the need for trauma-informed, inclusive policies integrating physical security with relational supports. While designed to promote safety, structured drills, and visible security measures can heighten stress and exclusion for vulnerable populations. Addressing these contradictions requires reflexive, evidence-based approaches that balance realism with psychological safety, inclusivity, and adaptability. By centering relational resilience, this study provides actionable insights to enhance school safety policies, fostering trust, equity, and preparedness across school communities.

Acknowledgments

Not applicable.

Authors contributions

Stephanie F. Dailey led the conceptualization and design of the study, developed the methodological approach, conducted formal analysis, and contributed to manuscript writing. Beth Hosek played a central role in drafting the manuscript, co-led the data analysis and thematic development, and contributed significantly to the manuscript's refinement during the revision process. Heather Walter contributed to the study's conceptual framework and provided critical feedback throughout the writing and editing stages. All authors reviewed and approved the final manuscript.

Funding

Not applicable.

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Redfame Publishing.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

References

Aldrich, D. P., & Meyer, M. A. (2015). Social capital and community resilience. *American Behavioral Scientist, 59*(2), 254-269. https://doi.org/10.1177/0002764214550299

Author 1 & Colleague (2023). [Details omitted for blind review].

Author, Colleague, & Colleague. (2022). [Details omitted for blind review].

Awada, M., Zhu, R., Becerik-Gerber, B., Lucas, G., & Southers, E. (2021). An integrated emotional and physiological assessment for VR-based active shooter incident experiments. *Advanced Engineering Informatics, 47*, 101227. http://doi.org/10.1016/j.aei.2020.101227

Beland, L. P., & Kim, D. (2016). The effect of high school shootings on schools and student performance. *Educational Evaluation and Policy Analysis, 38*(1), 113-126. https://doi.org/10.3102/01623737155906

Bevan, M. T. (2014). A method of phenomenological interviewing. *Qualitative Health Research, 24*(1), 136-144. https://doi.org/10.1177/1049732313519710

Birt, L., Scott, S., Cavers, D., Campbell, C., & Walter, F. (2016). Member checking: A tool to enhance trustworthiness or merely a nod to validation? *Qualitative Health Research, 26*(13), 1802-1811. https://doi.org/10.1177/104973231665487

Birt, J., Stromberga, Z., Cowling, M., & Moro, C. (2018). Mobile mixed reality for experiential learning and simulation in medical and health sciences education. *Information, 9*(2), 31. https://doi.org/10.3390/info9020031

Blascovich, J., & Mendes, W. B. (2010). Social psychophysiology and embodiment. In S. T. Fiske, D. T. Gilbert, & G.

Lindzey (Eds.), *Handbook of social psychology* (5th ed., Vol. 1, pp. 194-227). Wiley.

Blimling, G. S. (2010). *The growth and development of college students*. Kendall Hunt.

Bonanno, G. A. (2005). Resilience in the face of potential trauma. *Current Directions in Psychological Science, 14*(3), 135-138. https://doi.org/10.1111/j.0963-7214.2005.00347.x

Bonanno, G. A., Brewin, C. R., Kaniasty, K., & La Greca, A. M. (2010). Weighing the costs of disaster: Consequences, risks, and resilience in individuals, families, and communities. *Psychological Science in the Public Interest, 11*(1), 1-49. https://doi.org/10.1177/1529100610387086

Bradshaw, C. P., Debnam, K. J., Kush, J. M., & Johnson, S. L. (2022). Planning for a crisis, but preparing for every day: What predicts schools' preparedness to respond to a school safety crisis? *Frontiers in Communication, 7*. https://doi.org/10.3389/fcomm.2022.765336

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

Bronfenbrenner, U., & Morris, P. (2006). The bioecological model of human development. In W. Damon & R.M. Lerner (Eds.), *Handbook of child psychology: Vol. 1. Theoretical models of human development* (6 ed., pp. 793-828). Wiley Publishing.

Chiu, J. I., & Tsuei, M. (2022, June). Effects of Virtual Reality on School Students' Learning in Safety Education: A Meta-analysis. In *International Conference on Human-Computer Interaction* (pp. 130-137). Cham: Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-19682-9_17

Christianson, J. P., Fernando, A. B. P., Kazama, A. M., Jovanović, T., Ostroff, L. E., & Sangha, S. (2012). Inhibition of fear by learned safety signals: A mini-symposium review. *The Journal of Neuroscience, 32*(41), 14118-14124. https://doi.org/10.1523/jneurosci.3340-12.2012

Cresswell, J., & Poth, C. (2018). *Qualitative inquiry and research design*. Sage Publishing. https://doi.org/10.4135/97814129862681.n304

Curran, F. C., Fisher, B. W., & Viano, S. L. (2019). Mass school shootings and the short-run impacts on use of school security measures and practices: national evidence from the Columbine tragedy. *Journal of School Violence, 19*(1), 6-19. https://doi.org/10.1080/15388220.2019.1703713

Dickson, M. J., & Vargo, K. K. (2017). Training kindergarten students lockdown drill procedures using behavioral skills training. *Journal of Applied Behavior Analysis, 50*(2), 407-412. https://doi.org/10.1002/jaba.369

Eckhoff, A., & Goodman-Scott, E. (2021). School counselors' perceptions and understandings of lockdown drills: Navigating the paradox of safety and fear. *Educational Policy, 37*(2), 523-553. https://doi.org/10.1177/08959048211032667

Eppich, W., & Cheng, A. (2015). Promoting excellence and reflective learning in simulation (PEARLS): Development and rationale for a blended approach to health care simulation debriefing. *Simulation in Healthcare, 10*(2), 106-115. https://doi.org/10.1097/SIH.0000000000000072

Feitelson, D. G. (2015). Using students as experimental subjects in software engineering research: A review and discussion of the evidence. *ArXiv*, 1512.08409. https://doi.org/10.48550/arXiv.1512.08409

Gaias, L. M., Lindstrom Johnson, S., White, R. M., Pettigrew, J., & Dumka, L. (2019). Positive school climate as a moderator of violence exposure for Colombian adolescents. *American Journal of Community Psychology, 63*(1-2), 17-31. https://doi.org/10.1002/ajcp.12300

Galatzer-Levy, I. R., Huang, S. H., & Bonanno, G. A. (2018). Trajectories of resilience and dysfunction following potential trauma: A review and statistical evaluation. *Clinical Psychology Review, 63*, 41-55. https://doi.org/10.1016/j.cpr.2018.05.008

Gill, M. J. (2020). Phenomenological approaches to work and organization. In Cassell et al. (Eds.), *The Sage Handbook of Qualitative Business and Management Research Methods* (pp. 109-126). Sage.

Hobfoll, S. E., Stevens, N. R., & Zalta, A. K. (2015). Expanding the science of resilience: Conserving resources in the aid of adaptation. *Psychological Inquiry, 26*(2), 174-180. https://doi.org/10.1080/1047840x.2015.1002377

Huskey, M. G., & Connell, N. M. (2021). Preparation or provocation? Student perceptions of active shooter drills. *Criminal Justice Policy Review, 32*(1), 3-26. https://doi.org/10.1177/0887403419900316

Jennings, P. A., Brown, J. L., Frank, J. L., Doyle, S., Oh, Y., Davis, R., ... & Greenberg, M. T. (2017). Impacts of the CARE for Teachers program on teachers' social and emotional competence and classroom interactions. *Journal of*

Educational Psychology, 109(7), 1010-1028. https://doi.org/10.1037/edu0000187

Juvonen, J., Kogachi, K., & Graham, S. (2018). When and how do students benefit from ethnic diversity in middle school?. *Child development, 89*(4), 1268-1282. https://doi.org/10.1111/cdev.12834

Lazarus, R. S. (1991). *Emotion and adaptation*. Oxford University Press.

Lenzi, M., Sharkey, J., Furlong, M. J., Mayworm, A., Hunnicutt, K., & Vieno, A. (2017). School sense of community, teacher support, and students' school safety perceptions. *American Journal of Community Psychology, 60*(3-4), 527-537. https://doi.org/10.1002/ajcp.12174

Lowe, S. R., & Galea, S. (2017). The mental health consequences of mass shootings. *Trauma, Violence, & Abuse, 18*(1), 62-82. https://doi.org/10.1177/1524838015591572

Mahoney, M., Farmer, C., Sinclair, S., Sung, S., Dehaut, K., & Chung, J. (2020). Utilization of the DSM-5 self-rated level 1 cross-cutting symptom measure-adult to screen healthy volunteers for research studies. *Psychiatry Research, 286*, 112822. https://doi.org/10.1016/j.psychres.2020.112822

Marshall, M. L., & Clark, C. (2023). Schools as relational systems: Principals' social networks and emotional work during crises. *Educational Administration Quarterly, 59*(1), 3-36. https://doi.org/10.1177/0013161X221130843

Masson, F., & Smith, L. H. (2019). Colonisation as collective trauma. In T. Kleibl, R. Lutz, N.a Noyoo, B. Bunk, A. Dittmann, & B. Seepamore (Eds.), *The Routledge Handbook of Postcolonial Social Work* (pp. 13-26). https://doi.org/10.4324/9780429468728

Meyer, H. C., Odriozola, P., Cohodes, E. M., Mandell, J. D., Li, A., Yang, R., … & Gee, D. G. (2019). Ventral hippocampus interacts with prelimbic cortex during inhibition of threat response via learned safety in both mice and humans. *Proceedings of the National Academy of Sciences, 116*(52), 26970-26979. https://doi.org/10.1073/pnas.1910481116

National Association of School Psychologists (NASP). (2015). *Mitigating the psychological effects of lockdowns: Best practices for schools*.

National Association of School Psychologists, National Association of School Resource Officers, & Safe and Sound Schools. (2021). *Best practice considerations for armed assailant drills in schools.* National Association of School Psychologists.

Neergaard, M. A., Olesen, F., Andersen, R. S., & Sondergaard, J. (2009). Qualitative description–the poor cousin of health research? *BMC Medical Research Methodology, 9*(52). https://doi.org/10.1186/1471-2288-9-52

Nickerson et al. (2022).

Norris, F. H., Stevens, S. P., Pfefferbaum, B., Wyche, K. F., & Pfefferbaum, R. L. (2008). Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. *American Journal of Community Psychology*, *41*(1-2), 127-150. https://doi.org/10.1007/s10464-007-9156-6

Perkins, J. C. (2018). Preparing teachers for school tragedy: Reading, writing, and lockdown. Journal of Higher *Education Theory and Practice, 18*(1), 70-81. https://doi.org/10.33423/jhetp.v18i1.536

Perumean-Chaney, S. E., & Sutton, L. M. (2013). Students and perceived school safety: The impact of school security measures. *American Journal of Criminal Justice, 38*(4), 570-588. https://doi.org/10.1007/s12103-012-9182-2

Raghavan, S., & Sandanapitchai, P. (2020). The relationship between cultural variables and resilience to psychological trauma: A systematic review of the literature. *Traumatology, 30*(1), 37-51. https://doi.org/10.1037/trm0000239

Rajabi, M. S., Taghaddos, H., & Zahrai, M. (2022). Improving emergency training for earthquakes through immersive virtual environments and anxiety tests: A case study. *International Journal of Disaster Risk Reduction, 60,* 102-115. https://doi.org/10.48550/arXiv.2205.04993

Ravitch, S. M., & Carl, N. M. (2021). *Qualitative research: Bridging the conceptual, theoretical, and methodological*. Sage Publications.

Schildkraut, J., & Nickerson, A. B. (2022). *Lockdown drills: Connecting research and best practices for school administrators, teachers, and parents*. MIT Press. https://doi.org/10.7551/mitpress/14052.001.0001

Schildkraut, J., Greene-Colozzi, E., Nickerson, A. B., & Florczykowski, A. (2023). Can school lockdowns save lives? An assessment of drills and use in real-world events. *Journal of School Violence, 22*(2), 167-182. https://doi.org/10.1080/15388220.2022.2162533

Schildkraut, J., Nickerson, A. B., & Ristoff, T. (2020). Locks, lights, out of sight: Assessing students' perceptions of

emergency preparedness across multiple lockdown drills. *Journal of School Violence, 19*(1), 93-106. https://doi.org/10.1080/15388220.2019.1703720

Seidman, I. (2006). *Interviewing as qualitative research: A guide for researchers in education and the social sciences*. Teachers College Press.

Sellnow, T. L., & Seeger, M. W. (2013). *Theorizing crisis communication.* Wiley-Blackwell.

Slater, M., Gonzalez-Liencres, C., Haggard, P., Vinkers, C., Gregory-Clarke, R., Jelley, S., … & Silver, J. (2020). The ethics of realism in virtual and augmented reality. *Frontiers in Virtual Reality, 1*, 1. https://doi.org/10.3389/frvir.2020.00001

Ungar, M. (2012). Social ecologies and their contribution to resilience. In M. Ungar (Ed.), *The social ecology of resilience: A handbook of theory and practice* (pp. 13-31). Springer. https://doi.org/10.1007/978-1-4614-0586-3_2

VERBI Software. (2021). *MAXQDA 2022* [computer software]. https://www.maxqda.com

Yablon, Y. B. (2019). School safety and school connectedness as resilience factors for students facing terror. *School Psychology, 34*(2), 129-137. https://doi-org/10.1037/spq0000259

Zhe, E. J., & Nickerson, A. B. (2007). Effects of an intruder crisis drill on children's knowledge, anxiety, and perceptions of school safety. *School Psychology Review, 36*(3), 501-508. https://doi.org/10.1080/02796015.2007.12087936

Appendix A

Participant Training Materials and Screening Criteria

A.1 Participant Training Overview

All participants completed a two-day training prior to engaging in the virtual reality (VR) simulations. The purpose of this training was to ensure familiarity with the virtual environment, establish a baseline understanding of school lockdown procedures, and introduce the VR equipment.

Day 1: VR Equipment Orientation

a) Introduction to VR headset and hand controllers
b) Practice movement and interaction within the virtual environment
c) Troubleshooting common issues (e.g., motion sickness, equipment calibration)

Day 2: Lockdown Protocol Familiarization

a) Overview of standard school lockdown procedures (e.g., "Locks, Lights, Out of Sight")
b) Simulation walkthrough of a non-emergency school day in the virtual high school
c) Discussion of situational variables (e.g., classroom settings, hallway layouts, SRO presence)
d) Practice responding to auditory and visual cues (e.g., announcements, gunshot sounds)

A.2 Screening Criteria

Participants were screened for physical, psychological, and VR-readiness using a three-phase process:

1. Mental and Physical Health Screening

Completion of the *DSM-5 Self-Rated Level 1 Cross-Cutting Symptom Measure – Adult* Disqualification criteria included:

a) Active or untreated mental health conditions (e.g., PTSD, panic disorder)
b) Recent trauma exposure
c) History of seizures or neurological disorders

2. Zoom-Based Screening Interview

a) Conducted to confirm understanding of risks and procedures
b) Ensured informed consent and voluntary participation
c) Assessed willingness to engage in high-stress simulations

3. VR Suitability Assessment

30-minute in-person VR session to test headset tolerance and physical responsiveness. Observations focused on:

a) Signs of disorientation or motion sickness
b) Ability to interact with the virtual environment
c) Comfort navigating simulated school layouts

Exclusion Criteria Included:

a) Prior experience with an actual school shooting
b) Severe motion sickness or physical incompatibility with VR
c) Inability to follow safety protocols or instructions

Appendix B

Instruments Used for Screening, Post-Run Surveys, and Focus Groups

B.1 Pre-Screening Instruments

1. DSM-5 Self-Rated Level 1 Cross-Cutting Symptom Measure – Adult
   Participants completed this standardized instrument to assess general mental health functioning and screen for active psychiatric symptoms. (Mahoney et al., 2020)
2. Semi-Structured Zoom Screening Interview
   Purpose: Confirm participant understanding of study procedures, risks, and eligibility. Sample Questions:
   a. Can you describe your understanding of what will happen in the simulation?
   b. Have you experienced any adverse reactions to virtual reality (e.g., motion sickness)?
   c. Are you currently experiencing or receiving treatment for any mental health conditions?

B.2 Post-Run Survey Instrument & Focus Group Protocol

Administered after each of the 36 simulation runs, the post-run survey was designed to elicit participants' immediate observations, decisions, and emotional responses. Participants responded in open-ended text boxes.

Post-Run Survey Questions:

1. What did you observe during the experiment run?
2. What actions did you take during the experiment run?
3. Briefly describe what happened from your perspective.
4. Was there anything that made you feel more or less safe during this run?
5. How did the people around you (teachers, peers, staff) influence your experience?

Focus Group Protocol

Initial Focus Group

Conducted after all simulation runs, the focus group explored cumulative impressions, patterns in behavior or emotion, and reflections on context and social roles. Focus groups followed a semi-structured protocol and were moderated by trained facilitators using trauma-informed practices.

Sample Focus Group Prompts:

1. Looking back on all the scenarios, was there a particular moment that stood out to you? Why?
2. How did your interactions with teachers, staff, or other students affect your experience during the simulations?
3. Did you notice any recurring patterns in how you or others responded across the scenarios?
4. Was there anything about the virtual environment that influenced how you felt or behaved?
5. If you were to go through these simulations again, what would you do differently? Why?

Follow Up Focus Group

A second follow-up focus group was held 7 to 10 days later, allowing participants additional time to process their experiences and reflect on the preliminary themes presented by the research team. This follow-up session supported deeper thematic exploration and functioned as a formal member-checking process, with participants asked to validate or refine the initial findings.

1. Theme Validation
   a) "When we presented the preliminary theme *[insert theme, e.g., 'Ambiguity Elicits Stress']*, did this resonate with your experience? Why or why not?"
   b) "Do you feel this theme accurately captures what you and others experienced across the simulations?"
2. Theme Refinement

a) “Are there aspects of your experience that were not captured in the initial themes we shared?”
b) “How would you change or reword any of the themes to better reflect your perspective?”
c) “Do any of the themes need to be broken down into more specific parts?”

3. Emotional & Cognitive Processing
   a) “Now that you’ve had some time to reflect, how do you make sense of your reactions during the simulations?”
   b) “Have your thoughts or emotions about any particular moment changed since the day of the simulation?”
4. Additional Insights
   a) “What, if anything, do you think we missed in our initial analysis?”
   b) “Is there a theme or idea that now feels more important to you than it did immediately after the simulation?”