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SIMEX 20-6 AFTER-ACTION REPORT: SCHOOL SECURITY

December 2020



DEFEND TODAY,
SECURE TOMORROW

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EXECUTIVE SUMMARY

Simulation Experiment (SIMEX) 20-6 was conducted from August 3 to August 14, 2020, to explore casualty mitigation during an active assailant event in a suburban high school in the United States through virtual reality experimentation. The Department of Homeland Security's (DHS) Cybersecurity and Infrastructure Security Agency (CISA) sponsored this event in coordination with George Mason University's (GMU) College of Education and Human Development. The SIMEX modeled general school policies related to security during an active shooter event, simulated those policies through repeated experimental runs in a virtual reality environment, and generated data to determine their impact on the outcome of a school shooting scenario. SIMEX participants included teachers, students (played by GMU students simulating K-12 students), school resource officers (SRO), and a front office administrator.

This SIMEX investigated the impact of three factors on an active shooter scenario:

- **Factor 1 – Presence of SRO:** Whether an SRO was present and patrolling in the school or absent.
- **Factor 2 – Door-Locking Policy:** Whether classroom doors were pre-locked or had to be manually locked during lockdown.
- **Factor 3 – Lockdown Notification Policy:** Whether lockdown notifications were decentralized (could be made by teachers over public address system [PA]) or centralized (could only be issued by front office).

One participant played the role of the shooter, who was a current student of the simulated school. The SIMEX included both targeted and mass casualty shooting scenarios to account for a variety of known and documented shooter behaviors.

Experiment Purpose

Conducting this SIMEX 20-6 served two primary purposes. The first was to examine the above factors to develop recommendations to improve both physical and operational security in K-12 schools across the nation. The second was to evaluate the SIMEX platform to determine if it is an effective tool to evaluate school safety-related policies, technologies, and procedures in the future. In addition to the key findings and recommendations from this SIMEX, there are also documented takeaways that discuss the use of SIMEX as a tool included at the end of this section.

Experiment Structure

Following three days of training and system testing, experimental trials ran August 6 to 14 with typically six runs a day in order to collect enough data to precisely measure the effects of the factors of interest. Each run consisted of a participant briefing, setup, scenario execution, a post-run survey, and a post-run discussion.

Scenario

The SIMEX scenario was set in a virtual high school environment modeled after designs used in current day schools supporting 1,000 students. To accommodate the relatively small number of live participants in the experiment, just a section of the representative high school was modeled in the virtual environment using architectural best practices for school design. Each run took place at 7:45 a.m. to simulate the period in the school day involving school arrival and classroom transition activities.¹

Roles and Assignments

The simulated school was populated with 10 human-operated teachers and 20 human-operated students, as well as more than 300 non-player character students to fill out the student body. A human-operated school administrator handled communications through the front office. In several of the runs, a human-operated SRO patrolled the school. Participants were recruited based on their real-world experience in these roles.

At the scenario start, operators were instructed to perform actions that model a school morning. Ten of the classrooms were designated homerooms. Each teacher was assigned to a homeroom, one teacher per homeroom. Two human-operated students were also assigned to each one of these homerooms.

¹ Determined from data indicating that three quarters of school shootings occur in the morning before or during classes. [9]

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Prior to a threat, students and teachers were given assignments to circulate around the school on the way to their homerooms. During a threat, all participants were instructed to follow lockdown procedures as assembled from best practices of real school emergency procedures.

For each run, the shooter's mission was to either target a particular homeroom teacher or inflict as many injuries as possible. Analysis found that varying the shooter's mission had no significant effect on scenario outcomes in this experiment.

Data Collection and Analysis

To measure scenario outcomes, data was collected by automated event logging during the simulation as well as participant responses to post-run surveys. Quantitative measurements to evaluate each run included (but were not limited to):

- Casualties as percentage of total population
- Percentage of students "safe"—either evacuated or in a locked classroom
- Average time for homerooms to complete lockdown (close and lock doors) and number of homerooms completing lockdown
- Situational awareness, workload, and stress as reported by the participants in post-run surveys

In addition to the quantitative metrics, qualitative data was collected in the form of survey content and was analyzed to explore participants' attitudes and responses. SIMEX staff also observed the behavior of key participants during scenario execution.

Findings

Factor 1 Findings: Presence of an SRO

In half of the experimental runs, a human-operated SRO patrolled the school. The following statistically significant² results emerged from this factor:

- On average, **casualties were 7 percent of the total population when the SRO was present** as opposed to **13 percent when the SRO was absent**.
- On average, the **shooter discharged 52 percent of ammunition when the SRO was present** as opposed to **91 percent when the SRO was absent**.
- On average, **26 percent of students achieved safety when the SRO was present** as opposed to **18 percent when the SRO was absent**.
- On average, **50 percent of homerooms (5/10) completed lockdown when the SRO was present** as opposed to **30 percent (3/10) when the SRO was absent**. In survey feedback teachers reported closing their doors when they saw the SRO was nearby.

Factor 1 Conclusion

The presence of an SRO was found to have a significant impact on the outcome of an active school shooter event. In runs with an SRO, more students got safely outside the school or into locked classrooms and there were fewer casualties than in runs with no SRO.

Factor 2 Findings: Door-Locking Policy

In half of the experimental runs, classroom doors were "pre-locked," meaning they were locked automatically when closed. In the other runs, teachers had to manually lock doors by pressing a locking mechanism on the outside of the door in the virtual environment for a randomized time between 3 and 6 seconds. The manual lock would not engage if the locking process was interrupted during this time. This mechanic was intended to emulate the time needed to operate a keychain and keylock or keypad lock while experiencing the stress of an active shooter event in the school. The runs with pre-locked doors yielded the following statistically significant results:

² Findings that are statistically significant refer to those in which it would be extremely unlikely for that effect to be due to chance. Based on an analysis of the experiment data, these are the findings that can be reported confidently.

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- On average, **26 percent** of students achieved safety when doors were pre-locked as opposed to **18 percent** when doors had to be manually locked.
- On average, **50 percent** of homerooms completed lockdown when doors were pre-locked as opposed to **30 percent** when doors had to be manually locked.
- In survey and post-run feedback, teachers mentioned feeling frustrated and unsafe when faced with the manual locks.
- On average, **homerooms were locked 43 seconds before threat onset when doors were pre-locked** as opposed to **15 seconds after threat onset when doors had to be manually locked**. This difference is explained by the observation that teachers closed their doors when they decided to start class, which in the case of the pre-locked doors would lock them as well.
- **Casualties were not significantly affected by door-locking policy in this experiment.** Though more students were presumably safe behind locked doors, the shooter's casualty count was similarly high in both locking conditions. In this experiment, the shooter adopted a strategy of entering a classroom with the weapon concealed before the door was closed and locked. If the shooter had adopted a different strategy, the increase in student safety may have led to a reduction in casualty count. In addition, a few participants mentioned being shot by stray bullets through walls.

Factor 2 Conclusion

Classroom doors that lock without teacher intervention when closed were found to have a significant impact on the outcome of an active school shooter event. In runs with pre-locked doors, more classrooms completed lockdown procedures and more students got safely outside the school or into locked classrooms.

Factor 3 Findings: Lockdown Notification Policy

In half of the experimental runs, lockdown notifications were “decentralized,” meaning that teachers could use the PA system to alert the whole school of an active shooter incident taking place. The other runs were “centralized,” meaning that teachers reported the incident directly to the front office whereupon the school administrator made a formal notification of an active shooter event over the PA system. In both cases, the front office administrator responded to teachers' reports by issuing an official lockdown announcement over the PA system to the whole school. After the initial announcement, teachers continued to issue notifications on the shooter's location and description using the PA system or to the front office, respectively. The quantitative metrics did not indicate any significant effect of lockdown notification policy in this experiment. The following are notable results regarding the lockdown notification process:

- The **SRO reported consistently high situational awareness in runs with decentralized notifications** (average Situational Awareness Rating Technique [SART]) score 35 as opposed to 29; SRO's situational awareness ranged from 23 to 38 over the course of the experiment).
- In post-run survey feedback and hotwash feedback for centralized runs, the **SRO noted that information in the notifications lagged behind the shooter's actual location**. Analysis of survey content showed teachers felt decentralized notifications were more reliable.
- In post-run survey feedback, the **shooter described taking advantage of PA announcements to avoid the SRO and to surprise potential targets**. This was confirmed by observing the shooter's behavior.

Factor 3 Conclusion

Allowing teachers to give lockdown notifications over the PA system (the decentralized mode) did not have a significant impact on the outcome of an active shooter event in this experiment.

Related Findings

Shooter and SRO Interaction

The shooter eliminated the SRO in 11 of the 12 runs in which the SRO was present. While this result was due in small part to artificialities associated with the SRO's inability to confront the shooter in a realistic way (e.g., visual cues, non-lethal restraints), the shooter was generally able to target and eliminate the SRO before the SRO was able to engage the shooter.

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Two trends emerge from the quantitative and qualitative analysis. The first is that the shooter's situational awareness is both timely and sufficient whereas the SRO's situational awareness is both late and insufficient. The second is that the shooter's mental workload is less than that of the SRO. Both of these indicators contribute to the success of the shooter over the SRO in direct confrontation.

Recommendations

School security stakeholders should consider the following recommendations drawn from conclusions to mitigate the effects of school shootings. These recommendations are not prioritized (CISA does not recommend one recommendation over another) and it is critical that each be considered in accordance with state and/or district requirements and regulations as well as a school's existing policies, procedures, and operations. Furthermore, the recommendations were developed based on data analysis evaluated within the scope of the specific scenario described earlier in this section.

1. The presence of an SRO in this experiment reduced casualties and increased the number of students able to remain safe during an active school shooter event. As a result, **schools should consider the use of an SRO or equivalently trained security professional(s)** as a component of a layered security approach.
2. While an SRO's presence improved the safety of students and teachers during lockdown, their situational awareness was not sufficient to neutralize the shooter in an active shooter incident. To address this challenge, **schools should investigate potential strategies or technologies that improve the timeliness and accuracy of an SRO's (or external law enforcement's) situational awareness** to support the observing, processing, and decision-making process.
3. Given that pre-locked classroom doors may increase the number of students able to remain safe during an active school shooter event, **schools should consider establishing a policy to require that classroom doors be kept in the locked position at all times** during morning, daily, and departure periods where possible. Alternately, **schools could also consider adopting technology for automatically locking all classroom doors** when a lockdown is issued. Such a policy and/or technology could play a role in developing an effective, comprehensive security strategy.
4. A lockdown notification policy did not yield any clear effects in this experiment due to the finding that while decentralized notifications may have improved situational awareness, they did not seem to aid school security or mitigation of the shooter. In fact, there is evidence that the shooter benefitted from the PA notifications in completing their mission. As a result, **schools should consider developing a communications strategy/plan that allows for students, teachers, administrative staff, and an SRO (or external law enforcement) to effectively and efficiently share information** and updates with one another. Schools could also **consider investigating modern communications technologies** that could supplement such a strategy or policy.

SIMEX Takeaways

In addition to the findings and recommendations identified above, the following details the broader takeaways regarding the use of SIMEX as a tool to effectively evaluate school safety-related policies, technologies, and procedures:

- **SIMEX Assessment 1:** While SIMEX as a tool can provide valuable analysis and insights into the area of school safety, variables being examined need to be specific in scope, and constraints and assumptions need to be clearly outlined. Furthermore, when looking at an active shooter within a K-12 school scenario, SIMEX as a tool was found to be limited in flexibility and it does not always account for real-world factors that often influence incidents involving school security (i.e., behavioral and social cues exhibited by a shooter).
- **SIMEX Assessment 2:** Given the narrow scope of SIMEX as a tool when looking at an active shooter within a K-12 school scenario, findings are very context sensitive and as a result, associated recommendations need to account for the dynamic aspect of school operations and settings over the course of the school day.

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