



NAVIGATING THE CYBER HIGHWAY: ASSESSING THE KNOWLEDGE AND AWARENESS OF VEHICLE CYBERSECURITY AMONG LAW ENFORCEMENT OFFICERS (LEOS)

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Introduction

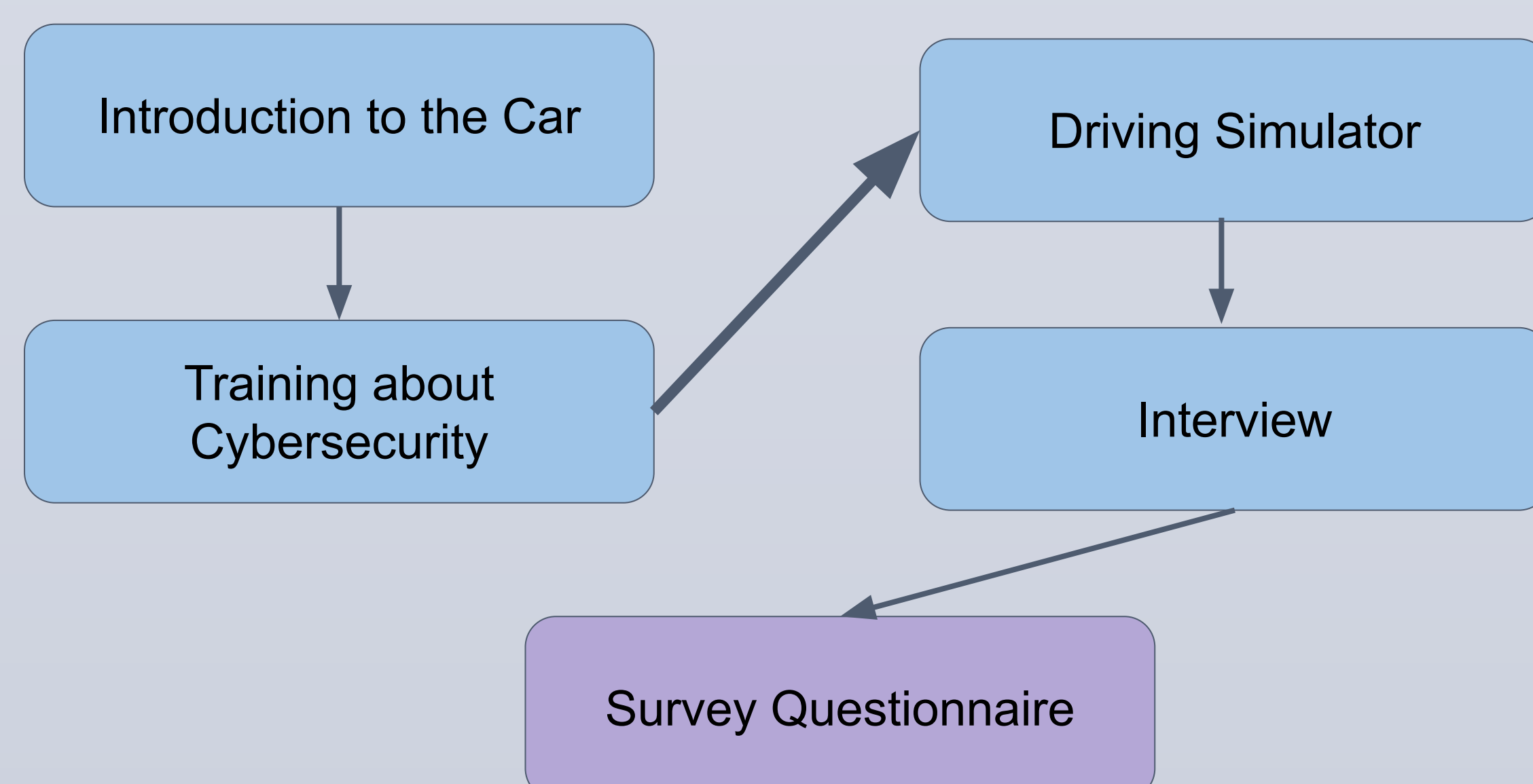
The integration of modern technology has radically impacted the driving scene, ushering in an era of more automated driving experiences. Despite this development, many cars, especially those used by law enforcement, still lack adequate cybersecurity protections, leaving them exposed to cyber assaults. In light of these issues, the purpose of this research is to raise law enforcement officers' (LEOs) knowledge of the growing hazards posed by vehicle cybersecurity vulnerabilities. This study investigates the consequences of such initiatives using a rigorously designed experimental training program, which is reinforced with a driving simulator study and interviews.

Research Question and Hypothesis

How can tailored training programs effectively enhance law enforcement officers' comprehension of vehicle cybersecurity risks and improve their response capabilities?

My hypothesis is that Law Enforcement Officers who participate in a tailored training program specifically designed to address vehicle cybersecurity vulnerabilities will exhibit notable advancements in their conceptual understanding of cybersecurity risks and demonstrate safer driving behaviors in simulated cyberattack scenarios. Specifically, we expect that officers who undergo this specialized training will display a greater ability to identify and mitigate cyber threats, resulting in more vigilant driving behaviors and a reduced susceptibility to cyberattacks compared to officers who do not receive such training.

Layout of the Study



Data and Method

Q. No	Questions asked in the Survey
1	Age
2	Gender
6	Years of Experience
7	Highest Level of Education
8	Hours spent in Police Vehicle
9	Military Experience
12	Cybercrime Cases in Police Agency
13	Cybercrime Unit in Police Agency
14	Cybercrime Training in Police Agency
15	Have you worked on a cybercrime case?
16	Do you have experience with vehicle cyberattacks?
18	Do you think police vehicles are susceptible to cyberattacks?
19	Are cyberattacks on police vehicles a serious concern for you?
22	What in-vehicle technology is most susceptible to cyberattacks?
23	Vehicle cybersecurity training in Police Agency
25	What information would you like to receive during training?
28	What is the best method to train officers for cybersecurity?

A total of 14 Law Enforcement Officers (LEOs) were recruited, ranging in age from 27 to 51 years, with 13 males and one female. Participants from Massachusetts were recruited using a variety of outreach approaches, including fliers, email ads, and visits to police stations across neighbouring towns. All participants had valid United States driver's licenses and were presently working as LEOs in the United States. On average, participants had 17.13 years of law enforcement experience, with a standard deviation of 7.9 years. Participants were divided into two groups: the Experimental and the Sham groups. Following an initial baseline drive, both groups were trained using a full PowerPoint presentation. This training explained the nature and history of vehicle cyberattacks, with contextual examples and solutions for both prevention and mitigation. The Experimental group was provided with supplemental material, where they were asked to apply what they learned to five hypothetical scenarios and had their answers recorded for later analyses. Out of the 28 questions in the survey, 13 questions for this study. It focuses on demographic data along with understanding and experience with cybersecurity. Descriptive statistical analysis was performed on quantitative data using metrics such as mean, median, and standard deviation, which provided useful insights into probable patterns and distributions. Furthermore, bar plots were rigorously created to graphically show and compare numerous parameters, such as education level and hours spent in work vehicles, between the Training and Sham groups.

Results

Among the numerous findings, I have handpicked and given a selection of key highlights that capture the core and importance of the research findings.

Comparison of the Experimental and Sham Groups



This plot depicts the influence of cybersecurity training on law enforcement officers (LEOs). The Experimental group, which received specialized training, expressed higher anxiety about cyberattacks on police cars than the Sham group. This demonstrates the effectiveness of cybersecurity training in increasing awareness of possible dangers. The statistics confirm the need for increased training programs, as seen in the bar plot, and provide unambiguous proof of training's effectiveness.

Regression Analysis

```
glm(formula = Q19 ~ stgroup, family = binomial, data = data)
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Coefficients:

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	0.9163	0.8367	1.095	0.273
stgroupSham	-1.8326	1.1832	-1.549	0.121

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 19.408 on 13 degrees of freedom
Residual deviance: 16.752 on 12 degrees of freedom
AIC: 20.752

Number of Fisher Scoring iterations: 4

The regression analysis proves 3 points -

- It suggests association between stgroup (Experimental and Sham groups), which was the training we provided during the study, and Q19 (Are cyberattacks on Police Vehicles a serious concern for you?)
- Although it suggests association between the two things, it is not statistically significant at the conventional threshold.
- The suggestion from the previous point is that we need to conduct the study on a larger level, i.e. a substantial participant group. This would give us a better regression analysis.

Correlation Analysis

	Q1	gender	Q6	time	Q12	Q13	Q14
Q1	1.0000000	-0.18772221	0.8950353	-0.3383844	-0.1413877	-0.4421114	0.1210772
gender	-0.1877222	1.0000000	-0.1624571	-0.4689972	-0.5310850	-0.1132277	-0.3721042
Q6	0.8950353	-0.1624571	1.0000000	-0.3875851	-0.1483135	-0.3152174	0.1217161
time	-0.3383844	-0.4689972	-0.3875851	1.0000000	0.5247362	0.3601801	0.3397579
Q12	-0.1413877	-0.5310850	-0.1483135	0.5247362	1.0000000	0.2132007	0.7006490
Q13	-0.4421114	-0.1132277	-0.3152174	0.3601801	0.2132007	1.0000000	0.3042903
Q14	0.1210772	-0.3721042	0.1217161	0.3397579	0.7006490	0.3042903	1.0000000
Q15	0.1412567	-0.20672456	0.3598564	0.1205593	0.3892495	0.1217161	0.2444444
Q18	-0.3379000	0.07692308	-0.2510701	0.1835207	0.5310850	0.1132277	0.3721042
Q19	-0.4061052	-0.27735010	-0.3372486	0.2205644	0.5222330	0.4082483	0.4472136
Q15	0.1412567	-0.33789998	-0.4061052				
gender	-0.2067246	0.07692308	-0.2773501				
Q6	0.3598564	-0.25107012	-0.3372486				
time	0.1205593	0.18352066	0.2205644				
Q12	0.3892495	0.53108500	0.5222330				
Q13	0.1217161	0.11322770	0.4082483				
Q14	0.2444444	0.37210420	0.4472136				
Q15	1.0000000	0.20672456	-0.1490712				
Q18	0.2067246	1.00000000	0.2773501				
Q19	-0.1490712	0.27735012	1.0000000				

Highlights from the Regression Analysis

- Gender has negative correlation to the rest of the questions. This was a surprise for us since we didn't think Gender would have any significant correlation to any of the questions.
- Age has a negative correlation to Q18 and Q19, which describes the Police Vehicle susceptibility of cyberattacks and concern for cyberattacks on police vehicle.
- Cybercrime experience and training have a correlation with each other as well as a positive correlation with cybercrime concern, which was expected and noted during interviews.
- Q18 (Police vehicle susceptibility of cyberattacks) and Q19 (Are cyberattacks on police vehicle a serious concern for you?) showed positive correlation to training, which proved our hypothesis.

Discussion & Conclusions

The exponential growth of automobile technology has sparked increased concern about vehicle cybersecurity, particularly among Law Enforcement Officers. This study sought to dive thoroughly into LEOs' responses to unanticipated vehicle cyber assaults, measuring the influence of comprehensive training on their replies. The research used a mixed-methods approach, combining data from surveys, interviews, eye tracking, and a sophisticated driving simulator. The overall hypothesis proposed that LEOs who received vehicle cybersecurity training would exhibit increased cognitive awareness and more careful driving behaviors when presented with cyberattack-induced circumstances. The findings highlight the critical relevance of targeted cybersecurity training programs for Law Enforcement Officers (LEOs) in improving their understanding of vehicle cybersecurity threats and response capability. The increased anxiety levels seen in the Experimental group, which received specialized training, compared to the Sham group, demonstrate the effectiveness of such training in boosting awareness of possible hazards. While the regression analysis indicated relationships between numerous parameters such as gender, age, and cybercrime experience, the importance of these correlations highlights the need for more study with bigger sample sizes. Overall, the study provides persuasive evidence that specialized training may help LEOs detect and mitigate cyber risks, therefore improving their cybersecurity preparedness.

Acknowledgement

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