Evaluation of Light-Vehicle Driver Education Programs Targeting Sharing the Road with Heavy Vehicles

A Case Study Analysis

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EXECUTIVE SUMMARY

The purpose of this project was twofold. First, researchers wanted to investigate current light-vehicle driver education programs that contain components on sharing the road with heavy vehicles and develop a supplemental practices document on key sharing-the-road information that teachers could cover with students. A public program (e.g., high school driver education program) and private programs (e.g., Commercial Vehicle Safety Alliance [CVSA] Teens & Trucks, Walmart Truck Team, etc.) that teach key sharing-the-road information were identified. These resources were used to develop a supplemental practices document on key sharing-the-road information and how the information may be taught.

Second, a case study was performed with a light-vehicle driver education program in a single state that only included a basic textbook-based component on sharing the road with heavy vehicles. Two components were introduced into different driver education classrooms and evaluated in comparison with the basic textbook-based component. The first component introduced was updated material in the form of a DVD developed by the CVSA titled Teens and Trucks. This DVD contained a series of recommended practices for safely sharing the road with heavy trucks (e.g., don’t cut off trucks, stay out of blind spots or no zones, maintain a safe following distance, understand trucks make wide right turns, and if your car breaks down pull off the highway as far as you can) with a special focus on the teen driving population. Video demonstrations were presented in this DVD showing proper and improper driving behavior.

The second component introduced into the driver education curriculum was a hands-on truck experience program developed by NSTSCE researchers. In developing the hands-on truck experience, VTTI researchers reviewed the educational resources provided by various organizations involved in teaching people to share the road with heavy trucks. Organizations included the CVSA, the Walmart Truck Team, the Wisconsin Road Team, the American Trucking Association (ATA), and the Federal Motor Carrier Safety Administration (FMCSA). The research team also reviewed the section on sharing the road with heavy trucks found in the eleventh edition of Pearson’s Drive Right textbook. Researchers also utilized the skills and expertise of VTTI staff, including those with Commercial Driver’s Licenses (CDLs), in creating the truck hands-on experience.

Each classroom of students that received one of the components was invited to take part in a survey two months later and knowledge retention of key learning points (e.g., heavy vehicle No-Zones) was measured. Focus groups were also conducted with students to explore learning preferences related to driver education, understanding of key sharing-the-road information, and ratings of the various components.

The mean percentage of correct responses for all survey questions was calculated and compared across the three conditions and did not show a statistically significant difference in knowledge retention of any one condition over another. Further analyses were performed to evaluate each survey question individually across conditions. As each survey question evaluated different types of information being taught (e.g., distance, maneuver), it was hypothesized that one condition may have resulted in improved knowledge retention for specific questions rather than the aggregate. Results found only one statistically significant
difference: the textbook and truck condition outperformed the textbook condition regarding the proper front No-Zone distance.

Although only one survey question analyzed for knowledge retention resulted in a statistically significant difference, students and teachers found the supplemental DVD and hands-on demonstration to be helpful, in particular the truck experience. The conclusion would seem to be that if a truck and driver are available teachers should try to include a truck hands-on experience when teaching sharing the road with trucks. Students are likely to find it helpful and preferable to just reading about sharing the road in their textbook.
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**LIST OF ABBREVIATIONS AND SYMBOLS**

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<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>ATA</td>
<td>American Trucking Association</td>
</tr>
<tr>
<td>CDL</td>
<td>Commercial Driver’s License</td>
</tr>
<tr>
<td>CTBS</td>
<td>Center for Truck and Bus Safety</td>
</tr>
<tr>
<td>CVSA</td>
<td>Commercial Vehicle Safety Alliance</td>
</tr>
<tr>
<td>FHWA</td>
<td>Federal Highway Administration</td>
</tr>
<tr>
<td>FMCSA</td>
<td>Federal Motor Carrier Safety Administration</td>
</tr>
<tr>
<td>IRB</td>
<td>Institutional Review Board</td>
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<tr>
<td>NSTSCE</td>
<td>National Surface Transportation Safety Center for Excellence</td>
</tr>
<tr>
<td>VARK</td>
<td>Visual, Auditory, Read/Write, Kinesthetic</td>
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<tr>
<td>VTTI</td>
<td>Virginia Tech Transportation Institute</td>
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CHAPTER 1. INTRODUCTION

The National Surface Transportation Safety Center for Excellence (NSTSCE) was formally awarded to the Virginia Tech Transportation Institute (VTTI) in 2006 through the Federal Highway Administration (FHWA).\(^{(1)}\) The mission of NSTSCE is to use “state-of-the-art facilities, including the Virginia Smart Road, to develop and test transportation devices and techniques that enhance driver performance, examine advanced roadway delineation and lighting systems, and address age-related and fatigued driver issues.”\(^{(1)}\) One goal of NSTSCE is to develop a greater understanding of driver decision-making and performance. Researchers at VTTI investigated light-vehicle/heavy-vehicle near-crashes and crashes (critical incidents) and found that 78% were initiated by the light-vehicle driver.\(^{(2)}\) This larger proportion of light-vehicle, at-fault incidents may result from inadequate training in driver education programs about how to safely share the road with heavy vehicles.

In response to consistent research literature showing that a larger proportion of light-vehicle drivers are at-fault in incidents involving light-vehicle/heavy-vehicle interactions, NSTSCE researchers surveyed light-vehicle driver education program administrators and teachers in each state in the United States to assess the presence of curricula relevant to heavy-vehicle characteristics and procedures for sharing the road.\(^{(3,4)}\) Preliminary results from the survey of light-vehicle driver education program administrators and teachers found that 91% of respondents indicated that the light-vehicle driver education curriculum they administer or teach does include a component dealing with how to safely share the road with heavy vehicles. When asked if they perceived that this component was effective in showing students how to safely share the road with heavy vehicles, approximately 82% agreed or strongly agreed. Respondents were also asked if their state required the driver education curriculum to include information on how to safely share the road with heavy vehicles, and results found that 53% responded “Yes,” 26% responded “No,” and 21% responded “Not Sure.”

Although preliminary results indicated that a large proportion of light-vehicle driver education programs include a component on how to safely share the road with heavy vehicles (91%), there may be room for improvement with regard to the content of these programs (82% perceived effectiveness).\(^{(3,4)}\) In addition, it may be beneficial for states that currently do not require their curriculum and/or driver education manual to include a component on safely sharing the road with heavy vehicles to have a supplemental practices document available detailing the key safety topics that should be covered when teaching students how to share the road with heavy trucks. As one participant indicated on the survey, “I would teach shared roadway safety dealing with heavy trucks if we had the information to teach.”

Furthermore, the qualitative data analysis performed using open-ended survey questions revealed two major issues driver education teachers had with teaching sharing the road with trucks:

1. Students need a hands-on experience with heavy vehicles as part of their driver education coursework; and
2. Instructors need up-to-date materials that they can use while teaching students how to share the road with heavy vehicles.
While other important issues were raised during the qualitative analysis, these two issues in particular arose throughout the qualitative analysis and were central to this case study on how to improve driver education on sharing the road with heavy vehicles.

PURPOSE OF THE STUDY

The purpose of this project was twofold. First, researchers wanted to investigate current light-vehicle driver education programs that contain components on sharing the road with heavy vehicles and develop a supplemental practices document on key sharing-the-road information teachers could cover with students. A public program (e.g., high school driver education program) and private programs (e.g., Commercial Vehicle Safety Alliance [CVSA] Teens & Trucks, Walmart Truck Team, etc.) that teach key sharing-the-road information were identified. These resources were used to develop a supplemental practices document on key sharing-the-road information and how the information may be taught (see Appendix A).

Second, a case study was performed with a light-vehicle driver education program in a single state that only included a basic textbook-based component on sharing the road with heavy vehicles. Based on the survey results mentioned earlier, two components were introduced into different driver education classrooms and evaluated in comparison with the basic textbook-based component. The first component introduced was updated material (i.e., a DVD developed by the CVSA titled Teens and Trucks). The second component introduced was a hands-on truck experience program developed by NSTSCE researchers based on an investigation of how other organizations conduct hands-on truck demonstrations at high schools. Each classroom of students that received one of the components was invited to take part in a survey approximately 2 months later and knowledge retention of key learning points (e.g., heavy vehicle No-Zones) was measured.
CHAPTER 2. METHODS

STUDY DESIGN

Performance and opinion data were gathered throughout the case study. The main objective of the performance testing was to determine knowledge retention of key learning points approximately 2 months after material was presented in class. The number of correct responses to survey questions served as the main dependent measure in the performance assessment. Overall, three conditions were tested in the public driver education program.

- **Textbook:** Basic textbook-based education curriculum in the public driver education program. The textbook used was *Drive Right* (11th edition).(6)
- **Textbook and DVD:** Basic textbook-based curriculum supplemented with the DVD developed by CVSA titled *Teens and Trucks*.
- **Textbook and Truck:** Basic textbook-based curriculum supplemented with the hands-on truck experience developed by NSTSCE researchers that demonstrates the proper procedures and dangerous areas surrounding a combination-unit truck.

The NSTSCE research team set out to test all three conditions across six available classes of students. The minimum goal was to collect at least 10 completed surveys for each of the three conditions (Figure 1).

![Figure 1. Diagram. Case study conditions broken out by available classes and semesters.](image)

PARTICIPANTS

The supplemental practices portion of this project involved primarily the review of websites, videos, educational materials, and discussions with organizations that teach people how to safely share the road with heavy trucks. Thus, there were not participants in the traditional sense for the supplemental practices portion of the study. The organizational materials the research team reviewed included:

- American Trucking Association (ATA)
- CVSA
- FHWA
- Pearson’s *Drive Right* textbook (11th edition)
- Walmart Truck Team
- Wisconsin Road Team
The research team also spoke with a representative from the Wisconsin Road Team who was very helpful in describing how the road team operates and the educational approach used to teach sharing the road with trucks. A member of the research team then visited a local high school where the Walmart Truck Team was performing a hands-on demonstration. Observing the demonstration and the topics that were covered was very informative in the development of the hands-on truck experience demonstration.

The case study portion of this project involved two types of participants: driver education teachers and students. Driver education teachers were involved in implementing the interventions in their classrooms and were interviewed at the end of the case study regarding their opinions of the intervention. Driver education students were also involved in the study through sharing their opinions in focus groups and being tested via survey on their knowledge of how to safely share the road with trucks.

**Participant Protection**

Several steps were taken to protect participant privacy. The recruitment approach and associated testing materials and protocols were reviewed and approved by the Virginia Tech Institutional Review Board (IRB). The research team did not collect participant names on surveys or transcribe participant names from student focus groups and teacher interviews. Participant contact information was stored on password-protected computers that were only accessible to NSTSCE researchers.

Potential participants were also given informed consent/assent information via mail or email and/or over the phone during recruitment prior to data collection. As this study included driver education students, parental/guardian permission (informed assent) was secured for minors prior to their participation. Students that were minors signed assent forms once parental permission was secured. Students over 18 were given informed consent forms. The consent information for teachers, parents, and students can be found in Appendix B.

Students and teachers were also reminded prior to data collection (i.e., survey, focus group, interview) that they were free to stop their participation at any time, that their names would not be transcribed, and that they did not have to answer any questions they were uncomfortable answering. The NSTSCE research team was cognizant of the age of the students and tried to make the focus groups fun and nonthreatening. Activities were included that allowed the students to write down their opinions in case some were uncomfortable talking in front of the group.

**Recruitment**

NSTSCE researchers used current contacts and reviewed public records (i.e., school/county websites) to identify an eligible and interested high school where driver education was being taught. A main criteria for selecting a school was that they were primarily using a textbook for teaching sharing the road with heavy trucks, not videos or hands-on experiences with trucks. Researchers then met with the teachers and the principal to describe the study in detail. Permission to include the school in the study was secured from the school principal once teachers had indicated their interest and willingness to participate.
In the spring semester of 2012, NSTSCE researchers provided one driver education teacher with the CVSA *Teens and Trucks* DVD and asked the teacher to show the DVD on the same day that the textbook material on sharing the road with trucks was taught. The other driver education teacher was asked to teach the textbook material on sharing the road with heavy trucks as usual. The textbook being used by the driver education teachers was Pearson’s *Drive Right* textbook.

Next, NSTSCE researchers gave driver education teachers flyers (see Appendix C) to hand out to students who were in their respective classes on the day sharing the road with heavy trucks was taught. Students were asked to take the flyers home to show to their parent(s)/guardian(s) if they were interested in the study. A parent/guardian could call or email a member of the research team to learn more about the study. A member of the research team then recruited interested students whose parent(s)/guardian(s) approved of their participation. Students that were already 18 did not need to have parent/guardian permission to speak to a researcher about the study.

A member of the research team also visited the driver education classes 2–3 weeks after the sharing-the-road information was taught to talk to students about participating in a survey and focus group. The research team member did not indicate what the topic would be, just that the survey/focus group would be in regard to what they had learned during driver education. A sign-up sheet was then passed around and students that were interested could sign up and list their parent/guardian contact information. An NSTSCE researcher then contacted parent(s)/guardian(s) to discuss the study and schedule each student for a focus group if the parent(s)/guardian(s) agreed and the student was still interested in participating. The only eligibility requirement for participating was that students had to have been in class on the day that the information about sharing the road with trucks was taught. To verify eligibility, researchers cross-referenced interested students against the classroom roster provided by teachers from the day they taught sharing the road.

The same process of intervention and recruitment was repeated in the fall semester of 2012. The difference was that NSTSCE researchers coordinated with one teacher to bring a truck and a researcher who holds a Class A Commercial Driver’s License (CDL) and has experience driving trucks to class on the day the teacher would normally teach sharing the road with trucks (the textbook and truck condition). The teacher was asked to teach the material from the textbook as usual and then allow the NSTSCE researchers to conduct the truck demonstration. The teacher that had been using the CVSA *Teens and Trucks* DVD was asked to continue to use it along with the textbook as in the spring (the textbook and DVD condition). After the interventions were conducted, flyers were handed out to students. As in the spring, a researcher visited the class 2–3 weeks after the intervention to discuss the survey and focus group and to pass around a sign-up sheet.

**APPARATUS**

**Content of Conditions**

To determine which sharing-the-road tips were going to be covered in the truck hands-on experience and follow-up survey, the NSTSCE research team reviewed the textbook the students were using and the CVSA video to find out which key sharing-the-road tips were covered by
The research team found that there were five key sharing-the-road tips covered by the textbook and video, including:

- Don’t Hang Out in the No-Zone
- Maintain a Safe Following Distance
- Don’t Get Squeezed
- Properly Pass Trucks
- Don’t Cut Trucks Off

These topics were then used in the hands-on experience. In this way, students surveyed for retention were asked questions regarding topics that had been covered in class, no matter what condition they experienced. A few topics were covered in the textbook that were not included on the video and vice versa. For example, the textbook covered what to do when meeting a large truck on a narrow, two-lane road, and the video covered the need to pull far off the highway if your car breaks down. While these issues are important, they were not integrated into this study as researchers only wanted to include topics that were covered in both the textbook and the video.

In development of the hands-on experience, the research team also looked at other sources (i.e., Walmart Truck Team, Wisconsin Road Team, ATA, Federal Motor Carrier Safety Administration [FMCSA], etc.) to help inform the points and activities that would be used. Though the information provided via the textbook, video, and hands-on experience varied slightly, the research team was careful to make sure the primary points on the survey were presented in all three conditions (textbook, video, and hands-on experience). Below is a summary of each media (textbook, video, and truck experience) and how it covered the key sharing-the-road tips that were part of this study. A detailed description of the content of conditions is found in Appendix D.

**Textbook**

The textbook used in this study was Pearson’s *Drive Right* (11th edition). The section on sharing the road with trucks spans three pages. The section covered heavy-vehicle characteristics, the No-Zone, following large trucks, trucks making right turns, passing and being passed by trucks, and meeting a large truck. The section also incorporated pictures and diagrams, including a diagram of the No-Zones and a diagram of a car attempting to pass a truck on the right and getting squeezed between the truck and the curb.

**DVD**

The DVD used in this study was called *Teens and Trucks* and was produced by the CVSA. The video is approximately 11 minutes long and covers heavy-vehicle characteristics and gives five basic driving habits to stay safe around trucks. The five driving habits include don’t cut off trucks, stay out of blind spots or No-Zones, maintain a safe following distance, understand trucks make wide turns, and if your car breaks down pull off the highway as far as you can. The DVD goes over each of the five driving habits and uses video clips of trucks and cars on the roadway to demonstrate the importance of each driving habit. For more detail on the DVD, see the supplemental practices document (Appendix A).
Truck

The truck hands-on experience was broken in two parts. The first was an approximately 20-minute presentation given by a researcher who holds a Class A CDL and has experience driving trucks. The presentation covered sobering facts about what can happen if light vehicles do not drive safely around heavy trucks, described heavy-vehicle characteristics, and introduced the five key sharing-the-road tips. The second portion of the hands-on experience was an approximately 40-minute demonstration that allowed students to sit in the cab of a truck and walk around the truck to learn about each of the five sharing-the-road tips. For detail on the presentation and hands-on experience, see the supplemental practices document (Appendix A).

Survey

In terms of the driver education students, a survey and focus group were used for data collection. The survey and focus group provided an opportunity for students to share what they had learned about sharing the road with heavy trucks during their driver education class. The survey included a total of 22 questions. Prior to implementation, the survey instrument was pretested by VTTI researchers to ensure that the survey questions were clear. The survey can be found in Appendix E.

Focus Groups

The student focus group moderator guide included three primary probe questions to gather information about students’ learning preferences, retention of key sharing-the-road information, and opinions regarding media format (i.e., textbook, video, or hands-on experience). These primary probes were used to identify information on what method each student perceived they learned best, what they specifically retained about safely sharing the road with trucks, and how helpful the condition they experienced was to understanding the concepts. The moderator guide used for the student focus groups can be found in Appendix F.

Teacher Interviews

The driver education teachers involved in the study were also interviewed. They were asked specific questions regarding how effective they thought the supplemental education components were to teaching students about sharing the road with trucks, how they were teaching the subjects prior to the introduction of these supplemental components and how effective they perceived them to be, whether there were any problems with the supplements, and other related questions. The teacher interview questions can be found in Appendix G.

PROCEDURE

In all, there were three conditions being evaluated as part of this case study project (i.e., textbook, textbook and DVD, and textbook and truck). Researchers aimed to obtain at least 10 completed surveys per condition. The study was executed during two of the high school’s semesters (Figure 1).

In Semester 1, there were three driver education classes. Two classes taught sharing the road with heavy trucks via textbook as the primary resource material, and one class was taught using
the textbook and supplemented with CVSA’s *Teens and Trucks* DVD. From the two classes using the textbook, 12 students were recruited and participated in the survey/focus group. From the one class taught using the textbook and the DVD, five students were recruited and participated in the survey/focus group.

In Semester 2, there were only two driver education classes, down from the expected three classes. This loss of a driver education class impacted the study as researchers had planned to include the textbook and DVD in one class and the textbook and truck in the other two classes. From the one class taught using the textbook and DVD, eight students were recruited and participated in the survey.

Recruiting and scheduling a busy teen population was an ongoing challenge for researchers. Numerous students scheduled for focus groups did not attend for various reasons. Those that alerted the research team that they could not attend at the last minute indicated conflicts such as changing work schedules, family commitments, and sports practice. A breakdown of total participants by condition for the survey and focus group can be found in Table 1.

### Table 1. Overall participation by condition type.

<table>
<thead>
<tr>
<th>Sharing the Road Condition</th>
<th>Students per Condition</th>
<th>Students Recruited</th>
<th>Students Completing Surveys</th>
<th>Participation Rate (Students from Class Completing Surveys)</th>
<th>Students Participating in Focus Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook (Semester 1)</td>
<td>38</td>
<td>17</td>
<td>12</td>
<td>32%</td>
<td>12</td>
</tr>
<tr>
<td>Textbook &amp; DVD (Semesters 1 &amp; 2)</td>
<td>45</td>
<td>19</td>
<td>13</td>
<td>29%</td>
<td>12</td>
</tr>
<tr>
<td>Textbook &amp; Truck (Semester 2)</td>
<td>26</td>
<td>12</td>
<td>7</td>
<td>27%</td>
<td>6</td>
</tr>
<tr>
<td>Student Numbers</td>
<td><strong>109</strong></td>
<td><strong>48</strong></td>
<td><strong>32</strong></td>
<td><strong>29%</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

The second class in Semester 2 was taught using the textbook and a hands-on experience with a heavy truck and researcher with CDL and truck experience. From this class, 12 students were recruited and scheduled, and 7 participated in the survey. One of these seven did not participate in the focus group but participated in the survey over the phone. This was the only student in the study to participate over the phone. On the days the focus groups were conducted in January 2013, road conditions were marginally adverse for rural areas that had experienced snow. Students were contacted and encouraged to come to the focus group only if they could safely travel to the public library where the groups were being held. Since numbers were low for the textbook and truck survey/focus group due to the cancellation of the second class, students that had not been able to attend the focus group were invited to take the survey over the phone. Only one student opted to complete the survey via phone.

With the exception of the one student that took the survey over the phone, the research team distributed the survey to participants when they arrived for the focus groups. The research team conducted focus groups with students immediately after they completed their surveys. In
addition, researchers interviewed the driver education teachers involved in the study via phone. Each of these data collection procedures is described briefly below.

Survey

The driver education survey was designed to take no more than ten minutes to complete. The survey included questions regarding demographics, licensure stage, driving experience, learning preference, and how to share the road with trucks. Students, and parents if the students were minors, were provided with consent information prior to taking the survey. After the survey was completed, students were able to take part in a focus group. Two students that took the survey did not participate in the focus group. The survey can be found in Appendix E.

Focus Group

The driver education focus group was designed to take approximately 1 hour to complete. The focus group included questions about learning preferences, how to share the road with heavy trucks, and opinions regarding the media used to teach students the information (i.e., textbook, DVD, truck/driver). After students completed the focus group, they were paid for their time. If they left the focus group early or only participated in the survey, they were paid for the portion of time they participated. The focus group moderator guide can be found in Appendix F.

Teacher Interviews

The interviews for two driver education teachers were designed to take approximately 30 minutes to complete. Both interviews took place separately over the phone. The interview was used to gather teacher opinions on the effectiveness of the intervention (i.e., DVD, truck/driver) at teaching the students how to share the road with heavy trucks. The interview instrument used for the teacher interviews can be found in Appendix G.
CHAPTER 3. RESULTS

As previously mentioned, the purpose of this study was twofold. The first purpose was to develop a supplemental practices document on how to teach sharing the road with heavy trucks (see Appendix A). The second purpose was to conduct a case study in a high school whereby two curricula were compared to determine what type of content (i.e., textbook, textbook and DVD, textbook and truck) would lead to the best knowledge retention of key sharing-the-road information by driver education students.

SUPPLEMENTAL PRACTICES

The goal of the supplemental practices document is to provide driver education professionals with key sharing-the-road information that they may use to teach students to safely share the road with heavy trucks. The supplemental practices document also provides guidance on ways to convey key sharing-the-road information to driver education students. Researchers reviewed materials from a number of helpful resources from industry, nonprofit, and government organizations that are helping light-vehicle drivers learn how to drive safely around heavy trucks. Researchers also used the skills and expertise of VTTI staff, including those with CDLs, in creating the supplemental practices document. The supplemental practices may be used in tandem with the textbook driver education professionals are using to teach sharing the road with trucks.

The supplemental practices document includes five key categories for sharing the road with heavy vehicles. These categories or tips include:

- Don’t Hang Out in the No-Zone
- Properly Pass Trucks
- Don’t Cut Trucks Off
- Don’t Get Squeezed
- Maintain a Safe Following Distance

The supplemental practices document outlines in detail suggested ways to convey the key sharing-the-road tips to students. It covers how the use of kinesthetic learning approaches such as videos and hands-on experiences with a heavy truck can be used to teach students to share the road with trucks. More information on the supplemental practices document is found in Appendix A.

CASE STUDY

The purpose of the case study was to determine which condition would result in the best knowledge retention of key sharing-the-road information. The case study was conducted over the course of two semesters at an area high school. The textbook condition was implemented in two classes, the textbook and DVD condition was implemented in two classes, and the textbook and truck condition was implemented in one class. As mentioned earlier, the research team planned to introduce each condition into two classes, but one of the driver education classes was cut from the school’s schedule unexpectedly. Each condition is described in more detail in Table 2.
Table 2. Classroom conditions by participants and days to survey completion.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Number of Classes</th>
<th>Number of Participants (survey)</th>
<th>Days from Condition to Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook (Semester 1)</td>
<td>2 Classes</td>
<td>12</td>
<td>59, 61</td>
</tr>
<tr>
<td>Textbook &amp; DVD (Semester 1)</td>
<td>1 Class</td>
<td>5</td>
<td>59, 62</td>
</tr>
<tr>
<td>Textbook &amp; DVD (Semester 2)</td>
<td>1 Class</td>
<td>8</td>
<td>73</td>
</tr>
<tr>
<td>Textbook &amp; Truck (Semester 2)</td>
<td>1 Class</td>
<td>7</td>
<td>73, 80*</td>
</tr>
</tbody>
</table>

*One truck experience participant completed the survey via phone and did not take part in a focus group.

The results of the survey, focus groups, and teacher interviews are presented in separate sections below.

SURVEY

As previously mentioned, the research team evaluated three conditions (textbook, textbook and DVD, textbook and truck). The public high school had planned on providing six driver education classes over the two semesters when the case study took place (three for each semester). A goal was set of implementing each condition in two classes. Each class was anticipated to hold approximately 20 students, resulting in a pool of approximately 120 students to potentially recruit for the follow-up survey and focus groups.

Due to uncontrollable circumstances, after the spring semester the driver education teachers alerted the research team that a driver education class was being cut for the fall semester and that they were only offering two classes instead of the originally scheduled three. The breakdown of final completed survey counts across conditions is shown in Table 3.

Table 3. Breakdown of completed surveys by condition and class.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Class 1</th>
<th>Class 2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook</td>
<td>6</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Textbook &amp; DVD</td>
<td>5</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>Textbook &amp; Truck</td>
<td>7</td>
<td>N/A</td>
<td>7</td>
</tr>
</tbody>
</table>

Student Driver Demographics

Student drivers who participated in the survey were asked a series of basic demographic questions. A breakdown of age and gender is shown in Table 4.
Table 4. Student driver demographic survey results by condition.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Age</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook</td>
<td>Mean = 16.67;</td>
<td>Female = 7; Male = 5</td>
</tr>
<tr>
<td></td>
<td>SD = 0.49</td>
<td></td>
</tr>
<tr>
<td>Textbook &amp; DVD</td>
<td>Mean = 16.85;</td>
<td>Female = 5; Male = 8</td>
</tr>
<tr>
<td></td>
<td>SD = 0.55</td>
<td></td>
</tr>
<tr>
<td>Textbook &amp; Truck</td>
<td>Mean = 16.71;</td>
<td>Female = 2; Male = 5</td>
</tr>
<tr>
<td></td>
<td>SD = 0.76</td>
<td></td>
</tr>
</tbody>
</table>

Student Driver Experience

Student drivers who participated in the survey were asked a series of questions regarding their driving experience. This section will present key results for each question broken down by condition (where applicable).

Results from the survey indicated that most students had an Instruction Permit (Level 1) or an Intermediate Driver’s License (Level 2). Only two students had a full, Class E license (Level 3). These results are broken down by condition in Table 5. When further asked when they received their Level 1 instructional permit, 16 students indicated at approximately 15 years of age, 10 indicated at greater than 16 years of age, and 6 did not answer.

Table 5. Driving permit by condition.

<table>
<thead>
<tr>
<th>Condition</th>
<th>No Answer</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Textbook &amp; DVD</td>
<td>3</td>
<td>1</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Textbook &amp; Truck</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

A series of questions were asked to determine participating students’ driving experience with road types, typical trip durations, and encountering heavy trucks in various scenarios. Table 6 presents results found when students were asked to identify what types of roads they drive on in a typical week. Table 6 also includes the mean estimate of how many days each student drives in a typical week and how many minutes per day.
Table 6. Road types encountered, days and minutes driven during a typical day or week.

<table>
<thead>
<tr>
<th>Condition</th>
<th>No Answer</th>
<th>Rural Routes/Local Roads</th>
<th>Highway</th>
<th>Interstate</th>
<th>Mean Days Driven per Week</th>
<th>Mean Min Minutes Driven per Day</th>
<th>Mean Max Minutes Driven per Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook</td>
<td>2</td>
<td>9</td>
<td>7</td>
<td>3</td>
<td>4.64</td>
<td>25.91</td>
<td>37.5</td>
</tr>
<tr>
<td>Textbook &amp; DVD</td>
<td>2</td>
<td>11</td>
<td>8</td>
<td>2</td>
<td>6.2</td>
<td>35.46</td>
<td>49.1</td>
</tr>
<tr>
<td>Textbook &amp; Truck</td>
<td>0</td>
<td>7</td>
<td>4</td>
<td>3</td>
<td>5.83</td>
<td>36.43</td>
<td>45.0</td>
</tr>
</tbody>
</table>

Table 7 presents results found when students were asked to estimate how many times they passed a heavy truck during a typical day, and how many times they encountered a heavy truck regardless of direction of travel and lane position. In addition, the table shows how many times student drivers found themselves driving behind a heavy truck during a typical day.

Table 7. Heavy truck experience by condition.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Mean Truck Passes per Day</th>
<th>Mean Truck Encounters per Day</th>
<th>Mean Encounters Behind Trucks per Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook</td>
<td>1.91</td>
<td>6.09</td>
<td>1.41</td>
</tr>
<tr>
<td>Textbook &amp; DVD</td>
<td>1.64</td>
<td>2.68</td>
<td>1.5</td>
</tr>
<tr>
<td>Textbook &amp; Truck</td>
<td>2.79</td>
<td>3.64</td>
<td>2.43</td>
</tr>
</tbody>
</table>

Knowledge Retention Performance

After all survey data were collected, scores were calculated based on the percentage correct for questions 13–22. A between-subjects analysis of variance (ANOVA) was performed to compare the mean final scores between the three conditions (i.e., textbook, textbook and DVD, textbook and truck). The results indicated there was no significant difference between the mean scores across the conditions $F(2,29) = 1.15$, $p = 0.3318$. The mean scores for each condition can be found in Figure 2.
Although no statistically significant differences were found in overall scores across conditions, the research team deemed it important to perform additional analyses comparing conditions on a question-by-question basis. It was hypothesized that the conditions may well have benefited knowledge retention performance for certain types of information. Of the 10 questions, 3 were answered correctly by all survey participants (questions 13, 16, and 18). These were removed from further analysis. The remaining seven questions were analyzed for correctness using Fisher’s exact tests to determine if any differences existed for one or more of the conditions. Tables 8–14 below contain the Fisher’s exact test results for each question.

Table 8. Total number of correct and incorrect answers with Fisher’s exact test result for Question 14: Which sentence describes the BEST way you can safely share the road with heavy trucks?

<table>
<thead>
<tr>
<th>Condition</th>
<th>Incorrect</th>
<th>Correct</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook</td>
<td>4</td>
<td>8</td>
<td>0.214</td>
</tr>
<tr>
<td>Textbook &amp; DVD</td>
<td>5</td>
<td>8</td>
<td>0.214</td>
</tr>
<tr>
<td>Textbook &amp; Truck</td>
<td>0</td>
<td>7</td>
<td>0.214</td>
</tr>
</tbody>
</table>

Figure 2. Chart. Mean percentage correct by conditions.
Table 9. Total number of correct and incorrect answers with Fisher’s exact test result for Question 15: The heavy truck no-zone [truck blind spots or areas where a driver cannot see other motorists] contains the following areas around the truck.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Incorrect</th>
<th>Correct</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook</td>
<td>0</td>
<td>12</td>
<td>0.686</td>
</tr>
<tr>
<td>Textbook &amp; DVD</td>
<td>1</td>
<td>12</td>
<td>0.686</td>
</tr>
<tr>
<td>Textbook &amp; Truck</td>
<td>1</td>
<td>6</td>
<td>0.686</td>
</tr>
</tbody>
</table>

Table 10. Total number of correct and incorrect answers with Fisher’s exact test result for Question 17: When you are attempting to pass a heavy truck, which area around the heavy truck is the most dangerous?

<table>
<thead>
<tr>
<th>Condition</th>
<th>Incorrect</th>
<th>Correct</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook</td>
<td>10</td>
<td>2</td>
<td>0.237</td>
</tr>
<tr>
<td>Textbook &amp; DVD</td>
<td>10</td>
<td>3</td>
<td>0.237</td>
</tr>
<tr>
<td>Textbook &amp; Truck</td>
<td>3</td>
<td>4</td>
<td>0.237</td>
</tr>
</tbody>
</table>

Table 11. Total number of correct and incorrect answers with Fisher’s exact test result for Question 19: Why is it unsafe to follow too closely behind a heavy truck?

<table>
<thead>
<tr>
<th>Condition</th>
<th>Incorrect</th>
<th>Correct</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook</td>
<td>0</td>
<td>12</td>
<td>0.105</td>
</tr>
<tr>
<td>Textbook &amp; DVD</td>
<td>4</td>
<td>9</td>
<td>0.105</td>
</tr>
<tr>
<td>Textbook &amp; Truck</td>
<td>1</td>
<td>6</td>
<td>0.105</td>
</tr>
</tbody>
</table>

Table 12. Total number of correct and incorrect answers with Fisher’s exact test result for Question 20: The front area of the heavy truck no-zone can extend up to ____ feet?

<table>
<thead>
<tr>
<th>Condition</th>
<th>Incorrect</th>
<th>Correct</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook</td>
<td>10</td>
<td>2</td>
<td>0.047</td>
</tr>
<tr>
<td>Textbook &amp; DVD</td>
<td>6</td>
<td>7</td>
<td>0.047</td>
</tr>
<tr>
<td>Textbook &amp; Truck</td>
<td>2</td>
<td>5</td>
<td>0.047</td>
</tr>
</tbody>
</table>
Table 13. Total number of correct and incorrect answers with Fisher’s exact test result for Question 21: Which is the BEST approach to passing a heavy truck?

<table>
<thead>
<tr>
<th>Condition</th>
<th>Incorrect</th>
<th>Correct</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook</td>
<td>7</td>
<td>5</td>
<td>0.901</td>
</tr>
<tr>
<td>Textbook &amp; DVD</td>
<td>8</td>
<td>5</td>
<td>0.901</td>
</tr>
<tr>
<td>Textbook &amp; Truck</td>
<td>5</td>
<td>2</td>
<td>0.901</td>
</tr>
</tbody>
</table>

Table 14. Total number of correct and incorrect answers with Fisher’s exact test result for Question 22: True or False? If you can’t see the truck driver’s mirrors, the truck driver can’t see you.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Incorrect</th>
<th>Correct</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook</td>
<td>1</td>
<td>11</td>
<td>0.502</td>
</tr>
<tr>
<td>Textbook &amp; DVD</td>
<td>0</td>
<td>13</td>
<td>0.502</td>
</tr>
<tr>
<td>Textbook &amp; Truck</td>
<td>1</td>
<td>6</td>
<td>0.502</td>
</tr>
</tbody>
</table>

Results presented in the tables above indicated a significant difference was found for one or more conditions for question 20. Also notable, question 19 resulted in a $p$ value = 0.105 (not statistically significant, but worth further analysis). Fisher’s exact test results that compared each condition with one another for questions 19 and 20 will be further described below.

**Question 19**

Question 19 was presented as follows:

Why is it unsafe to follow too closely behind a heavy truck? (Please choose the BEST option from the list)

- a) It will increase your vehicle’s fuel consumption.
- b) Cargo may shift and fall from the truck onto the road in front of your vehicle.
- c) If the driver brakes the truck you may not have enough time and space to avoid crashing into the truck.
- d) Both “a” and “b”
- e) Both “a” and “c”
- f) Both “b” and “c”

*The answer “f” was correct.*

Fisher’s exact tests were performed comparing each condition to identify if any patterns emerged about knowledge retention performance. Although not statistically significant, the largest difference in performance showed that performance for the textbook condition was almost statistically significant over the textbook and DVD condition (Table 15).
Table 15. Fisher’s exact test results comparing each condition for Question 19.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Incorrect</th>
<th>Correct</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook</td>
<td>0</td>
<td>12</td>
<td>0.096</td>
</tr>
<tr>
<td>Textbook &amp; DVD</td>
<td>4</td>
<td>9</td>
<td>0.096</td>
</tr>
<tr>
<td>Textbook</td>
<td>0</td>
<td>12</td>
<td>0.368</td>
</tr>
<tr>
<td>Textbook &amp; Truck</td>
<td>1</td>
<td>6</td>
<td>0.368</td>
</tr>
<tr>
<td>Textbook &amp; DVD</td>
<td>4</td>
<td>9</td>
<td>0.613</td>
</tr>
<tr>
<td>Textbook &amp; Truck</td>
<td>1</td>
<td>6</td>
<td>0.613</td>
</tr>
</tbody>
</table>

Question 20 was presented as follows:

The front area of the heavy truck no-zone can extend up to ____ ? (Please choose one option from the list)
  a) 9 feet
  b) 10 feet
  c) 14 feet
  d) 20 feet
  e) 25 feet

*An answer of either “d” or “e” above was determined as correct.

Fisher’s exact tests were performed comparing each condition to identify which outperformed the others. Due to the poor performance in the textbook condition, the textbook and truck condition resulted in a statistically significant improvement in knowledge retention (Table 16). Also notable, although not statistically significant, the textbook and DVD condition almost outperformed the textbook condition.

Table 16. Fisher’s exact test results comparing each condition for Question 20.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Incorrect</th>
<th>Correct</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook</td>
<td>10</td>
<td>2</td>
<td>0.097</td>
</tr>
<tr>
<td>Textbook &amp; DVD</td>
<td>6</td>
<td>7</td>
<td>0.097</td>
</tr>
<tr>
<td>Textbook</td>
<td>10</td>
<td>2</td>
<td>0.045</td>
</tr>
<tr>
<td>Textbook &amp; Truck</td>
<td>2</td>
<td>5</td>
<td>0.045</td>
</tr>
<tr>
<td>Textbook &amp; DVD</td>
<td>6</td>
<td>7</td>
<td>0.642</td>
</tr>
<tr>
<td>Textbook &amp; Truck</td>
<td>2</td>
<td>5</td>
<td>0.642</td>
</tr>
</tbody>
</table>
FOCUS GROUPS

During the focus groups, students were asked to discuss their learning preferences, to brainstorm what they had learned about sharing the road with trucks in driver education, and to rate the methods used in their classes to teach them the information (i.e., textbook, textbook and DVD, textbook and truck). The results from each area covered in the focus groups (i.e., learning preferences, brainstorming, and ratings) are discussed in this section. The approach used to review, analyze, and summarize the focus group discussions and activities was an adaption of framework analysis, a methodology developed during the 1980s at the National Centre for Social Research in Britain. The approach involved a researcher reviewing the entire data set (i.e., transcripts), identifying the major themes/subthemes in the data set, arranging the themes and subthemes into an index, and then applying the index to the data set. Comments from the transcripts that related to the themes/subthemes were pulled into an Excel spreadsheet and sorted by theme/subtheme. A researcher then reviewed all the themes/subthemes and summarized the findings. Representative quotes were pulled and used to highlight points throughout the results section. This adapted framework approach is outlined in more detail in Appendix H.

Learning Preferences

At the start of the focus groups, students were asked how they learn best about driver education. In terms of understanding learning preferences, a model that researchers found clear and easy to use in guiding this discussion was the VARK model. The acronym VARK stands for Visual, Auditory, Read/write, and Kinesthetic modalities used to learn information (http://www.vark-learn.com/english/page.asp?p=categories).

Under the VARK model, both interventions introduced during the case study would be considered kinesthetic (i.e., DVD showing sharing-the-road behaviors and a hands-on experience with a truck). For this reason, the research team wanted to look at how students felt they best learn driver education information and not just assume they prefer kinesthetic approaches. Therefore, one question students were asked during the focus groups was how they believe they best learn driver education information.

Researches adapted the concepts described in the VARK model to come up with options that would cover the types of learning one might experience in driver education. During the focus groups, students were presented with the following question on flip chart paper as a facilitator went around the room and asked them to state and briefly discuss their learning preferences.

- Describe how you learn best about driver education. For instance, do you learn best by:
  - Reading a textbook/handout and writing notes
  - Listening to a teacher/speaker and discussing it with others
  - Looking at diagrams, flow charts, pictures, and graphs
  - Example and experience (seeing someone adjusting mirrors and then doing it myself)
  - Watching videos showing real driving situations
  - Other
The options given to students correspond to the following categories in Neil Fleming’s VARK model (Table 17). (8)

Table 17. Learning preference options.

<table>
<thead>
<tr>
<th>Learning Preference Option</th>
<th>VARK Model Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading a textbook/handout and writing notes</td>
<td>Read/Write</td>
</tr>
<tr>
<td>Listening to a teacher/speaker and discussing it with others</td>
<td>Auditory</td>
</tr>
<tr>
<td>Looking at diagrams, flow charts, pictures, and graphs</td>
<td>Visual</td>
</tr>
<tr>
<td>Example and experience (e.g., seeing someone adjusting mirrors and then doing it myself)</td>
<td>Kinesthetic</td>
</tr>
<tr>
<td>Watching videos showing real driving situations</td>
<td>Kinesthetic</td>
</tr>
</tbody>
</table>

Though researchers were trying to identify the primary learning preference of each driver education student, some students gave more than one response during this discussion of learning preferences. Under the VARK model, more than one learning preference is considered “multimodal.” It should be noted that more students might have indicated a multimodal preference had they been encouraged to choose more than one option if that was applicable.

As can be seen in Figure 3, 20 of the 30 focus group students indicated a preference for kinesthetic approaches to learning driver education information. Of those 20, 17 preferred to learn by example and experience, while 3 preferred to learn by watching videos showing real driving situations. The next closest learning preference was for auditory approaches (4 out of 30 students).

![Figure 3. Chart. Self-reported learning preference from focus groups.](image-url)
Students were asked in focus groups to comment on their learning preferences. Some comments from students under each learning preference include:

- **Kinesthetic (K): Example and experience.**
  - One student said, “I think that driving is more of a hands-on, a work in progress. I think you can’t really learn anything just by books. You have to get out and do it.”
- **Kinesthetic (K): Watching videos showing real driving situations.**
  - One student said, “Watching videos. We did do a lot of that showing real world driving situations. That did help a lot.”
- **Auditory (A): Listening to a teacher/speaker and discussing it with others.**
  - One student said, “I like discussing things. Like that way if I say it, I learn it better.”
- **Visual (V): Looking at diagrams, flow charts, pictures, and graphs.**
  - One student commented on his/her preference for looking at diagrams. The student said, “Pretty much like aerial views of intersections and things and different turning lanes and curves.”
- **Multimodal (Auditory and Kinesthetic):**
  - One participant preferred to learn driver education information by “discussing it with others and also the experience.”
- **Multimodal (Read/Write and Kinesthetic):**
  - One student said, “Yeah when I was in drivers ed I was reading the chapter on how to operate the vehicle” and then “I got home and got in my car and tested it out” [comment amended to take out identifying information].
- **Multimodal (Read/Write and Visual):**
  - One student said, “I do better with reading about and then seeing pictures…. I hate parallel parking—it is terrible. So I have read about it and then they had a picture in the book that showed you how to do it and that helped a lot.”

**Brainstorming Results**

After learning preferences, students were asked to discuss “what, if anything, you learned in your driver’s education class about how to safely share the road with trucks.” Students were given large Post-it® note pads and asked to write down what they had learned. Examples of some of the ideas each group came up with are listed in Table 18.
Table 18. Brainstorming results.

<table>
<thead>
<tr>
<th></th>
<th>Textbook</th>
<th>Textbook &amp; DVD</th>
<th>Textbook &amp; Truck</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Don’t Hang out in the No-Zone</strong></td>
<td>Stay out of their no-zones</td>
<td>Stay out of “No Zone”</td>
<td>Stay out of as many blind spots as possible</td>
</tr>
<tr>
<td></td>
<td>Don’t linger in the no zone</td>
<td>Do not linger in truck’s blind spots</td>
<td>Don’t linger in the blind spots</td>
</tr>
<tr>
<td><strong>Properly Pass Trucks</strong></td>
<td>Pass with no stops</td>
<td>When passing do not linger</td>
<td>When passing a truck, pass at a steady pace, don’t hang beside the truck</td>
</tr>
<tr>
<td></td>
<td>Passing safely</td>
<td>If passing, make sure it can be done safely</td>
<td>To never pass on the right side because it is the biggest blind spot</td>
</tr>
<tr>
<td><strong>Don’t Cut Trucks Off</strong></td>
<td>Never cut in front of them</td>
<td>When passing leave plenty of space in front</td>
<td>Drive far ahead of the truck</td>
</tr>
<tr>
<td><strong>Don’t Get Squeezed (Trucks make wide right turns)</strong></td>
<td>Wide turns</td>
<td>Do not pass trucks at an intersection or turns</td>
<td>Don’t pass at intersections</td>
</tr>
<tr>
<td></td>
<td>Wide right turns and can’t see cars</td>
<td>When trucks are making turns be sure to give enough space to do so</td>
<td>Watch for them swinging left on a right hand turn</td>
</tr>
<tr>
<td><strong>Maintain a Safe Following Distance</strong></td>
<td>Not to follow too closely</td>
<td>Follow at a safe distance</td>
<td>To stay back 500 feet</td>
</tr>
<tr>
<td></td>
<td>Keep a good following distance</td>
<td>If you can’t see mirrors, they can’t see you</td>
<td>If you can’t see the driver’s mirrors he can’t see you</td>
</tr>
</tbody>
</table>

As the table shows, ideas were generated that covered each of the key sharing-the-road tips being considered in this study. While the five key concepts were covered during brainstorming, sometimes there was a lack of clarity on some aspects of the topic. For instance, though students seemed to understand that it is important to maintain a safe following distance behind trucks, they were not always clear as to what constituted a safe following distance. It should be noted that other sharing-the-road concepts were mentioned by students, such as not passing trucks going downhill and properly passing trucks on an undivided highway. Below is a breakdown of each group’s discussion regarding the five key sharing-the-road tips.

**Don’t Cut Trucks Off**

Textbook
Students in the textbook condition talked about how you should never cut in front of trucks. A couple of students also brought up the issue of how trucks have longer stopping distances than cars, which can cause them to hit a car if they are too close. One student said, “Leave enough space between you and the truck so you know once you cut back over you don’t suddenly like cause them to slam on their brakes so they don’t know what they’re doing and they run into the back of you. So make sure you have enough space before you get back into the lane.” Students did not clearly indicate how far in front of a truck they should be before they pull over. When students were asked how much space to leave in front of a truck, their responses included “I don’t remember,” “like 15 feet,” and “make sure that they can see you before you change lanes.”
Textbook and DVD
The issue of not cutting off trucks was mentioned by students in the textbook and DVD condition. In addition, they also recognized that trucks take longer to stop than cars. As one student said, “When you are passing you should always leave plenty of space in front. Always signal well in advance of it so they know exactly what you are doing.” Another student commented on the stopping distances, saying, “It just takes them a while to stop. Don’t be too close in front of them just in case you have to stop fast.” One student brought up the point that truck drivers cannot see directly in front of their trucks. This student mentioned that it is important not to get too close in front of a truck because “if you are like right there on the truck in front of it they can’t see because like the truck is long, they can’t see down.” Students disagreed on how far in front of the truck a light vehicle should be before pulling back into the lane. One student indicated a car length of space in front of the truck while another student said roughly 50 feet of space is needed.

Textbook and Truck
Students in the textbook and truck condition talked about the dangers of putting themselves in the front No-Zone and raised the issue of how trucks have longer stopping distances than cars. One student described how the front No-Zone is dangerous because “a truck cannot stop as quick as a car and if you have to stop fast that truck is going to hit you.” A student also described how the hands-on truck experience demonstrated the visibility issues truck drivers have over the truck bonnet, saying, “If you are really close on they have a big bump. We sat up and could see, they can’t really see too well so … I try to stay like far ahead of them.” Students in the truck group had differing opinions on when it is safe to pull in front of a truck. For example, one student said, “If I can’t see their front bumper then I think I am a little too close,” while another student said “If I can’t see the truck in my rear view mirror and both my side mirrors then I am too close.” Another student thought 30–40 feet was the appropriate amount of space to leave between the back of a car and the front of a truck.

Summary of “Don’t Cut Trucks Off”
Students across the groups seemed to understand that trucks take longer to stop than cars and that it is dangerous to cut off trucks and/or put themselves into the front No-Zone. Yet none of the groups (i.e., textbook, DVD, truck) appeared to have a consensus on how far in front of a truck a car should be before pulling in front. Knowing the distance in feet a car should be before pulling in front of a truck appeared to be difficult for students to grasp, with suggested distances ranging from 15 feet to 50 feet.

Don’t Get Squeezed
Textbook
Students in the textbook condition generally described the importance of being aware that trucks make wide turns. As one student described, “You need to be aware that they need a lot more space to turn. Like sometimes they have to go in another lane to turn sharply.” Though some students spoke of the importance of knowing trucks make wide turns, they did not talk specifically about the danger of being squeezed when passing turning trucks. One student did talk about blind spots in relation to turning trucks, commenting that they can’t see you if you put yourself in one of their blind spots when they go to turn. A couple of students talked about the
danger of hitting a truck that is not indicating a turn properly. Related comments tended to focus on how trucks signal and turn but not on the danger of being squeezed.

*Textbook & DVD*

The students in the textbook and DVD condition discussed how trucks make wide turns. As one student described, “We talked about how sometimes they’ll have to swing wide and it’ll look like they are turning the other direction but you should never try and pass that truck that is turning because remember they come back around. They make really wide turns. You could be stuck.” Another student described how “if you are impatient and they swing over to the left to turn right and you speed up then you are going to get trapped between the truck and the curb.” As demonstrated by these comments, the textbook and DVD group took their understanding of how trucks make wide turns to the next level by describing the danger of being squeezed when passing a turning truck.

*Textbook & Truck*

Students in the textbook and truck condition described how trucks make wide turns but did not focus attention on the problem of being squeezed. One student did describe the need to stay back when trucks are turning. The student said, “When they are turning… they might have to come into your lane. You might want to stay far back.” When prompted about why it is important to stay back and not pass a turning truck, the student said, “You could hit their truck or they could hit you.”

Summary “Don’t Get Squeezed”

Students across the groups appeared to understand that trucks make wide turns. A few textbook and textbook and truck students also noted that staying back from a turning truck is important and that the consequence of trying to pass could be a collision. Yet the textbook and DVD group discussion was the clearest in terms of noting the danger of being squeezed when attempting to pass a turning truck.

*Don’t Hang Out in the No-Zone*

*Textbook*

Students in the textbook condition described No-Zones but were not always able to indicate where the No-Zones were located. Some mentioned all four blind spots, while others mentioned only two or three. Several students did note that the right side of trucks has the most dangerous blind spot. A few students also described how being in No-Zones or blind spots is dangerous. One student said, “Stay out of the blind spots because if they can’t see you they could come over in your lane at any point and then you’d get run off the road. So just stay away, stay out of them.”

*Textbook & DVD*

In the textbook and DVD group discussions, most of the students described four No-Zones or blind spots around the truck and that drivers should stay out of these spots or zones. A few also mentioned the blind spot on the right side of the truck as the most dangerous. Though students said it was important to stay out of these spots, the issue of why it is important to stay out of blind spots did not come up much in the discussions. One student did say, “If you are in a blind spot in another lane and they have to change lanes they could run you over.”
Textbook & Truck
Students from the textbook and truck group also mentioned all four No-Zones and the hazards of hanging out in No-Zones. As one student said, “If you stay in the blind spot you are probably going to get hit.”

Summary of “Don’t Hang Out in the No-Zone”
Most students were able to describe the location of the No-Zones and the need to stay out of these zones. A few students took this to the next level and described how hanging out in No-Zones can result in an accident. A few students were also able to identify the right side as the most dangerous.

Maintain a Safe Following Distance

Textbook
The textbook group described the importance of maintaining a safe following distance and the repercussions of following too closely. As one student said, “You should keep a good following distance when you are following behind them because you never know how many cars are in front of them and when they are going to have to make a sudden stop, you don’t want to ram into the back of them.” The group was not as clear as to what a safe following distance might entail. When asked what a safe following distance behind a truck would be, student responses varied. Some of the comments included:
- “About a car and a half I’d say.”
- “I go by the 3 second rule.”
- “I usually go by the 4 seconds just to be safe.”
- “You should be able to see their mirrors, that is good.”

Textbook and DVD
The textbook and DVD group discussed several issues about maintaining a safe following distance. One student said, “If you follow too close and they have to make a stop you don’t want to run into the back of their truck.” The students also discussed the problems with following too closely, including being in the blind spot where a truck driver cannot see you, hitting the back of the truck, and having cargo fall off the truck onto the car. Like the textbook group, student responses varied on how far back a car should stay from a truck to maintain a safe following distance. Distances mentioned included:
- “Give a couple of car lengths instead of just one”
- “Three seconds”
- “At least (3 seconds)”
- “Approximately 100 feet or see both of the side mirrors”
- “Give a car length”
- “Just to where you can see their mirrors, their side mirrors”

Textbook and Truck
The textbook and truck students also noted the importance of maintaining a safe following distance. They discussed several reasons why it is important to maintain a safe following distance, including colliding into the back of a truck and having cargo shift and fall onto the car. As one student said, “If you are following real close and you can’t see what is going on in front
of that truck, if say that truck has to hit the brakes really hard, you are just going to collide right into that truck.” The truck group also varied in how far back they thought a car should be behind a truck to maintain a safe following distance. Comments on distances included:

- “50 feet … 30 feet … something like that. If I can see both the left mirror and the right mirror full view then I am safe.”
- “…I try to stay 5 seconds behind.”
- “When you can see both mirrors on the sides of the truck that is when you know you are far back enough and it is safe.”
- “If can’t see their mirrors, they can’t see you. Should be able to see all of mirror.”
- “Stay back 500 feet.”

**Summary**

All of the groups discussed the importance of maintaining a safe following distance. Within each group, there was variation on what was considered a safe following distance. The shortest following distances mentioned were “give a car length” (textbook and DVD group) and “about a car and a half” (textbook group). The longest distances were mentioned in the textbook and truck group, including “stay back 500 feet” and “stay 5 seconds behind.” In all the groups, at least one participant mentioned that a good way to know if you are far enough back is to see the truck driver’s mirrors.

**Properly Pass**

**Textbook**

During brainstorming, the textbook group brought up ideas related to properly passing trucks. The groups discussed passing on the left and not lingering beside a truck. As one participant described, “When you are passing don’t just sit in the lane, don’t linger in the lane. Never ride beside a truck. Be sure that you can pass before you do.” One student commented that an important part of passing safely was leaving the right amount of space before pulling back in front of a truck. That student indicated that 15 feet was likely to be enough space. Another student commented, “I don’t remember… Is it when you can see the whole truck in your side mirrors?” This concept of when it is safe to pull back over in front of a truck after passing is covered in the section on not cutting off trucks.

**Textbook and DVD**

Students in the textbook and DVD group, for the most part, accurately described how to properly pass a truck. Steps mentioned included signal early, pass on the left, do not linger, and leave plenty of space before pulling back over. As one student described the process, “Signal early, get over, and once you pass give plenty of space once you get back over in their lane.” The concept of “don’t linger when passing” was one mentioned by several students.

**Textbook and Truck**

The students in the textbook and truck group brought up several points about passing trucks. Ideas mentioned included signaling before starting a passing maneuver, passing on the left, not lingering beside a truck, and making sure you can see the truck in your mirrors before pulling back into the right lane. A few students stressed the dangers of the right side of the truck when passing. As one student said, “When they taught us up there, because we had people come up
there to talk about the truck and stuff, they said it was the biggest blind spot was on the right side for the driver. So never pass on the right side unless you have to.”

**Summary**

Overall, across groups the students mentioned most of the points about properly passing trucks. There was ambiguity for some students on certain steps such as how far to be in front of the truck before pulling back in, a concept also covered under “Don’t Cut Trucks Off.” A few students in the textbook and truck group stressed the dangers of passing on the right.

**Ratings**

At the end of the focus groups, students were given an opportunity to rate the teaching method used in their class when they were learning how to share the road with heavy trucks. Students were asked to rate the textbook, textbook and DVD, or textbook and truck lessons as very helpful, helpful, neutral (was not helpful or unhelpful), unhelpful, or very unhelpful. Students only rated the approaches they experienced in class.

Learning preferences may have played a role in how some students rated the approaches. A few comments about learning preferences during the rating discussion included:

- “I just learn better by reading.”
- “I don’t like learning from a textbook.”
- “I found it [DVD] very helpful because I am more of a visual learner.”

While learning preference appeared to play a role to some extent in the rating activity, students mentioned a range of other reasons why they found the approach used in their class to be helpful, neutral, or unhelpful. Each approach (textbook, textbook and DVD, textbook and truck) is described in more detail below.

**Textbook**

As can be seen in Table 19, 79% (23 out of 29) of the students found the textbook helpful or very helpful in teaching them to share the road with trucks. A few students mentioned liking the text because it was informative and gave helpful examples. As one student said, “It just explained. I like how it explained different situations.” Several students said they liked the pictures and diagrams in the textbook and found them helpful. One picture in particular was mentioned on several occasions, which was an overhead diagram of a truck with the No-Zone areas designated with shading. One student commented on how “that picture really stuck with me. But none of like the text or anything.”
Table 19. Ratings of helpfulness for the textbook.

<table>
<thead>
<tr>
<th>Group</th>
<th>F: Very Unhelpful</th>
<th>D: Unhelpful</th>
<th>C: Neutral (Wasn't unhelpful or helpful)</th>
<th>B: Helpful</th>
<th>A: Very Helpful</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>8</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>Textbook &amp; DVD</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>6</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Textbook &amp; Truck</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Totals</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>16</td>
<td>7</td>
<td>29</td>
</tr>
<tr>
<td>Percentage</td>
<td>0%</td>
<td>7%</td>
<td>14%</td>
<td>55%</td>
<td>24%</td>
<td></td>
</tr>
</tbody>
</table>

Not all students gave the textbook a helpful grade (14% rated it neutral and 7% rated it unhelpful). A few reasons given included the textbook was repetitive/boring, too general, or confusing in content and/or organization. One student mentioned having mixed feelings about the textbook because while it helped with passing the permit test, it did not help with understanding the No-Zones. The student said, “Well it talked about the No-Zone which I had on my own permit test and what it told me about that helped me pass. But it wasn’t very … I don’t remember exactly some of the stuff that you are supposed to do. So it didn’t help me remember how far you are supposed to stay away, it just told me ‘don’t go there.’ But how far do you keep from it?”

When asked how the textbook could be improved, students provided several examples of how they would like the text supplemented. Students mentioned adding more examples, diagrams, oral explanations, videos, and demonstrations. This idea of supplementing the textbook goes along with a comment by one of the textbook and truck students on how helpful the textbook was in combination with the truck experience. The student said, “It explained to me, which I thought was very helpful, because we went in the book after the demonstration and everything with the truck. And after everything was explained through the demonstration when we went over the section it was like putting two and two together. It explained like the turns and swinging left before it goes right and following distance.” Overall, the students found the textbook information helpful and suggested that it would be even more helpful if combined with visual materials such as diagrams and/or a kinesthetic approach such as a video.

**DVD**

As seen in Table 20, 91% (10 out of 11) of students that saw the DVD thought it was helpful or very helpful in teaching them to share the road with trucks. No students rated the DVD as unhelpful, with one student grading it as neutral. The students primarily talked about the DVD being helpful because it showed them real-life situations or scenarios. As one student said, “Compared to the textbook I found it very helpful because it was more like that … showing the scenario instead of just reading about it.” Another student talked about how the DVD helped with retention of the information. The student said, “I remember stuff from it. I remember seeing from it where a truck was trying to turn and someone was trying to pass. And they got stuck.” The student that graded the DVD “neutral” stated that the DVD repeated information already learned from the book, saying, “I guess I would’ve liked the DVD better if I didn’t have the textbook first.”
Table 20. Ratings of helpfulness for the DVD.

<table>
<thead>
<tr>
<th>Group</th>
<th>F: Very Unhelpful</th>
<th>D: Unhelpful</th>
<th>C: Neutral (Wasn't unhelpful or helpful)</th>
<th>B: Helpful</th>
<th>A: Very Helpful</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVD</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>4</td>
<td>11</td>
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<tr>
<td>Percentage</td>
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<td>0%</td>
<td>9%</td>
<td>55%</td>
<td>36%</td>
<td></td>
</tr>
</tbody>
</table>

One critical comment a couple of students in the DVD group raised was that the DVD overexaggerated the way teens act. As one student said, “They took like being a teen and not paying attention and stuff to the extreme.” A few students had suggestions for how the DVD could be improved, including showing more examples of what could happen if light vehicles do not drive safely around trucks and posing questions at the end of each section. A student said it would be helpful to have questions at the end of each section on the DVD to “jog your memory of what you learned.” It should be noted that only the CVSA video was given to the teacher for use in the classroom. The CVSA video does not include follow-up questions after each section; however, on the CVSA website teachers can download lesson plans with follow-up questions for use with each section of the video. Since the research team was only looking at the knowledge retention from the video, the lesson plans and follow-up questions from the website were not included in the study. The teacher that used the DVD in this study did mention following-up with his or her own questions.

**Truck Hands-on Experience**

Of the six truck students that participated in the focus group, 100% (6 of 6) rated the truck experience as very helpful in teaching them to share the road with heavy trucks (Table 21). Student comments focused on how they found it helpful to have a hands-on, visual experience. As one student said, “It was more of a real life experience than just explaining that you need to be this far … it gives you a grasp of how far, where, it helps you judge better.” Another student commented, “I liked the whole thing because every section we went to everything was explained in detail. Like when he was behind the truck the guy was explaining the safe following distance and how, as we stood behind the car, we still couldn’t see the mirrors even standing behind the car so … and just all the blind spots and everything and sitting in the truck and actually looking from the driver’s point of view it helps a lot.”

Table 21. Ratings of helpfulness for the truck hands-on experience.

<table>
<thead>
<tr>
<th>Group</th>
<th>F: Very Unhelpful</th>
<th>D: Unhelpful</th>
<th>C: Neutral (Wasn't unhelpful or helpful)</th>
<th>B: Helpful</th>
<th>A: Very Helpful</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truck</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>6</td>
</tr>
<tr>
<td>Percentage</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

**TEACHER INTERVIEWS**

In addition to the student surveys and focus groups, NSTSCE researchers interviewed the teachers involved in the case study. Teachers were asked what they thought about the supplements (DVD, truck hands-on experience) and how easy or difficult the supplements were
to implement in their classrooms. Transcripts were made of the teacher interviews and a researcher reviewed and summarized the findings.

**DVD**

The teacher who taught with the textbook and the DVD found the addition of the DVD to be an improvement. The teacher commented that the DVD was a useful supplement to the textbook because it allowed students to see what they had been reading about and discussing in class. As the teacher commented, “…talking about it and then showing it on the film made the big difference. We can tell students something but once they see it I think that makes a big difference in making them understand what is going on.”

The teacher using the DVD said it was not difficult to integrate into the lesson. The teacher said that she or he taught the lesson in the book, showed the DVD, and then conducted a question-and-answer session. The teacher commented, “I really enjoyed this and I think more schools should have this in their lesson plans. Let these kids see what we are trying to teach them.”

**Hands-on Experience**

The teacher who taught with the textbook and included the truck hands-on experience found the addition of the truck experience to be an improvement. The teacher said, “It was a definite improvement because it was a hands-on experience, and they actually got to talk to the driver, and they actually got to sit in the driver seat and see for themselves the blind spots.” The teacher also found the use of stations helpful because it kept students occupied and provided them with a variety of information about staying safe around trucks. The teacher said it was helpful because “by moving them to different stations there was different information as opposed to just going in the driver seat. I thought this was a lot more effective because it gave them different angles: following the truck too close, being right in front of the truck, not leaving enough distance between themselves and the truck, and how long it takes to pass the truck that they can’t see that.”

The teacher did not find the inclusion of the truck experience to be a problem to integrate into the classroom. The teacher said that the section is only three or four pages in the textbook so they had time to go over the material in the textbook and have the truck experience.

**Summary of Teacher Comments**

Both teachers using the DVD and the hands-on experience supplements said that these approaches improved their lesson on sharing the road with trucks because students were able to see and experience what was being taught rather than just reading about it or discussing it. Both teachers said the addition of the supplemental DVD or hands-on experience was an improvement that was not difficult to integrate into their lesson on sharing the road with trucks.
CHAPTER 4. DISCUSSION AND CONCLUSIONS

There were two primary goals of the current project. The first was to develop a supplemental practices document describing key sharing-the-road information and approaches to teaching sharing the road with heavy trucks. The second was to perform a case study to evaluate these methods to find out which would lead to the best knowledge retention of key sharing-the-road information. The research team wanted to understand whether providing students with updated materials or a hands-on experience would increase their retention of key sharing-the-road information.

SUPPLEMENTAL PRACTICES

The supplemental practices portion of this project involved primarily the review of websites, videos, educational materials, and discussions with organizations that teach people to safely share the road with heavy trucks. A document was written (Appendix A) that includes a list of key sharing-the-road tips for students, a description of the video used in the case study, and detailed information on how VTTI conducted the hands-on experience with students during the case study. The goal of the document is to provide teachers and others working with driver education students with resources to help them teach how to safely share the road with trucks.

CASE STUDY

The purpose of the case study was to determine which condition (i.e., textbook, textbook and DVD, and textbook and truck) would result in the best knowledge retention of key sharing-the-road information. Knowledge retention and overall acceptance of the conditions were investigated through the use of surveys and focus groups approximately 2 months after the completion of each condition.

Survey

When aggregated across all questions, the mean percentage of correct responses did not show a statistically significant difference in the performance of conditions. Further analysis was performed to evaluate each question individually to identify potential condition performance benefits based on the type of information being taught (e.g., distance, maneuver). This analysis found that the textbook and truck condition outperformed the textbook condition regarding the proper front No-Zone distance. This was the only statistically significant difference found for knowledge retention.

FOCUS GROUPS

The front No-Zone is one that teachers will need to describe in depth and give students clear examples of how far in front of a truck they should be before cutting over into the lane in front of the truck. Students across the conditions seemed to understand that trucks take longer to stop than cars and that it is dangerous to cut off trucks and/or put themselves into the front No-Zone. Yet across the conditions, students did not appear to have a consensus on how far in front of a truck a car should be before pulling in front. Knowing the distance in feet a car should be before pulling in front of a truck appeared to be difficult for students to grasp, with distances suggested ranging from 15 feet to 50 feet.
Another observation, related to the item above, was that distances described in feet were difficult for students to apply, whereas distances presented using a visual cue or guide were more accurately described. For example, one student when describing proper following distance said “50 feet … 30 feet … something like that. If I can see both the left mirror and the right mirror full view then I am safe.” To see both mirrors when following a tractor-trailer, a driver is required to follow at a much greater distance than 30 to 50 feet.

While survey results indicate that the textbook and DVD together provided no benefit in knowledge retention, focus group findings indicate students in this condition had an improved understanding of “being squeezed.” For example, one student described it as “if you are impatient and they swing over to the left to turn right and you speed up then you are going to get trapped between the truck and the curb.” This finding may be due to the video showing the maneuver, whereas the textbook and textbook and truck conditions could only describe it.

Further observations from the focus groups indicated that in some instances while students were able to retain information about the issues, they were not always able to adequately describe why (i.e., could not always describe the consequences involved with poor sharing-the-road behavior). One interesting comment from a student described how the textbook condition prepared her for passing the permit test; however, the student could not remember the reasoning behind the lesson. The student said, “Well it talked about the No-Zone which I had on my own permit test and what it told me about that helped me pass. But it wasn’t very … I don’t remember exactly some of the stuff that you are supposed to do. So it didn’t help me remember how far you are supposed to stay away, it just told me ‘don’t go there.’ But how far do you keep from it?”

Overall, the students found the textbook information helpful and suggested it would be even more helpful if combined with visual materials such as diagrams and/or a kinesthetic approach such as a video. A student in the textbook and truck condition said, “It explained to me, which I thought was very helpful, because we went in the book after the demonstration and everything with the truck. And after everything was explained through the demonstration when we went over the section it was like putting two and two together. It explained like the turns and swinging left before it goes right and following distance.” This finding indicates that the textbook is a good resource to teach basic concepts, and more valuable if combined with more experiential materials such as an instructor providing real-life examples, videos being presented, and/or hands-on experiences.

Both teachers using the DVD and the hands-on experience supplements said that these approaches improved their lesson on sharing the road with trucks because students were able to see and experience what was being taught rather than just reading about it or discussing it. Both teachers said the addition of the supplemental DVD or hands-on experience was an improvement that was not difficult to integrate into their lesson on sharing the road with trucks.

The focus group results showed that students, as groups, were able to brainstorm most of the key sharing-the-road tips independent of the condition that they experienced. It would appear that the kinesthetic learning experiences (i.e., DVD and truck experience) did not make a substantial difference in what students retained. What appeared to be the bigger difference than retention was in student preference and interest in learning the information based on condition. One hundred percent of the students participating in the truck focus groups said that they found the
truck experience to be very helpful, while only 24% of all the focus group participants found the textbook to be very helpful. Thirty-six percent of the DVD participants found the DVD to be very helpful in learning to share the road with trucks. While the truck focus group participation was lower than the other conditions due to one truck class being canceled, it is still an interesting finding for teachers to consider when planning their curriculum on sharing the road with trucks.

At the start of the focus groups students were asked how they prefer to learn driver-education information. A majority of students explained that they prefer kinesthetic approaches when learning driver-education information (20 out of 30 students). While student learning preferences are important to consider, even apart from student learning preferences, driver education is a subject matter that would seem to lend itself well to kinesthetic approaches. Dr. Bill Cerbin, the Director of the Center for Advancing Teaching and Learning and Professor of Psychology at the University of Wisconsin-La Crosse, stated in a 2011 interview on learning styles:

> There may be evidence that indicates that there are some ways to teach some subjects that are just better than others, despite the learning styles of individuals…. If you’re thinking about teaching sculpture, I’m not sure that long tracts of verbal descriptions of statues or of sculptures would be a particularly effective way for individuals to learn about works of art. Naturally, these are physical objects and you need to take a look at them, you might even need to handle them.\(^{(9)}\)

The same principle would seem to hold true for the subject matter of driver education, including sharing the road with heavy trucks. For example, in the same way a sculpture student may need to look at and handle clay to understand sculpture, it may be beneficial in teaching sharing the road with trucks to have students sit in the cab of a truck and see the blind spots from a truck driver’s perspective. This does not mean that reading about blind spots in a textbook or hearing a teacher describe blind spots is not helpful or important. Students are often given some hands-on experience with heavy trucks during their behind-the-wheel sessions; however, this can be limited by low exposure to and not receiving the unique and valuable experience of sitting inside a heavy truck cab. Supplementing driver education classroom materials (e.g., textbook) with hands-on experiences (e.g., sitting in the cab of a truck) may be an effective way of teaching students critical information about sharing the road.

**SUMMARY**

While student learning preferences and ratings are helpful to understand, what is even more important is how such information is most effectively conveyed (i.e., verbally, kinesthetically, etc.) so that students remember how to drive safely. Results of the survey seem to indicate potential minor improvement of knowledge retention when adding supplemental learning methods. When a DVD or a hands-on experience is added to textbook material, the students and teachers found the inclusion of such information to be helpful, in particular the truck experience. The conclusion seems to indicate that if a truck and driver are available teachers should try to include a truck hands-on experience when teaching sharing the road with trucks. Students are likely to find it helpful and preferable to just reading about sharing the road in their textbook.
LIMITATIONS

Cancellation of the third driver education class in the fall of 2012 meant that researchers could not introduce the truck experience into two classes as originally planned. This reduced the number of students exposed to the truck experience and lessened the pool of potential participants that could be recruited for the survey/focus groups. The researchers’ target of 10 students per condition was not met, which reduced the strength of the findings.

Conducting surveys and focus groups for the students that took driver education in the fall of 2012 meant holding the focus groups in January. Issues with snow on the days focus groups were scheduled potentially contributed to the low turnout. Researchers did provide all the students that did not attend the focus groups in January 2013 the opportunity to take the survey over the phone, though only one student chose to complete the survey in this manner.

The driver education teachers that the research team worked with were extremely helpful and open to finding ways to help their students learn to share the road with heavy trucks. The research team could not have undertaken this case study without the cooperation and assistance of the driver education teachers. The only limitation of working through the teachers rather than running the study independently is that the researchers could not control all of the materials students experienced in the classroom related to sharing the road with trucks. For example, a couple of students from the textbook condition mentioned having seen a video that included the danger of truck drivers falling asleep while driving. While this video was not shown during the intervention period and is not directly related to how to safely share the road with trucks, it may have influenced student responses. Students were also taking behind-the-wheel at the same time as they were receiving the truck and DVD interventions. For example, one student in the textbook condition mentioned learning how to properly pass trucks during behind-the-wheel. Researchers want to raise the point that because the study involved working through the driver education teachers versus running the conditions independently of any driver education classroom, the conditions could not be completely controlled. The research team believed the benefits of working through the teachers outweighed these few drawbacks. The students experienced the material in a classroom setting similar to what other students across the country experience when they take driver education.

Another study limitation was that during data reduction one of the textbook and truck focus group audio files was corrupted and could not be transcribed. The research team was able to use the written participant results of the brainstorming, flip chart notes, and researcher notes to gather the main findings from the focus group. However, the verbal comments made by participants could not be captured and analyzed for the second truck group. The brainstorming findings, learning preferences, and ratings were included for all the students because these were captured on Post-it® notes and flip chart paper for all students at the focus groups. What was impacted was the summary of the focus group discussions on the key sharing-the-road tips. The qualitative analysis presented in this report had to be drawn from the comments of only three of the truck students.
FUTURE WORK

Results from this study indicate that when a DVD or a hands-on experience is added to textbook material, the students and teachers find the inclusion of such information to be helpful, in particular a truck experience. The conclusion would seem to be that if a truck and driver are available teachers should try to include a truck hands-on experience when teaching sharing the road with trucks. Students are likely to find it helpful and preferable to just reading about sharing the road in their textbook. The teacher whose class hosted the truck demonstration said, “It was a definite improvement because it was a hands-on experience, and they actually got to talk to the driver, and they actually got to sit in the driver seat and see for themselves the blind spots.”

Though students may benefit from and enjoy a hands-on truck experience, driver education teachers may not know where to find a truck and driver to come to their school to conduct a hands-on experience with students. It is recommended that future work be performed to create a Sharing the Road Directory that would include listings by state of trucking companies that are willing to be contacted for a truck hands-on experience. The companies could use the supplemental practices portion of this document as guidance when planning their hands-on experience.
Goal of Supplemental Practices Document
The goal of this supplemental practices document is to provide teachers and others working with driver education students with key sharing-the-road information that they may use to teach students to share the road with heavy trucks. The supplemental practices document also provides guidance on ways to convey key sharing-the-road information to driver education students. The document is the basis for a website that the Virginia Tech Transportation Institute (VTTI) is creating that will provide naturalistic driving videos for the key sharing-the-road tips described in this supplemental practices document.

Background
Recent survey research at VTTI showed that driver education teachers would like to have updated materials such as videos and a hands-on experience with a truck to teach students how to share the road with heavy trucks (Baker, S., Schaudt, W. A., Freed, J. C. & Toole, L., 2012). Researchers also found during a case study project with high school driver education classes that many students prefer having hands-on experiences when learning driver-education information. For this reason, researchers recommend that when teaching students to share the road with heavy trucks, teachers include a hands-on experience with a truck in addition to a textbook. If a hands-on experience cannot be arranged, teachers could also supplement the textbook with a video on sharing the road with trucks. More information on VTTI’s Driver Education Survey and Case Study projects can be found at http://www.vtti.vt.edu/moreinformation/sharing-the-road.html

Key Sharing-the-road Information
For this supplemental practices document, VTTI researchers reviewed the educational resources provided by various organizations involved in teaching people to share the road with heavy trucks. Organizations included the Commercial Vehicle Safety Alliance (CVSA), the Walmart Truck Team, the Wisconsin Road Team, the American Trucking Association (ATA), and the Federal Motor Carrier Safety Administration (FMCSA). The research team also reviewed the section on sharing the road with heavy trucks found in the eleventh edition of Pearson’s Drive Right textbook. Researchers also utilized the skills and expertise of VTTI staff, including those with Commercial Driver’s Licenses (CDLs), in creating the supplemental practices document.

This review of organizational and textbook materials, as well as staff expertise, led VTTI researchers to focus on a few key tips for sharing the road:
- Don’t Hang Out in the No-Zone
- Properly Pass Trucks
- Don’t Cut Trucks Off
- Don’t Get Squeezed
- Maintain a Safe Following Distance
Kinesthetic Learning Approach
The use of videos and hands-on experiences fits well with the Kinesthetic Learning approach described in Neil Fleming’s (n.d.) VARK model. The VARK model refers to kinesthetic learning as processing information through the use of experience and simulated or real practice (http://www.vark-learn.com/english/page.asp?p=categories). Examples of kinesthetic learning include videos and demonstrations of “real things.” During VTTI’s Driver Education Case Study project, driver education students reported that they prefer learning driver-education information through kinesthetic learning experiences and teachers indicated that they thought these approaches were helpful.

Sharing the Road Video
In VTTI’s recent Driver Education Case Study project, researchers provided a driver education class with a Teens and Trucks video produced by the CVSA. The teacher used the video to help teach driver education students how to share the road with heavy trucks. The video covers the following topics:
- Don’t Cut Off Trucks
- Stay Out of the Blind Spots/No-Zones
- Maintain a Safe Following Distance
- Understand Trucks Make Wide Turns
- If Your Car Breaks Down, Pull Off Highway as Far as You Can

The list varies slightly from the list VTTI presented. The main difference is the inclusion of pulling off the highway if your car breaks down. The key information found on the CVSA video is roughly the same as what VTTI presented in the hands-on truck experience described below and what is covered in the Drive Right textbook.

The CVSA encourages industry and education professionals, among others, to use their video and other materials to spread the word on how to safely share the road with trucks. To learn more about CVSA’s Teens and Trucks program go to http://www.cvsa.org/programs/teens_and_trucks.php

Hands-on Truck Experience
For the Driver Education Case Study, VTTI researchers created a hands-on truck experience for use in a driver education class. The hands-on experience had two parts, a presentation and a truck demonstration. A member of the VTTI research team with a CDL made the presentation. The presentation was given immediately before the truck demonstration to provide students with information to help them understand why they need to safely share the road with heavy trucks. During the truck demonstration, students sat in the cab of the heavy truck to see the blind spots for themselves. In addition, light vehicles were strategically placed around a heavy vehicle to show students proper following, leading, and passing positions. Each piece of the hands-on truck experience is described in detail below for use by teachers or organizations such as trucking companies that may want to provide a school with a hands-on truck experience.

Sharing the Road Presentation
The presentation covered sobering facts about crashes involving heavy trucks, provided information about heavy-vehicle characteristics, and introduced the five key sharing-the-road
tips. The sobering facts were used to inform students why it is so important to share the road with heavy trucks. The heavy-truck characteristics were used to help students understand how heavy trucks operate. For instance, researchers thought it was important for students to understand that it takes trucks longer to stop than passenger cars. Finally, the research team introduced the five key sharing-the-road tips that the students would be covering during the truck demonstration and discussed why they are important.

**Sobering Facts**

- Light vehicle drivers are usually at fault in a crash with a heavy vehicle.
  - Seventy-eight percent of near-crashes and crashes involving large trucks are initiated by the light-vehicle driver (Hanowski, Hickman, Wierwille, Keisler, 2007).
- Light-vehicle drivers often do not survive a crash with a heavy vehicle.
  - Of the fatalities in crashes involving large trucks in 2011, 72% were occupants of other vehicles (National Highway Traffic Safety Administration, 2013).
- Passenger-vehicle crashes are the leading cause of death for teenagers in the United States.
  - In 2010, on average seven teens age 16 to 19 died every day from motor vehicle injuries (Centers for Disease Control and Prevention, 2012).

**Heavy-vehicle Characteristics**

- Large trucks are very different in size than passenger vehicles.
  - Tractor-trailers typically weigh up to 80,000 lbs.
  - Trucks can exceed 65 feet in length.
    - Passenger vehicles range from 12 to 17 feet in length (American Trucking Association et al., 2009).
  - Trucks are not just longer but also wider than passenger vehicles.
  - Truck drivers sit much higher off the roadway; however, this does not improve visibility.
- Large trucks usually lose speed when going uphill and gain speed when going downhill.
  - It is safer to pass trucks going uphill than trucks going downhill (Crabb, Thiel, Mottola & Weaver, 2010).
- Large trucks have much longer stopping distances than passenger cars.
  - At 55 mph it takes a tractor-trailer more than the length of a football field to stop.
- Large trucks make wide turns.
  - Light vehicle drivers should observe tractor-trailer turn signals.
  - Trucks may straddle lanes to set up a turn.
  - Trucks may start by moving in the opposite direction of the turn (e.g., swing wide to the left when making a right turn).
Key Sharing-the-road Tips
- Don’t Hang Out in the No-Zone
- Properly Pass Trucks
- Don’t Cut Trucks Off
- Don’t Get Squeezed
- Maintain a Safe Following Distance

Truck Demonstration
The VTTI truck demonstration covered key sharing-the-road tips with driver education students using hands-on experiences in and around a heavy truck. Students were taken through several stations where they were able to sit in the truck, walk around the truck, and see the blind spots for themselves. Below is a detailed description of how each station was set up and conducted. This information may be helpful guidance for trucking companies that partner with driver education professionals to conduct a hands-on experience for driver education students.

Preparing for the Demonstration: Logistics, Equipment, and Materials
The research team prepared a detailed plan of the logistics, equipment, and materials needed for the demonstration. The information is listed below.

Logistics
The logistics VTTI used for the truck demonstration involved the following:
- Coordination: Work with driver education teachers to secure permission to use a large enough section of a parking lot for the demonstration. The teachers may also be able to provide light vehicles for the demonstration (i.e., driver education cars).
- Site Preparation: Well in advance, block off the area where the demonstration will take place with cones.
- Set-up Time: Show up at least 1 hour before the start time to set up and to touch base with the teaching staff.
- Presentation Time: Plan approximately 20 minutes for the presentation.
- Demonstration Time: Plan approximately 40 minutes for the demonstration.
  - Example: Nine groups of three students spend approximately 4 minutes per station.
- Demonstration Team: Four drivers/safety managers.

Equipment
The equipment VTTI used for the truck demonstration included the following:
- 4 compact light vehicles
- 1 class 8 combination-unit truck
- 2 pop-up tents for students and demonstration personnel to stand under
- Measurement device (e.g., 100 ft. long tape)
- Bright colored chalk for marking positions on pavement
Materials
Truck Demonstration Stations and Map (see Figure 1)

- Station 1 (Tents on Passenger Side of Trailer)
  - Staging Point for Students and Demonstration Personnel
- Station 2 (Rear of Truck)
  - Rear Blind Spot, Proper Following Distance, and Turning Trucks
- Station 3 (Inside Cab)
  - Blind Spots and Passing on Right
- Station 4 (Left Side and Front of Truck)
  - Passing (Properly Pass and Don’t Cut In)
  - Front Blind Spot
Figure 1. Truck Demonstration Station Map
Key Sharing-the-road Tips
The list of key sharing-the-road tips and materials for the demonstration covered Don’t Hang out in the No-Zone, Properly Pass Trucks, Don’t Cut Trucks Off, Don’t Get Squeezed, and Maintain a Safe Following Distance.

Each key sharing-the-road tip was covered at a station set up by VTTI researchers. Students were walked through the station and provided with information on how to safely share the road with trucks. Below is a description of each station, the logistics of how researchers ran each station, and the talking points used by researchers at each station. It should be noted that researchers tried to discuss each key sharing-the-road tip at more than one station so that the points could be reinforced. The stations included:

- Station 1: Staging Point for Students and Demonstration Personnel
- Station 2: Rear Blind Spot, Proper Following Distance, and Turning Trucks
- Station 3: Blind Spots and Passing on the Right
- Station 4: Passing (Pass and Don’t Cut In) and Front Blind Spot

Station 1: Staging Point for Students and Demonstration Personnel
Below is an image of VTTI’s Station 1 for the truck demonstration and details of VTTI’s setup, staff, and procedures for Station 1.

![Image of Station 1](image)

Station 1: Logistics
- **Setup:** Place tents on the passenger side in adjacent lane halfway down the trailer.
- **Staff:** Driver/Safety Manager A
- **Procedure:** Station 1 leader will describe how the hands-on truck demonstration will work depending on class size and availability of truck drivers/managers.
  - **Example:** A class of 18 students can be broken into six groups of three students. Each student can be provided with a group number tag (e.g., G1–G6). Three groups may begin at a teaching station (Station 2, Station 3, or Station 4). The other nine students not starting at one of these stations will wait in the tents on the passenger side of the truck. Essentially, students in groups of three will progress through the three teaching stations in and around the truck, moving in clockwise fashion.
• **Talking Points:** There are no talking points for Station 1.

**Station 2: Rear Blind Spot, Proper Following Distance, and Turning Trucks**
Below is an image of VTTI’s Station 2 for the truck demonstration and details of VTTI’s setup, staff, procedures, and talking points for Station 2.

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**Station 2: Logistics**

- **Setup:** Place a car in the truck’s rear blind spot (80 feet back) and place an X using chalk at a safe following distance (distance far back enough to where the mirrors are visible when positioned in the driver seat position of a following vehicle).
- **Staff:** Driver/Safety Manager B
- **Procedure:** Station 2 leader should keep track of the timing of the groups working through the stations.
  - Take three students from the tent to the car at the rear of truck. Explain that the car is in the rear blind spot.
  - Walk them to the X and ask them if they can see the truck’s mirrors. Explain that if you cannot see the truck’s side-mirrors, the truck driver cannot see you.
  - Explain that trucks make wide turns and that it is unsafe to pass a turning truck.
  - After 4 minutes, walk students to the cab and help the first student into the cab.
  - Return to the tent and begin the station demonstration with the next three students.

**Station 2: Talking Points for Rear Blind Spot**

- **Position:** Stand next to car in the rear blind spot.
- **Prompt Question:** “We are in the rear blind spot. Why is this spot a bad place to be?”
• **Responses:** Confirm anything correctly answered, but go over all points below regardless.
  o “Following this close behind a truck is dangerous for lots of reasons. You can’t see what’s in front of the truck on the road ahead. If the truck straddles debris in the road, like a truck tire, you won’t see it in time to safely avoid hitting it.”
  o “If the truck driver brakes and you are following this close, you won’t have enough time and space to avoid crashing into the back of the truck.”
  o “Another problem with being in this blind spot is that some trucks carry cargo that may move and fall from the truck onto the road in front of you, leaving you no time or space to avoid an accident. So stay back … it is unsafe to be this close.”

**Station 2: Talking Points for Proper Following Distance**
- **Position:** Move back to the X.
- **Prompt Question:** “How do you decide if you are far enough back when following a truck?”
- **Response:** Confirm anything correctly answered, but go over the point below regardless.
  o “A good way to know if you are far enough back is to look for the truck driver’s mirrors as you are following. To do this properly, first be sure your car and the truck are both centered in the lane. Once you are centered, look for the truck’s side mirrors. Ideally you want to be far enough back to see the mirrors on both sides of the truck. But at a minimum, you should see the mirrors on the left side of the truck. And remember if you don’t see his side mirrors, he doesn’t see you.”

**Station 2: Talking Points for Turning Truck**
- **Position:** Stand at the X.
- **Prompt Question:** “Why is it dangerous to pass a truck on the right, especially at an intersection?”
- **Responses:** Confirm anything correctly answered, but go over the point below regardless.
  o “It is never safe to pass a truck on the right. The right side has the largest blind spot around a truck. And at intersections, such as stoplights, it is especially risky because heavy trucks swing left before they turn right so they can get their trailer around the corner safely. If you try to squeeze between a truck and the curb you can get crushed. Stay back and wait. Let the truck make its turn.”

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Station 3: Blind Spots and Passing on the Right
Below is an image of VTTI’s Station 3 for the truck demonstration and details of VTTI’s setup, staff, procedures, and talking points for Station 3.

Station 3: Logistics
- **Setup:** Make space available for three students to sit in the cab.
- **Staff:** Driver/Safety Manager C
- **Procedure:**
  - Three students will sit in the cab at a time, with each student having a chance to sit in the driver’s seat to see blind spots.
  - Students take turns in the driver’s seat learning about blind spots and passing behavior.
  - After 4 minutes, they will go to Station 4.
    - Station 4 Driver/Safety Manager should help students out of the cab as they move to Station 4.

Station 3: Talking Points for Overall Visibility
- **Position:** Students sit in the truck driver’s seat, in the passenger seat, and on a stool in between other seats. The Driver/Safety Manager sits in the sleeper berth area.
- **Prompt Question:** “Sitting and looking out the window and in all these mirrors, do you think a truck driver has better visibility around her truck than you do in your car?”
- **Response:** Confirm anything correctly answered, but go over the point below regardless.
  - “I know it is hard to believe because we are sitting up so high and we have all these mirrors, but a truck driver DOES NOT have better visibility around her truck than you do in your car. The truck driver has blind spots all around the truck where your car disappears from her view.”
Station 3: Talking Points for Rear Blind Spot
- **Position**: Students sit in the truck driver’s seat, in the passenger seat, and on a stool in between other seats. The Driver/Safety Manager sits in the sleeper berth area.
- **Prompt Question**: “What do you see behind the truck?”
- **Response**: Confirm anything correctly answered, but go over the point below regardless.
  - “If you recall, there is a car about 80 feet behind the truck. That car is in the rear No-Zone. As a truck driver, you can’t see someone that is in that rear No-Zone or blind spot. Trucks don’t have rearview mirrors.”

Station 3: Talking Points for Left Blind Spot
- **Position**: Students sit in the truck driver’s seat, in the passenger seat, and on a stool in between other seats. The Driver/Safety Manager sits in the sleeper berth area.
- **Prompt Question**: “Look in the mirror on the left, what can you see?”
- **Response**: Confirm anything correctly answered, but go over the point below regardless.
  - “You can’t see the car because the car is in the left blind spot. The blind spot on this left side of the truck is small and located here along the cab. It is okay to pass on this left side, just don’t linger.”

Station 3: Talking Points for Front Blind Spot
- **Position**: Students sit in the truck driver’s seat, in the passenger seat, and on a stool in between other seats. The Driver/Safety Manager sits in the sleeper berth area.
- **Prompt Question**: “Look out through the windshield, do you see a car in front of the truck?”
- **Response**: Confirm anything correctly answered, but go over the point below regardless.
  - “There is a car located directly in front of the truck in the front No-Zone. Do not cut into that No-Zone. If you cut in there and hit the brakes, the truck driver won’t see you and you will cause a crash. Look for the entire front of the truck cab (bumper to the top of cab) in your rearview mirror before you pull back in. See that car in the passing lane ahead? That is the minimum proper passing distance for merging in front of a truck.”

Station 3: Talking Points for Right Blind Spot
- **Position**: Students sit in the truck driver’s seat, in the passenger seat, and on a stool in between other seats. The Driver/Safety Manager sits in the sleeper berth area.
- **Prompt Question**: “Look in the mirror on the right, do you see the tents?”
- **Response**: Confirm anything correctly answered, but go over the point below regardless.
  - “Take a moment and think about how big those tents are that you were standing under. That is a HUGE area where the truck driver can’t see you at all. When you need to pass a heavy truck, DON’T pass on the RIGHT. It is the most dangerous area to try and pass!”

Station 3: Overall Point for Blind Spots
- “So remember, a heavy truck has four No-Zones or blind spots where your car ‘disappears’ from the truck driver’s view. The No-Zones are at the front, back, left, and right sides of the truck. These areas are dangerous. The only blind spot you should ever
be in is the left blind spot and you should move through it steadily when you are passing a truck.”

Station 4: Passing (Pass and Don’t Cut In) and Front Blind Spot
Below is an image of VTTI’s Station 4 for the truck demonstration and details of VTTI’s setup, staff, procedures, and talking points for Station 4.

Station 4: Logistics
- Setup: Position a car in the left blind spot, a car in front blind spot, and a car in the passing lane in front of the truck at the distance ahead that a car should be before pulling in front of a truck.
  - If a car cannot be positioned far enough ahead due to spacing constraints, place an X at the position a car should be before pulling in front of a truck.
- Staff: Driver/Safety Manager D
- Procedure: Explain the proper procedure for passing a truck.
  - Pass steadily on left. Do not linger.
    - Point out the car in the left blind spot. Tell students to pass on the left and not to linger in the No-Zone.
  - As you pass a truck, look to see the entire front of the truck in your rearview mirror.
    - If time allows, let students get in the car and look for the front of the truck in the rearview mirror.
  - Signal your intention to change lanes.
  - Make sure you are far enough ahead before pulling in front of the truck.
    - Point out the car that is at the correct distance ahead of truck [when you can see the entire front of the truck (top of cab to bottom of bumper) in your rearview mirror] prior to pulling in versus the car that is in the front blind spot.
    - Once you change lanes, maintain speed (do not slow down!).
    - Stress that students should NEVER cut off a truck.
Take the three students to the tent and meet the next group of students at the cab. Help them out of the truck.

Station 4: Talking Points for Proper Passing Behavior (Passing on Left)
- **Position**: Stand at the car located in the front left passing lane. Look back at the car in the left No-Zone.
- **Prompt Question**: “Why is it best to pass a truck in the left lane?”
- **Response**: Confirm anything correctly answered, but go over the point below regardless.
  - “Pass a truck in the left lane because that is the side where the truck driver is sitting. He can see better on his left side. The left blind spot is much smaller than the right blind spot. So the BEST place to pass is on the left at a steady speed, just don’t linger alongside the truck.”

Station 4: Talking Points for Pulling In Front of a Truck
- **Position**: Stand and/or sit in the car in the passing lane.
- **Prompt Question**: “After passing a truck, what should you do before pulling back in front of it?”
- **Response**: Confirm anything correctly answered, but go over the point below regardless.
  - “Before you pull in front of a truck, signal your intent to change lanes AND as part of safe scanning, glance in your mirrors to see if you have enough space. You want to see AT A MINIMUM the entire front of the truck in your rearview mirror (bottom of bumper to top of cab). You must leave plenty of space between you and the truck before you pull in front. Never cut into the front blind spot [point to car in the front blind spot], or you can cut your life short. Then, once you safely pass, maintain your speed.”

Station 4: Talking Points for Front Blind Spot
- **Position**: Stand at the X.
- **Prompt Question**: “When you were in the cab, could you see that car through the windshield?”
- **Response**: Confirm anything correctly answered, but go over the point below regardless.
  - “The car is in the truck’s front blind spot. The front blind spot of a truck can extend more than 20 feet. Imagine you are driving down the road and you cut in front of a truck, putting yourself in the front blind spot. A moment later, a deer runs into the road and you slam on your brakes. The truck will not have time to stop and you will have an approximately 80,000 lb. truck crashing into the back of your car. Don’t put yourself and others in harm’s way—stay out of the front blind spot.”
**Quiz: Key Sharing-the-road Information**

One way to help reinforce what the students learned and to see what information they retained from their textbook, truck demonstration, and/or the video is to give them a quick quiz over the key sharing-the-road points. Make sure to cover at least these key sharing-the-road tips (i.e., Don’t Hang Out in the No-Zone, Properly Pass, Don’t Cut Trucks Off, Don’t Get Squeezed, Maintain a Safe Following Distance). Below are sample quiz questions and the corresponding answers. These questions were used with students in the VTTI Driver Education Case Study. The questions are broken down here by key sharing-the-road tip.

- **Don’t Hang Out in the No-Zone**
  - **Question:** The heavy truck No-Zone (truck blind spots or areas where a driver cannot see other motorists) contains the following areas around the truck. (Please choose one option from the list.)
    - A. The right and left sides of a truck only
    - B. The front and back of a truck only
    - C. The right side and back of a truck only
    - D. The front, back, left and right sides of a truck
  - **Answer:** The answer is D. A heavy truck has four blind spots where your car “disappears” from the truck driver’s view. The No-Zones are at the front, back, left, and right sides of the truck. These areas are dangerous. The only blind spot you should ever be in is the left blind spot and you should move through it steadily when you are passing a truck.

- **Properly Pass (Passing Position)**
  - **Question:** When you are attempting to pass a heavy truck, which area around the heavy truck is the most dangerous?
    - A. Front
    - B. Right
    - C. Left
    - D. Behind
    - E. All areas above are equally dangerous
  - **Answer:** The answer is B. When you need to pass a heavy truck, DON’T pass on the RIGHT. It is the most dangerous area to try and pass a heavy truck.

- **Properly Pass (Passing Procedure)**
  - **Question:** Which is the BEST approach to passing a heavy truck? (Please choose one option from the list.)
    - A. Heavily accelerate your vehicle until you have completely passed the truck
    - B. Pass the heavy truck steadily and do not linger
    - C. Do not ever pass a heavy truck
    - D. Pass the heavy truck in the left lane while moving steadily and do not linger
    - E. All of the above
  - **Answer:** The answer is D. Pass a truck in the left lane because that is the side where the truck driver is sitting. The driver can see the left side of the truck better. The left blind spot is much smaller than the right blind spot. The BEST place to pass is on the left at a steady speed, just don’t linger alongside the truck.
• **Don’t Cut Trucks Off**
  - Question: Which sentence below describes the BEST way you can safely share the road with heavy trucks? (Please choose one sentence.)
    A. When pulling in front of a heavy truck, signal your lane change well in advance and leave plenty of space
    B. Give 15 feet of space (1 car length) when merging in front of a truck
    C. Pass a heavy truck at an intersection when the truck is not signaling a turn because truck drivers always signal the way in which they turn
  - Answer: The answer is A. Before you pull in front of a truck, signal your intent to change lanes AND as part of safe scanning, glance in your mirrors to see if you have enough space. You want to see AT A MINIMUM the entire front of a truck in your rearview mirror (bottom of bumper to top of cab). You must leave plenty of space between you and the truck before you pull in. Never cut into the front No-Zone of a truck! Once you safely pass, maintain your speed.

• **Don’t Get Squeezed**
  - Question: At a roadway intersection, why is it common for a heavy truck to initially turn left while signaling a right turn? (Please choose one option.)
    A. Truck drivers are notoriously bad at using their turn signals properly
    B. Truck drivers prefer to make right turns from left lanes only
    C. Truck drivers are making space available on the right side for light vehicles to pass
    D. Truck drivers swing left prior to a right turn so that their trailer can make it around the corner safely
  - Answer: The answer is D. It is never safe to pass a truck on the right. The right side has the largest blind spot around a truck. And at intersections, such as stoplights, it is especially risky because heavy trucks swing left before they turn right so they can get their trailer around the corner safely. If you try to squeeze between a truck and the curb you can get crushed. Stay back and wait.

• **Maintain Safe Following Distance**
  - Question: True or False? If you can’t see the truck driver’s mirrors, the truck driver can’t see you.
  - Answer: The answer is True. A good way to know if you are far enough back is to look for the truck driver’s mirrors as you are following. To do this properly, first be sure your car and the truck are both centered in the lane. Once you are centered, look for the truck’s side mirrors. Ideally you want to be far enough back to see the mirrors on both sides of the truck. But at a minimum, you should see the mirrors on the left side of the truck. And remember if you don’t see his side mirrors, he doesn’t see you.
Helpful Resources
There are many helpful resources for teachers, parents, and organizations that want to teach students to safely share the road with trucks. Below are a few of the organizations that provide sharing-the-road resources. The Virginia Tech Transportation Institute reference is included in this list as researchers are in the process of taking these sharing-the-road tips and creating a website that can be used to teach these important concepts.

- American Trucking Association
  - [http://www.trucking.org/Share_the_Road.aspx](http://www.trucking.org/Share_the_Road.aspx)
- Commercial Vehicle Safety Alliance
- Federal Motor Carrier Safety Administration
- Virginia Tech Transportation Institute

References


APPENDIX B. CONSENT FORMS

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Parental/Guardian Permission for Student Participation

Title of Project: Driver Education Case Study
Investigators: Stephanie Baker, Andy Schaudt, JC Freed, Spencer Joslin

I. PURPOSE OF THIS RESEARCH PROJECT
The purpose of this project is to learn more about driver education. The research team also wants to develop a set of best practices related to driver education.

II. PROCEDURES
Your child will be taking part in a survey and focus group, which should take about 80 minutes. During this time, your child will be asked questions and can share his/her opinions. The focus group will be audio recorded.

III. RISKS
There is very little risk involved in this study. The risks include your child feeling uncomfortable being audio recorded or sharing his/her opinions in front of researchers and other participants.

IV. BENEFITS
No promise of benefits will be made to your child to make him/her want to participate. Your child may enjoy taking part in the survey and focus group. Your child’s opinions may help in the development of best practices related to driver education.

V. EXTENT OF ANONYMITY AND CONFIDENTIALITY
The data we collect will be kept confidential. Your child’s name will not be connected with any comments s/he makes on the survey or in the focus group. For confidentiality reasons, we will not share your child’s results with you. Audio recordings will be transcribed and then erased. All other data we collect will be saved for at least 3 years and a decision to destroy the data will be made at that time. The data will be stored at the Virginia Tech Transportation Institute (VTTI).

The Institutional Review Board (IRB) may view this study’s data for auditing purposes. The IRB is responsible for the oversight of the protection of participants involved in research. Access to the data will be under the supervision of Stephanie Baker, Andy Schaudt, JC Freed, and Spencer Joslin (VTTI Research Team). Stephanie Baker or Andy Schaudt may use, or allow other VTTI researchers to access, data with no names attached for use in other IRB approved research projects.

VI. PAYMENT
Your child will be paid $40 for taking part in the survey and focus group. If your child decides to stop early, s/he will be given partial payment (e.g., $10 for 20 minutes completed). Your child will be paid in cash at the end of his/her participation in the survey and focus group.
VII. FREEDOM TO WITHDRAW
As a volunteer, your child may stop at any time. No one will be upset with your child if s/he does not want to answer a question or if your child decides s/he wants to stop. If your child chooses to stop early, s/he will be provided with a phone to contact you (parent/guardian).

VIII. APPROVAL OF RESEARCH
This project has been approved by the Institutional Review Board for Research Involving Human Subjects at Virginia Polytechnic Institute and State University. This form is valid for the period listed at the bottom of the page.

IX. CHILD ASSENT
Please talk about this study with your child before s/he decides if s/he wants to participate. We will also ask your child to give his/her assent to participate. Even if you say, “yes” your child can still decide later not to participate.

X. PARENT/GUARDIAN PERMISSION
By signing this parent/guardian permission form, you are acknowledging that you understand what is contained in this form, that you have had all of your questions answered, and that you give your child permission to participate. If your child participates in this study, remember your child is a volunteer and may stop at any time. Researchers will not be upset if your child decides to stop.

______________________________
Parent/Guardian Name (Print) Signature Date
______________________________
Researcher Name (Print) Signature Date

If you have any questions about this study, please contact:
Stephanie Baker, Project Manager
540-231-1092 or sbaker@vtti.vt.edu

If you have any questions about the protection of research participants in this study, please contact:
Dr. David Moore,
Chair of the Virginia Tech Institutional Review Board for the Protection of Human Subjects
(540) 231-4991
moored@vt.edu
Office of Research Compliance (Attn: IRB)
2000 Kraft Drive, Suite 2000, Blacksburg, VA 24061
Title of Project: Driver Education Case Study
Investigators: Stephanie Baker, Andy Schaudt, JC Freed, Spencer Joslin

I. PURPOSE OF THIS RESEARCH PROJECT
The purpose of this project is to learn more about driver education. The research team also wants to develop a set of best practices related to driver education.

II. PROCEDURES
You will be taking part in a survey and focus group, which should take about 80 minutes. During this time, you will be asked questions and can share your opinions. The focus group will be audio recorded.

III. RISKS
There is very little risk involved in this study. The risks include feeling uncomfortable being audio recorded or sharing your opinions in front of researchers and other participants.

IV. BENEFITS
No promise of benefits will be made to you to make you want to participate. You may enjoy taking part in the survey and focus group. Your opinions may help the development of best practices related to driver education.

V. EXTENT OF ANONYMITY AND CONFIDENTIALITY
The data we collect will be kept confidential. Your name will not be connected with any comments you make on the survey or in the focus group. For confidentiality reasons, we will not share your results with your parent/guardian. Audio recordings will be transcribed and then erased. All other data we collect will be saved for at least 3 years and a decision to destroy the data will be made at that time. The data will be stored at the Virginia Tech Transportation Institute (VTTI).

The Institutional Review Board (IRB) may view this study’s data for auditing purposes. The IRB is responsible for the oversight of the protection of participants involved in research. Access to the data will be under the supervision of Stephanie Baker, Andy Schaudt, JC Freed, and Spencer Joslin (VTTI Research Team). Stephanie Baker or Andy Schaudt may use, or allow other VTTI researchers to access, data with no names attached for use in other IRB approved research projects.

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VII. FREEDOM TO WITHDRAW
As a volunteer, you may stop at any time. No one will be upset with you if you do not want to answer a question or if you decide you want to stop. If you choose to stop early, you will be provided with a phone to contact a parent/guardian.

VIII. APPROVAL OF RESEARCH
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IX. PARENT/GUARDIAN PERMISSION
Please talk about this study with your parent/guardian before you decide if you want to participate. We will also ask your parent/guardian to give his/her permission for you to participate. Even if your parent/guardian says, “yes” you can still decide later not to participate.

X. PARTICIPANT ASSENT
By signing this participant assent, you are acknowledging that you understand what is contained in this form, that you have had all of your questions answered, and that you assent to participate. If you participate in this study, remember you are a volunteer and may stop at any time. Researchers will not be upset if you decide to stop.

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If you have any questions about this study, please contact:
Stephanie Baker, *Project Manager*
540-231-1092 or sbaker@vtti.vt.edu

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Investigators: Stephanie Baker, Andy Schaudt, JC Freed, Spencer Joslin

I. PURPOSE OF THIS RESEARCH PROJECT
The purpose of this project is to learn more about driver education. The research team also wants to develop a set of best practices related to driver education.

II. PROCEDURES
You will be taking part in a survey and focus group, which should take about 80 minutes. During this time, you will be asked questions and can share your opinions. The focus group will be audio recorded.

III. RISKS
There is very little risk involved in this study. The risks include feeling uncomfortable being audio recorded or sharing your opinions in front of researchers and other participants.

IV. BENEFITS
No promise of benefits will be made to you to make you want to participate. You may enjoy taking part in the survey and focus group. Your opinions may help the development of best practices related to driver education.

V. EXTENT OF ANONYMITY AND CONFIDENTIALITY
The data we collect will be kept confidential. Your name will not be connected with any comments you make. Audio recordings will be transcribed and then erased. All other data we collect will be saved for at least 3 years and a decision to destroy the data will be made at that time. The data will be stored at the Virginia Tech Transportation Institute (VTTI).

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VI. PAYMENT
You will be paid $40 for taking part in the survey and focus group. If you decide to stop early, you will be given partial payment (e.g., $10 for 20 minutes completed). You will be paid in cash at the end of your participation in the survey and focus group.
VII. FREEDOM TO WITHDRAW
As a volunteer, you may stop at any time. No one will be upset with you if you do not want to answer a question or if you decide you want to stop.

VIII. APPROVAL OF RESEARCH
This project has been approved by the Institutional Review Board for Research Involving Human Subjects at Virginia Polytechnic Institute and State University. This form is valid for the period listed at the bottom of the page.

IX. PARTICIPANT CONSENT
By signing this participant assent, you acknowledge that you understand what is contained in this form, that you have had all of your questions answered, and that you assent to participate. If you participate in this study, remember you are a volunteer and may stop at any time. Researchers will not be upset if you decide to stop.

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If you have any questions about this study, please contact:
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540-231-1092 or sbaker@vtti.vt.edu

If you have any questions about the protection of human research participants regarding this study, please contact:
Dr. David Moore,
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(540) 231-4991
moored@vt.edu
Office of Research Compliance (Attn: IRB)
2000 Kraft Drive, Suite 2000, Blacksburg, VA 24061
Title of Project: Driver Education Case Study
Investigators: Stephanie Baker, Andy Schaudt, JC Freed, Spencer Joslin

I. PURPOSE OF THIS RESEARCH PROJECT
The purpose of this project is to learn more about driver education. The research team also wants to develop a set of best practices related to driver education. During the interview we will ask for your opinions regarding the materials (i.e., sharing the road with heavy trucks) we provided to your class.

II. PROCEDURES
You have been invited to take part in an interview. The interview will last no more than 30 minutes and will be audio recorded. The interview will be an informal discussion where you will have the opportunity to share your thoughts and opinions about the sharing the road materials we provided to your class.

III. RISKS
There is minimal risk involved in this study. The minimal risks include: possible minor discomfort from expressing your opinions to researchers and being audio recorded.

IV. BENEFITS
No promise or guarantee of benefits will be made to encourage your participation. You may find the discussion interesting and your opinions may influence the development of best practices for driver education regarding sharing the road with heavy trucks.

V. EXTENT OF ANONYMITY AND CONFIDENTIALITY
The data we collect will be kept confidential. Your name will not be connected with any comments you make. Audio recordings will be transcribed and then erased. All other data we collect will be saved for at least 3 years and a decision to destroy the data will be made at that time. The data will be stored at the Virginia Tech Transportation Institute (VTTI). The Institutional Review Board (IRB) may view this study’s data for auditing purposes. The IRB is responsible for the oversight of the protection of participants involved in research. Access to the data will be under the supervision of Stephanie Baker, Andy Schaudt, JC Freed, and Spencer Joslin (VTTI Research Team). Stephanie Baker or Andy Schaudt may use, or allow other VTTI researchers to access, data with no names attached for use in other IRB approved research projects.

VI. COMPENSATION
You will be paid $30 for taking part in the interview. If you decide to stop early, you will be given partial payment (e.g., $10 for every 10 minutes completed). If this interview takes place on-site, you will be paid in cash. If this interview takes place over the phone, you will be paid in the form of a check that you should receive within 30 days of your participation.
VII. FREEDOM TO WITHDRAW
As a voluntary participant in this study, you are free to withdraw at any time for any reason. No penalties will be assessed if you choose to withdraw at any point from the study. You are also free to refrain from answering any questions that you would rather not answer.

VIII. APPROVAL OF RESEARCH
This research project has been approved, as required, by the Institutional Review Board for Research Involving Human Subjects at Virginia Polytechnic Institute and State University.

IX. PARTICIPANT’S PERMISSION
I have read and understand the requirements, procedures, and conditions of this project. I have had all of my questions answered. By providing my verbal consent at the start of the interview, I voluntarily agree to participate in this study and have my voice recorded during the interview. If I participate in this study, I understand that I may withdraw at any time without penalty. I agree to abide by the rules of this project.

If you have any questions about this study, please contact:
Stephanie Baker, Project Manager
540-231-1092 or sbaker@vtti.vt.edu

If you have any questions about the protection of human research participants regarding this study, please contact:
Dr. David Moore,
Chair of the Virginia Tech Institutional Review Board for the Protection of Human Subjects
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Office of Research Compliance (Attn: IRB)
2000 Kraft Drive, Suite 2000, Blacksburg, VA 24061
Attention Driver Ed Students

THE VIRGINIA TECH TRANSPORTATION INSTITUTE (VTTI) IN BLACKSBURG, VIRGINIA IS RECRUITING STUDENTS FOR A DRIVER EDUCATION STUDY.

PARTICIPATION WILL INVOLVE A SHORT SURVEY AND GROUP DISCUSSION ABOUT DRIVER ED.

PAYMENT FOR PARTICIPATING IS $40.

IF YOU ARE INTERESTED, PLEASE SHARE THIS FLYER WITH YOUR PARENT/GUARDIAN. IF YOU ARE 18, YOU MAY CONTACT MS. BAKER DIRECTLY.

Deadline for contacting Ms. Baker about the study is (DATE).

What is going on?
Survey and Group Discussions

For how long?
One hour and 20 minutes

Where?
[Location Redacted]

Stephanie Baker
Project Manager

Virginia Tech Transportation Institute
Contact Information Redacted
APPENDIX D. CONTENT OF CONDITIONS

To determine which sharing-the-road tips were going to be covered in the truck hands-on experience and follow-up survey, the NSTSCE research team reviewed the textbook the students were using and the CVSA video they were going to watch to find out which key sharing-the-road tips were covered by each media (i.e., textbook and video). The research team found that there were five key sharing-the-road tips covered by the textbook and video including:

- Don’t Hang Out in the No-Zone
- Maintain a Safe Following Distance
- Don’t Get Squeezed
- Properly Pass Trucks
- Don’t Cut Trucks Off

These topics were then used to create the hands-on experience. In this way, students surveyed for retention were asked topics that had been covered in class, no matter what condition they experienced. A few topics were covered in the textbook that were not included on the video and vice versa. For example, the textbook covered what to do when meeting a large truck on a narrow, two-lane road and the video covered the need to pull far off the highway if your car breaks down. While these issues are important, they were not integrated into this study as researchers only wanted to include topics that were covered in both the textbook and the video. Below is a detailed description of each media (textbook, video, and truck experience) and how it covered the key sharing-the-road tips that were part of this study.

**Textbook**

The textbook used in this study was Pearson’s *Drive Right* (11th edition). The section on sharing the road with trucks spanned three pages. The section covered heavy-vehicle characteristics, the No-Zone, following large trucks, trucks making right turns, passing and being passed by trucks, and meeting a large truck. The section also incorporated pictures and diagrams including a diagram of the No-Zones and a diagram of a car attempting to pass a truck on the right and getting squeezed between the truck and the curb. Below is a summary of how the textbook addressed each of the key sharing-the-road tips covered in this study.

**Don’t Hang Out in the No-Zone**

In the textbook there is a section titled “The No Zone.” The section covers several points about the blind spots or No-Zones around a truck where a truck driver may be unaware of the presence of a car. The textbook notes that there are No-Zones on the side, rear, and front of a truck. It notes that the front No-Zone can extend more than 20 feet and that the right-side blind spot is the most dangerous. The textbook also describes how “if you can’t see the truck driver in the truck’s mirrors, the truck driver can’t see you” (*Drive Right*, p. 219).

The book includes a diagram of the truck No-Zones that shows a truck from an overhead angle with the No-Zones shaded around the truck. Text is included with the figure stating, “Truck drivers have four large blind spots. If you are in a truck’s no zone, the driver cannot see you” (*Drive Right*, p. 219).
Maintain a Safe Following Distance
The textbook includes a section titled “Following Large Trucks.” The section covers how following a large truck can cause line-of-sight restrictions and increases the chances of a crash if the truck brakes suddenly. To maintain a safe following distance, the textbook recommends to “Increase your following distance to more than four seconds and stay well out of the rear no zone” (*Drive Right*, p. 219).

Don’t Get Squeezed
Under a section titled “Trucks Making Right Turns,” the textbook covers the concept that trucks make wide right turns and passing a turning truck is dangerous. The book states:

When following large trucks, be aware that they require plenty of space to make a turn. In order to turn right, a truck usually starts by swinging out to the left. Drivers of these vehicles cannot see other drivers directly behind or beside them. Always watch a truck’s turn signals and leave plenty of room for the truck to make its turn. Trying to squeeze in between the truck and the curb is an invitation for disaster. (*Drive Right*, p. 219)

The textbook also provides a figure showing a truck clearly squeezing a car attempting to pass a truck on the right side at an intersection.

Properly Pass Trucks
The textbook includes a section called “Passing and Being Passed.” The section covers proper passing procedures. The book states:

When you are in a position to pass, check your front and rear zones and your blind spots. Then signal a lane change. Reduce your risk by using these two good habits when you pass:

- Stay in lane position 2 and complete your pass carefully and quickly. Don’t linger in the no zone.
- Signal and return to your lane only after you can see at least one headlight in your rearview mirror. Don’t slow down! (*Drive Right*, p. 220)

The textbook included several other points related to passing. For example, the textbook mentioned that it is safer to pass a truck going uphill than a truck going downhill. The issue regarding passing trucks going uphill was included in the supplemental practices document (Appendix A) of this report as an important heavy-vehicle characteristic (i.e., trucks usually gain speed going downhill and decrease speed going uphill).

Don’t Cut Trucks Off
The textbook did not have an entire section dedicated to not cutting off trucks. The concept was covered under the sections on No-Zones and proper passing. The textbook indicated that the front No-Zone of a truck “can extend more than 20 feet” (*Drive Right*, p. 219). The textbook also said that when pulling in front of a truck after passing “signal and return to your lane only after you can see at least one headlight in your rearview mirror. Don’t slow down!” (*Drive Right*, p. 220).

It is notable here that the NSTSCE research team felt, based on reviewing other sources and from staff expertise, that light-vehicle drivers should see more than just one headlight before pulling in
front of a truck. During the truck demonstration, the research team recommended that the students see the entire truck in the rearview mirror (top to bottom) before pulling back in front of a truck.

**DVD**
The DVD used in this study was called *Teens and Trucks* and was produced by the Commercial Vehicle Safety Alliance (CVSA). The video is approximately 11 minutes long and covers heavy-vehicle characteristics and gives five basic driving habits to stay safe around trucks. The five driving habits include don’t cut off trucks, stay out of blind spots or No-Zones, maintain a safe following distance, understand trucks make wide turns, and if your car breaks down pull off the highway as far as you can. The DVD goes over each of the five driving habits and uses video clips of trucks and cars on the roadway to demonstrate the importance of each driving habit. Below is a summary of how the DVD addressed each of the key sharing-the-road tips covered in this study.

**Don’t Hang Out in the No-Zone**
The DVD included a section called “Blind Spots.” The section ran for approximately 2 minutes. An example of how the section describes the front and side blind spots is covered below:

Large truck and bus drivers constantly indicate that one of the most dangerous things they see on the road is passenger cars moving into their blind spots. Truck and bus drivers cannot monitor and be aware of all traffic around them due to several blind spots located on all sides of their rig. Research indicates a significant number of crashes involving cars and large trucks occur in blind spots or No-Zones. The first No-Zone is directly in front of the hood of a large truck. Long hoods can create blind spots up to 20 feet in front of the bumper, easily enough room for a small passenger car to move into without being seen. Each side of a large truck also has a No-Zone. The left side extends from the driver’s door to the middle of the trailer; passenger cars should move through this zone steadily and not linger. The right side No-Zone is much larger; it extends from the front of the truck all the way to the rear and three lanes over. Truck drivers are trained that this is one of the most dangerous areas around the truck and car drivers should avoid it when possible. (CVSA Video 03:33–04:33)

The DVD explained the rear No-Zone as follows:

Another No-Zone or blind spot is directly behind the trailer where a car driver’s visibility is severely limited. When drivers travel in a trucks blind spots or No-Zones they put themselves at risk because they cannot be seen by the truck driver. A good rule is to make sure that you can see the truck driver in one of his or her mirrors so they can see you. When you are following a large truck increase your following distance to allow clear site distance ahead. Stay far enough back so you can see the side view mirrors of the truck. If you can’t see one of the driver’s side view mirrors then the driver can’t see you. Minimize time in the No-Zones and share the road. (CVSA Video 04:57–05:34)

This section on blind spots included a diagram of a truck with the No-Zones shaded around the truck. It also shows cars moving through these blind spots. For example, when describing the rear No-Zone, the video shows a car moving into the rear No-Zone of a truck. It then describes
the importance of avoiding blind spots and that a way to do this is to make sure you can see the truck driver in the truck’s rear-view mirrors.

**Maintain a Safe Following Distance**

The DVD included a section titled “Following Distance.” The section ran for approximately 80 seconds. An excerpt from the video on following distance is provided below:

> Following large trucks or buses at a proper distance is important. If you follow too closely, the truck size will prevent you from viewing the road ahead. The truck’s brake lights may be your first indication of a hazard and limit your response time. Try to position your vehicle so you can see the truck driver’s side mirrors, that way he can see you as well. (CVSA Video 05:39–5:59)

The DVD also described the dangers of following too closely.

Another danger for passenger car drivers is striking the back of a large truck. This type of crash can cause the rear of the truck trailer or other areas of the tractor or trailer to impact the passenger vehicle in areas that are catastrophic to the occupants. Be sure to allow a space between the back of the truck and your car. Trucks are able to straddle debris in the road while you may not have enough time to react. Some drivers think drafting a large truck is safe and saves gas. Actually, this can result in a traffic ticket and drastically reduces visibility for the car driver. If the truck changes lanes or slows to avoid an obstacle, the car driver may not have enough time and space to avoid a crash. Following at a safe distance is always important. Sharing the road with trucks and buses requires leaving enough space to be safe. (CVSA Video 06:10–6:57)

The section on following distances showed video clips of a truck’s side-view mirrors, cars following trucks at various distances, and images of the type of catastrophic accidents that can occur when a car strikes the back of a truck.

**Don’t Get Squeezed**

The DVD touched on the topic of not getting squeezed in a section of the video titled “Turns.” The section covers how trucks, due to their length, will often move into adjacent lanes when making a turn to avoid hitting a curb. An excerpt from the section on turns and how passing a turning truck is dangerous is provided below:

> When making a right turn, large trucks will often move left prior to making the turn. Inattentive drivers may see this as a lane change to the left, not the beginning of a right turn and attempt to pass on the right. Look for the right turn signal on the trailer before attempting to pass on the right. Passing any large truck on the right can be risky. Occasionally, truck drivers will fail to signal or the trailer’s signal light may be inoperative. Safety drivers will wait to assess the truck driver’s intent before passing. If a truck is stopped at or approaching an intersection never attempt to cut in along the right side as the driver first maneuvers left or you will find yourself sandwiched between the turning truck and the curb. (CVSA Video 07:26-08:01)

The DVD also covers the dangers of passing a right-turning truck on the left and the importance of staying behind white stop lines at intersections to avoid getting squeezed by turning trucks. The video shows images of cars attempting to pass on the left and right as well as sitting over the...
stop lines. The video describes, while showing these images, how dangerous passing a turning truck can be for cars. This section of the video is approximately 2 minutes.

**Properly Pass Trucks**
The DVD did not have an entire section dedicated to properly passing trucks, but the concept was covered under the sections “Don’t Cut Off Trucks” and “Blind Spots.” The section on “Don’t Cut Off Trucks” covered points about signaling lane changes well in advance and making sure to leave enough space between your car and a truck before pulling back in front of a truck after passing. The section on “Blind Spots” covered the points that passing on the right is dangerous and that cars should pass trucks steadily on the left and not linger.

**Don’t Cut Trucks Off**
The DVD included a section called “Don’t Cut Off Trucks.” The section covered how “Cutting off trucks is dangerous” and “Sharing the road saves lives” (CVSA Video, 03:22–03:25). For example, the video noted that:

Trucks and buses can take twice as long as cars to stop. Often passenger cars pass trucks and move in front of the truck too quickly without leaving enough room for the truck to maintain a safe following distance. Truck drivers are trained to maintain at least three seconds between themselves and traffic in front of them. At 65 mph, that is about 300 feet, the length of a football field. When you pass a truck and move in front of it without leaving enough room, you create an unsafe situation and actually break the law. Most states have a traffic law regarding lane usage or passing that requires you to leave a safe distance between your car and the vehicle you pass before moving into their lane. (CVSA Video, 02:21–02:59)

The DVD also noted, “Car drivers can help truck drivers anticipate traffic conditions by signaling lane changes well in advance. Sharing the road is always safer than ignoring other vehicles and pushing your way through traffic” (CVSA Video, 03:04–03:15).

The video included clips of cars cutting off trucks as well as cars pulling in front of trucks at a safe distance ahead. It also shows images of cars that have been hit due to cutting off a truck. The section on cutting off trucks ran for about 90 seconds.

**Truck**
The truck hands-on experience was broken in two parts. The first was an approximately 20-minute presentation given by a researcher that holds his CDL and has experience driving trucks. The presentation covered sobering facts about what can happen if light vehicles do not drive safely around heavy trucks, heavy-vehicle characteristics (e.g., truck size, weight, stopping distance), and introduced the five key sharing-the-road tips. The second portion of the hands-on experience was an approximately 40-minute demonstration that allowed students to sit in the cab of a truck as well as walk around the truck and learn about each of the five sharing-the-road tips. For detail on the presentation and hands-on experience see the supplemental practices document (Appendix A). Below is a summary of what was covered during the truck demonstration for each of the five sharing-the-road tips.
Don't Hang Out in the No-Zone
During the truck demonstration, students were taught about the front, back, and side No-Zones, or blind spots. Light vehicles were placed in the front, left, and rear blind spots and two tents were placed in the right blind spot. Students were shown the blind spots from various angles while standing around the truck as well as from the perspective of the driver (i.e., sitting in the truck cab). Examples of the points researchers made to the students during the demonstration regarding these blind spots is provided below.

- **Right Blind Spot**
  - “Take a moment and think about how big those tents are that you were standing under. That is a HUGE area where the truck driver can’t see you at all. When you need to pass a heavy truck, DON’T pass on the RIGHT. It is the most dangerous area to try and pass!”

- **Left Blind Spot**
  - “You can’t see the car because the car is in the left blind spot. The blind spot on this left side of the truck is small and located here along the cab. It is okay to pass on this left side, just don’t linger.”

- **Front Blind Spot**
  - “There is a car located directly in front of the truck in the front No-Zone. Do not cut into that No-Zone. If you cut in there and hit the brakes, the truck driver won’t see you and you will cause a crash. Look for the entire front of the truck cab (bumper to the top of cab) in your rearview mirror before you pull back in. See that car in the passing lane ahead? That is the minimum proper passing distance for merging in front of a truck.”

- **Rear Blind Spot**
  - “Following this close behind a truck is dangerous for lots of reasons. You can’t see what’s in front of the truck on the road ahead. If the truck straddles debris in the road, like a truck tire, you won’t see it in time to safely avoid hitting it.”
  - “Or if the truck driver brakes and you are following this close, you won’t have enough time and space to avoid crashing into the back of the truck.”
  - “Another problem with being in this blind spot is that some trucks carry cargo that may move and fall from the truck onto the road in front of you leaving you no time or space to avoid an accident. So stay back… it is unsafe to be this close.”

Maintain a Safe Following Distance
The truck students were taught about the importance of maintaining a safe following distance. They were told the points regarding the dangers of the rear blind spot, shown a car in the rear blind spot of a truck, and shown the distance they should be back when following a truck. For instance, during the truck demonstration students were told:

- “If you recall there is a car about 80 feet behind the truck. That car is in the rear No-Zone. As a truck driver, you can’t see someone that is in that rear No-Zone or blind spot. Trucks don’t have rear-view mirrors.”
- “A good way to know if you are far enough back is to look for the truck driver’s mirrors as you are following. To do this properly, first be sure your car and the truck are both centered in the lane. Once you are centered, look for the mirrors on the left side of the truck. And remember if you don’t see his side mirrors, he doesn’t see you.”

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Don’t Get Squeezed
During the hands-on experience students were told about how trucks make wide turns. Students were told while standing behind the heavy truck that “It is never safe to pass a truck on the right. The right side has the largest blind spot around a truck. And at intersections, such as stoplights, it is especially risky because heavy trucks swing left before they turn right so they can get their trailer around the corner safely. If you try to squeeze between a truck and the curb you can get crushed. Stay back and wait. Let the truck make its turn.”

Properly Pass Trucks
During the truck demonstration students were told about how to properly pass a truck. A researcher went over these points while walking the students around the left side of the truck. The researcher pointed out the car in the left blind spot and the car in the front blind spot while going over the following points about properly passing:
- “Pass a truck in the left lane because that is the side where the truck driver is sitting. He can see better on his left side. The left blind spot is much smaller than the right blind spot. So the BEST place to pass is on the left at a steady speed, just don’t linger alongside the truck.”
- “Before you pull in front of a truck, signal your intent to change lanes AND as part of safe scanning, glance in your mirrors to see if you have enough space. You want to see AT A MINIMUM the entire front of the truck in your rearview mirror (bottom of bumper to top of cab). You must leave plenty of space between you and the truck before you pull in front. Never cut into the front No-Zone [point to car in the front No-Zone], or you can cut your life short. Then once you safely pass, maintain your speed.”
- “The car is in the truck’s front No-Zone. The front No-Zone of a truck can extend more than 20 feet. Imagine you are driving down the road and you cut in front of a truck, putting yourself in the front No-Zone. A moment later, a deer runs into the road and you slam on your brakes. The truck will not have time to stop and you will have an approximately 80,000 lb. truck crashing into the back of your car. Don’t put yourself and others in harm’s way—stay out of the front No-Zone.”

Don’t Cut Trucks Off
As described in the section on properly passing trucks, during the truck experience students were shown a car positioned in the front blind spot. Students were told, “Before you pull in front of a truck, signal your intent to change lanes and as part of safe scanning, glance in your mirrors to see if you have enough space. You want to see at a minimum the entire front of the truck in your rearview mirror (bottom of bumper to top of cab). You must leave plenty of space between you and the truck before you pull in front. Never cut into the front No-Zone [point to car in the front No-Zone], or you can cut your life short. Then, once you safely pass, maintain your speed.”
APPENDIX E. SURVEY QUESTIONS

1. What is your age? __________

2. What is your gender? (Please check one)
   _____ Male
   _____ Female

3. What level driving permit do you currently hold? (Please check the permit level that applies)
   _____ Level 1 Instructional Permit
   _____ Level 2 Intermediate License
   _____ Level 3 License (Full Privilege)

4. When did you receive your Level 1 Instructional Permit? If you cannot recall the exact date, please provide the month and year.
   Month ___________ Day ___________ Year ____________

5. Have you participated in any other formal driver education other than [School Name Redacted] Public High School’s Driver Education Course? If so, please check all that apply.
   _____ Private school driver education course (classroom)
   _____ Private school driver education course (behind the wheel)
   _____ On-line driver education course
   _____ Other

   If you checked any of the above, list the name(s) of the education program(s) ______________________

6. What types of roads do you drive on in a typical week? (Please check all answers that apply)
   _____ Rural routes or local roads (for example, [Street Name Redacted])
   _____ Highway (for example, [Highway Name Redacted])
   _____ Interstate (for example, [Interstate Name Redacted])

7. Give an estimate of how many days you drive during a typical week. (Please check the answer that applies)
   _____ I don’t drive during a typical week
   _____ 1 day
   _____ 2 days
   _____ 3 days
   _____ 4 days
   _____ 5 days
   _____ 6 days
   _____ 7 days
8. Give an estimate of how many minutes you drive during a typical day. (Please check the answer that applies)
   _____ Less than 15 minutes
   _____ 15 to less than 30 minutes
   _____ 30 to less than 45 minutes
   _____ 45 to less than 60 minutes
   _____ More than 60 minutes

9. Give an estimate of how many times you pass a heavy truck while driving during a typical day. (Please check the answer that applies)
   _____ Never
   _____ 1-2 times a day
   _____ 3-4 times a day
   _____ 5-6 times a day
   _____ More than 6 times a day

10. Give an estimate of how many heavy trucks you encounter while driving during a typical day. The trucks can be in the same or oncoming lane of traffic. (Please check the answer that applies)
    _____ No heavy trucks
    _____ 1-2 heavy trucks
    _____ 3-4 heavy trucks
    _____ 5-6 heavy trucks
    _____ More than 6 heavy trucks

11. Give an estimate of how many times you find yourself driving behind a heavy truck during a typical day. (Please check the answer that applies).
    _____ Never
    _____ 1-2 times a day
    _____ 3-4 times a day
    _____ 5-6 times a day
    _____ More than 6 times a day

12. How do you think you learn best about driver education? (Please check ONE answer that BEST describes your learning preference)
    _____ I learn by reading a textbook/handout and writing notes
    _____ I learn by listening to a teacher/speaker and discussing it with others
    _____ I learn by looking at diagrams, flow charts, pictures, and graphs
    _____ I learn by example and experience (seeing someone adjusting mirrors and then doing it myself)
    _____ I learn by watching videos showing real driving situations
    _____ Other

    If you checked “other”, describe the way you think you learn best about driver education _______________________
13. True or False? Truck drivers have better visibility around their vehicle than light-vehicle drivers.
   _____ True
   _____ False

14. Which sentence below describes the BEST way you can safely share the road with heavy trucks? (Please choose one sentence)
   _____ When pulling in front of a heavy truck, signal your lane change well in advance and leave plenty of space
   _____ Give 15 feet of space (1 car length) when merging in front of a heavy truck
   _____ Pass a heavy truck at an intersection when the truck is not signaling a turn because truck drivers always signal the way in which they turn

15. The heavy truck no-zone (truck blind spots or areas where a driver cannot see other motorists) contains the following areas around the truck. (Please choose one option from the list)
   _____ The right and left sides of a truck only
   _____ The front and back of a truck only
   _____ The right side and back of a truck only
   _____ The front, back, left and right sides of a truck

16. True or False? Following a large truck too closely can prevent you from seeing what is in front of the truck on the road ahead.
   _____ True
   _____ False

17. When you are attempting to pass a heavy truck, which area around the heavy truck is the most dangerous? (Please choose one option from the list)
   _____ Front
   _____ Right
   _____ Left
   _____ Behind
   _____ All areas above are equally dangerous

18. At a roadway intersection, why is it common for a heavy truck to initially turn left while signaling a right turn? (Please choose one option from the list)
   _____ Truck drivers are notoriously bad at using their turn signals properly
   _____ Truck drivers prefer to make right turns from left lanes only
   _____ Truck drivers are making space available on the right side for light vehicles to pass
   _____ Truck drivers swing left prior to a right turn so that their trailer can make it around the corner safely

19. Why is it unsafe to follow too closely behind a heavy truck? (Please choose the BEST option from the list)
   _____ a) It will increase your vehicle’s fuel consumption.
b) Cargo may shift and fall from the truck onto the road in front of your vehicle.
c) If the driver brakes the truck you may not have enough time and space to avoid crashing into the truck.
d) Both “a” and “b”
e) Both “a” and “c”
f) Both “b” and “c”

20. The front area of the heavy truck no-zone can extend up to ____? (Please choose one option from the list)
   ___ 9 feet
   ___ 10 feet
   ___ 14 feet
   ___ 20 feet
   ___ 25 feet

21. Which is the BEST approach to passing a heavy truck? (Please choose one option from the list)
   ___ Heavily accelerate your vehicle until you have completely passed the heavy truck
   ___ Pass the heavy truck steadily and do not linger
   ___ Do not ever pass a heavy truck
   ___ Pass the heavy truck in the left lane while moving steady and do not linger
   ___ All of the above

22. True or False? If you can’t see the truck driver’s mirrors, the truck driver can’t see you.
   ___ True
   ___ False
APPENDIX F. STUDENT FOCUS GROUP GUIDE

The following questions are primary probes. Secondary probes may be used and will depend upon the issues that arise during the focus group discussion. Secondary probes will not stray from the general line of questioning presented here.

I. Greetings and Informed Consent (5 minutes)
- Participants will be greeted & names checked to ensure paperwork is complete.
- Participants that have not already filled out the Permission/Assent/ICF will be given the appropriate forms and may voice any concerns/questions to a researcher.

II. Entrance Survey (10 minutes)
- Hand out survey to students who have finished assent/permission or ICF.

II. Facilitator Introduction and Ground Rules (5 minutes)
Hello, our names are (NAMES). We are researchers at the Virginia Tech Transportation Institute. Thank you for taking the time to come and share your thoughts/opinions with us.

PURPOSE OF THE MEETING
- Purpose of this meeting is to discuss issues related to driver education.
- We are going to ask you some questions and need you to respond openly and honestly. There are no right or wrong answers—we just want your opinions.

CONFIDENTIALITY
- We are audio recording this discussion. Please speak loudly and clearly so that we can get a good recording of your comments.
- We will make a transcript, but what you say will not be linked to your name.
- If you feel uncomfortable, you can refuse to answer a question or you may stop.

LOGISTICS
- This focus group will run for about 1 hour, we are very appreciative of the time that you are spending and will honor it by not running over.
- Bathrooms are located (DIRECTIONS). Refreshments are at the back. If you would like something to eat or drink please help yourself now before we get started.
- Please silence phones and only take a call if it is important (for instance, if your parent or guardian is calling). This will help us to avoid distractions and finish on time.

GROUND RULES
- Please let me know if you are uncomfortable with any of these rules. If you are ok with these rules, let's agree to follow them during this meeting.
  - Listen to each other
  - Everyone participate fully
  - No side conversations
  - Spelling does not count
  - Don’t criticize others
  - Finish on time
III. Group Introductions and Warm-up (5-10 minutes)

Facilitator Question:
- I’d like to go around the room and have you all give me your names and describe to me how you learn best about driver education: for instance, do you learn best by:
  - Reading a textbook/handout and writing notes
  - Listening to a teacher/speaker and discussing it with others
  - Looking at diagrams, flow charts, pictures, and graphs
  - Example and experience (seeing someone adjusting mirrors & then doing it myself)
  - Watching videos showing real driving situations
  - Other
- Please tell me your Name and your learning preference
  - Learning preference—describe?

Activity: Put up a sheet of flip chart paper with examples. Go around the room and as each person speaks, mark learning preference on flip chart. Do not note names. Have the students describe their learning style. Tell them it is okay if they don’t fit any of these examples and ask them to describe how they learn best in their own words.

IV. Sharing the road (30 minutes)

Facilitator Question/Directions (10 minutes): BRAINSTORM
- Now I would like to discuss what, if anything, you learned in your driver’s education class about how to safely share the road with trucks.
- Please take a moment and think about what you learned.
- Take a few sheets of sticky paper and write one thing on each sheet. Please keep each comment to 5 words or less and write BIG (show example: WRITE THIS BIG).
- Use as many sheets as you need. It is o.k. if you only use 1 or if you use 10.
- Take your time and remember there are no right or wrong answers.
- Now I am going to go around the room and ask each of you what you learned in driver education about how to safely sharing the road with trucks.
- It is ok if we have duplicates. Duplicates show me a lot of people learned about it.
- Are there any more ideas?

Activity: Hand out pens and sticky pads. After everyone has written his/her ideas, collect ideas in a round robin fashion and place them on the wall. Continue to ask for ideas until all have been collected and posted. As collect each idea, if one is unclear ask for clarification. After everyone is done, ask if anything is missing from the list or if anyone wants to add any ideas that s/he forgot.

Facilitator Question/Directions (5 minutes): CLUSTER
- Now I’d like you to help me cluster these into common ideas.
- Lets do this activity silently.
- If one idea doesn’t fit into a group, that is ok, just put it out to the side.
• Don’t argue—just keep sorting until you are happy with the groupings.

**Activity:** Have group come up and silent sort.

**Facilitator Question/Directions (5 minutes): TITLE**
• Let’s give these ideas/clusters a title.
• What is common about these ideas? Is anything out of place? Is anything missing?
• Things can be unique and don’t have to fit nicely into a group.

**Activity:** Have group give each cluster a title. Try to open discussion.

**Facilitator Question/Directions (10 minute): CLUSTER DISCUSSION**
• Now that we have these groups or clusters, I want to discuss them.
• Can you describe to me in more detail what you learned about *(example: “Stay out of No-Zone”)*? *What is the No-Zone? Why do you need to stay out of it?”*
• How did you learn this information? Do you remember?

**Activity:** Go through each cluster and have them discuss what they learned about the clusters. Note on cluster if they say DVD, textbook, truck driver, etc.

*Should be about 1 hour*

**V. MEDIA (10-15 minutes):**

**Facilitator:**
• Your class was given information about sharing the road with trucks using *(textbook/manual; DVD; truck/driver)*. I want you to take this sticky dot and tell me how well the *(textbook/manual; DVD; truck/driver)* helped you understand how to share the road with trucks. We want you to give the *(textbook/manual; DVD; truck/driver)* a grade.

**Definitions:**
- Unhelpful: providing no assistance or not serving a useful function (useless)
- Helpful: providing assistance or serving a useful function (useful)

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- We want your **honest opinion**: it is okay to say that the *(textbook/DVD/hands-on experience)* was, “Very unhelpful” or “Very helpful” or you may think it is somewhere in between.
- Take a sticky dot, come over to the chart, give the *(media format)* a grade.

**Activity:** Post chart. Show them how the scale works. Let them put their dot on the chart. If they were exposed to more than one media format *(i.e., textbook and DVD)* then put up two charts.

**Facilitator:**
• Looking at the chart, it seems like many of you think the *(media format)* was *(helpful/unhelpful, etc.)*.
• Why do you think this is the case? What was helpful/unhelpful about (textbook, DVD, truck/driver)?
• What do you think would have helped you better understand the information on sharing the road with heavy trucks.

**Activity:** Allow the kids to discuss what was helpful/unhelpful about the media format (i.e., textbook, DVD, truck/driver). Mark comments on flip chart paper.

**Note:** If more than 15 minutes remains at this point show ‘Sharing the Road with Heavy Trucks’ DVD. If time allows explain to the students the key points about sharing the road and tell them a bit more about the study.

**Closing/Payment (Leave 5 minutes for payment):**
• Thank all the students for their time and contributions!
• Have each person sign the payment forms, and hand them the cash.
• Make sure none of the students needs to borrow a phone to call parent/guardian.

*Total Time: 1 hour and 20 minutes*
APPENDIX G. TEACHER INTERVIEW

The following questions are primary probes. Secondary probes may be used and will depend upon the issues that arise during the discussion. Secondary probes will not stray from the general line of questioning presented here.

- **Secure Verbal Consent:** Before we get started, do you have any questions about the consent information you received or the study in general? (Answer questions). Okay, do I have your consent to continue and record the interview?

1. Do you think the (DVD, truck/driver) was an effective way of teaching students about sharing the road with heavy trucks? Please explain.

2. Prior to our intervention (DVD, truck/driver) how were you teaching this topic (i.e., sharing the road with heavy trucks)?

3. In your opinion, was our intervention an improvement on what you were doing before? Please explain why or why not.

4. What did you like/dislike about the (DVD, truck/driver)?

5. Was this intervention easy/hard to implement? Please explain.

6. What would you change, if anything, about the (DVD, truck/driver)?

7. Is there anything more you would like to share about the (DVD, truck/driver)?
APPENDIX H. ADAPTED FRAMEWORK ANALYSIS APPROACH

The approach used to review and summarize the focus group discussions and activities was an adaption of framework analysis, a methodology developed during the 1980s at the National Centre for Social Research in Britain.\(^{(7)}\) Several sources were used for the review, including the results of student activities (i.e., rating the teaching methods, writing on Post-it\(^{®}\) notes during brainstorming), as well as researcher notes and transcripts. The steps taken by the research team to conduct the review of each focus group activity (i.e., learning preferences, brainstorming, and rating) were as follows:

1. **Determine Focus**: NSTSCE researchers determined that the focus of the qualitative analysis would be the following for each activity:
   a. Learning Preferences: participant comments related to learning preferences for driver education.
   b. Brainstorming Sharing-the-road Information: Post-it\(^{®}\) notes collected during brainstorming and participant comments related to key sharing-the-road information.
   c. Ratings: Participant ratings for each teaching method and related comments.

2. **Familiarization**: Transcripts were reviewed along with the results of student activities. Student activities and researcher handwritten notes were reviewed for the second truck group.

3. **Identifying Thematic Framework**: A review of each data set was conducted and themes were identified. In the case of rating the teaching method, subthemes were created, as they were useful in understanding student comments. Each set of themes and subthemes is listed below.
   a. Learning Preferences Themes: Listening and Discussion, Example and Experience, etc.
   b. Brainstorming Themes: Don’t Cut Trucks Off, Maintain a Safe Following Distance, etc.
   c. Rating Themes: Textbook, DVD, Truck Experience
      i. Rating Subthemes: Helpful, Unhelpful, and Ways to Improve

4. **Indexing**: The themes and subthemes were arranged in logical order to create an index. The index was applied to the data set, and relevant comments related to each theme or subtheme were identified and highlighted.

5. **Charting**: All the indexed comments were arranged into Microsoft\(^{®}\) Excel\(^{®}\) spreadsheets based on key themes and subthemes and sorted.

6. **Interpretation**: The themes and subthemes captured and detailed in the charts were used to better understand student perspectives. Some participant comments are included in the results section of this report to illustrate student perspectives.


