Text Set 7

Crash

Grouping Sequence: Whole class, pairs, whole class. For the extension: pairs, whole class

The relationship between American teenagers and cars is emotional and complex. Even though getting your driver's license doesn't seem to have the urgency of yore (see page 40), most kids still see it as a rite of passage and the ticket to a kind of freedom that's not obtainable otherwise. You've got to get away from those parents, the more literally and rapidly the better. Smoking tires preferred. But car crashes are also the leading cause of death among American teens. Sad but true, in 2010, over 5,000 kids lost their lives in cars, and 350,000 were seriously injured in automobile accidents.

While this text set does not focus on death and destruction, it does give kids a chance to understand the physics, psychology, and sociology of driving while distracted. The lesson makes use of graphs, charts, and text to help students explore the choices and possible consequences of using their phones to talk or text while driving. Big questions to consider include:

- How do weight and speed affect a car's stopping distance?
- What kinds of activities distract drivers from paying attention to their driving?
- How are car accidents and distracted driving connected?
- What is the best way to prevent distracted driving?

TEXTS IN ORDER OF USE

Main Lesson:

"Stopping Distance" (text and chart; easier)

"Study: Distractions Cause Most Car Crashes" (easier)

Extension:

"Texting While Driving: How Dangerous Is It?" (text and charts)

"New Data from VTTI Provides Insight into Cell Phone Use and Driving Distraction" (text and chart)

CURRICULUM CONNECTIONS

Physics: Force and motion.

Biology: Nervous system, neural pathways, eye-hand coordination.

Health: Personal safety.

Driver Education: Avoiding distractions that cause accidents.

Social Studies: Federal, state, and local laws; law enforcement; how laws evolve as technology changes.

Language Arts: Read and understand information presented in charts and tables; use text annotation to deepen understanding; connect nonfiction text to one's own life experience; meet in small, peer-led groups to discuss and debate readings.

STRATEGIES USED

Turn and Talk, Read with a Question in Mind, Conversation Questions, Save the Last Word for Me, Jigsaw, Text Coding

MATERIALS NEEDED

For the main lesson, copies of the Stopping Distance chart and "Distractions" article for each student; for the extension, copies of the additional two articles for each pair plus some extra copies of "Texting While Driving"; whiteboard or projector for brainstorming.

Steps and Teaching Language

PART 1 INTRODUCE THE DYNAMICS OF STOPPING DISTANCE

(20 minutes)

STEP 1 **Introduce the concept of force and motion** *Anybody ever ride in a car while the driver was using a cell phone?* Note the show of hands. *Just about everybody. How much do you think the average car weighs?* Listen to volunteer estimates. *The average car weighs between 3,000 and 5,000 pounds. Pick-up trucks and SUV's are even heavier. How do you think the weight of a car affects its ability to stop?* Listen to ideas. Answer: *The heavier the car is, the longer it takes to stop. What else would affect the stopping distance of a car besides its weight?* Listen to responses. Answer: *The speed at which it is traveling. Of course, the condition of your brakes and pavement are going to make a difference as well. But the two biggest factors that affect stopping distance are weight and speed.*

How fast do you think a car can travel in one second at a given speed, say 70 miles per hour? Listen to guesses. *Actually, there's a formula that can give you a rough estimate. First take the speed, 70 miles per hour, and divide it in half. What's the answer? Yes, 35. Then take that number, 35, and multiply it by three. What's the answer? Yes, 105. That means that a car moving at 70 mph travels 105 feet every second. How many feet would that car travel in three seconds? Yes, 315 feet. How long is a football field? Remember, 100 yards equals 300 feet. So in three seconds, a car going 70 miles per hour travels further than the length of a football field.*

STEP 2 **Discuss the stopping distance chart** Pass out the stopping distance handout.

Any time you try to stop a car, two things come into play. First is the driver's reaction distance. That's the distance the car travels between the moment a driver recognizes a danger and the moment the driver actually hits the brake pedal. The braking distance is the distance traveled by the car after the brakes are applied and until the vehicle comes to a complete stop.

Take a look at this chart. What is the connection between stopping distance and speed? (The faster a car travels, the greater the stopping distance.)

Notice that this chart estimates the stopping distance of cars on dry, level pavement. Besides speed, what else could increase stopping distance? Take responses (rain, snow, gravel, traveling downhill, heavier vehicle, slower reaction time).

STEP 3 **Pairs discuss reaction time** Students form pairs (self-chosen or teacher determined).

Strategy 1: **TURN AND TALK**

All of those definitely could lengthen stopping distance. Let's think about reaction time. This chart assumes that the driver is paying total attention to the road conditions and traffic. What kinds of things might lengthen reaction time by distracting the driver? Turn to your partner and make a quick list.

Give students a minute or two to brainstorm and jot answers.

Now, with your partner, go back through the list and prioritize your items. Which is most distracting? The most likely to keep your eyes off the road? Number the circumstance that is most likely to lengthen reaction time #1 and then continue numbering according to importance.

STEP 4 **Share reasons for lengthened reaction time** Give pairs another minute to prioritize their lists. Before sharing, choose a volunteer recorder to write the items on the board or in a projectable form.

As I call on each pair, I want you to give us your #1 item. If that's taken, give us your #2; if that's taken, give us your #3; and so on. Any questions? If I get to you and all of your ideas are taken, give us your #1 and we'll put a check by it on the list. As we create our master list, I want everyone to copy it down because you'll need to refer to this list for the next activity.

Go around the room and get one idea from each pair. After creating the list, take a moment to discuss what the top reaction time extenders are. (The following example shows one class's final ranking.)

Possible Distractions

1. Texting
2. Talking on cell phone
3. Eating
4. Reaching for something
5. Listening to iPod
6. Talking to passenger
7. Putting on make-up
8. Sleep deprivation
9. Yelling at kids
10. Looking in another direction
11. Changing radio station/CD
12. Using GPS navigation system
13. Looking for an address

PART 2 STUDENTS ANNOTATE AND DISCUSS THE ARTICLE

(20 minutes)

STEP 1 **Give reading instructions** Pass out the article "Distractions Cause Most Car Crashes."

Strategy 2: **READ WITH A QUESTION IN MIND**

This article talks about how most car accidents are caused by the drivers being distracted. Remember, any distraction can increase your reaction time. As you read, I want you to look for the distractions we just listed. Then do three things: First, when you see one, put the number from our list by it.

Strategy 11: **CONVERSATION QUESTIONS**

Second, underline three statements or pieces of information that you thought were important or surprising. Third, next to each underline, jot down a related question that would be interesting to discuss.

STEP 2 **Pairs discuss** As kids finish up, call time. *Turn to your partner and compare what you found in the article. How did our class predictions compare with what this article discussed about dangerous distractions?* Allow pairs to discuss for a couple of minutes and then open up the question to the whole class for a quick discussion.

Strategy 10: **SAVE THE LAST WORD FOR ME**

Turn back to your partner again and take a look at the passages you underlined because you found them important or surprising. Take turns with your partner reading your passages aloud and using "save the last word." Rather than reading aloud and immediately explaining, have your partner first guess why you picked that passage. Then you can add any ideas they might not have mentioned or continue the discussion by asking your question. Be sure to switch after each passage.

Finally, display the projectable "big questions" listed on page 215. *Based on what you've read and discussed just now, how would you answer these questions? Take a couple of minutes with your partner to discuss them.*

STEP 3 **Whole class shares** As conversation winds down, call time. Ask for some volunteers to read their most interesting/surprising underlining aloud and explain. End by discussing the big questions and asking students if anything needs to be done about driving distractions, either through laws or personal responsibility.

EXTENSION

EXTENSION JIGSAW *(30 minutes)*

STEP 1 **Introduce additional articles**

More and more organizations are starting to do studies on how distracted people become when they are talking on the phone or texting while trying to drive. Today I have two articles that describe these studies.

The first article is from Car and Driver *magazine. This piece describes an experiment they conducted as they tried to determine how a driver's reaction time lengthens when he is reading or writing a text.*

The second article describes a cell phone/texting study done by the Virginia Tech Transportation Institute. They studied distractions by installing cameras that recorded driver behavior and traffic conditions as well as other instrumentation that recognized and recorded dangerous driving events.

STEP 2 **Pairs assign readings** Pass out a set of articles to each pair and have them negotiate who reads what article. Since the Virginia Tech article is shorter, have extra copies of the *Car and Driver* article available for those kids who finish early.

Strategy 23: **JIGSAW**

STEP 3 **Give instructions for reading** Once negotiating is done, give these instructions:

As you read your article, be on the lookout for information that is surprising, connects with something in a previous article, or raises a question. Then I want you to do three things.

Strategy 4: **TEXT CODING**

When you see something that fits, underline it and mark a code by it:

! *exclamation point for surprising*

 *chain links for connection*

? *question mark for question*

Then, in the margin, jot down your thoughts or conversation questions. Remember that your goal is to bring interesting information, thoughts, and questions to the discussion you will soon be having with your partner.

STEP 4 **Partners discuss annotation and connections between all four texts** As they finish reading and coding, call time.

Turn to your partner and compare what you found in these articles. Read what you've underlined aloud to each other and discuss your thoughts, questions, and connections. Then figure out how all of the charts connect to one another.

STEP 5 **Share with the whole class** End with a short large-group discussion, sharing ideas about the articles and how the charts are interconnected. End by discussing these questions (project if possible):

- How do weight and speed increase your chances of getting into an accident if distracted?
- What advice would you give to someone texting or talking on their cell phone while driving? What facts would you use to convince them that this is creating dangerous conditions for themselves and others?
- Is controlling distracted driving purely the responsibility of the driver, or should laws be passed that prohibit electronic device use while driving?

Tips and Variations

■ **STAGE A REAL CRASH** Our colleague Ben Warner, who teaches science at Federal Hocking High School in Stewart, Ohio, shares another extension of the crash lesson. "A great way to get your students to see the relationship between mass and force is to have them build cars and then crash them. This is a variation on the 'egg drop' that ties in some safety engineering and design components. I use a physics cart as a base for their car and have kids build a body out of cardboard (or any other material they want). They incorporate safety features such as crumple zones, air bags, seat belts, and once even an ejector seat (that didn't work so well). The idea is for the team's egg to survive the impact of the car going down an eight-foot ramp into a large brick. The trick is that the car must be realistic in that the features must deploy on impact, not before (you wouldn't drive around packed in foam or wrapped in bubble wrap). In the end, the mass of the car and the impact velocity are used to determine the instantaneous force of impact that the egg hopefully survived."

Missouri Department of

Revenue

Forms & Manuals | Online Services | Personal Tax | Motor Vehicle | Driver License

Driver Guide

Safe Driving Tips for Everyday Driving

Stopping Distance

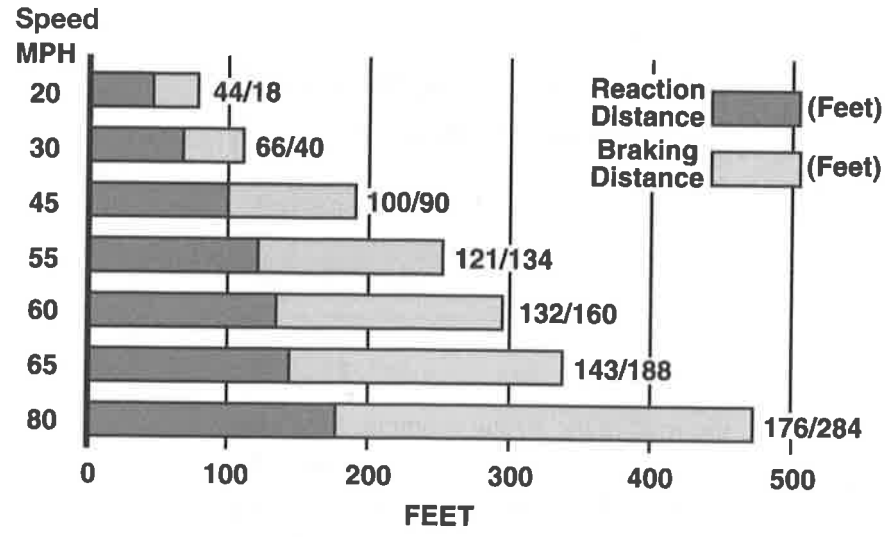
http://dor.mo.gov/forms/Driver_Guide_Chapter8.pdf

Your *stopping distance* equals your *reaction distance* plus your *braking distance*. If you are driving fast, are very tired, or if your vehicle has bad brakes, you will need more space to stop your vehicle.

The *following distance* equals your *reaction distance* plus your vehicle's *braking distance* at different speeds. The reaction distance is the distance you travel after you see a danger and before you apply your brakes. In the chart shown below, the reaction distance is for 1.5 seconds. You have to be alert to react within one and one-half seconds.

The *braking distance* is the distance you travel after you apply your brakes and before your vehicle comes to a stop. In the chart shown below, the braking distance is for a vehicle with good brakes and tires, in good weather, and on a good road.

AVERAGE STOPPING DISTANCE OF CARS ON DRY LEVEL PAVEMENT



San Francisco Chronicle

Study: Distractions Cause Most Car Crashes

By KEN THOMAS, The Associated Press, April 21, 2006

Those sleep-deprived, multitasking drivers—clutching cell phones, fiddling with their radios or applying lipstick—apparently are involved in an awful lot of crashes. Distracted drivers were involved in nearly eight out of 10 collisions or near-crashes, says a study released Thursday by the government.

"We see people on the roadways talking on the phone, checking their stocks, checking scores, fussing with their MP3 players, reading e-mails, all while driving 40, 50, 60, 70 miles per hour and sometimes even faster," said Jacqueline Glassman, acting administrator of the government's highway safety agency.

Researchers at the National Highway Traffic Safety Administration and the Virginia Tech Transportation Institute found that the risk of a crash increases almost threefold when a driver is dialing a cell phone.

Researchers said the report showed the first links between crash risks and a driver's activities, from eating and talking to receiving e-mail. "All of these activities are much more dangerous than we thought before," said Dr. Charlie Klauer, a senior research associate at the institute. Data from police reports had estimated that driver inattention was a factor in about 25 percent of crashes.

For more than a year, researchers studied the behavior of the drivers of 100 vehicles in metropolitan Washington, D.C. They tracked 241 drivers, who were involved in 82 crashes of various degrees of seriousness—15 were reported to police—and 761 near-crashes. The air bag deployed in three instances. The project analyzed nearly 2 million miles driven and more than 43,300 hours of data.

Drowsy driving increased the driver's risk of a crash or near-crash by four times to six times, the study said. But the study's authors said drowsy driving is frequently underreported in police investigations.

> *"We see people on the roadways talking on the phone, checking their stocks, checking scores, fussing with their MP3 players, reading e-mails, all while driving 40, 50, 60, 70 miles per hour and sometimes even faster."*
>
> —JACQUELINE GLASSMAN, ACTING ADMINISTRATOR OF THE GOVERNMENT'S HIGHWAY SAFETY AGENCY

When drivers took long glances away from the road at the wrong moment, they were twice as likely to get into a crash, the report said. Assessing cell phone use, the researchers said the number of crashes or near-crashes linked to dialing the phones was nearly identical to those tied to talking or listening on the phone.

CAR AND DRIVER

TEXTING WHILE DRIVING

How Dangerous Is It?

BY MICHAEL AUSTIN, June 2009

Texting is on the rise, up from 9.8 billion messages a month in December '05 to 110.4 billion in December '08. Undoubtedly, more than a few of those messages are being sent by people driving cars. Is texting while driving a dangerous idea? We decided to conduct a test. Previous academic studies—much more scientific than ours—conducted in vehicle simulators have shown that texting while driving impairs the driver's abilities. But as far as we know, no study has been conducted in a real vehicle that is being driven.

To keep things simple, we would focus solely on the driver's reaction times to a light mounted on the windshield at eye level, meant to simulate a lead car's brake lights. Wary of the potential damage to man and machine, all of the driving would be done in a straight line. We rented the taxiway of the Oscoda-Wurtsmith Airport in Oscoda, Michigan. Given the prevalence of the BlackBerry, the iPhone, and other text-friendly mobile phones, the test subjects would have devices with full "qwerty" keypads and would be using text-messaging phones familiar to them. Intern Jordan Brown, 22, armed with an iPhone, would represent the younger crowd. The older demographic would be covered by head honcho Eddie Alterman, 37, using a Samsung Alias.

Our Honda Pilot (four-wheel-drive SUV) served as the test vehicle. When the red light on the windshield lit up, the driver was to hit the brakes. The author, riding shotgun, would use a hand-held switch to trigger the red light and monitor the driver's results. Each trial would have the driver respond five times to the light, and the slowest reaction time (the amount of time between the activation of the light and the driver hitting the brakes) was dropped.

AVERAGES AT 35 MPH	Reaction Time (sec)		Extra Distance Traveled (ft)	
	Brown	Alterman	Brown	Alterman
BASELINE	0.45	0.57	–	–
READING	0.57	1.44	6	45
TEXTING	0.52	1.36	4	41

AVERAGES AT 75 MPH	Reaction Time (sec)		Extra Distance Traveled (ft)	
	Brown	Alterman	Brown	Alterman
BASELINE	0.39	0.56	–	–
READING	0.50	0.91	11	36
TEXTING	0.48	1.24	9	70

First, we tested both drivers' reaction times at 35 mph and 70 mph to get baseline readings. Then we repeated the driving procedure while they read a text message aloud (a series of *Caddyshack* quotes). This was followed by a trial with the drivers typing the same message they had just received. Both of our lab rats were instructed to use their phones exactly as they would on a public road.

The results, though not surprising, were eye-opening. Intern Brown's baseline reaction time at 35 mph of 0.45 second worsened to 0.57 while reading a text, and improved to 0.52 while writing a text. At 70 mph, his baseline reaction was 0.39 second, while the reading (0.50) and texting (0.48), numbers

continues on next page

TEXTING WHILE DRIVING

continued from previous page

were similar. But the averages don't tell the whole story. Looking at Brown's slowest reaction time at 35 mph, he traveled an extra 21 feet (more than a car length) before hitting the brakes while reading and went 16 feet longer while texting. At 70 mph, a vehicle travels 103 feet every second, and Brown's worst reaction time while reading at that speed put him about 30 feet (31 while typing) farther down the road.

The key element to driving safely is keeping your eyes and your mind on the road. Text messaging distracts any driver from that primary task.

Alterman fared much, much worse. While reading a text and driving at 35 mph, his average baseline reaction time of 0.57 second nearly tripled, to 1.44 seconds. While texting, his response time was 1.36 seconds. These figures correspond to an extra 45 and 41 feet, respectively, before hitting the brakes. The results at 70 mph were similar: Alterman's response time while reading a text was 0.35 second longer than his base performance of 0.56 second, and writing a text added 0.68 second to his reaction time.

As with the younger driver, Alterman's slowest reaction times were a grim scenario. He went more than four seconds before looking up while reading a text message at 35 mph and over three and a half seconds while texting at 70 mph. Even in the best of his bad reaction times while reading or texting, Alterman traveled an extra 90 feet past his baseline performance; in the worst case, he went 319 feet farther down the road. Moreover, his two-hands-on-the-phone technique resulted in some serious lane drifting.

The prognosis doesn't improve when you look at the limitations of our test. We were using a straight road without any traffic, road signals, or pedestrians, and we were only looking at reaction times. Even though our young driver fared better than the balding Alterman, Brown's method of holding the phone up above the dashboard and typing with one hand would make it difficult to do anything except hit the brakes. And if anything in the periphery required a response, well, both drivers would probably be unable to react.

Both socially and legally, drunk driving is completely unacceptable. Texting, on the other hand, is still in its formative period with respect to laws and opinion. A few jurisdictions have passed ordinances against texting while driving. But even if sweeping legislation were passed to outlaw any typing behind the wheel, it would still be difficult to enforce the law.

In our test, neither subject had any idea that using his phone would slow down his reaction time so much. Like most folks, they think they're pretty good drivers. Our results prove otherwise, at both city and highway speeds. The key element to driving safely is keeping your eyes and your mind on the road. Text messaging distracts any driver from that primary task. So the next time you're tempted to text, tweet, e-mail, or otherwise type while driving, either ignore the urge or pull over. We don't want you rear-ending us.

New Data from Virginia Tech Transportation Institute Provides Insight into Cell Phone Use and Driving Distraction

http://www.vtti.vt.edu/PDF/7-22-09-VTTI-Press_Release_Cell_phones_and_Driver_Distraction.pdf

BLACKSBURG, VA., JULY 27, 2009—Several large-scale, naturalistic driving studies (using sophisticated cameras and instrumentation in participants' personal vehicles) conducted by the Virginia Tech Transportation Institute (VTTI) provide a clear picture of driver distraction and cell phone use under real-world driving conditions. Combined, these studies continuously observed drivers for more than 6 million miles of driving.

VTTI's studies of light-vehicle drivers and truck drivers engaged in manual manipulation of phones such as dialing and texting of the cell phone show these behaviors lead to a substantial increase in the risk of being involved in a safety-critical event (e.g., crash or near crash). Text messaging on a cell phone was associated with the highest risk of all cell phone–related tasks.

Cell Phone Task	Risk of Crash or Near Crash Event
Light Vehicles/Cars	
Dialing cell phone	2.8 times as high as nondistracted driving
Talking/listening to cell phone	1.3 times as high as nondistracted driving
Reaching for object (i.e., electronic device and other)	1.4 times as high as nondistracted driving
Heavy Vehicles/Trucks	
Dialing cell phone	5.9 times as high as nondistracted driving
Talking/listening to cell phone	1.0 times as high as nondistracted driving
Use/reach for electronic device	6.7 times as high as nondistracted driving
Text messaging	23.2 times as high as nondistracted driving

VTTI's recommendations (based on findings from research studies)

Driving is a visual task and non-driving activities that draw the driver's eyes away from the roadway, such as texting and dialing, should always be avoided.

Texting should be banned in moving vehicles for all drivers. As shown in the table, this cell phone task has the potential to create a true crash epidemic if texting-type tasks continue to grow in popularity and the generation of frequent text message senders reach driving age in large numbers.

"Headset" cell phone use is not substantially safer than "hand-held" use because the primary risk associated with both tasks is answering, dialing, and other tasks that require your eyes to be off the road.

All cell phone use should be banned for newly licensed teen drivers. Our research has shown that teens tend to engage in cell phone tasks much more frequently, and in much more risky situations, than adults. Thus, our studies indicate that teens are four times more likely to get into a related crash or near crash event than their adult counterparts.