

Teen Driving: Skills, Responsibilities and Reactions

by

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Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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Introduction

Teens are more likely to die in a car crash than from any other cause. In order to best understand good driving skills, students should be introduced to the principles of good driving at both middle and high school levels. This lesson plan is arranged to spiral from introductions to reinforcement. It is recommended that teachers choose one or two activities as well as one or two minilabs.

Summary

This lesson plan is designed for middle school science, as well as high school physical science or biology classes. The lesson objectives include an introduction to the potential dangers and risks in driving, and the reaction times associated with a variety of road side safety issues. The lessons will help teens to realize that driving requires practiced, coordinated, and complex physical and analytical skills. It is expected that the activities performed in this unit can help pre-teens and teens better understand the complexities and risks involved in driving — thus become safer drivers and passengers.

Learning Outcomes

- Middle school students will be able to define related terms.
- Middle school students will be able to create a poster, radio commercial, podcast, or brochure as a public service announcement on a road safety issue.
- Middle school students will be able to get information from their state's motor vehicle department and present statistics, and/or laws on motor vehicle safety.
- Middle school students will be able to test their reaction time in simulated games.
- High school students will be able to understand the effort and time required to gain expertise in coordinated mental and physical skills.
- High school students will be able to learn factors (e.g., sleep, stress, gender, age, and distractions) that increase risk when driving.
- High school students will be able to develop and implement three lab activities.
- High school students will be able to combine the learned objectives with the "Ride Like A Friend" and "Commentary" driving programs to become safer, more responsible drivers and passengers.

Materials

1. Computer and internet access
2. Poster board
3. Crayons
4. Markers
5. Pencils
6. Audio recording device
7. Video camera
8. Classroom whiteboard or blackboard
9. Teen survey (1 copy per high school student)
10. Stopwatches (1 per every 2–3 students)
11. Small bouncy ball (e.g., tennis ball, golf ball, racketball)

Teacher Preparation

- Print copies of the teen student survey (one for each high school student).
- If needed, reserve computer use (one for every two students). *If computer access is unavailable, printed copies of the Web resources could be made ahead of time.*
- Set out lab supplies (paper and stopwatches)

Anticipatory Set Activity (middle school introduction)

Duration: 45 minutes

1. Divide the class into groups of four students per group.
2. Each student in the group should be assigned a different starting position (standing, kneeling, sitting, or lying down) and a start point agreed upon by the class.
3. Teacher will stand in front of the students and drop a ball from shoulder height.
4. Each student will sprint and catch the ball before its second bounce.

Note: Students participate in this activity one at a time. This is not a competition to see who gets the ball first.

5. The three other students will measure and record the sprint time on a data table.
6. Upon completion of class data collection, students will calculate the average time for each starting position.
7. Students will discuss which graph type is appropriate for this type of data, which variable is dependent, and which variable is independent.

Note: The most appropriate graph type is bar, since the data is discrete, because it is discussing discrete data: data that stands alone. The dependent variable is the sprint time average, y axis and the independent variable is the starting position, x axis. The class may also determine the standard deviations or percentiles for these data and plot them as box-whisker plots. Also teachers may want to have the class graph data from each student. In that case, the independent variable would be the student.

8. Students will neatly graph the data.
 - a. Graphs should include labeled axes, correct increments, a proper title, and bars showing average times for each position.
 - b. Graphs should be very neat — rulers should be used.
9. The activity can be repeated with distractions occurring during the timed sprints. Distractions could include texting on a cell phone, holding a discussion with nearby students or eating snacks (e.g., a bag of chips).
 - a. All other steps would remain the same.
 - b. A second bar (in another color) could be added for each student in order to depict distracted sprint times for students.

Introductory Activity (high school introduction)

Duration: 30 minutes

1. Teacher tells students to “Imagine you are a soccer or hockey goal keeper.”
2. Teacher asks “What type of things do you need to do in order to protect your goal?”
 - a. Students record these skills on the board under the title “Goal Protection.”
3. Teacher asks “What types of distractions might occur during your game?”
 - a. Students record these on the board under the title “Goal Protection Distractions.”
 - b. Students discuss how each listed distraction might affect their game.
 - i. Students record explanations next to each distraction.
4. Teacher asks students to “Discuss what types of things can you do in order to become a better goalie?”
 - a. Students list ideas on board under the title “Improvement Goals.”

- b. Teacher asks students to “Discuss specific strategies you could use to reach the improvement goal and the reasoning for each.”
- c. Students record strategies next to each distraction.

Total Duration: 60 min.

Procedures

Step 1

Reaction Time Activity: How Fast Are You? (middle school)

Duration: 20 minutes

- Students will engage in an online reaction-time test game.
- Students will track their progress, taking note of any strategies that help them improve their performance.
- This activity encourages students to think about their abilities and illustrates that skills, when practiced, can become automatic.

Web Resources

Title: Reaction Time 2: Zap

URL: <http://www.sciencenetlinks.com/interactives/zap.html>

Description: This website contains a reaction time activity where students will test their reaction time by catching a fly as soon as they see or hear it

Note: Students should do the simulations four times. Reaction times should be recorded and graphed. Students will then reflect on whether practice affects reaction time rates.

Supplemental Documents

Title: Neuroscience for Kids—Home

URL: <http://faculty.washington.edu/chudler/neurok.html>

Description: Online response time experiments

Note: Students may test their response times using reaction time experiments such as the Start/Stop Test, the Hit the Dot Test, and the Stoplight Test. Data should be collected for each test. Tests should be repeated at least three times. Compiled data should then compared with other students in order to answer the following questions: Does age make a difference? Does gender make a difference? Does practice time make a difference? Does the type of test make a difference?

Reaction Time Activity (high school)

Duration: 2 hours, 5 minutes

In order to test, record and analyze personal and class data, students will research, develop, and implement three lab activities related to variables affecting reaction time.

Part One: Driving While Texting (30 minutes)

1. Working in groups of 2–3, students will connect to the *New York Times* driving game via the website listed below. (5 minutes)
2. Students will each complete the driving game and copy and paste their graph results onto a word document. (15 minutes)
3. Students within each group should then compare graphs before and during texting in order to discuss results. (10 minutes)

Part Two: Reaction Time Information and Minilabs (85 minutes)

1. Working in groups of 2–3, students will connect to the reaction time literature reviews on the Clemson website: <http://biology.clemson.edu/bpc/bp/Lab/110/reaction.htm>. (5 minutes)
 - a. Students will read the reviews from the Clemson website and answer the following questions. How do simple, recognition, and choice reaction time activities differ, and which is least related to driving? (20 minutes)
 - b. Does driving tend to have a small or large number of valid stimuli? How does this affect driving?
 - c. Would a driver be more likely to respond quicker to a flash of bright light or a loud sound?
 - d. Explain why driving statistics put young males as the group most likely to be involved in a serious car crash even though the researchers in this paper say that reaction times are typically quicker in those who are young and male.
2. Students will devise tests to determine reaction time differences for three of the following areas: direct versus peripheral vision, practice and errors, distraction, warning of impending stimuli, or order of presentation. (70 minutes)
 - a. Using a stopwatch, paper, pencils, the computer, or other group members. Student groups will devise simple lab activities that will test reaction time differences based on direct versus peripheral vision, practice and errors, distraction, warning of impending stimuli, or order of introduction. (20 minutes)
 - i. The group should determine and record the purpose of the first minilab.
 - ii. The group should number and record the steps required to test reaction time in a clear, concise, and orderly fashion.
 - iii. Once steps are recorded, the teacher will approve them.
 - iv. Once steps are approved, students should perform the lab and record results on a data table.
 - v. Each member of the group should participate as a test subject.
 - vi. The group's data measurements should also be averaged.
 - vii. Data should be graphed and analyzed.
 - viii. A reflection should be written that correlates the purpose and the data.
 - b. Students will remain in the same groups in order to devise and perform a second minilab. (20 minutes)
 - i. Students will choose another category from the list in step three.
 - ii. Students should follow the criteria listed in section 3.a., I – viii.
 - c. Students will remain in the same groups in order to devise and perform a third minilab. (20 minutes)
 - i. Students will choose a final category from the list in step three.
 - ii. Students should follow the criteria listed in section 3.a., I – viii.
 - d. Questions (10 minutes):
 - i. How might these minilabs relate to driving?
 - ii. Are there factors that might affect reaction time results within the class? Within individuals?
 - iii. Does “scoring” well in these labs mean you will be a terrific driver? Explain.

Web Resources

Title: NY Times Driving Game

URL: <http://www.nytimes.com/interactive/2009/07/19/technology/20090719-driving-game.html>

Description: A computerized driving activity tests reaction time with and without texting — graphs of personal results are included at the end of the driving test

Title: A Literature Review of Reaction Time

URL: <http://biology.clemson.edu/bpc/bp/Lab/110/reaction.htm>

Description: From Clemson University's, Robert J. Kosinski, in which he summarized major literature conclusions on reaction time relating to brain activity

Supplemental Documents

Title: Reaction Time Teacher Supplement

Description: This supplement includes answers to the reaction time questions and information on guiding student minilab performance

Step 2

Science Vocabulary (middle school)

Duration: 10 minutes

Research has demonstrated that vocabulary assists students in expanding their knowledge to raise student achievement. Vocabulary development increases when students have visual images of word meanings and when words are categorized into groups.

PAVE Method: Prediction-Association-Verification-Evaluation (PAVE) Procedure.

This vocabulary-teaching strategy encourages students to predict a word's meaning within the context it appears, consult a dictionary, and re-evaluate predictions.

Students will use the PAVE method to define the words ***prefrontal cortex, public health, and distraction.***

Web Resources

Title: FCAT 8th grade reading — teaching strategies

URL: <http://fcit.usf.edu/>

Description: Prediction-Association-Verification-Evaluation (PAVE) Procedure

Note: This vocabulary teaching strategy encourages students to predict a word's meaning within the context it appears, consult a dictionary, and re-evaluate predictions.

Title: MIT Young Adult Development Project: Brain Changes

URL: <http://hrweb.mit.edu/worklife/youngadult/brain.html>

Description: Brain anatomy diagram and descriptions on prefrontal cortex functions and development are included

Title: What is Public Health? (video)

URL: <http://www.youtube.com/watch?v=Bpu42LmLo4U>

Description: This 3-minute video was produced by public health students as part of a campaign to inform the public about the many ways that public health protects their lives and well being

Note: There is a short segment on condoms

Title: CDC A-Z Index

URL: <http://www.cdc.gov/az/>

Description: Alphabetized terms are listed and defined by the CDC

Note: A variety of public health terms are included therefore allowing a variety of contextual learning.

Title: Distracted Driving

URL: <http://www.distraction.gov/>

Description: Distraction.gov has an informational website that discusses distracted driving issues and contextual news stories

Supplemental Documents

Title: Vocabulary Activities

Description: This site, <http://www.cobbk12.org/>, is an excellent site for the use of vocabulary games and activities for all age groups

Teen Survey (high School)

Duration: One hour, 15 minutes

In order to recognize the factors that exacerbate risk when driving (e.g., sleep, nutrition, stress, gender, age, distractions) students will take a survey, analyze national survey results, learn about teen brain development, and consolidate and reflect on these factors.

1. Teacher will hand out the teen driving survey (see attached).
2. Students will complete questions 1–18 of the teen driving survey individually. (15 minutes)
3. Once done, students will go to a computer to research and complete questions 19–20 of the teen driving survey. (45 minutes)
4. Students will return to their desks to complete the final reflection question. (5 minutes)
5. Students will then meet in groups of four and discuss their findings. (10 minutes)

Web Resources

Title: Driving: Through the Eyes of Teens

URL: http://stokes.chop.edu/programs/injury/files/PCPS_Reports/1289teen.pdf

Description: A national teen survey results to use to compare with personal and class results

Title: MIT Young Adult Development Project: Brain Changes

URL: <http://hrweb.mit.edu/worklife/youngadult/brain.html>

Description: Brain anatomy diagram and descriptions on pre-frontal cortex functions and development to use in order to answer question 20 of the teen driving survey

Additional Documents

Title: Teen Driving Survey

Description: Students will fill out the survey as directed on the worksheet.

Step 3

Safe Driving Activity (middle school)

Duration: One hour, 30 minutes

Introduction: According to the Insurance Institute of Highway Safety, studies show that teens face more driving risks than any other age group. U.S. Centers for Disease Control and Prevention (CDC) states that in 2007, one out of every three teen deaths was caused by a car crash.

Lesson focus: To learn about safe practices and laws designed to prevent accidents.

1. The teacher will divide students into five groups. (5 minutes)
 - a. The teacher will assign one of the following topics to each group: Impaired driving (DUI/DWI), seat belts, speeding, distracted driving (such as driving while eating or talking on a cell phone) and drowsy driving.
2. Students will research each topic. (25 minutes)

3. Student groups will discuss their research findings. (15 minutes)
4. Students will then work in groups to develop a public service announcement such as a poster, mock television or radio commercial, website, or brochure. (45 minutes)
 - a. Students are encouraged to use statistics and specific state laws from their research and include descriptions of physical injuries that can occur as a result of unsafe driving.

Web Resources

Title: Safe Driving

URL: <http://school.discoveryeducation.com>

Description: This Web resource, school.discoveryeducation.com was used to develop lesson plans for different learning styles

Supplemental Documents

Title: Ride Like a Friend. Drive Like You Care.

URL: <http://www.ridelikeyfriend.org>

Description: This is a school-based, peer-to-peer initiative focused on the relationship between teen drivers and their teen passengers — the program hopes to increase risk awareness and promote safe driving

Title: Insurance Institute for Highway Safety

URL: <http://www.iihs.org/>

Description: This website contains the most recent crash statistics, topic-specific fact sheets and other resources (examples: “teenagers” or “alcohol and drugs”) and up-to-date information about state traffic laws

Note: The Insurance Institute for Highway Safety is an independent, nonprofit, scientific, and educational organization dedicated to reducing crashes on the nation's highways.

Title: CDC Injury Prevention and Control/ Data and Statistics — WISQARS

URL: <http://www.cdc.gov/injury/wisqars/index.html>

Description: This is CDC’s website for Web-based Injury Statistics Query and Reporting System

Note: This site has several features that allow users to examine varied statistics on fatal injuries. Students and teachers will need to familiarize themselves with the website before asking students to navigate through it.

Title: Video — Avoiding Collisions: How to Survive the Teenage Driving Years

Description: Avoiding Collisions: How to Survive the Teenage Driving Years," is a driving safety program focusing on four areas of driving safety — safety belt use, speeding, night driving, and driving under the influence of drugs and alcohol

Note: The program offers families a free 15-minute video and brochure by calling a local Liberty Mutual office or 1-800-4-LIBERTY. Liberty Mutual lists its local sales offices at <http://www.libertymutualinsurance.com>.

Title: Text Messaging and Driving, A Lethal Combination

URL: http://www.connectwithkids.com/tipsheet/2006/293_aug9/thisweek/060809_text.shtml

Description: A video showing the dangers of text messaging while driving produced by Connect with Kids

Personal and Public Health (high school)**Duration: 45 minutes**

In order to apply and combine skills, and become safer, more responsible drivers and passengers, students will combine the information learned from the first three learning modules with the Ride Like a Friend program and the commentary driving technique.

Part One: (25 minutes)

1. Students will connect to the Ride Like A Friend website. (5 minutes)
2. Students will navigate around the website in order to see the organization's goals, risks, activities, research, and recommendations. (10 minutes)
3. Students will complete an activity of choice (PSA contest, a friend driving friend poll, spread the word activity, distracting pop quiz, or create your own safe driving activity) from the activity page. (10 minutes)

Part Two: (20 minutes)

1. The teacher will show the commentary driving youtube video to the class. (10 minutes)
2. Students will discuss the concept of commentary driving as a class by answering the following (10 minutes):
 - a. Analyze the types of circumstances that promoted driver comments.
 - b. Discuss why this technique is thought to be helpful to drivers.
 - c. Discuss how you might use this technique to improve your driving.
 - d. Discuss the relationship between teen driving and both personal and public health.
 - e. The opening activity was a brainstorming session about being a goalie. Explain the correlation of this activity to driving.

Web Resources

Title: Ride Like A Friend. Drive Like You Care.

URL: <http://www.ridelikeafriend.org/>

Description: This is a school-based peer-to-peer initiative focused on the relationship between teen drivers and their teen passengers

Note: The program hopes to increase risk awareness and promote safe driving.

Title: Commentary Driving

URL: <http://www.youtube.com/watch?v=cASEscf4IK4>

Description: This is a youtube video that shows a driver commenting on all he views as he drives

Conclusion

Students should be more conscientious drivers after completing the lessons on the complexities of driving, analyzing teen driving survey results, learning about risks associated with driving, learning about pre-frontal cortex development, the factors affecting reaction rates, and learning strategies to become a safer driver and passenger.

Assessment

The Three Reaction Time minilabs will be assessed using the Teen Driving Reaction Time Minilab Rubric.

Supplemental Documents

Title: Teen Driving Reaction Time Minilab Rubric

Description: The rubric describes the required elements and states the expectations that should be included in each lab group's write up. Use the rubric to grade the Reaction Time Minilabs.

Modifications

Extensions

1. The effects of sleep deficiencies can be further connected to driving abilities. Students could research these resources and produce data that correlates hours of sleep verses reaction time in classmates.
2. A survey of school parking lot seat belt use could be conducted and data could be used to improve seat belt use by way of a local public relations seat belt campaign.
3. Policy and research on teen driving can be researched and discussed.
4. More activities or minilabs could be completed.
5. The teacher could use social math to translate data for the class (e.g., how many kids in this class or school?)

Web Resources

Title: Fatigue

URL: http://www.teendriversonline.org/stats/support_teens/detail/65

Description: A website that features findings on drowsy driving and is from the Research Institute and the Children's Hospital of Philadelphia

Title: Sleep: Why Do You Need It?

URL: <http://outreach.mcb.harvard.edu/materials.htm>

Description: This is a sleep powerpoint created by Margie Clark-Kevan that has three embedded activities in order to show the importance of sleep and its relevance to many other activities

Title: Teen Driver Source

URL: <http://www.teendriversonline.org/>

Description: A website on teen driving research and resources from the Research Institute and the Children's Hospital of Philadelphia

Other Modifications

1. More or less minilabs could be performed as time allows.
2. Groups can be larger if necessary or preferred.

Education Standards

National Science Education Standards

SCIENCE AS INQUIRY, CONTENT STANDARD A

As a result of activities in grades 9–12, all students should develop the following:

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

LIFE SCIENCE, CONTENT STANDARD C

As a result of their activities in grades 9–12, all students should develop understandings of the following:

- Interdependence of organisms
- Behavior of organisms

SCIENCE AND TECHNOLOGY, CONTENT STANDARD E

As a result of activities in grades 9–12, all students should develop the following:

- Understandings about science and technology

SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES, CONTENT STANDARD F

As a result of activities in grades 9–12, all students should develop understanding of the following:

- Personal and community health
- Natural and human-induced hazards

Specific descriptions of 9–12 content standards can be found at

<http://www.nap.edu/readingroom/books/nses/html/6e.html>

CDC's 2010 Science Ambassador Program

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Supplemental Documents

Teen Driving Survey

Name _____

1. My age is _____ years.
2. I am a male / female.
3. I drive because _____.
4. I drive _____ hours per week on average.
5. I have been in _____ crashes where I have been a driver.
6. I have been in _____ crashes where I have been a passenger.
7. I have been injured _____ times while driving.
8. I have been injured _____ times as a passenger.
9. The type of vehicle I usually drive is a compact car / midsize sedan / SUV / pickup truck.
(circle one)
10. I contribute approximately these percentages toward car expenses:
 - a. _____% towards car insurance
 - b. _____% towards purchase of a car
 - c. _____% towards fuel
 - d. _____% towards repairs
 - e. _____% towards maintenance
11. Having passengers in the car affects my driving.
 - a. Yes or no
 - b. Explain
12. I use a cell phone while driving. Circle the following: never / rarely / sometimes / frequently. (circle one)
13. I tend to get _____ hours of sleep per night on average.
14. I tend to drive during the hours of _____ and _____.
15. I drive over the speed limit. Circle the following: never / rarely / sometimes / frequently.
(circle one)
16. I wear a seatbelt while driving. Circle the following: never / rarely / sometimes / frequently. (circle one)
17. I wear a seatbelt as a passenger. Circle the following: never / rarely / sometimes / frequently. (circle one)
18. Describe four risks that can make driving more difficult for teens.
19. Once your survey is completed, go to following website:
http://stokes.chop.edu/programs/injury/files/PCPS_Reports/1289teen.pdf
 - a. Read the teen survey results starting on page 10 of the document.
 - b. Compare your survey results with national data that matches your age and sex by writing short comments in a different color next to each of your personal survey results.
20. Go to the following website: <http://hrweb.mit.edu/worklife/youngadult/brain.html>

- a. Read about brain development in teens.
- b. Answer the following questions.
 - i. What section of the brain is most involved with the mental challenges associated with driving well?
 - ii. List and describe the specific thinking skills that this brain section is involved in.

Teen Driving Survey (Teacher)

Name _____

21. My age is _____ years.

22. I am a male / female.

23. I drive because _____.

24. I drive _____ hours per week on average.

25. I have been in _____ crashes where I have been a driver.

26. I have been in _____ crashes where I have been a passenger.

27. I have been injured _____ times while driving.

28. I have been injured _____ times as a passenger.

29. The type of vehicle I usually drive is a compact car / midsize sedan / SUV / pickup truck. (circle one)

30. I contribute approximately these percentages toward car expenses:

- a. _____ % towards car insurance
- b. _____ % towards purchase of a car
- c. _____ % towards fuel
- d. _____ % towards repairs
- e. _____ % towards maintenance

31. Having passengers in the car affects my driving.

- a. Yes or no.
- b. Explain

32. I use a cell phone while driving. Circle the following: never / rarely / sometimes / frequently. (circle one)

33. I tend to get _____ hours of sleep per night on average.

34. I tend to drive during the hours of _____ and _____.

35. I drive over the speed limit. Circle the following: never / rarely / sometimes / frequently. (circle one)

36. I wear a seatbelt while driving. Circle the following: never / rarely / sometimes / frequently. (circle one)

37. I wear a seatbelt as a passenger. Circle the following: never / rarely / sometimes / frequently. (circle one)

38. Describe four risks that can make driving more difficult for teens.

39. Once your survey is completed, go to following website:

http://stokes.chop.edu/programs/injury/files/PCPS_Reports/1289teen.pdf

- a. Read the teen survey results starting on page 10 of the document.
- b. Compare your survey results with national data that matches your age and sex by writing short comments in a different color next to each of your personal survey results.

Answers will vary for questions 1-19.

40. Go to the following website: <http://hrweb.mit.edu/worklife/youngadult/brain.html>

- a. Read about brain development in teens.
- b. Answer the following questions.
 - i. What section of the brain is most involved with the mental challenges associated with driving well?

The prefrontal cortex.

- ii. List and describe the specific thinking skills that this brain section is involved in.

The prefrontal cortex skills include planning, risk assessment, rewards, prioritizing, self-evaluation, emotion regulation, and problem solving.

Teen Driving

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1. Write a short personal reflection about your thoughts on reaction rates, risky behaviors, teen brain development, differences among teens, and methods to build driving skills. Specify what new knowledge might cause a change in your driving habits. Why?

Student answers will vary, but they should include a discussion and personal reflection that includes reaction rates, risky behaviors, teen brain development, differences among teens and methods to build driving skills.

2. Why is the brain section answered in the previous question (20.b.i.) a concern as far as teen drivers?

The prefrontal cortex is involved in many driving related skills. The prefrontal cortex also communicates with other brain sections.

Teen Driving Reaction Rate Minilabs

CDC's 2010 Science Ambassador Program

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Student's Name:

| Criteria | 1 or Needs Improvement | 2 or Good | 3 or Very Good | 4 or Excellent |
|--|---|---|--|--|
| The purpose and steps are clearly stated and teacher approved. | The group lab report was written with either a purpose only or incomplete, disorderly steps. Teacher did not approve. | The group lab report was written and a teacher approved it; but it had an incomplete purpose and unclear steps. | The group lab report was written with a teacher approved purpose and steps that can be understood, however they are excessively wordy or disorderly. | The group lab report was written and had a teacher-approved relevant purpose and concise, orderly steps that could be easily understood. |
| Data | The group lab report includes few data measurements that are recorded. Numbers have no labels or units. | The group lab report includes measurements from each group member. Numbers have no labels or units. | The group lab report includes measurements from some group members that are clearly labeled and recorded with the appropriate units. | The group lab report includes measurements from each group member that are clearly labeled and recorded with the appropriate units. |

Continued on the following page ...

| | | | | |
|-------------------------|--|--|---|---|
| Averages | The group lab report includes no reaction time averages. | The group lab report includes one team member's average without units. | The group lab report includes two team member's average with units. | The group lab report includes three team member's average with units. |
| Analysis and reflection | The group lab report includes an analysis and reflection, but does not relate the collected data to the purpose. | The group lab report includes an analysis and reflection that vaguely relates the collected data to the purpose. | The group lab report includes an analysis and reflection that somewhat relates the collected data to the purpose. | The group lab report includes an analysis and reflection that specifically relates the collected data to the purpose. |
| Post lab questions | The group lab report properly answers one question. | The group lab report properly answers two questions. | The group lab report properly answers three questions. | The group lab report properly answers four questions. |

Adapted From: <http://rubistar.4teachers.org/index.php?screen=WhatIs&module=Rubistar>