## STEM Curriculum Planning Guide

This instructional design guide serves as the template for the design and development of STEM units of instruction at the Dayton Regional STEM Center in Dayton, Ohio. The guide is anchored to the *STEM Education Quality Framework* also developed at the Dayton Regional STEM Center.

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|---|---|
| **STEM Unit Title** | **Vehicle Ergonomics: How Big is Big Enough?** |
| Economic Cluster | Human Performance & Medicine<br>Advanced Manufacturing and Materials |
| Targeted Grades | 4, 5, 6 |
| STEM Disciplines | Science<br>Technology<br>Engineering<br>Math |
| Non-STEM Disciplines | |

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## Section I: STEM Unit Overview

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| Unit Overview | Students are challenged to design an ergonomic automobile driver's seat. They will take into consideration body proportion measurements and comfort for the average-size students in their class. Students will engineer the seat based on data collected for student population measurements. |
| Essential Question | How are human body measurements used to design and construct an ergonomic driver's seat for an automobile? |
| Enduring Understanding | Automobile driver's seats are designed by measuring anthropometric (study of human dimensions) characteristics in mind. |
| Engineering Design Challenge | A new automobile company, Electrik, has contacted students and requested that these future drivers design and construct a prototype of seat for a small automobile. This car, while currently only a prototype itself, could be on the assembly line by the time these students get their drivers permit. |

Time and Activity Overview

| Day | Time Allotment | Actvities |
|---|---|---|
| 1 | 50 minutes | Pretest<br>Pre-Activity Discussion |
| 2 | 50 minutes | Engineering Design Challenge<br>Introduction of Engineering Design Process |
| 3 | 50 minutes | Population Measurements & Calculations |
| 4 | 50 minutes | Chair Measurements for Comfort |
| 5 | 50 minutes | Design Brainstorming |
| 6 | 50 minutes | Scale Drawing |
| 7 | 50 minutes | Seat Construction |
| 8 | 50 minutes | Seat Construction |
| 9 | 50 minutes | Presentation<br>Measurement Verification |
| 10 | 50 minutes | Redesign |

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|---|---|---|
| 11 | 50 minutes | Post-Test |

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| Pre-requisite Knowledge & Skill | Students should have basic knowledge of mean, median, mode, and range. Students should be competent in the use of a metric measuring device. |

# Academic Content Standards

| Add Standard | Mathematics |
| --- | --- |
| Grade/Conceptual Category | 6 |
| Domain | Statistics and Probability |
| Cluster | Summarize and describe distributions |
| Standards | 5. Summarize numerical data sets in relation to their context, such as by:<br>a. Reporting the number of observations.<br>b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.<br>c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.<br>d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered |

| Add Standard | Mathematics |
| --- | --- |
| Grade/Conceptual Category | 5 |
| Domain | Measurement and Data |
| Cluster | Represent and interpret data. |
| Standards | 2. Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Use operations on fractions for this grade to solve problems involving information presented in line plots. For example, given different measurements of liquid in identical beakers, find the amount of liquid each beaker would contain if the total amount in all the beakers were redistributed equally. |

| Add Standard | Mathematics |
|---|---|
| Grade/Conceptual Category | 4 |
| Domain | Measurement and Data |
| Cluster | Geometric measurement: understand concepts of angle and measure angles. |
| Standards | 5. Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement:<br>a. An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through 1/360 of a circle is called a “one-degree angle,” and can be used to measure angles.<br>b. An angle that turns through n one-degree angles is said to have an angle measure of n degrees.<br>6. Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure. |

| Add Standard | Mathematics |
|---|---|
| Grade | |
| Standard | |
| Benchmark | |
| Indicator | |

| Add Standard | English Language Arts |
|---|---|
| Grade | |
| Strand | |
| Topic | |
| Standard | |

| Add Standard | English Language Arts |
|---|---|
| Grade | |
| Standard | |
| Benchmark | |
| Indicator | |

| Add Standard | Social Studies |
|---|---|
| Grade | |
| Theme | |
| Strand (pk-8 only) | |
| Topic | |
| Content Standard | |

| Add Standard | Social Studies |
|---|---|
| Grade | |
| Standard | |
| Benchmark | |
| Indicator | |

| Add Standard | Science |
| --- | --- |
| Grade | |
| Theme | |
| Topic | |
| Content Standard | |

| Add Standard | Science |
| --- | --- |
| Strand | |
| Course Content | |
| Content Elaboration | |

| Add Standard | Science |
| --- | --- |
| Grade | |
| Standard | |
| Benchmark | |
| Indicator | |

| Add Standard | Fine Arts |
| --- | --- |
| Grade | |
| Subject | |
| Standard | |
| Benchmark | |
| Indicator | |

| Add Standard | Technology |
| --- | --- |
| Grade | 6 |
| Standard | Nature of Technology |
| Benchmark | Analyze information relative to the characteristics of technology and apply in a practical setting. |
| Indicator | 1. Recognize that there are multiple factors associated with developing products and systems.<br>2. Suggest alternative technological solutions for everyday problems that occur in the school or classroom.<br>3. Follow procedures for identifying and solving system and equipment problems that may occur.<br>4. Cite examples of how characteristics of technology are evident in daily life:<br>a. Technology is based on human knowledge;<br>b. Technology involves tools, materials and systems;<br>c. Application of technology results in artifacts (things or items);<br>d. Technology is develop |

| Add Standard | Technology |
| --- | --- |
| Grade | 6 |
| Standard | Technology and Society Interaction |
| Benchmark | Assess the impact of technological products and systems. |
| Indicator | 1. Employ the use of measuring instruments to collect data.<br>2. Use data collected to analyze and interpret trends in order to identify the positive or negative effects of a technology. |

| Add Standard | **Technology** |
|---|---|
| Grade | 5 |
| Standard | Nature of Technology |
| Benchmark | Compare and discuss the characteristics of technology in our community. |
| Indicator | 1. Create a human-made product from natural materials (e.g., process natural materials into new products).<br>2. Use tools, materials and processes to produce products and carry out tasks efficiently and effectively. |

| Add Standard | **Technology** |
|---|---|
| Grade | 5 |
| Standard | Technology and Society Interaction |
| Benchmark | Identify development patterns and examine the influence of technology on the world. |
| Indicator | 1. Compare, contrast and classify collected information in order to identify patterns of technology development.<br>2. Investigate and assess the influence of a specific technology on the environment.<br>3. Examine the trade-offs of using a product or system and decide when it should be used (e.g., determine the amount of supplies/luggage and mode of transportation needed for traveling various lengths of days and distances). |

| Add Standard | **Technology** |
|---|---|
| Grade | 4 |
| Standard | Nature of Technology |
| Benchmark | Compare and discuss the characteristics of technology in our community. |
| Indicator | 1. Describe how the processing of things found in nature result in human-made artifacts (e.g., furniture may be made from lumber, which comes from trees).<br>2. Demonstrate how tools, materials and skills are used to perform tasks (e.g., computers and cell phones are used to communicate; pencil sharpeners). |

| Add Standard | Technology | |
|---|---|---|
| Grade | 4 | |
| Standard | Technology and Society Interaction | |
| Benchmark | Identify development patterns and examine the influence of technology on the world. | |
| Indicator | 1. Classify collected information in order to identify technology development patterns.<br>2. Investigate and assess the influence of a specific technology on families and the community.<br>3. Develop rules for evaluating the trade-offs when selecting or using a product or system. | |

Assessment Plan

What evidence will show that students have acquired the enduring understandings for this STEM unit?

| | |
|---|---|
| **Performance Task, Projects** | Seat Construction Project<br>Rubric |
| **Quizzes, Tests, Academic Prompts** | Pre-Test<br>Post-Test |
| **Other Evidence** (e.g. observations, work samples, student artifacts, etc.) | Sketches of Prototype<br>Observing Team Collaboration<br>Seat Construction<br>Presentation to Class<br>Student Artifacts<br>Rubric |
| **Student Self- Assessment** | Rubric |

Technology Integration

## ADISC Technology Integration Model*

| | Type of Integration | Application(s) in this STEM Unit |
|---|---|---|
| A | Technology tools and resources that support students and teachers in ***adjusting, adapting, or augmenting*** teaching and learning to meet the needs of individual learners or groups of learners. | Microsoft Excel<br>Electronic White Board<br>Internet Videos |
| D | Technology tools and resources that support students and teachers in ***dealing effectively with data***, including data management, manipulation, and display. | Microsoft Excel<br>Electronic White Board<br>Google Sketchup<br>Google Docs<br>Calculator<br>Protractors |
| I | Technology tools and resources that support students and teachers in conducting ***inquiry***, including the effective use of Internet research methods. | Microsoft Excel<br>Electronic White Board<br>Google Sketchup<br>Google Docs<br>Calculator<br>Protractors |
| S | Technology tools and resources that support students and teachers in ***simulating*** real world phenomena including the modeling of physical, social, economic, and mathematical relationships. | Google Sketchup<br>Internet Videos |
| C | Technology tools and resources that support students and teachers in ***communicating and collaborating*** including the effective use of multimedia tools and online collaboration. | Microsoft Excel<br>Electronic White Board<br>Google Sketchup<br>Google Docs<br>Calculator<br>Protractors |
| | **The ADISC Model was developed by James Rowley PhD, Executive Director of the Institute for Technology-Enhanced Learning at the University of Dayton* | |

Career Connections

## Career Description

Human Factors Engineers focus on human and machine interfaces. These individuals study human needs and physical constraints and use this knowledge to design and redesign products. Examples include: industrial engineering where individual may focus on the most effective and safest designs for an assembly line; the design of a safe cockpit that can provide the pilot with ample visibility and ease of access to all necessary controls needed; or even the design of an automobile given certain constraints such as ones outlined in this lesson. Human Factors Engineering is a diverse career field that spans all avenues of human interaction with man-made technology.

## Section II: STEM Lesson Plan

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|---|---|
| **Title of Lesson** | **Day 1: Pre-Activity Discussion** |
| Time Required | 50 minutes |
| Materials | Appendix A: Pre-test (1 per student)<br>Appendix B: Pre/Post-test Key (1 per teacher)<br>Appendix C: Pre-Activity Discussion (1 per teacher)<br>Ruler (one per student)<br>Protractor (one per student) |
| Objectives | Students will draw on their prior knowledge to demonstrate understanding of the unit concepts by completing a pre-test.<br><br>Students will discuss what makes seats comfortable, important aspects of car seats, and prior experiences with long car rides. |
| Instructional Process | 1. Administer the pre-test<br>2. Lead pre-activity discussion |
| Differentiation | Pre-Activity discussion can be presented in multiple formats; Think-Pair-Share, independent questions, etc..<br><br>Students could be provided independent time to research cars and car seats |
| Assessments | The Pre-Test should be used to assess students' prior knowledge and guide the instructor in modifying this unit as necessary for particular class and student needs.<br><br>Formative assessment through student responses to the pre-activity discussion. |

## Section II: STEM Lesson Plan

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|---|---|
| **Title of Lesson** | **Day 2: Engineering Design Challenge** |
| Time Required | 50 minutes |
| Materials | Appendix E: Engineering Design Process (1 per student)<br>Appendix F: Engineering Design Challenge (1 per student) |

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| Objectives | Students will discuss and be able to take human body measurements to design and create a drivers's seat. |
| Instructional Process | 1. Distribute and read through the Engineering Design Challenge<br>2. Show video clip "Engineering the BMW Driver's Seat": http://www.youtube.com/watch?v=DmvoPh3EIsw (3m 50 sec).<br>3. Pose the lesson's essential question: How are human body measurements used to design and construct an ergonomic driver's seat for an automobile?<br>4. Discuss what parts of the body affect comfort. Such as: leg length, arm reach, back height, etc.<br>5. Distribute and read through the Engineering Design Process.<br>6. Discuss this process and its importance and how engineers use the process when designing things, such as car seats. |
| Differentiation | For challenge, students could be tasked with researching how measurements are used to create car seats. |
| Assessments | Formative assessment through student responses. |

**Title of Lesson** **Day 3: Student Teams**

Time Required 50 minutes

Materials

Appendix G & H: Important Body Measurements (1 per team)
Meter stick or measuring tape (2 per team)

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Objectives

Students will be able collect various measurements, calculate measurements of central tendency, and decide which measurements to use for designing an ergonomic car seat.

Instructional Process

1. Form student teams of 3 - 4 students.
2. Hand out Important Body Measurements.
3. Have students collect teammates measurements as outlined in Important Body Measurements.
4. Instruct students to collect data from all teams and record it on the class calculations table.
5. Have students calculate range, mean, median, mode for each set and answer the provided critical thinking question in Important Body Measurements.
6. Share and discuss answers.
7. As a class, decide which calculation the class should use for their seat design challenge.

Teachers Note: Use the time to gauge individual student understanding and provide scaffolding for students that are struggling with specific concepts.

Differentiation

Students can use Excel to calculate mean, range, median, and mode for data sheets.

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| Assessments | Team measurements<br>Class calculations |

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## Section II: STEM Lesson Plan

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|---|---|
| **Title of Lesson** | **Day 4: Chair Measurement** |
| Time Required | 50 minutes |
| Materials | Appendix I: Report Packet (1 per student)<br>Lawn Chair or Adjustable Desk Chair (1 per team)<br>Protractor (2 per team)<br>Meter Stick or Measuring Tape (2 per team) |

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| Objectives | Student will be able redefine problem and identify criteria and constraints.<br><br>Student will be able to compare and measure various angles to determine comfort of seat. |
| Instructional Process | 1. Distribute and explain the Report Packets to each team.<br>2. Have teams complete steps 1-3. |
| Differentiation | If students are unable to create a team generated table for data collection, you may create a sample and display this for class use. It is recommended that students set-up their chair facing a wall. The teacher should place a piece of paper (post it's work well) that is 26 inches from the floor. This is to serve as the test steering wheel. Verify that students are placing the chair six inches from the wall as stipulated in the student instructions. |
| Assessments | Report Packet Steps 1-3 |

## Section II: STEM Lesson Plan

**Title of Lesson** **Day 5: Brainstorming**

Time Required 50 minutes

Materials
Notebooks (1 per student)
Appendix I: Report Packet
Appendix G & H: Important Body Measurements

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Objectives
Students design a car seat.
Students will sketch a seat based on measurements determined previously.

Instructional Process

1. Discuss that students are now going to create a diagram of the chair their team wants to build.
2. Have teams brainstorm for 5-10 minutes about seat details, including what measurements they will use for their seat as well as other aspects of seat design. Students should use their Report Packets and Important Body Measurements as resources.
3. Individual members should then each draw their own design idea in Step 4 of the Report Packet. Encourage students to continue communicating while they draw their diagram. Diagrams will reflect individual interpretations of the team goal. All diagrams should include:
   -Distance of seat from dash
   -Size of each part of the seat
   -Measurements for each portion of the design
4. Lead a class discussion on the importance of making scale models first and then the full size prototype. Discuss:
   a. What is a scale model or design as a representation or a copy of an object that is larger or smaller than the actual size of the object, which seeks to maintain the relative proportions (the scale factor) of the physical size of the original object.
   b. Elicit why it is important to worry about measurement when creating something.
   (Example: Think about designing a bike, what if you created a bike that's handle bars were 4 feet wide, wheels that made the bike ride too high, a water bottle holder that was too skinny, and seat that was the size of a box of crayons or a chain that was fatter than the gear.)
   c. Discuss how students will create a scale diagram from their first diagram

tomorrow; this will be what students build their prototype from.

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|---|---|
| Differentiation | Students could complete one sketch per team. |
| Assessments | Student sketch<br>Class discussion |

## Section II: STEM Lesson Plan

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|---|---|
| **Title of Lesson** | **Day 6: Scale Model** |
| Time Required | 50 minutes |
| Materials | Computer with projector<br>Appendix J: Scale Model (1 per team) |

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| Objectives | Students will create a scale design of their seats. |
| Instructional Process | 1. Show "ICIDO Virtual Reality: IDO Ergonomics" video: http://www.youtube.com/watch?v=namDFPIgONc<br>2. Lead a brief discussion on the financial importance of engineers making scale drawings and models first and then a full-size prototype.<br>3. Instruct teams to draw a scale diagram of their design using Scale Model.<br>4. Students should work as a team to create a materials list in their notebook. This list will include any and all materials they will need to create a prototype of their seat. |
| Differentiation | Students could be given a scale to use<br>Students could create scale drawing using 3-D modeling software such as Google Sketch-Up<br>Students will need to provide a exact measurements of cardboard needed. |
| Assessments | Scale drawing<br>Materials List |

## Section II: STEM Lesson Plan

**Title of Lesson**

**Day 7 and 8: Seat Construction**

Time Required

100 minutes (2 days)

Materials

Corrugated Cardboard (at least 1 sq. yd. per team)
Duct Tape (3 meters per team)
Scissors (2 per team)
Protractor (2 per team)
Low Temperature Hot Glue Gun (1 per team)
Low Temperature Hot Glue Stick (2 per team)
Meter Stick or Measuring Tape (2 per group)

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Objectives

Students will be able to apply previously gather measurement data to construct a prototype for a driver's car seat.

Instructional Process

1. Instruct teams to build full-size prototypes using available materials that reflect their scale diagram, class population measurements and the 5 key measurements (sitting height, eye-height sitting, buttock-popliteal length, functional arm reach, and should breadth).

Teachers Note: Emphasis should be placed on measurement and following the scale diagram.

Differentiation

Teachers will need to aid students with cutting some of the cardboard. Students will struggle with the building process. Depending on skill level, you may need to provide direction on cross bracing or using additional cardboard supports.

Only provided a specific amount of materials (such as tape or glue)
"Charged" a monetary amount for each supply used and must calculated a total cost of their prototype.

Assessments Prototype and accuracy of meausements

## Section II: STEM Lesson Plan

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|---|---|
| **Title of Lesson** | **Day 9: Presentation** |
| Time Required | 50 minutes |
| Materials | Appendix K: Test and Evaluation (1-2 per student, depending on numbers of teams presenting) |
| Objectives | While the class evaluates their design, students will demonstrate key design features and rationalize design choices as through presentation of their prototype and measurements choices. |
| Instructional Process | 1. Have teams share their prototype with the class.<br>2. Each team should place their chair with the provided teacher dash (see Dashboard Design).<br>3. Each student should complete a Seat Test and Evaluation for each group. This will require taking measurements or being provided measurements by each team presenting.<br>4. Lead a class discussion on "best prototype" design features. Elicit from each team which of their design parameters need to be redesigned according to the test they have just conducted. |
| Differentiation | Provide team measurements to the class. |
| Assessments | Presentations<br>Discussions |

## Section II: STEM Lesson Plan

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|---|---|
| **Title of Lesson** | **Day 10: Re-Design (optional)** |
| Time Required | 50 minutes |
| Materials | Appendix K: Test and Evaluate<br>Appendix L: Reflection (1 per student) |
| Objectives | Students evaluate and identify modifications to made to their prototype design. |
| Instructional Process | 1. Have teams complete the Redesign section of the Test and Evaluate handout.<br>2. Instruct students to complete the Reflection handout. |
| Differentiation | Students could be provided time to redesign their prototype |
| Assessments | Redesign<br>Reflections |

## Section II: STEM Lesson Plan

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|---|---|
| **Title of Lesson** | **Day 11: Post-Test** |
| Time Required | 50 minutes |
| Materials | Appendix A: Post-test (1 per student)<br>Appendix B: Pre/Post-test key (1 per teacher)<br>Ruler (one per student)<br>Protractor (one per student) |
| Objectives | Student will demonstrate learned skills on assessment |
| Instructional Process | 1. Administer the Post-Test. |
| Differentiation | Modify the test as necessary based on individual student needs. |
| Assessments | Summative Assessment: Post-Test |

Materials and Resource Master List

Per Team (recommended 4-6 students per team):
Corrugated Cardboard – at least 1 square yard for each student.  (Teachers Note: This can be obtained from donations from retail stores)
Tape (Duct or Masking) – minimum of 1 roll
2 Scissors (that are capable of cutting through cardboard)
2 Meter Stick and/or Measuring Tape
2 Protractors
Reclining lawn chair or adjustable desk chair
Calculator

Class:
Appendices
Ruler (1 per student)
Proractor (1 per student)
Microsoft Excel (optional)
Electronic White Board (optional)
Mock dashboard to help design the seat
Teachers Note: This should be designed to test reach from seat, more details provided in Appendix M.
Box cutter/ Exacto blade (Teachers Note: This if for teacher use, only)

Key Vocabulary

Anthropometric
study of human dimensions

Data
individual facts, statistics, or items of information

Datum
a single piece of information, as a fact, statistic, or code; an item of data.

Ergonomics
the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and other methods to design in order to optimize human well-being and overall system performance (from International Ergonomics Association www.iea.cc)

Length
the longest extent of anything as measured from end to end

Linear units
units of the measurement of length

Mean
the arithmetic average

Median
the numeric value separating the higher half of a sample, a population, or a probability distribution, from the lower half. Arranging all the observations from lowest value to highest value, the middle value is the median in a finite list of numbers. If there is an even number of observations, then there is no single middle value; the median in that case is the mean of the two middle values.

Mode
the most commonly occurring value in a sample, population or probability distribution
Prototype- one of the first units manufactured of a product, which is tested so that the design can be changed if necessary before the product is manufactured commercially

Protractor
an instrument having a graduated arc for plotting or measuring angles

Range
the difference or interval between the smallest and largest values in a set of data

Scale Design
a representation or copy of an object that is larger or smaller than the actual size of the object, which seeks to maintain the relative proportions (the scale factor) of the physical size of the original object.

(Definitions from dictionary.com)

Technical Brief

In this day and age, the demand for a more eco-friendly car is at a premium and car manufacturers are willing to spend more to develop a car that will consume less gasoline. With wind resistance and friction being a large reason vehicles get the mile per gallon ratio they do, it has been shown that a single-seated car weighs less, has less aerodynamic drag and therefore could run on much less fuel.

The student Engineering Design challenge addresses these consumer demands. The scenario is: a new start-up car company, Electrik, has contacted the 5th and 6th Graders at the Engineering Middle School of Design so that these future drivers can develop a seat for a one- seated car that could accommodate those students when they turn 16. This car, while currently only a prototype, could be on the assembly line by the time these students get their drivers permits.

Students, especially those 11 to 12 year olds, are on the cusp of becoming drivers of cars that have not even been invented yet, and they have a vested interest in the way future cars will perform. The comfort and safety of the driver of any car is important, and the size and shape of the vehicle play an intricate part in its performance. Students are to design the seat for a vehicle that is large enough to be functional, yet small enough to fit the constraints of a required vehicle size. How big is big enough?

Mean, median and mode are statistics used to gather information about a population. Collectively these terms are known as measures of central tendency. Finding the median of the data set will allow students to design a seat for a one-seated car that will accommodate the average student based on class generated data. The mean has a direct application to manufacturing a product for the average population. Using the mode of the data set is also important in manufacturing, if the mode is not considered in the manufacturing process then too much or too little may be produced which will lower profit.

Students will have the opportunity to use the class generated statistical calculations based on class measurements to design a seat for a vehicle that is large enough to be functional, yet small enough to fit the constraints of a required vehicle size. Car seats are usually designed to fit a majority of the driver population. The measurements will be collected, sorted and interpreted by the students.

The engineering design process is used to create a product that will, hopefully solve a problem or fill a need. Based on the given criteria and constraints, students will apply these mathematical concepts and engineering skills to develop a car seat prototype.

**Safety and Disposal**

Proper use of equipment should be discussed before project is started.
Adults should assist students in cutting cardboard if open blade is needed to cut cardboard for final prototype.

Proper use of equipment should be discussed before project is started.
Adults should assist students in cutting cardboard if open blade is needed to cut cardboard for final prototype.

**References**

dictionary.com

U. S. Army Natick RD&E Center. (1991). Anthropometry of U.S. Military Personnel (Metric) (DOD-HDBK-743A). Washington, DC: U. S. Government Printing Office

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## Section IV: Appendices

Appendix A: Pre / Post-Test
Appendix B: Pre / Post-Test ANSWER KEY
Appendix C: Pre-Activity Discussion Teacher Guide
Appendix D: Engineering Design Challenge Rubric
Appendix E: Engineering Design Process
Appendix F: Engineering Design Challenge
Appendix G: Important Body Measurements
Appendix H: Important Body Measurements
Appendix I: Report Packet
Appendix J: Scale Model
Appendix K: Test and Evaluate
Appendix L: Reflection
Appendix M: Dashboard Design Example