Everett School District Framework: Engineering the Future

Course: MS Introduction to Engineering	**Total Framework Hours:** 360 Hours
CIP Code: 149995	**Type:** Exploratory
Career Cluster: Science, Technology, Engineering and Mathematics	**Date Last Modified:** Monday, August 18, 2014

Resources and Standard used in Framework Development:

Standards and competencies used in this framework are from the International Technology Education Association (ITEA) Standards for Technical Literacy outlined in the OSPI Model Framework for Technologies Foundations

Unit 1 INTRO TO ENGINEERING — Hours: 20

Performance Assessment(s):

Students research an artifact and determine how Science, Engineering, Technology, and Math were involved in the creation of the artifact. Students create a presentation showcasing how each discipline involved in the STEM framework contributed to the creation. The students then present their findings to the class with a visual and oral presentation.

Leadership Alignment:

Students are introduced to how this course prepares them for various TSA competitive opportunities including Energy Sources, Go Green Manufacturing, Problem Solving, and Technical Design.

Standards and Competencies

Standard 1: The characteristics and scope of technology.

- C1.1 The history and development of technological knowledge and processes are functions of the setting and have been driven by needs.

Standard 9: The design process

- DP9.1 Established design principles are used to evaluate existing designs, to collect data, and to guide the design process; Design principles are often rules of thumb rather than absolutes.
- DP9.2 The design process is influenced by personal characteristics, such as creativity, teamwork, resourcefulness, and the ability to visualize and think abstractly.

Aligned to Washington State Standards

Arts

Communication - Speaking and Listening

Health and Fitness

Language

Mathematics

CC: Mathematical Practices (MP)

MP.1 Make sense of problems and persevere in solving them. Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and go

Reading

CC: Reading for Literacy in Science and Technical Subjects

Integration of Knowledge and Ideas:

Science

Science and Engineering Practices

1. Asking questions and defining problems
5. Using mathematics and computational thinking

Engineering, Technology, and Applications of Science

MS-ETS1 Engineering Design

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Social Studies

Writing

21st Century Skills

LEARNING AND INNOVATION

Creativity and Innovation
- [x] Think Creatively
- [ ] Work Creatively with Other
- [x] Implement Innovations

Creative Thinking and Problem Solving
- [x] Reason Effectively
- [ ] Use Systems Thinking
- [ ] Make Judgements and Decisions
- [x] Solve Problems

Communication and Collaboratio
- [x] Communicate Clearly
- [x] Collaborate with Others

INFORMATION, MEDIA AND TECHNOLOGY SKILLS

Information Literacy
- [x] Access and Evaluate Information
- [ ] Use and Manage Information

Media Literacy
- [x] Analyze Media
- [ ] Create Media Products

Information, Communications, and Technology (ICT Literacy)
- [x] Apply Technology Effectively

LIFE AND CAREER SKILLS

Flexibility and Adaptability
- [ ] Adapt to Change
- [ ] Be Flexible

Initiative and Self-Direction
- [ ] Mange Goals and Time
- [ ] Work Independently
- [ ] Be Self-Directed Learners

Social and Cross-Cultural
- [ ] Interact Effectively with Other
- [x] Work Effectively in Diverse Teams

Productivity and Accountability
- [x] Manage Projects
- [ ] Produce Results

Leadership and Responsibility
- [ ] Guide and Lead Others
- [ ] Be Responsible to Others

Unit 2 DESIGN PROCESS — Hours: 20

Performance Assessment(s):

Students learn the Design Process and go through each step of the process when designing a piece of furniture, a chair or a table, with a group.

Leadership Alignment:

Students are introduced to how this course prepares them for various TSA competitive opportunities including Energy Sources, Go Green Manufacturing, Problem Solving, and Technical Design.

Standards and Competencies

Standard 9: The design process

- DP9.1 Established design principles are used to evaluate existing designs, to collect data, and to guide the design process; Design principles are often rules of thumb rather than absolutes.
- DP9.2 The design process is influenced by personal characteristics, such as creativity, teamwork, resourcefulness, and the ability to visualize and think abstractly.
- DP9.3 A prototype is a working model used to test a design concept by making actual observations and necessary adjustments.
- DP9.4 The design process takes into account a number of factors, including safety, reliability, economic considerations, manufacturability, maintenance and repairs, and human factors engineering; the design process can't be complete without a prototype or virtual model.

Aligned to Washington State Standards

Arts

Communication - Speaking and Listening

Health and Fitness

Language

Mathematics

CC: Mathematical Practices (MP)

MP.1 Make sense of problems and persevere in solving them. Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and go

MP.5 Use appropriate tools strategically. Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet

MP.6 Attend to precision. Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including usin

Reading

Science

Engineering, Technology, and Applications of Science

MS-ETS1 Engineering Design

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MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

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MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Social Studies

Writing

CC: Writing for Literacy in History/Social Studies, Science, and Technical Subjects

Text Types and Purposes:

Production and Distribution of Writing:

Research to Build and Present Knowledge:

21st Century Skills

LEARNING AND INNOVATION

Creativity and Innovation
- ☑ Think Creatively
- ☑ Work Creatively with Other
- ☑ Implement Innovations

Creative Thinking and Problem Solving
- ☐ Reason Effectively
- ☑ Use Systems Thinking
- ☐ Make Judgements and Decisions
- ☑ Solve Problems

Communication and Collaboratio
- ☑ Communicate Clearly
- ☐ Collaborate with Others

INFORMATION, MEDIA AND TECHNOLOGY SKILLS

Information Literacy
- ☐ Access and Evaluate Information
- ☐ Use and Manage Information

Media Literacy
- ☐ Analyze Media
- ☐ Create Media Products

Information, Communications, and Technology (ICT Literacy)
- ☐ Apply Technology Effectively

LIFE AND CAREER SKILLS

Flexibility and Adaptability
- ☐ Adapt to Change
- ☐ Be Flexible

Initiative and Self-Direction
- ☐ Mange Goals and Time
- ☐ Work Independently
- ☐ Be Self-Directed Learners

Social and Cross-Cultural
- ☐ Interact Effectively with Other
- ☐ Work Effectively in Diverse Teams

Productivity and Accountability
- ☐ Manage Projects
- ☐ Produce Results

Leadership and Responsibility
- ☐ Guide and Lead Others
- ☐ Be Responsible to Others

Unit 3 MEASUREMENT	Hours: 10

Performance Assessment(s):

-Demonstrate the ability to measure accurately with different devices and scales.
-Explain how to meaure in different contexts.
-Measure using both the English and Metric systems.
Students use measurement to create a skimmer that glides across the floor. If their measurement is not not accurate their skimmer will not be a successful project.

Leadership Alignment:

Measurement is embedded in TSA as the Structural Engineering challenge requires an accurate cutlist measured in either the Metric or English system.

Standards and Competencies

Standard 11: Apply the design process.

- DP11.1 Identify the design problem to solve and decide whether or not to address it; differentiate between problems and solutions.
- DP11.2 Identify criteria and constraints and determine how these will affect the design process.
- DP11.3 Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.

Aligned to Washington State Standards

Arts

Communication - Speaking and Listening

Health and Fitness

Language

Mathematics

CC: Mathematical Practices (MP)

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Reading

Science

Science and Engineering Practices

4. Analyzing and interpreting data

Social Studies

Writing

21st Century Skills

LEARNING AND INNOVATION

Creativity and Innovation
- ☐ Think Creatively
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Unit 4 SKETCHING AND DIMENSIONING TECHNIQUES | Hours: 10

Performance Assessment(s):

-Summarize the reasoning for using sketching as a comminication tool.
-Use visualization, spatial rasoning, and geometric shapes to sketch two and three dinmensional shapes.
-Recognize and create thumbnail, perspective, isometric, and orthographic sketches.
-Recognize and accurately interpret one and two point perspective drawings.
-Communicate ideas for design using various sketching methods, notes, and drafting views.
-Dimension orthographic sketch following the guidelines for dimensioning.
Students create orthographic and isometric sketches of block shapes for other students to recreate using wooden blocks to test their accuracy.

Leadership Alignment:

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Standards and Competencies

Standard 8: The attributes of design.

- DP8.1 Design problems are seldom presented in a clearly defined form; the best results are often based on the clarity of the design problem.
- DP8.2 The design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved; the best results are often achieved when the process in non-linear.

Standard 11: Apply the design process.

- DP11.3 Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.

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Arts

Communication - Speaking and Listening

Health and Fitness

Language

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Reading

Science

Science and Engineering Practices

1. Asking questions and defining problems
2. Developing and using models

8. Obtaining, evaluating, and communicating information

Social Studies

Writing

21st Century Skills

LEARNING AND INNOVATION

Creativity and Innovation
- ☐ Think Creatively
- ☐ Work Creatively with Other
- ☐ Implement Innovations

Creative Thinking and Problem Solving
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LIFE AND CAREER SKILLS

Flexibility and Adaptability
- ☐ Adapt to Change
- ☐ Be Flexible

Initiative and Self-Direction
- ☐ Mange Goals and Time
- ☐ Work Independently
- ☑ Be Self-Directed Learners

Social and Cross-Cultural
- ☐ Interact Effectively with Other
- ☑ Work Effectively in Diverse Teams

Productivity and Accountability
- ☐ Manage Projects
- ☐ Produce Results

Leadership and Responsibility
- ☐ Guide and Lead Others
- ☐ Be Responsible to Others

Unit 5 DESIGNING FOR PRODUCTION | Hours: 30

Performance Assessment(s):

Students create and assemble a pegboard toy using Autodesk Inventor, and create a playground model using Autodesk Inventor.

Leadership Alignment:

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Standards and Competencies

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Aligned to Washington State Standards

Arts

Communication - Speaking and Listening

Health and Fitness

Language

Mathematics

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Reading

Science

Engineering, Technology, and Applications of Science

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Social Studies

Writing

CC: Writing for Literacy in History/Social Studies, Science, and Technical Subjects

Text Types and Purposes:

Production and Distribution of Writing:

Research to Build and Present Knowledge:

21st Century Skills

LEARNING AND INNOVATION

Creativity and Innovation
- [x] Think Creatively
- [x] Work Creatively with Other
- [ ] Implement Innovations

Creative Thinking and Problem Solving
- [ ] Reason Effectively
- [x] Use Systems Thinking
- [ ] Make Judgements and Decisions
- [x] Solve Problems

Communication and Collaboratio
- [ ] Communicate Clearly
- [ ] Collaborate with Others

INFORMATION, MEDIA AND TECHNOLOGY SKILLS

Information Literacy
- [x] Access and Evaluate Information
- [ ] Use and Manage Information

Media Literacy
- [ ] Analyze Media
- [ ] Create Media Products

Information, Communications, and Technology (ICT Literacy)
- [x] Apply Technology Effectively

LIFE AND CAREER SKILLS

Flexibility and Adaptability
- [ ] Adapt to Change
- [ ] Be Flexible

Initiative and Self-Direction
- [x] Mange Goals and Time
- [ ] Work Independently
- [x] Be Self-Directed Learners

Social and Cross-Cultural
- [ ] Interact Effectively with Other
- [x] Work Effectively in Diverse Teams

Productivity and Accountability
- [ ] Manage Projects
- [ ] Produce Results

Leadership and Responsibility
- [ ] Guide and Lead Others
- [ ] Be Responsible to Others

Unit 6 INVESTIGATING ENERGY | Hours: 20

Performance Assessment(s):

Students learn about wind turbines and build different blades for them to determine the most effiicient design while calculating power and work by measuring force, distance, and time.

Leadership Alignment:

Students are introduced to how this course prepares them for various TSA competitive opportunities including Energy Sources, Go Green Manufacturing, Problem Solving, and Technical Design.

Standards and Competencies

Standard 1: The characteristics and scope of technology.

- C1.1 The history and development of technological knowledge and processes are functions of the setting and have been driven by needs.
- C1.3 Inventions and innovations in a specific area are generally driven by research to achieve a specific objective.

Standard 2: The core concepts of technology.

- C2.1 Systems thinking involves input, process, output and feedback and applies logic and creativity with appropriate compromises in complex real-life problems.
- C2.2 Technological systems interact with other systems including social, environmental, and scientific. Outputs - expected desirable, expected undesirable, unexpected desirable, unexpected undesirable.
- C2.6 Constraints impact the design process.
- C2.7 New technology creates new processes.

Standard 5: The effects of technology on the environment.

- C5.1 Humans can devise technologies to conserve water, soil, and energy through such techniques as reusing, reducing, and recycling; technology impacts on the environment can be either positive or negative depending on how they are used.
- C5.3 With the aid of technology, various aspects of the environment can be monitored to provide information for decision-making.
- C5.4 The alignment of technological processes with natural processes maximizes performance and reduces negative impacts on the environment.
- C5.5 Humans devise technologies to reduce the negative consequences of other technologies.

Standard 6: The role of society in the development and use of technology.

- C6.3 A number of different factors, such as advertising, the strength of the economy, the goals of a company, and the latest fads contribute to shaping the design of and demand for various technologies. Entrepreneurism is often the driving force behind perceived needs.

Aligned to Washington State Standards

Arts

Communication - Speaking and Listening

Health and Fitness

Language

Mathematics

CC: Mathematical Practices (MP)

MP.1 Make sense of problems and persevere in solving them. Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and go

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MP.6 Attend to precision. Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including usin

Reading

Science

Science and Engineering Practices

1. Asking questions and defining problems
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Social Studies

Writing

CC: Writing (8)

Text Types and Purposes:

Production and Distribution of Writing:

Research to Build and Present Knowledge:

21st Century Skills

LEARNING AND INNOVATION

Creativity and Innovation

- [x] Think Creatively
- [ ] Work Creatively with Other
- [x] Implement Innovations

Creative Thinking and Problem Solving

- [ ] Reason Effectively
- [ ] Use Systems Thinking
- [ ] Make Judgements and Decisions
- [x] Solve Problems

Communication and Collaboratio

- [ ] Communicate Clearly
- [ ] Collaborate with Others

INFORMATION, MEDIA AND TECHNOLOGY SKILLS

Information Literacy

- [x] Access and Evaluate Information
- [ ] Use and Manage Information

Media Literacy

- [ ] Analyze Media
- [ ] Create Media Products

Information, Communications, and Technology (ICT Literacy)

- [x] Apply Technology Effectively

LIFE AND CAREER SKILLS

Flexibility and Adaptability

- [ ] Adapt to Change
- [ ] Be Flexible

Initiative and Self-Direction

- [x] Mange Goals and Time
- [ ] Work Independently
- [x] Be Self-Directed Learners

Social and Cross-Cultural

- [x] Interact Effectively with Other
- [x] Work Effectively in Diverse Teams

Productivity and Accountability

- [x] Manage Projects
- [ ] Produce Results

Leadership and Responsibility

- [ ] Guide and Lead Others
- [ ] Be Responsible to Others

Unit 7 SUSTAINABLE ENERGY | Hours: 20

Performance Assessment(s):

Students are responsible to research an alternative form of energy and produce a prototype of the energy source. They then are responsible to present their prototype to the class with a visual presentation (poster, PowerPoint, Prezi, Etc.) detailing the alternative energy source and the benefits and drawbacks associated with it and relevant background information.

Leadership Alignment:

Students are introduced to how this course prepares them for various TSA competitive opportunities including Energy Sources, Go Green Manufacturing, Problem Solving, and Technical Design.

Standards and Competencies

Standard 2: The core concepts of technology.

- C2.1 Systems thinking involves input, process, output and feedback and applies logic and creativity with appropriate compromises in complex real-life problems.
- C2.4 Tradeoffs result from competing values such as availability, cost, desirability, and waste within a system.
- C2.5 Requirements involve the identification of the criteria and constraints of a product or system. The system design is driven by the requirements.
- C2.6 Constraints impact the design process.

Standard 8: The attributes of design.

- DP8.1 Design problems are seldom presented in a clearly defined form; the best results are often based on the clarity of the design problem.
- DP8.2 The design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved; the best results are often achieved when the process in non-linear.
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Standard 9: The design process

- DP9.1 Established design principles are used to evaluate existing designs, to collect data, and to guide the design process; Design principles are often rules of thumb rather than absolutes.
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- DP9.4 The design process takes into account a number of factors, including safety, reliability, economic considerations, manufacturability, maintenance and repairs, and human factors engineering; the design process can't be complete without a prototype or virtual model.

Aligned to Washington State Standards

Arts

Communication - Speaking and Listening

Health and Fitness

Language

Mathematics

CC: Mathematical Practices (MP)

MP.1 Make sense of problems and persevere in solving them. Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and go

MP.2 Reason abstractly and quantitatively. Mathematically proficient students make sense of the quantities and their relationships in problem situations. Students bring two complementary abilities to bear on problems involving quantitative relationships:

MP.4 Model with mathematics. Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to descri

MP.5 Use appropriate tools strategically. Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet

Reading

Science

Science and Engineering Practices

1. Asking questions and defining problems
2. Developing and using models

Social Studies

Writing

CC: Writing (8)

Text Types and Purposes:

Production and Distribution of Writing:

21st Century Skills

LEARNING AND INNOVATION

Creativity and Innovation

- [x] Think Creatively
- [x] Work Creatively with Other
- [ ] Implement Innovations

Creative Thinking and Problem Solving

- [ ] Reason Effectively
- [ ] Use Systems Thinking
- [x] Make Judgements and Decisions
- [x] Solve Problems

Communication and Collaboratio

- [x] Communicate Clearly
- [x] Collaborate with Others

INFORMATION, MEDIA AND TECHNOLOGY SKILLS

Information Literacy

- [ ] Access and Evaluate Information
- [x] Use and Manage Information

Media Literacy

- [ ] Analyze Media
- [ ] Create Media Products

Information, Communications, and Technology (ICT Literacy)

- [ ] Apply Technology Effectively

LIFE AND CAREER SKILLS

Flexibility and Adaptability

- [ ] Adapt to Change
- [ ] Be Flexible

Initiative and Self-Direction

- [ ] Mange Goals and Time
- [x] Work Independently
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Social and Cross-Cultural

- [ ] Interact Effectively with Other
- [x] Work Effectively in Diverse Teams

Productivity and Accountability

- [ ] Manage Projects
- [ ] Produce Results

Leadership and Responsibility

- [ ] Guide and Lead Others
- [ ] Be Responsible to Others

Unit 8 MAKING AN IMPACT	Hours: 10

Performance Assessment(s):

Students design a pengin dwelling out of various materials in an effort to reduce an ice cube penguin from melting while in a heated environment. Various designs are tested and then revised to develop the best solution to preserve the melting ice penguin. Students learn about global climate change, fossil fuels, and carbon emmisions and the impact upon our planet. Students analyze the solutions now and why they will become more important in their lifetimes and for generations to come.

Leadership Alignment:

Skills and knowledged taught in this unit prepare students for a variety of TSA competitive events including including Energy Sources, Go Green Manufacturing, Problem Solving, and Technical Design.

Standards and Competencies

Standard 1: The characteristics and scope of technology.

- C1.3 Inventions and innovations in a specific area are generally driven by research to achieve a specific objective.
- C1.4 Most development of technologies is driven by profit motive and the market; corporations need to continue to make a profit to continue to develop new products and continue research.

Standard 9: The design process

- DP9.1 Established design principles are used to evaluate existing designs, to collect data, and to guide the design process; Design principles are often rules of thumb rather than absolutes.
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Health and Fitness

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Reading

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MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Social Studies

Writing

21st Century Skills

LEARNING AND INNOVATION

Creativity and Innovation
- [x] Think Creatively
- [x] Work Creatively with Other
- [ ] Implement Innovations

Creative Thinking and Problem Solving
- [ ] Reason Effectively
- [x] Use Systems Thinking
- [ ] Make Judgements and Decisions
- [x] Solve Problems

Communication and Collaboratio
- [x] Communicate Clearly
- [x] Collaborate with Others

INFORMATION, MEDIA AND TECHNOLOGY SKILLS

Information Literacy
- [ ] Access and Evaluate Information
- [ ] Use and Manage Information

Media Literacy
- [ ] Analyze Media
- [x] Create Media Products

Information, Communications, and Technology (ICT Literacy)
- [x] Apply Technology Effectively

LIFE AND CAREER SKILLS

Flexibility and Adaptability
- [x] Adapt to Change
- [x] Be Flexible

Initiative and Self-Direction
- [x] Mange Goals and Time
- [x] Work Independently
- [x] Be Self-Directed Learners

Social and Cross-Cultural
- [x] Interact Effectively with Other
- [x] Work Effectively in Diverse Teams

Productivity and Accountability
- [x] Manage Projects
- [x] Produce Results

Leadership and Responsibility
- [x] Guide and Lead Others
- [x] Be Responsible to Others

Unit 9 WHAT IS AUTOMATION AND ROBOTICS | Hours: 10

Performance Assessment(s):

Students create a visual presentation that shows how robots are used in our world in sectors such as medicine, industry, agriculture, etc. The presentations are created in groups and are presented to their peers for review.

Leadership Alignment:

This unit aligns with the TSA events dealing with Robotics as the students use the VEX kits to build different mechanical systems for the event based upon the same principles taught in the unit.

Standards and Competencies

Standard 4: The cultural, social, economics, and political effects of technology.

- C4.1 Changes caused by the use of technology can range from gradual to rapid and from subtle to obvious.
- C4.2 Making decisions about the use of technology involves understanding the impacts.
- C4.3 Ethical considerations are important in the development, selection, and use of technologies (should we do it just because we can?).

Standard 6: The role of society in the development and use of technology.

- C6.1 Different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values, and standard of living.
- C6.2 Perceived needs are sometimes based on the existence of a technology not on real needs.
- C6.3 A number of different factors, such as advertising, the strength of the economy, the goals of a company, and the latest fads contribute to shaping the design of and demand for various technologies. Entrepreneurism is often the driving force behind perceived needs.

Aligned to Washington State Standards

Arts

Communication - Speaking and Listening

Comprehension and Collaboration:

Presentation of Knowledge and Ideas:

Health and Fitness

Language

Mathematics

Reading

Science

Social Studies

Writing

CC: Writing for Literacy in History/Social Studies, Science, and Technical Subjects

Text Types and Purposes:

Production and Distribution of Writing:

Research to Build and Present Knowledge:

21st Century Skills

LEARNING AND INNOVATION

Creativity and Innovation
- ☐ Think Creatively
- ☐ Work Creatively with Other
- ☐ Implement Innovations

Creative Thinking and Problem Solving
- ☐ Reason Effectively
- ☐ Use Systems Thinking
- ☐ Make Judgements and Decisions
- ☐ Solve Problems

Communication and Collaboratio
- ☑ Communicate Clearly
- ☑ Collaborate with Others

INFORMATION, MEDIA AND TECHNOLOGY SKILLS

Information Literacy
- ☑ Access and Evaluate Information
- ☐ Use and Manage Information

Media Literacy
- ☑ Analyze Media
- ☐ Create Media Products

Information, Communications, and Technology (ICT Literacy)
- ☑ Apply Technology Effectively

LIFE AND CAREER SKILLS

Flexibility and Adaptability
- ☐ Adapt to Change
- ☐ Be Flexible

Initiative and Self-Direction
- ☐ Mange Goals and Time
- ☑ Work Independently
- ☑ Be Self-Directed Learners

Social and Cross-Cultural
- ☐ Interact Effectively with Other
- ☐ Work Effectively in Diverse Teams

Productivity and Accountability
- ☐ Manage Projects
- ☐ Produce Results

Leadership and Responsibility
- ☐ Guide and Lead Others
- ☐ Be Responsible to Others

Unit 10 MECHANICAL SYSTEMS | Hours: 20

Performance Assessment(s):

Students learn about and create prototypes of diffrerent mechanical gear systems (bevel, rack and pinion, etc.). Students are assessed on the workability of their different prototypes, build quality, and practical applications of the different mechanical systems.

Leadership Alignment:

Mechanical systems aligns with the TSA events dealing with Robotics as the students use the VEX kits to build different mechanical systems for the event based upon the same principles taught in the unit.

Standards and Competencies

Standard 6: The role of society in the development and use of technology.

- C6.1 Different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values, and standard of living.
- C6.2 Perceived needs are sometimes based on the existence of a technology not on real needs.
- C6.4 The decision whether to develop a technology is influenced by societal opinions and demands, in addition to corporate cultures.

Standard 11: Apply the design process.

- DP11.1 Identify the design problem to solve and decide whether or not to address it; differentiate between problems and solutions.
- DP11.2 Identify criteria and constraints and determine how these will affect the design process.
- DP11.3 Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.
- DP11.4 Evaluate the design solution using conceptual, physical and mathematical models at various intervals of the design process in order to check for proper design and to note where areas of improvements are needed.
- DP11.5 Develop and produce a product or system using a design process.
- DP11.6 Evaluate final solutions and communicate observations, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models.

Aligned to Washington State Standards

Arts

Communication - Speaking and Listening

Health and Fitness

Language

Mathematics

CC: Mathematical Practices (MP)

MP.1 Make sense of problems and persevere in solving them. Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and go

MP.3 Construct viable arguments and critique the reasoning of others. Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a l

MP.5 Use appropriate tools strategically. Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet

MP.6 Attend to precision. Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including usin

Reading

CC: Reading for Literacy in Science and Technical Subjects

Key Ideas and Details:

Craft and Structure:

Science

Engineering, Technology, and Applications of Science

MS-ETS1 Engineering Design

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Social Studies

Writing

21st Century Skills

LEARNING AND INNOVATION

Creativity and Innovation
- [x] Think Creatively
- [ ] Work Creatively with Other
- [ ] Implement Innovations

Creative Thinking and Problem Solving
- [ ] Reason Effectively
- [x] Use Systems Thinking
- [x] Make Judgements and Decisions
- [x] Solve Problems

Communication and Collaboratio
- [x] Communicate Clearly
- [ ] Collaborate with Others

INFORMATION, MEDIA AND TECHNOLOGY SKILLS

Information Literacy
- [ ] Access and Evaluate Information
- [ ] Use and Manage Information

Media Literacy
- [ ] Analyze Media
- [ ] Create Media Products

Information, Communications, and Technology (ICT Literacy)
- [x] Apply Technology Effectively

LIFE AND CAREER SKILLS

Flexibility and Adaptability
- [x] Adapt to Change
- [x] Be Flexible

Initiative and Self-Direction
- [x] Mange Goals and Time
- [x] Work Independently
- [x] Be Self-Directed Learners

Social and Cross-Cultural
- [x] Interact Effectively with Other
- [x] Work Effectively in Diverse Teams

Productivity and Accountability
- [x] Manage Projects
- [ ] Produce Results

Leadership and Responsibility
- [ ] Guide and Lead Others
- [ ] Be Responsible to Others

Unit 11 AUTOMATED SYSTEMS | Hours: 10

Performance Assessment(s):

Students create an automated solution that will solve a given problem. They use VEX robotics kits and program them to ultimately perform a task in a factory setting (i.e. drill a hole then pass the block to the next station).

Leadership Alignment:

Mechanical systems aligns with the TSA events dealing with Robotics as the students use the VEX kits to build different mechanical systems for the event based upon the same principles taught in the unit.

Standards and Competencies

Standard 9: The design process

- DP9.1 Established design principles are used to evaluate existing designs, to collect data, and to guide the design process; Design principles are often rules of thumb rather than absolutes.
- DP9.2 The design process is influenced by personal characteristics, such as creativity, teamwork, resourcefulness, and the ability to visualize and think abstractly.
- DP9.3 A prototype is a working model used to test a design concept by making actual observations and necessary adjustments.
- DP9.4 The design process takes into account a number of factors, including safety, reliability, economic considerations, manufacturability, maintenance and repairs, and human factors engineering; the design process can't be complete without a prototype or virtual model.

Standard 10: The role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

- DP10.1 Research and development is an integral part of the design process.

Aligned to Washington State Standards

Arts

Communication - Speaking and Listening

Health and Fitness

Language

Mathematics

CC: Mathematical Practices (MP)

MP.4 Model with mathematics. Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to descri

MP.5 Use appropriate tools strategically. Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet

Reading

Science

Engineering, Technology, and Applications of Science

MS-ETS1 Engineering Design

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Social Studies

Writing

21st Century Skills

LEARNING AND INNOVATION

Creativity and Innovation
- [x] Think Creatively
- [ ] Work Creatively with Other
- [ ] Implement Innovations

Creative Thinking and Problem Solving
- [x] Reason Effectively
- [x] Use Systems Thinking
- [x] Make Judgements and Decisions
- [x] Solve Problems

Communication and Collaboratio
- [ ] Communicate Clearly
- [x] Collaborate with Others

INFORMATION, MEDIA AND TECHNOLOGY SKILLS

Information Literacy
- [ ] Access and Evaluate Information
- [x] Use and Manage Information

Media Literacy
- [ ] Analyze Media
- [ ] Create Media Products

Information, Communications, and Technology (ICT Literacy)
- [x] Apply Technology Effectively

LIFE AND CAREER SKILLS

Flexibility and Adaptability
- [x] Adapt to Change
- [x] Be Flexible

Initiative and Self-Direction
- [ ] Mange Goals and Time
- [ ] Work Independently
- [x] Be Self-Directed Learners

Social and Cross-Cultural
- [x] Interact Effectively with Other
- [x] Work Effectively in Diverse Teams

Productivity and Accountability
- [x] Manage Projects
- [ ] Produce Results

Leadership and Responsibility
- [x] Guide and Lead Others
- [x] Be Responsible to Others

Unit 12 DESIGN THE BEST ORGANIZER IN THE WORLD | Hours: 45

Performance Assessment(s):

Students design a better cell phone holder. They also learn how to make engineering drawings, a skill that they will use throughout the course. During the next design challenge, which is the major project of the first unit, the students work in teams to conduct marketing surveys to find out what kinds of organizers people would like to purchase. The concept of an "organizer" also helps students recognize the vast array of technologies that exist in the world around them. Student teams design, draw, and construct models of their organizer concepts, then redesign their organizers for manufacturing. Finally, they build a prototype for testing with the intended audience.

Leadership Alignment:

Skills and knowledged taught in this unit prepare students for a variety of TSA competitive events including including Energy Sources, Go Green Manufacturing, Problem Solving, and Technical Design..

Standards and Competencies

Standard 1: The characteristics and scope of technology.

- C1.1 The history and development of technological knowledge and processes are functions of the setting and have been driven by needs.
- C1.2 The rate of technological development and diffusion is increasing rapidly; advancements in technology drive more advances in technology.
- C1.3 Inventions and innovations in a specific area are generally driven by research to achieve a specific objective.
- C1.4 Most development of technologies is driven by profit motive and the market; corporations need to continue to make a profit to continue to develop new products and continue research.
- C1.5 Technologies career options and opportunities cross many disciplines: Medical technologies, Agricultural and related biotechnology, Energy and power technologies, Information and communication technologies, Transportation technologies, Manufacturing technologies, Construction technologies, Materials science, Principles of technology
- C1.6 Non-traditional training and employment options/opportunities are both possible and encouraged in all technologies.

Standard 2: The core concepts of technology.

- C2.1 Systems thinking involves input, process, output and feedback and applies logic and creativity with appropriate compromises in complex real-life problems.
- C2.2 Technological systems interact with other systems including social, environmental, and scientific. Outputs - expected desirable, expected undesirable, unexpected desirable, unexpected undesirable.
- C2.3 Systems feedback is the process we use to measure and adjust a system based on the output. The stability of a technological system is influenced by all of the components in the system.
- C2.4 Tradeoffs result from competing values such as availability, cost, desirability, and waste within a system.
- C2.5 Requirements involve the identification of the criteria and constraints of a product or system. The system design is driven by the requirements.
- C2.6 Constraints impact the design process.
- C2.7 New technology creates new processes.

Standard 8: The attributes of design.

- DP8.1 Design problems are seldom presented in a clearly defined form; the best results are often based on the clarity of the design problem.
- DP8.2 The design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved; the best results are often achieved when the process in non-linear.
- DP8.3 Requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other.

Standard 9: The design process

- DP9.1 Established design principles are used to evaluate existing designs, to collect data, and to guide the design process; Design principles are often rules of thumb rather than absolutes.
- DP9.2 The design process is influenced by personal characteristics, such as creativity, teamwork, resourcefulness, and the ability to visualize and think abstractly.
- DP9.3 A prototype is a working model used to test a design concept by making actual observations and necessary adjustments.
- DP9.4 The design process takes into account a number of factors, including safety, reliability, economic considerations, manufacturability, maintenance and repairs, and human factors engineering; the design process can't be complete without a prototype or virtual model.

Standard 10: The role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

- DP10.1 Research and development is an integral part of the design process.

- DP10.2 Technological problems must be researched before they can be solved.
- DP10.3 Not every problem can be solved using technology.
- DP10.4 Many technological problems require a multidisciplinary approach.

Standard 11: Apply the design process.

- DP11.1 Identify the design problem to solve and decide whether or not to address it; differentiate between problems and solutions.
- DP11.2 Identify criteria and constraints and determine how these will affect the design process.
- DP11.3 Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.
- DP11.4 Evaluate the design solution using conceptual, physical and mathematical models at various intervals of the design process in order to check for proper design and to note where areas of improvements are needed.
- DP11.5 Develop and produce a product or system using a design process.
- DP11.6 Evaluate final solutions and communicate observations, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models.

Aligned to Washington State Standards

Arts

Communication - Speaking and Listening

Health and Fitness

Language

Mathematics

CC: Mathematical Practices (MP)

MP.1 Make sense of problems and persevere in solving them. Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and go

MP.6 Attend to precision. Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including usin

Reading

CC: Reading for Literacy in Science and Technical Subjects

Key Ideas and Details:

Craft and Structure:

Integration of Knowledge and Ideas:

Range of Reading and Level of Text Complexity:

Science

Science and Engineering Practices

1. Asking questions and defining problems
4. Analyzing and interpreting data
6. Constructing explanations and designing solutions

Social Studies

Writing

CC: Writing (8)

Text Types and Purposes:

W.8.1 Write arguments to support claims with clear reasons and relevant evidence.

W.8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

W.8.3 Write narratives to develop real or imagined experiences or events using effective technique, relevant descriptive details, and well-structured event sequences.

Production and Distribution of Writing:

Research to Build and Present Knowledge:

21st Century Skills

LEARNING AND INNOVATION

Creativity and Innovation
- [x] Think Creatively
- [x] Work Creatively with Other
- [x] Implement Innovations

Creative Thinking and Problem Solving
- [x] Reason Effectively
- [x] Use Systems Thinking
- [ ] Make Judgements and Decisions
- [ ] Solve Problems

Communication and Collaboratio
- [ ] Communicate Clearly
- [ ] Collaborate with Others

INFORMATION, MEDIA AND TECHNOLOGY SKILLS

Information Literacy
- [x] Access and Evaluate Information
- [x] Use and Manage Information

Media Literacy
- [x] Analyze Media
- [x] Create Media Products

Information, Communications, and Technology (ICT Literacy)
- [x] Apply Technology Effectively

LIFE AND CAREER SKILLS

Flexibility and Adaptability
- [x] Adapt to Change
- [x] Be Flexible

Initiative and Self-Direction
- [x] Mange Goals and Time
- [x] Work Independently
- [x] Be Self-Directed Learners

Social and Cross-Cultural
- [x] Interact Effectively with Other
- [x] Work Effectively in Diverse Teams

Productivity and Accountability
- [x] Manage Projects
- [x] Produce Results

Leadership and Responsibility
- [x] Guide and Lead Others
- [x] Be Responsible to Others

Unit 13 DESIGN A BUILDING OF THE FUTURE | Hours: 45

Performance Assessment(s):

Project 2.0 introduces students to the problems of urban sprawl. To address these problems, the students learn about the “new urbanism” movement in which city planners, architects, and engineers work together to design structures that serve a variety of functions. Students are challenged to work in teams to design a structure for housing and at least one other function, such as office space, retail shops, or manufacturing facilities. But first they need to determine how to design structures that
will bear heavy loads, how to test materials that have the properties needed in different parts of the structure, and how to design a building that minimizes the amount of energy needed to maintain a comfortable temperature. Finally, they apply the concepts and tools of science to design a building that is structurally sound, thermally efficient, and promises to help solve the problems of urban
sprawl Included performance assessments:

Define the Problem
Identify the Loads the Building Must Support
Use Failure Analysis to Design a Safer Building
Test Construction Materials for Strength
Describe Mechanical Properties of Materials
Experiment with Concrete
Make Your Building Energy Efficient
Make a Scale Drawing of Your Building Design
Design a Building of the Future

Leadership Alignment:

Skills and knowledged taught in this unit prepare students for a variety of TSA competitive events including including Energy Sources, Go Green Manufacturing, Problem Solving, and
Technical Design.

Standards and Competencies

Standard 1: The characteristics and scope of technology.

- C1.1 The history and development of technological knowledge and processes are functions of the setting and have been driven by needs.
- C1.2 The rate of technological development and diffusion is increasing rapidly; advancements in technology drive more advances in technology.
- C1.3 Inventions and innovations in a specific area are generally driven by research to achieve a specific objective.

Standard 2: The core concepts of technology.

- C2.1 Systems thinking involves input, process, output and feedback and applies logic and creativity with appropriate compromises in complex real-life problems.
- C2.2 Technological systems interact with other systems including social, environmental, and scientific. Outputs - expected desirable, expected undesirable, unexpected desirable, unexpected undesirable.
- C2.3 Systems feedback is the process we use to measure and adjust a system based on the output. The stability of a technological system is influenced by all of the components in the system.
- C2.6 Constraints impact the design process.
- C2.7 New technology creates new processes.

Standard 7: The influence of technology on history.

- C7.1 Most technological development has been evolutionary, the result of a series of refinements to a basic invention; many technology changes have driven and have been impacted by history.
- C7.2 Civilization has been directly affected by, and has in turn affected, the development and use of tools and materials.

Standard 8: The attributes of design.

- DP8.1 Design problems are seldom presented in a clearly defined form; the best results are often based on the clarity of the design problem.
- DP8.2 The design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved; the best results are often achieved when the process in non-linear.

- DP8.3 Requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other.

Standard 9: The design process

- DP9.1 Established design principles are used to evaluate existing designs, to collect data, and to guide the design process; Design principles are often rules of thumb rather than absolutes.
- DP9.2 The design process is influenced by personal characteristics, such as creativity, teamwork, resourcefulness, and the ability to visualize and think abstractly.
- DP9.3 A prototype is a working model used to test a design concept by making actual observations and necessary adjustments.
- DP9.4 The design process takes into account a number of factors, including safety, reliability, economic considerations, manufacturability, maintenance and repairs, and human factors engineering; the design process can't be complete without a prototype or virtual model.

Standard 10: The role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

- DP10.1 Research and development is an integral part of the design process.
- DP10.2 Technological problems must be researched before they can be solved.
- DP10.4 Many technological problems require a multidisciplinary approach.

Aligned to Washington State Standards

Arts

Communication - Speaking and Listening

Health and Fitness

Language

Mathematics

CC: Mathematical Practices (MP)

MP.1 Make sense of problems and persevere in solving them. Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and go

MP.2 Reason abstractly and quantitatively. Mathematically proficient students make sense of the quantities and their relationships in problem situations. Students bring two complementary abilities to bear on problems involving quantitative relationships:

MP.3 Construct viable arguments and critique the reasoning of others. Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a l

MP.4 Model with mathematics. Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to descri

MP.5 Use appropriate tools strategically. Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet

MP.6 Attend to precision. Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including usin

MP.7 Look for and make use of structure. Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a

MP.8 Look for and express regularity in repeated reasoning. Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that th

Reading

CC: Reading Informational Text

Key Ideas and Details:

RI.8.3 Analyze how a text makes connections among and distinctions between individuals, ideas, or events (e.g., through comparisons, analogies, or categories).

Integration of Knowledge and Ideas:
Range of Reading and Level of Text Complexity:

Science

Science and Engineering Practices

1. Asking questions and defining problems
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Social Studies

Writing

CC: Writing (8)
Text Types and Purposes:
Production and Distribution of Writing:

21st Century Skills

LEARNING AND INNOVATION

Creativity and Innovation
- ☑ Think Creatively
- ☑ Work Creatively with Other
- ☑ Implement Innovations

Creative Thinking and Problem Solving
- ☑ Reason Effectively
- ☑ Use Systems Thinking
- ☑ Make Judgements and Decisions
- ☑ Solve Problems

Communication and Collaboratio
- ☑ Communicate Clearly
- ☑ Collaborate with Others

INFORMATION, MEDIA AND TECHNOLOGY SKILLS

Information Literacy
- ☑ Access and Evaluate Information
- ☑ Use and Manage Information

Media Literacy
- ☑ Analyze Media
- ☑ Create Media Products

Information, Communications, and Technology (ICT Literacy)
- ☑ Apply Technology Effectively

LIFE AND CAREER SKILLS

Flexibility and Adaptability
- ☐ Adapt to Change
- ☑ Be Flexible

Initiative and Self-Direction
- ☑ Mange Goals and Time
- ☑ Work Independently
- ☑ Be Self-Directed Learners

Social and Cross-Cultural
- ☑ Interact Effectively with Other
- ☑ Work Effectively in Diverse Teams

Productivity and Accountability
- ☑ Manage Projects
- ☑ Produce Results

Leadership and Responsibility
- ☑ Guide and Lead Others
- ☑ Be Responsible to Others

Unit 14 IMPROVE A PATENTED BOAT DESIGN | Hours: 45

Performance Assessment(s):

This unit invites students to build a putt-putt boat that is powered by a thermal/fluid engine. The challenge is to apply fundamental concepts of energy to understand how the boat works, and then
redesign it. Lab teams work together in a series of activities to learn how energy is transferred through the boat system, from a candle that provides energy input, to the jets of water that propel the boat forward. These experiments involve the behavior of compressible gases and noncompressible fluids, conduction of thermal energy, and the concept of resistance to fluid flow in pipes. As students build knowledge of the science behind the putt-putt boat, they take on the role of working engineers and produce a patent to communicate their ideas.

Performance Assessments:
Putt-Putt Boats and Patents
Manufacture a Putt-Putt Boat
Investigate Fluid Systems
Develop a Manufacturing Press
Investigate Heat Engines
The Rocket Effect
Investigate Resistance in Pipes
Redesign the Putt-Putt Boat
Present Your Patent

Leadership Alignment:

Skills and knowledged taught in this unit prepare students for a variety of TSA competitive events including including Energy Sources, Go Green Manufacturing, Problem Solving, and Technical Design.

Standards and Competencies

Standard 1: The characteristics and scope of technology.
- C1.1 The history and development of technological knowledge and processes are functions of the setting and have been driven by needs.
- C1.3 Inventions and innovations in a specific area are generally driven by research to achieve a specific objective.

Standard 2: The core concepts of technology.
- C2.1 Systems thinking involves input, process, output and feedback and applies logic and creativity with appropriate compromises in complex real-life problems.
- C2.2 Technological systems interact with other systems including social, environmental, and scientific. Outputs - expected desirable, expected undesirable, unexpected desirable, unexpected undesirable.
- C2.4 Tradeoffs result from competing values such as availability, cost, desirability, and waste within a system.
- C2.5 Requirements involve the identification of the criteria and constraints of a product or system. The system design is driven by the requirements.
- C2.6 Constraints impact the design process.
- C2.7 New technology creates new processes.
- C2.8 Quality control is a planned process to ensure that a product, service, or system meets established criteria and is embedded in the feedback loop.
- C2.9 Management is the process of planning, organizing, and controlling work.

Standard 3: The relationships among technologies and the connections between technology and other fields of study.
- C3.1 Technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function; al technical systems are interrelated.
- C3.2 Technological innovation often results when ideas, knowledge, or skills are shared within a technology, among technologies, or across other fields.
- C3.3 Technological ideas are sometimes protected through the patent process.

Standard 8: The attributes of design.
- DP8.1 Design problems are seldom presented in a clearly defined form; the best results are often based on the clarity of the design problem.

- DP8.2 The design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved; the best results are often achieved when the process in non-linear.

- DP8.3 Requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other.

Standard 9: The design process

- DP9.1 Established design principles are used to evaluate existing designs, to collect data, and to guide the design process; Design principles are often rules of thumb rather than absolutes.

- DP9.2 The design process is influenced by personal characteristics, such as creativity, teamwork, resourcefulness, and the ability to visualize and think abstractly.

- DP9.3 A prototype is a working model used to test a design concept by making actual observations and necessary adjustments.

- DP9.4 The design process takes into account a number of factors, including safety, reliability, economic considerations, manufacturability, maintenance and repairs, and human factors engineering; the design process can't be complete without a prototype or virtual model.

Standard 10: The role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

- DP10.1 Research and development is an integral part of the design process.

- DP10.2 Technological problems must be researched before they can be solved.

- DP10.3 Not every problem can be solved using technology.

- DP10.4 Many technological problems require a multidisciplinary approach.

Standard 11: Apply the design process.

- DP11.1 Identify the design problem to solve and decide whether or not to address it; differentiate between problems and solutions.

- DP11.2 Identify criteria and constraints and determine how these will affect the design process.

- DP11.3 Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.

- DP11.4 Evaluate the design solution using conceptual, physical and mathematical models at various intervals of the design process in order to check for proper design and to note where areas of improvements are needed.

- DP11.5 Develop and produce a product or system using a design process.

- DP11.6 Evaluate final solutions and communicate observations, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models.

Aligned to Washington State Standards

Arts

Communication - Speaking and Listening

Health and Fitness

Language

Mathematics

CC: Mathematical Practices (MP)

MP.4 Model with mathematics. Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to descri

MP.5 Use appropriate tools strategically. Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet

MP.6 Attend to precision. Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including usin

Reading

CC: Reading Informational Text

Key Ideas and Details:
Craft and Structure:
Integration of Knowledge and Ideas:
Range of Reading and Level of Text Complexity:

Science

Science and Engineering Practices

1. Asking questions and defining problems
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Social Studies

Writing

CC: Writing for Literacy in History/Social Studies, Science, and Technical Subjects
Text Types and Purposes:
Production and Distribution of Writing:
Research to Build and Present Knowledge:
Range of Writing:

21st Century Skills

LEARNING AND INNOVATION

Creativity and Innovation
- [x] Think Creatively
- [x] Work Creatively with Other
- [x] Implement Innovations

Creative Thinking and Problem Solving
- [x] Reason Effectively
- [x] Use Systems Thinking
- [x] Make Judgements and Decisions
- [x] Solve Problems

Communication and Collaboratio
- [x] Communicate Clearly
- [x] Collaborate with Others

INFORMATION, MEDIA AND TECHNOLOGY SKILLS

Information Literacy
- [x] Access and Evaluate Information
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Media Literacy
- [x] Analyze Media
- [x] Create Media Products

Information, Communications, and Technology (ICT Literacy)
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LIFE AND CAREER SKILLS

Flexibility and Adaptability
- [x] Adapt to Change
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Productivity and Accountability
- [x] Manage Projects
- [x] Produce Results

Leadership and Responsibility
- [x] Guide and Lead Others
- [x] Be Responsible to Others

Unit 15 ELECTRICITY AND COMMUNICATION SYSTEMS | Hours: 45

Performance Assessment(s):

This unit revolves around a communications activity in which the students build a circuit to control a scoreboard numeral and create a binary code for each numeral. They then conduct a variety of activities to learn about the basics of circuit electricity using Snap Circuits. With a strong foundation in electricity, students then explore various communications systems using microphones, speakers, laser diodes, and fiber optics. Students also learn about electrical power systems and why some systems work better than others for different applications. Throughout the unit the students design and test circuits to solve specific problems, from detecting rodents in the basement to controlling two fans so they run at variable speeds.

Performance Assessments:
Create a Scoreboard
Design a Mouse Detector
Design a Communications System
Explore Circuits with an Ammeter
Explore Circuits with a Voltmeter
Design a Fan Control System
Provide Energy to a Lighthouse
Analyze Consumer Electronics

Leadership Alignment:

Students work collaboratively to design electrical projects.

Standards and Competencies

Standard 2: The core concepts of technology.

- C2.1 Systems thinking involves input, process, output and feedback and applies logic and creativity with appropriate compromises in complex real-life problems.
- C2.2 Technological systems interact with other systems including social, environmental, and scientific. Outputs - expected desirable, expected undesirable, unexpected desirable, unexpected undesirable.
- C2.3 Systems feedback is the process we use to measure and adjust a system based on the output. The stability of a technological system is influenced by all of the components in the system.
- C2.7 New technology creates new processes.

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Standard 12: Use and maintain technological products and systems.

- DP12.1 Document process and procedures and communicate them to different audiences using appropriate oral and written techniques; technical communications is critical to maintaining and operating a system.
- DP12.2 Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it.
- DP12.3 Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.
- DP12.4 Operate systems so that they function in the way they were designed; management and quality control are necessary for the system to operate the way it was designed.
- DP12.5 Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.

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Health and Fitness

Language

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MP.2 Reason abstractly and quantitatively. Mathematically proficient students make sense of the quantities and their relationships in problem situations. Students bring two complementary abilities to bear on problems involving quantitative relationships:

MP.3 Construct viable arguments and critique the reasoning of others. Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a l

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MP.7 Look for and make use of structure. Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a

MP.8 Look for and express regularity in repeated reasoning. Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that th

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CC: Writing for Literacy in History/Social Studies, Science, and Technical Subjects

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