MOORESTOWN TOWNSHIP PUBLIC SCHOOLS
MOORESTOWN, NEW JERSEY

Moorestown High School
Arts & Technology

Honors Robotics

Grade – 10 - 12

Date : Jul 22, 2023
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Course Description and Fundamental Concepts

Honors Robotics provides an opportunity to work with programming, mechanical, electrical and other subsystems of robotics in practical terms. Students will work collaboratively through robotics based projects which entail research, design, and prototyping. As robotics is heavily dependent upon systems engineering, independent robotic subsystems designed are stressed to build skills required to continually adapt to new challenges and systems. Robotics utilizes hand-on problem solving challenges that will culminate in a robotics competition. Class meets five (5) single periods per week.and theoretical terms. This technology program is valuable to those considering technical or engineering careers.

Topics include:

- Engineering and Design Process
- Electrical Systems and engineering
- Structural systems and engineering
- Manufacturing and prototyping
- Research
- Problem solving
- Computer Aided Drafting and Design
- Mechanical advantage
- Computer programming
- Robotic systems
- Safety and tool usage

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New Jersey Student Learning Standards (NJSLS)

Technological and Engineering Literacy / Computer Science & Design Thinking

ITEEA Standards for Technological and Engineering Literacy		
	Standard #	**Standard Description**
1,3,4,5,6,7,8,9,10,&11	**1**	**Nature and Characteristics of Technology and Engineering**
1,2,3,4,5,6,7,8,9,10,&11	**2**	**Core concepts of Technology and Engineering**
1,3,4,5,6,7,8,9,10,&11	**3**	**Integration of knowledge, technology, and Practices**
3,4,5,6,7,8,9,10,&11	**4**	**Impacts of technology**
3,4,5,6,7,8,9,10,&11	**5**	**Influence of Society on Technology and Engineering Education**
1,10,11	**6**	**History of Technology**
1,3,4,5,6,7,8,&9	**7**	**Design in technology and engineering education**
2,3,4,5,6,7,8,9,10	**8**	**Applying, maintaining, and assessing technological products and systems**
NJSLS - Computer Science and Design Thinking		
3,4,5,6,7,8,9&11	**8.1.12.CS.1**	**Describe ways in which integrated systems hide underlying implementation details to simplify user experiences.**
	8.1.12.CS.2	**Model interactions between application software, system software, and hardware.**
	8.1.12.CS.3	**Compare the functions of application software, system software, and hardware.**
2	**8.1.12.CS.4**	**Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.**
	8.1.12.NI.1	**Evaluate the scalability and reliability of networks, by describing the relationship between routers, switches, servers, topology, and addressing.**

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	8.1.12.NI.2	**Evaluate security measures to address various common security threats.**
	8.1.12.NI.3	**Explain how the needs of users and the sensitivity of data determine the level of security implemented.**
	8.1.12.NI.4	**Explain how decisions on methods to protect data are influenced by whether the data is at rest, in transit, or in use.**
	8.1.12.IC.1	**Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.**
	8.1.12.IC.2	**Test and refine computational artifacts to reduce bias and equity deficits.**
	8.1.12.IC.3	**Predict the potential impacts and implications of emerging technologies on larger social, economic, and political structures, using evidence from credible sources.**
	8.1.12.DA.1	**Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.**
	8.1.12.DA.2	**Describe the trade-offs in how and where data is organized and stored.**
	8.1.12.DA.3	**Translate between decimal numbers and binary numbers.**
	8.1.12.DA.4	**Explain the relationship between binary numbers and the storage and use of data in a computing device.**
	8.1.12.DA.5	**Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.**
3,4,5,6,7,8,&9	**8.1.12.DA.6**	**Create and refine computational models to better represent the relationships among different elements of data collected from a phenomenon or process.**
	8.1.12.AP.1	**Design algorithms to solve computational problems using a combination of original and existing algorithms.**
	8.1.12.AP.2	**Create generalized computational solutions using collections instead of repeatedly using simple variables.**
	8.1.12.AP.3	**Select and combine control structures for a specific application based upon performance and readability, and identify trade-offs to justify the choice.**
	8.1.12.AP.4	**Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue.**
	8.1.12.AP.5	**Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.**

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	8.1.12.AP.6	**Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.**
1	**8.1.12.AP.7**	**Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users.**
	8.1.12.AP.8	**Evaluate and refine computational artifacts to make them more usable and accessible.**
	8.1.12.AP.9	**Collaboratively document and present design decisions in the development of complex programs.**
1,3,4,5,6,7,8, &9	**8.2.12.ED.1**	**Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.**
3,4,5,6,7,8,&9	**8.2.12.ED.2**	**Create scaled engineering drawings for a new product or system and make modifications to increase optimization based on feedback.**
3,4,5,6,7,8,&9	**8.2.12.ED.3**	**Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.**
	8.2.12.ED.4	**Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.**
3,4,5,6,7,8,&9	**8.2.12.ED.5**	**Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).**
	8.2.12.ED.6	**Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor).**
1	**8.2.12.ITH.1**	**Analyze a product to determine the impact that economic, political, social, and/or cultural factors have had on its design, including its design constraints.**
	8.2.12.ITH.2	**Propose an innovation to meet future demands supported by an analysis of the potential costs, benefits, trade-offs, and risks related to the use of the innovation.**
	8.2.12.ITH.3	**Analyze the impact that globalization, social media, and access to open source technologies has had on innovation and on a society's economy, politics, and culture.**
	8.2.12.NT.1	**Explain how different groups can contribute to the overall design of a product.**
1	**8.2.12.NT.2**	**Redesign an existing product to improve form or function.**

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	8.2.12.ETW.1	**Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product.**
	8.2.12.ETW.2	**Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment.**
	8.2.12.ETW.3	**Identify a complex, global environmental or climate change issue, develop a systematic plan of investigation, and propose an innovative sustainable solution.**
	8.2.12.EC.1	**Analyze controversial technological issues and determine the degree to which individuals, businesses, and governments have an ethical role in decisions that are made.**
	8.2.12.EC.2	**Assess the positive and negative impacts of emerging technologies on developing countries and evaluate how individuals, non-profit organizations, and governments have responded.**
10	**8.2.12.EC.3**	**Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society, and environment and share this information with the appropriate audience.**
	8.2.12.ETW.4	**Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints.**

English Companion Standards

List grade-level appropriate companion standards for History, Social Studies, Science and Technical Subjects (CTE/Arts) 6-12. English Companion Standards are required in these subject/content areas.

Unit Addressed	Standard #	Standard Description
1,3,4,5,6,7,8,9,10,&11	**NJSLSA.R1**	*Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.*
1,3,4,5,6,7,8,9,10,&11	**NJSLSA.R7**	*Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.*
1,3,4,5,6,7,8,9,10,&11	**NJSLSA.W 2**	*Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.*
1,3,4,5,6,7,8,9,10,&11	**NJSLSA.W 4**	*Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.*

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1,3,4,5,6,7,8,9,10,&11	**NJSLSA.W 6**	*Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.*
1,3,4,5,6,7,8,9,10,&11	**NJSLSA.W 8**	*Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.*

Career Awareness, Exploration, Preparation, and Training (Standard 9.2)
List appropriate units below for which standards will be addressed

By Grade 12		
Unit Addressed	**Core Idea**	**Standard / Description**
3,4,5,6,7,8,9,10,&11	There are strategies to improve one's professional value and marketability.	***9.2.12.CAP.1**: Analyze unemployment rates for workers with different levels of education and how the economic, social, and political conditions of a time period are affected by a recession.* ***9.2.12.CAP.2**: Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.* ***9.2.12.CAP.3**: Investigate how continuing education contributes to one's career and personal growth.*
3,4,5,6,7,8,9,10,&11	Career planning requires purposeful planning based on research, self-knowledge, and informed choices.	***9.2.12.CAP.4**: Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.* ***9.2.12.CAP.5**: Assess and modify a personal plan to support current interests and postsecondary plans.* ***9.2.12.CAP.6**: Identify transferable skills in career choices and design alternative career plans based on those skills.* ***9.2.12.CAP.7**: Use online resources to examine licensing, certification, and credentialing requirements at the local, state, and national levels to maintain compliance with industry requirements in areas of career interest.* ***9.2.12.CAP.8**: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.*

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		9.2.12.CAP.9*: Locate information on working papers, what is required to obtain them, and who must sign them.* ***9.2.12.CAP.10****: Identify strategies for reducing overall costs of postsecondary education (e.g., tuition assistance, loans, grants, scholarships, and student loans).* ***9.2.12.CAP.11****: Demonstrate an understanding of Free Application for Federal Student Aid (FAFSA) requirements to apply for postsecondary education.*
	An individual's income and benefit needs and financial plan can change over time.	***9.2.12.CAP.12****: Explain how compulsory government programs (e.g., Social Security, Medicare) provide insurance against some loss of income and benefits to eligible recipients.* ***9.2.12.CAP.13****: Analyze how the economic, social, and political conditions of a time period can affect the labor market.*
	Securing an income involves an understanding of the costs and time in preparing for a career field, interview and negotiation skills, job searches, resume development, prior experience, and vesting and retirement plans.	***9.2.12.CAP.14****: Analyze and critique various sources of income and available resources (e.g., financial assets, property, and transfer payments) and how they may substitute for earned income.*
	Understanding income involves an analysis of payroll taxes, deductions and earned benefits.	***9.2.12.CAP.15****: Demonstrate how exemptions, deductions, and deferred income (e.g., retirement or medical) can reduce taxable income.* ***9.2.12.CAP.16****: Explain why taxes are withheld from income and the relationship of federal, state, and local taxes (e.g., property, income, excise, and sales) and how the money collected is used by local, county, state, and federal governments.* ***9.2.12.CAP.17****: Analyze the impact of the collective bargaining process on benefits, income, and fair labor practice.* ***9.2.12.CAP.18****: Differentiate between taxable and nontaxable income from various forms of employment (e.g., cash business, tips, tax filing and withholding).* ***9.2.12.CAP.19****: Explain the purpose of payroll deductions and why fees for various benefits (e.g., medical benefits) are taken out of pay, including the cost of employee benefits to employers and self-employment income.*

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		9.2.12.CAP.20*: Analyze a Federal and State Income Tax Return.*
	There are ways to assess a business's feasibility and risk and to align it with an individual's financial goals.	***9.2.12.CAP.21****: Explain low-cost and low-risk ways to start a business.* ***9.2.12.CAP.22****: Compare risk and reward potential and use the comparison to decide whether starting a business is feasible.* ***9.2.12.CAP.23****: Identify different ways to obtain capital for starting a business*

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Life Literacies and Key Skills (Standard 9.4)
List appropriate units below for which standards will be addressed

By Grade 12		
Unit Addressed	**Core Idea**	**Standard / Description**
	Creativity and Innovation: With a growth mindset, failure is an important part of success.	***9.4.12.CI.1****: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).*
	Creativity and Innovation: Innovative ideas or innovation can lead to career opportunities.	***9.4.12.CI.2:*** *Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).* ***9.4.12.CI.3:*** *Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).*
3,4,5,6,7,8,9,10, &11	**Critical Thinking and Problem-solving:** Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.	***9.4.12.CT.1:*** *Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).* ***9.4.12.CT.2:*** *Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).* ***9.4.12.CT.3:*** *Enlist input from a variety of stakeholders (e.g., community members, experts in the field) to design a service learning activity that addresses a local or global issue (e.g., environmental justice).* ***9.4.12.CT.4:*** *Participate in online strategy and planning sessions for course-based, school-based, or other projects and determine the strategies that contribute to effective outcomes.*
	Digital Citizenship: Laws govern the use of intellectual property and there are legal consequences to utilizing or sharing another's original works without permission or appropriate credit.	***9.4.12.DC.1****: Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content (e.g., 6.1.12.CivicsPR.16.a).* ***9.4.12.DC.2****: Compare and contrast international differences in copyright laws and ethics*

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	Digital Citizenship: Laws govern many aspects of computing, such as privacy, data, property, information, and identity. These laws can have beneficial and harmful effects, such as expediting or delaying advancements in computing and protecting or infringing upon people's rights.	***9.4.12.DC.3****: Evaluate the social and economic implications of privacy in the context of safety, law, or ethics (e.g., 6.3.12.HistoryCA.1).* ***9.4.12.DC.4****: Explain the privacy concerns related to the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3).* ***9.4.12.DC.5****: Debate laws and regulations that impact the development and use of software.*
	Digital Citizenship: Cultivating online reputations for employers and academia requires separating private and professional digital identities.	***9.4.12.DC.6****: Select information to post online that positively impacts personal image and future college and career opportunities.*
	Digital Citizenship: Digital communities influence many aspects of society, especially the workforce. The increased connectivity between people in different cultures and different career fields have changed the nature, content, and responsibilities of many careers.	***9.4.12.DC.7****: Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society (e.g., 6.1.12.CivicsPD.16.a).*
	Digital Citizenship: Network connectivity and computing capability extended to objects, sensors and everyday items not normally considered computers allows these devices to generate, exchange, and consume data with minimal human intervention. Technologies such as Artificial Intelligence (AI) and blockchain can help minimize the effect of climate change.	***9.4.12.DC.8****: Explain how increased network connectivity and computing capabilities of everyday objects allow for innovative technological approaches to climate protection.*
	Global and Cultural Awareness: Solutions to the problems faced by a global society require the contribution of individuals with different points of view and experiences.	***9.4.12.GCA.1:*** *Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political. economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3).*

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3,4,5,6,7,8,9,10, &11	**Information and Media Literacy:** Advanced search techniques can be used with digital and media resources to locate information and to check the credibility and the expertise of sources to answer questions, solve problems, and inform the decision-making.	***9.4.12.IML.1:*** *Compare search browsers and recognize features that allow for filtering of information.* ***9.4.12.IML.2:*** *Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJSLSA.W8, Social Studies Practice: Gathering and Evaluating Sources.*
	Information and Media Literacy: Digital tools such as artificial intelligence, image enhancement and analysis, and sophisticated computer modeling and simulation create new types of information that may have profound effects on society. These new types of information must be evaluated carefully	***9.4.12.IML.3****: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)* ***9.4.12.IML.4****: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience (e.g., S-ID.B.6b, HS-LS2-4).*
	Information and Media Literacy: In order for members of our society to participate productively, information needs to be shared accurately and ethically.	***9.4.12.IML.5****: Evaluate, synthesize, and apply information on climate change from various sources appropriately (e.g., 2.1.12.CHSS.6, S.IC.B.4, S.IC.B.6, 8.1.12.DA.1, 6.1.12.GeoHE.14.a, 7.1.AL.PRSNT.2).* ***9.4.12.IML.6****: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity (e.g., NJSLSA.SL5).*
	Information and Media Literacy: Accurate information may help in making valuable and ethical choices.	***9.4.12.IML.7****: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change (e.g., NJSLSA.W1, 7.1.AL.PRSNT.4).*
	Information and Media Literacy: Media have embedded values and points of view.	***9.4.12.IML.8****: Evaluate media sources for point of view, bias, and motivations (e.g., NJSLSA.R6, 7.1.AL.IPRET.6).* ***9.4.12.IML.9****: Analyze the decisions creators make to reveal explicit and implicit messages within information and media (e.g., 1.5.12acc.C2a, 7.1.IL.IPRET.4).*

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3,4,5,6,7,8,9,10, &11	**Technology Literacy:** Digital tools differ in features, capacities, and styles. Knowledge of different digital tools is helpful in selecting the best tool for a given task.	***9.4.12.TL.1****: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specific task (e.g., W.11-12.6.).* ***9.4.12.TL.2****: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.*
3,4,5,6,7,8,9,10, &11	**Technology Literacy:** Collaborative digital tools can be used to access, record and share different viewpoints and to collect and tabulate the views of groups of people.	***9.4.12.TL.3****: Analyze the effectiveness of the process and quality of collaborative environments.* ***9.4.12.TL.4****: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).*

Interdisciplinary Connections (2020 NJSLS)
List any other content standards addressed as well as appropriate units. All arts integration connections may be listed within this chart.

Visual & Performing Arts Integration (Standard 1)
List appropriate units below for which standards (1.1 through 1.5) may be addressed

Unit Addressed	Artistic Process	Anchor Standard
1,3,4,5,6,7,8,9,10 ,&11	**Creating**	*Anchor Standard 1: Generating and conceptualizing ideas.* *Anchor Standard 2: Organizing and developing ideas.* *Anchor Standard 3: Refining and completing products.*
1,3,4,5,6,7,8,&9	**Connecting**	*Anchor Standard 10: Synthesizing and relating knowledge and personal experiences to create products.* *Anchor Standard 11: Relating artistic ideas and works within societal, cultural, and historical contexts to deepen understanding.*
1,3,4,5,6,7,8,&9	**Performing/ Presenting/ Producing**	*Anchor Standard 4: Selecting, analyzing, and interpreting work.* *Anchor Standard 5: Developing and refining techniques and models or steps needed to create products.* *Anchor Standard 6: Conveying meaning through art.*
1,3,4,5,6,7,8,&9	**Responding**	*Anchor Standard 7: Perceiving and analyzing products.* *Anchor Standard 8: Applying criteria to evaluate products.* *Anchor Standard 9: Interpreting intent and meaning.*

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Pacing Guide (All Dates are approximate based on the school calendar)

Unit/ Topic	Month (w/Approx number of Teaching Days)
Introduction Unit (1) : Design Process and Documentation review. Safety Unit (2) : General safety, hand tool safety, machine safety review	September (~19 days)
Unit (3) Systems engineering design practice (3-d modeling and design generation) Unit (4) Drive system chassis development	October (~19 days)
Unit (4) Drive system chassis development Unit (5) Programing Presentation	November (~16 days)
Unit (5) Programing Presentation Unit (6) Environmental manipulation devices	December (~15 days)
Unit (6) Environmental manipulation devices	January (~18 days)
Unit (7): Classroom robotics competition with redesign Unit (10) Presentations	February (~18 days)
Unit (8) Inclusive supply list robotics activity Unit (10) Presentations	March (~15-20 days)
Unit (8) Inclusive supply list robotics activity Unit (9) Arduino Based Robotics	April (~15-20 days)
Unit (9) Arduino Based Robotics Unit (11) Technological Debate	May (~18 days)
Unit (12): Portfolio Development	June (~15 days)

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Units Scope and Sequence

Unit Name: Introduction Unit (1) : Design Process and Docum Documentation review.

Learning Goals: What do I want my students to learn?

Standards

NJSLS Computer Science and Design Thinking - **8.2.12.ED.1, 8.2.12.NT.2, 8.2.12.ITH.1, 8.1.12.AP.7**
ITEEA Technological and Engineering Literacy -
*Standard 1:***Nature and Characteristics of Technology and Engineering**
Standard 2: **Core concepts of Technology and Engineering**
Standard 3: **Integration of knowledge, technology, and Practices**
Standard 6: **History of Technology**
Standard 7: **Design in technology and engineering education**
NJSLS - Career Awareness, Exploration, Preparation, and Training
NJSLS - Life Literacies and Key Skills
NJSLS - Interdisciplinary Standards

Fundamental Concepts / Big Ideas

- How is the formal process of design able to be implemented both formally and informally at the same time within society, and on an individual basis?
- Documenting work allows for the examination of work and the repeatability of experimental design which has similarities to other content areas but has importance in the engineering world.
- Established design principles are used to evaluate existing design, to collect data, and to guide the design process. The principles include: flexibility, balance, function, and proportion.
- Engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
- A prototype is a working model that is used to test a design concept by making actual observations and necessary adjustments.
- An engineer must not only design a product that works—s/he must consider many other factors, such as safety, environmental concerns, ethical considerations, and risks and benefits.

Learning Objectives

Students will be able to…

- The student will demonstrate systems thinking through the completion of a small introduction activity which will be made evident through the development portions of the project documentation.
- The student will develop creativity in design thinking and application through the development and implementation of multiple design techniques and ideas throughout the unit which will be made evident through the development portions of the project documentation.
- The student will build skills in the area of the design process and documentation through the completion of a small introduction activity
- The student will demonstrate critical thinking through the development of unique and original design based ideas which will be further implemented to meet a set of design requirements that are presented to the student and further analyzed by them.
- Students will work to generate creative and unique designs as they examine design requirements and are encouraged to think outside of the box in potential solutions.

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- Explain how the world around them guides technological development and engineering design.
- Assess how similarities and differences among scientific, mathematics, engineering, and technological knowledge and skills contributed to the design of a product or system.
- Conduct research to inform intentional inventions and innovations that address specific needs and wants.
- Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.
- Determine the best approach by evaluating the purpose of the design.
- Document trade-offs in the technology and engineering design process to produce the optimal design.
- Optimize a design by addressing desired qualities within criteria and constraints.
- Illustrate principles,elements and factors of design.
- Implement the best possible solution to a design.
- Apply a broad range of design skills to their design process.

Students will subsequently apply the design process in further Activities and will:

- Analyze the rate of technological development and predict future diffusion and adoption of new technologies.
- Develop a plan that incorporates knowledge from science, mathematics, and other disciplines to design or improve a technological product or system.
- Demonstrate the use of conceptual, graphical, virtual, mathematical, and physical modeling to identify conflicting considerations before the entire system is developed and to aid in design decision making.
- Diagnose a flawed system embedded within a larger technological, social, or environmental system.
- Select resources that involve tradeoffs between competing values, such as availability, cost, desirability, and waste while solving problems.
- Implement quality control as a planned process to ensure that a product, service, or system meets established criteria.
- Use management processes in planning, organizing, and controlling work.
- Analyze how technology transfer occurs when a user applies an existing innovation developed for one function for a different purpose.
- Evaluate how technology enhances opportunities for new products and services through globalization.
- Connect technological progress to the advancement of other areas of knowledge.
- Evaluate ways that technology can impact individuals, society, and the environment.
- Critique whether existing and proposed technologies use resources sustainably.
- Assess a technology that minimizes resource use and resulting waste to achieve a goal.
- Develop a solution to a technological problem that has the least negative environmental and social impact.
- Evaluate how technologies alter human health and capabilities.
- Evaluate a technological innovation that arose from a specific society's unique need or want.
- Evaluate a technological innovation that was met with societal resistance impacting its development.
- Design an appropriate technology for use in a different culture.
- Verify that the evolution of civilization has been directly affected by, and has in turn affected, the development and use of tools, materials and processes.
- Evaluate how technology has been a powerful force in reshaping the social, cultural, political, and economic landscapes throughout history.
- Analyze how the Industrial Revolution resulted in the development of mass production, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.
- Investigate the widespread changes that have resulted from the Information Age, which has placed emphasis on the processing and exchange of information.
- Apply principles of human-centered design.
- Apply a broad range of making skills to their design process.
- Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.
- Develop a device or system for the marketplace.
- Apply appropriate methods to diagnose, adjust and repair systems to ensure precise, safe and proper functionality.
- Synthesize data and analyze trends to make decisions about technological products, systems or processes.

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Unit Name: Safety Review (2) : General safety, hand tool safety, machine safety review

Learning Goals: What do I want my students to learn?

Standards

NJSLS Computer Science and Design Thinking - 8.1.12.CS.4
ITEEA Technological and Engineering Literacy
Standard 2: Core concepts of Technology and Engineering
Standard 8: Applying, maintaining, and assessing technological products and systems
NJSLS - Career Awareness, Exploration, Preparation, and Training
NJSLS - Life Literacies and Key Skills
NJSLS - Interdisciplinary Standards

Fundamental Concepts / Big Ideas

- Safety is a fundamental responsibility of everyone in the technology laboratory at all times.
- All safety procedures must be followed at all times and safety assessments must be passed with 100% accuracy.
- A prototype is a working model that is used to test a design concept by making actual observations and necessary adjustments.
- An engineer must not only design a product that works—s/he must consider many other factors, such as safety, environmental concerns, ethical considerations, and risks and benefits.

Learning Objectives

Students will be able to…

- The student will demonstrate proper machine and tool usage at all times.
- The student will build skills in the area of tools and machine safety procedures through the completion of tutorial and safety assessments.
- Select resources that involve tradeoffs between competing values, such as availability, cost, desirability, and waste while solving problems.
- Implement quality control as a planned process to ensure that a product, service, or system meets established criteria.
- Evaluate ways that technology can impact individuals, society, and the environment.
- Critique whether existing and proposed technologies use resources sustainably.
- Assess a technology that minimizes resource use and resulting waste to achieve a goal.

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Unit Name (3): Systems engineering design practice (3-d modeling and design generation)

Learning Goals: What do I want my students to learn?

Standards

NJSLS Computer Science and Design Thinking - 8.1.12.CS.1, 8.1.12.DA.6, 8.2.12.ED.1, 8.2.12.ED.2, 8.2.12.ED.3, 8.2.12.ED.5
ITEEA Technological and Engineering Literacy
*Standard 1:*Nature and Characteristics of Technology and Engineering
Standard 2: Core concepts of Technology and Engineering
Standard 3: Integration of knowledge, technology, and Practices
Standard 4: Impacts of technology
Standard 5: Influence of Society on Technology and Engineering Education
Standard 7: Design in technology and engineering education
Standard 8: Applying, maintaining, and assessing technological products and systems
NJSLS - Career Awareness, Exploration, Preparation, and Training
NJSLS - Life Literacies and Key Skills
NJSLS - Interdisciplinary Standards

Fundamental Concepts / Big Ideas

- Designing engineering components rarely occurs in a solitary setting and requires in depth collaboration with others.
- Communication when designing is required throughout the process including redesigns in order to ensure functionality of all sub components.
- Established design principles are used to evaluate existing design, to collect data, and to guide the design process. The principles include: flexibility, balance, function, and proportion.
- Engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
- A prototype is a working model that is used to test a design concept by making actual observations and necessary adjustments.
- An engineer must not only design a product that works—s/he must consider many other factors, such as safety, environmental concerns, ethical considerations, and risks and benefits.

Learning Objectives

Students will be able to…

- The student will demonstrate systems thinking through the development of interlocking components which will be made evident through the development portions of the project documentation.
- The student will develop creativity in design thinking and application through the development and implementation of multiple design techniques and ideas throughout the unit which will be made evident through the development portions of the project documentation.
- The student will build skills in the area of systems engineering and design in the completion of a multi group CAD based design activity.
- The student will demonstrate critical thinking through the development of unique and original design based ideas which will be further implemented to meet a set of design requirements that are presented to the student and further analyzed by them. :

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- Students will work to generate creative and unique designs as they examine design requirements and are encouraged to think outside of the box in potential solutions.
- When the unit activity is implemented as a group based assignment students will actively engage together in a collaborative manner allowing them to expand their knowledge through discussion and brainstorming activities as well as other forms of group based work.
- Students will engage in written documentation of their work via word processing applications where the design development and testing of student developed work.
- Use management processes in planning, organizing, and controlling work.
- Optimize a design by addressing desired qualities within criteria and constraints.
- Illustrate principles,elements and factors of design.
- Implement the best possible solution to a design..

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Unit Name (4): Drive system chassis development

Learning Goals: What do I want my students to learn?

Standards

NJSLS Computer Science and Design Thinking - 8.1.12.CS.1, 8.1.12.DA.6, 8.2.12.ED.1, 8.2.12.ED.2, 8.2.12.ED.3, 8.2.12.ED.5
ITEEA Technological and Engineering Literacy
*Standard 1:*Nature and Characteristics of Technology and Engineering
Standard 2: Core concepts of Technology and Engineering
Standard 3: Integration of knowledge, technology, and Practices
Standard 4: Impacts of technology
Standard 5: Influence of Society on Technology and Engineering Education
Standard 7: Design in technology and engineering education
Standard 8: Applying, maintaining, and assessing technological products and systems
NJSLS - Career Awareness, Exploration, Preparation, and Training
NJSLS - Life Literacies and Key Skills
NJSLS - Interdisciplinary Standards

Fundamental Concepts / Big Ideas

- Systems engineering is important to robotics as robots are made up of multiple subsystems.
- The chassis or drivetrain is an integral portion of a driving robot.
- Established design principles are used to evaluate existing design, to collect data, and to guide the design process. The principles include: flexibility, balance, function, and proportion.
- Engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
- A prototype is a working model that is used to test a design concept by making actual observations and necessary adjustments.
- An engineer must not only design a product that works—s/he must consider many other factors, such as safety, environmental concerns, ethical considerations, and risks and benefits.

Learning Objectives

Students will be able to…

- The student will demonstrate systems thinking through the development of robotic systems and subsystems which will be made evident through the development portions of the project documentation.
- The student will develop creativity in design thinking and application through the development and implementation of multiple design techniques and ideas throughout the unit which will be made evident through the development portions of the project documentation.
- The student will build skills in the area of robotics through the development of chassis / drivetrain subassembly of a robot.
- The student will demonstrate critical thinking through the development of unique and original design based ideas which will be further implemented to meet a set of design requirements that are presented to the student and further analyzed by them. :
- Students will work to generate creative and unique designs as they examine design requirements and are encouraged to think outside of the box in potential solutions.

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- When the unit activity is implemented as a group based assignment students will actively engage together in a collaborative manner allowing them to expand their knowledge through discussion and brainstorming activities as well as other forms of group based work.
- Students will engage in written documentation of their work via word processing applications where the design development and testing of student developed work.

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Unit Name (5) : Programing (complete obstacle course with the drivetrain and redesign)

Learning Goals: What do I want my students to learn?

Standards

NJSLS Computer Science and Design Thinking - 8.1.12.CS.1, 8.1.12.DA.6, 8.2.12.ED.1, 8.2.12.ED.2, 8.2.12.ED.3, 8.2.12.ED.5
ITEEA Technological and Engineering Literacy
*Standard 1:*Nature and Characteristics of Technology and Engineering
Standard 2: Core concepts of Technology and Engineering
Standard 3: Integration of knowledge, technology, and Practices
Standard 4: Impacts of technology
Standard 5: Influence of Society on Technology and Engineering Education
Standard 7: Design in technology and engineering education
Standard 8: Applying, maintaining, and assessing technological products and systems
NJSLS - Career Awareness, Exploration, Preparation, and Training
NJSLS - Life Literacies and Key Skills
NJSLS - Interdisciplinary Standards

Fundamental Concepts / Big Ideas

- Systems engineering is important to robotics as robots are made up of multiple subsystems.
- Programming is an integral part of robotics, and any form of troubleshooting requires a detailed understanding of multiple aspects of robotics.
- Established design principles are used to evaluate existing design, to collect data, and to guide the design process. The principles include: flexibility, balance, function, and proportion.
- Engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
- A prototype is a working model that is used to test a design concept by making actual observations and necessary adjustments.
- An engineer must not only design a product that works—s/he must consider many other factors, such as safety, environmental concerns, ethical considerations, and risks and benefits.

Learning Objectives

Students will be able to…

- The student will demonstrate systems thinking through the development of robotic systems and subsystems which will be made evident through the development portions of the project documentation.
- The student will develop creativity in design thinking and application through the development and implementation of multiple design techniques and ideas throughout the unit which will be made evident through the development portions of the project documentation.
- The student will build skills in the area of robotics through the development of functional programming allowing for the testing of not only the programming but also the mechanical portions of the robotic system.
- The student will demonstrate critical thinking through the development of unique and original design based ideas which will be further implemented to meet a set of design requirements that are presented to the student and further analyzed by them. :
- Students will work to generate creative and unique designs as they examine design requirements and are encouraged

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to think outside of the box in potential solutions.

- When the unit activity is implemented as a group based assignment students will actively engage together in a collaborative manner allowing them to expand their knowledge through discussion and brainstorming activities as well as other forms of group based work.
- Students will engage in written documentation of their work via word processing applications where the design development and testing of student developed work.

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Unit Name: (6) Environmental manipulation devices

Learning Goals: What do I want my students to learn?

Standards

NJSLS Computer Science and Design Thinking - 8.1.12.CS.1, 8.1.12.DA.6, 8.2.12.ED.1, 8.2.12.ED.2, 8.2.12.ED.3, 8.2.12.ED.5
ITEEA Technological and Engineering Literacy
Standard 1: Nature and Characteristics of Technology and Engineering
Standard 2: Core concepts of Technology and Engineering
Standard 3: Integration of knowledge, technology, and Practices
Standard 4: Impacts of technology
Standard 5: Influence of Society on Technology and Engineering Education
Standard 7: Design in technology and engineering education
Standard 8: Applying, maintaining, and assessing technological products and systems
NJSLS - Career Awareness, Exploration, Preparation, and Training
NJSLS - Life Literacies and Key Skills
NJSLS - Interdisciplinary Standards

Fundamental Concepts / Big Ideas

- Systems engineering is important to robotics as robots are made up of multiple subsystems.
- End effectors are a universal term for the portion of a robotic arm or system which manipulates or interacts with the environment.
- Robotic systems serve a purpose and universally that purpose is to interact with or to manipulate the environment in some way.
- Established design principles are used to evaluate existing design, to collect data, and to guide the design process. The principles include: flexibility, balance, function, and proportion.
- Engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
- A prototype is a working model that is used to test a design concept by making actual observations and necessary adjustments.
- An engineer must not only design a product that works—s/he must consider many other factors, such as safety, environmental concerns, ethical considerations, and risks and benefits.

Learning Objectives

Students will be able to…

- The student will demonstrate systems thinking through the development of robotic systems and subsystems which will be made evident through the development portions of the project documentation.
- The student will develop creativity in design thinking and application through the development and implementation of multiple design techniques and ideas throughout the unit which will be made evident through the development portions of the project documentation.
- The student will build skills in the area of robotics through the development of an end effector sub system to modify or manipulate the environment around the robotic system.
- The student will demonstrate critical thinking through the development of unique and original design based ideas which will be further implemented to meet a set of design requirements that are presented to the student and further

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analyzed by them. :

- Students will work to generate creative and unique designs as they examine design requirements and are encouraged to think outside of the box in potential solutions.
- When the unit activity is implemented as a group based assignment students will actively engage together in a collaborative manner allowing them to expand their knowledge through discussion and brainstorming activities as well as other forms of group based work.
- Students will engage in written documentation of their work via word processing applications where the design development and testing of student developed work.

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Unit Name: (7) Classroom robotics competition with redesign

Learning Goals: What do I want my students to learn?

Standards

NJSLS Computer Science and Design Thinking - 8.1.12.CS.1, 8.1.12.DA.6, 8.2.12.ED.1, 8.2.12.ED.2, 8.2.12.ED.3, 8.2.12.ED.5
ITEEA Technological and Engineering Literacy
*Standard 1:*Nature and Characteristics of Technology and Engineering
Standard 2: Core concepts of Technology and Engineering
Standard 3: Integration of knowledge, technology, and Practices
Standard 4: Impacts of technology
Standard 5: Influence of Society on Technology and Engineering Education
Standard 7: Design in technology and engineering education
Standard 8: Applying, maintaining, and assessing technological products and systems
NJSLS - Career Awareness, Exploration, Preparation, and Training
NJSLS - Life Literacies and Key Skills
NJSLS - Interdisciplinary Standards

Fundamental Concepts / Big Ideas

- Systems engineering is important to robotics as robots are made up of multiple subsystems.
- Actual performance based testing reveals design concerns and design flaws which must be overcome or addressed appropriately.
- Established design principles are used to evaluate existing design, to collect data, and to guide the design process. The principles include: flexibility, balance, function, and proportion.
- Engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
- A prototype is a working model that is used to test a design concept by making actual observations and necessary adjustments.
- An engineer must not only design a product that works—s/he must consider many other factors, such as safety, environmental concerns, ethical considerations, and risks and benefits.

Learning Objectives

Students will be able to…

- The student will demonstrate systems thinking through the development of robotic systems and subsystems which will be made evident through the development portions of the project documentation.
- The student will develop creativity in design thinking and application through the development and implementation of multiple design techniques and ideas throughout the unit which will be made evident through the development portions of the project documentation.
- The student will build skills in the area of robotics through the development of a functional robotic system which will be tested in a competitive manner in the classroom setting.
- The student will demonstrate critical thinking through the development of unique and original design based ideas which will be further implemented to meet a set of design requirements that are presented to the student and further analyzed by them. :

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- Students will work to generate creative and unique designs as they examine design requirements and are encouraged to think outside of the box in potential solutions.
- When the unit activity is implemented as a group based assignment students will actively engage together in a collaborative manner allowing them to expand their knowledge through discussion and brainstorming activities as well as other forms of group based work.
- Students will engage in written documentation of their work via word processing applications where the design development and testing of student developed work.

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Unit Name: (8) Inclusive supply list robotics activity

Learning Goals: What do I want my students to learn?

Standards

NJSLS Computer Science and Design Thinking - 8.1.12.CS.1, 8.1.12.DA.6, 8.2.12.ED.1, 8.2.12.ED.2, 8.2.12.ED.3, 8.2.12.ED.5
ITEEA Technological and Engineering Literacy
*Standard 1:*Nature and Characteristics of Technology and Engineering
Standard 2: Core concepts of Technology and Engineering
Standard 3: Integration of knowledge, technology, and Practices
Standard 4: Impacts of technology
Standard 5: Influence of Society on Technology and Engineering Education
Standard 7: Design in technology and engineering education
Standard 8: Applying, maintaining, and assessing technological products and systems
NJSLS - Career Awareness, Exploration, Preparation, and Training
NJSLS - Life Literacies and Key Skills
NJSLS - Interdisciplinary Standards

Fundamental Concepts / Big Ideas

- Systems engineering is important to robotics as robots are made up of multiple subsystems.
- Often in design there are significant materials limitations which require design to take place within an inclusive list of supplies.
- Established design principles are used to evaluate existing design, to collect data, and to guide the design process. The principles include: flexibility, balance, function, and proportion.
- Engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
- A prototype is a working model that is used to test a design concept by making actual observations and necessary adjustments.
- An engineer must not only design a product that works—s/he must consider many other factors, such as safety, environmental concerns, ethical considerations, and risks and benefits.

Learning Objectives

Students will be able to…

- The student will demonstrate systems thinking through the development of robotic systems and subsystems which will be made evident through the development portions of the project documentation.
- The student will develop creativity in design thinking and application through the development and implementation of multiple design techniques and ideas throughout the unit which will be made evident through the development portions of the project documentation.
- The student will build skills in the area of robotics through the development of a small scale robotic system developed with a limited set of materials.
- The student will demonstrate critical thinking through the development of unique and original design based ideas which will be further implemented to meet a set of design requirements that are presented to the student and further analyzed by them. :
- Students will work to generate creative and unique designs as they examine design requirements and are encouraged

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to think outside of the box in potential solutions.

- When the unit activity is implemented as a group based assignment students will actively engage together in a collaborative manner allowing them to expand their knowledge through discussion and brainstorming activities as well as other forms of group based work.
- Students will engage in written documentation of their work via word processing applications where the design development and testing of student developed work.

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Unit Name: (9) Arduino based robotics and output systems

Learning Goals: What do I want my students to learn?

Standards

NJSLS Computer Science and Design Thinking - 8.1.12.CS.1, 8.1.12.DA.6, 8.2.12.ED.1, 8.2.12.ED.2, 8.2.12.ED.3, 8.2.12.ED.5
ITEEA Technological and Engineering Literacy
*Standard 1:*Nature and Characteristics of Technology and Engineering
Standard 2: Core concepts of Technology and Engineering
Standard 3: Integration of knowledge, technology, and Practices
Standard 4: Impacts of technology
Standard 5: Influence of Society on Technology and Engineering Education
Standard 7: Design in technology and engineering education
Standard 8: Applying, maintaining, and assessing technological products and systems
NJSLS - Career Awareness, Exploration, Preparation, and Training
NJSLS - Life Literacies and Key Skills
NJSLS - Interdisciplinary Standards

Fundamental Concepts / Big Ideas

- Systems engineering is important to robotics as robots are made up of multiple subsystems.
- Robotics can be prototyped virtually and implemented physically utilizing sensors and microcontrollers.
- Established design principles are used to evaluate existing design, to collect data, and to guide the design process. The principles include: flexibility, balance, function, and proportion.
- Engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
- A prototype is a working model that is used to test a design concept by making actual observations and necessary adjustments.
- An engineer must not only design a product that works—s/he must consider many other factors, such as safety, environmental concerns, ethical considerations, and risks and benefits.

Learning Objectives

Students will be able to…

- The student will demonstrate systems thinking through the development of robotic systems and subsystems which will be made evident through the development portions of the project documentation.
- The student will develop creativity in design thinking and application through the development and implementation of multiple design techniques and ideas throughout the unit which will be made evident through the development portions of the project documentation.
- The student will build skills in the area of robotics through the development of an arduino microcontroller based robotic system which utilizes sensors allowing or specific inputs to produce a desired output from the robotic system.
- The student will demonstrate critical thinking through the development of unique and original design based ideas which will be further implemented to meet a set of design requirements that are presented to the student and further analyzed by them. :
- Students will work to generate creative and unique designs as they examine design requirements and are encouraged

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to think outside of the box in potential solutions.

- When the unit activity is implemented as a group based assignment students will actively engage together in a collaborative manner allowing them to expand their knowledge through discussion and brainstorming activities as well as other forms of group based work.
- Students will engage in written documentation of their work via word processing applications where the design development and testing of student developed work.

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Unit Name: (10) Presentation

Learning Goals: What do I want my students to learn?

Standards

NJSLS Computer Science and Design Thinking - 8.2.12.EC.3
ITEEA Technological and Engineering Literacy
Standard 4: **Impacts of technology**
Standard 8: **Applying, maintaining, and assessing technological products and systems**
NJSLS - Career Awareness, Exploration, Preparation, and Training
NJSLS - Life Literacies and Key Skills
NJSLS - Interdisciplinary Standards

Fundamental Concepts / Big Ideas

- A well rounded and technologically competent individual is able to articulate and present fundamental technological and technical content.
- An engineer must not only design a product that works—s/he must consider many other factors, such as safety, environmental concerns, ethical considerations, and risks and benefits.

Learning Objectives

Students will be able to…

- The student will demonstrate systems thinking through the development of a technical presentation which will be made evident through the actual presentation of the content.
- The student will develop creativity in design thinking and application through the development and implementation of multiple design techniques and ideas throughout the unit which will be made evident through the development portions of the project documentation.
- The student will build skills in the area of research, design and presentation in the development and presentation of content.
- The student will demonstrate critical thinking through the development of an in depth understanding of a base technical content and the presentation of that content.
- Explain how the world around them guides technological development and engineering design.
- Conduct research to inform intentional inventions and innovations that address specific needs and wants.
- Connect technological progress to the advancement of other areas of knowledge.
- Evaluate ways that technology can impact individuals, society, and the environment.
- Critique whether existing and proposed technologies use resources sustainably.

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Unit Name: (11) Technological debate (automation and the economy)

Learning Goals: What do I want my students to learn?

Standards

NJSLS Computer Science and Design Thinking - 8.2.12.EC.3
ITEEA Technological and Engineering Literacy
Standard 4: Impacts of technology
Standard 8: Applying, maintaining, and assessing technological products and systems
NJSLS - Career Awareness, Exploration, Preparation, and Training
NJSLS - Life Literacies and Key Skills
NJSLS - Interdisciplinary Standards

Fundamental Concepts / Big Ideas

- Every topic has multiple viewpoints and the decisions on how to proceed are often based upon a myriad of factors dependent upon the stakeholders involved.
- To become knowledgeable on a subject one must become familiar with the pros and cons of the topic as well as multiple viewpoints both in favor and opposed to the topic.
- Engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.

Learning Objectives

Students will be able to…

- The student will demonstrate systems thinking through the development of a complex debate preparation on a set technological topic.
- The student will build skills in the area of debate through the collaborative research and preparation through engaging in a debate on a technical subject
- The student will demonstrate critical thinking through the development of unique and spirited ideas in the debate process.
- When the unit activity is implemented as a group based assignment students will actively engage together in a collaborative manner allowing them to expand their knowledge through discussion and brainstorming activities as well as other forms of group based work.

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Unit Name: 12
Portfolio Development

Learning Goals: What do I want my students to learn?

Standards

NJSLS - 9.3.12.AC-DES.1, 9.3.12.AC-DES.6, 9.3.12.AC-DES.8, 8.1.12.CS.1, 8.1.12.IC.4, 8.1.12.IC.3, 8.1.12.CS.4, 8.2.12.ED.1, 8.2.12.ED.2, 8.2.12.ED.3, 8.2.12.ITH.2
NJSLS - Career Awareness, Exploration, Preparation, and Training
NJSLS - Life Literacies and Key Skills
NJSLS - Interdisciplinary Standards

Fundamental Concepts / Big Ideas

- A portfolio of work is able to document acquired knowledge and skill as well as to demonstrate growth over time, and the importance of a portfolio as a documentation tool allowing one to look back at previous work can at times be indispensable.
- Established design principles are used to evaluate existing design, to collect data, and to guide the design process. The principles include: flexibility, balance, function, and proportion.
- Robotic systems development and programming are influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
- An engineer must not only design a product that works—s/he must consider many other factors, such as safety, environmental concerns, ethical considerations, and risks and benefits.

Learning Objectives

Students will be able to…

- The student will document systems thinking and previous work through the development and upkeep of a portfolio which highlights project work skill and knowledge development, as well as technical aspects of coursework.
- The student will develop creativity in design thinking and application through the development and implementation of multiple design techniques and ideas throughout the unit which will be made evident through the development portions of the project documentation.
- When the unit activity is implemented as a group based assignment students will actively engage together in a collaborative manner allowing them to expand their knowledge through discussion and brainstorming activities as well as other forms of group based work.
- Students will engage in written documentation of their work via word processing applications where the design development and testing of student developed work.
- 1P. Analyze the rate of technological development and predict future diffusion and adoption of new technologies.
- 1R. Develop a plan that incorporates knowledge from science, mathematics, and other disciplines to design or improve a technological product or system.
- 2T. Demonstrate the use of conceptual, graphical, virtual, mathematical, and physical modeling to identify conflicting considerations before the entire system is developed and to aid in design decision making.
- 2U. Diagnose a flawed system embedded within a larger technological, social, or environmental system.
- 2V. Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.
- 2W. Select resources that involve tradeoffs between competing values, such as availability, cost, desirability, and waste while solving problems.

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- 2Z. Use management processes in planning, organizing, and controlling work.
- 4T. Evaluate how technologies alter human health and capabilities.
- 7Z. Apply principles of human-centered design.
- 7AA. Illustrate principles,elements and factors of design.
- 7BB. Implement the best possible solution to a design.
- 7CC. Apply a broad range of design skills to their design process.
- 7DD. Apply a broad range of making skills to their design process.
- 8N. Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

Please contact the Content Supervisor for any questions.

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