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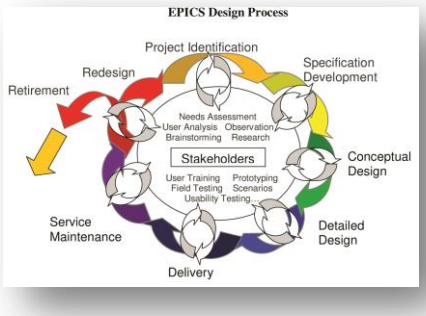
EPICS Program

Year Long Design Process

Overview: *In focus of this unit is for the students to walk through the EPICS Engineering Design Cycle with the students completing a design that will impact their community. They will identify needs within the community, develop the specifications for that project, develop a conceptual design which will be refined into a detailed design and will deliver the project to the stakeholder.*



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Year Long Curriculum Module 1- Project Identification Phase

Project Identification Phase Overview Statement: *The goal of this phase is to identify a specific, compelling need to be addressed by the project.*

When a team is in this phase of the design process, they will determine the exact problem to be solved by the project. This means the following criteria must be determined:

- *The tasks to be accomplished – these are called **project objectives.***
- *The reasons for the project – these are called **motivations.***
- *What results, documents, or objects that will be produce at the end of the project- these are called **outcomes and deliverables.***
- *How long they want to spend on the project – this is called **duration.***

*Who is the representative for the community organization that is helping with the project– this person is the **community partner contact.***

Lesson	Overview and Essential Question	Major Concepts
1.1 Introduction to Service-Learning Standards ELA- WHST.9-12.7	**Essential Question:** What does Service-Learning mean to me?	**Major Concepts** • History of Service-Learning • Components of Service-Learning • Notebook and team building
1.2 Code of Conduct Standards NGSS HS-ETS1-3. ELA- SL.11-12.1d- SL.11-12.3-	**Essential Question:** What are specific actions and code of conduct that is essential for a productive team and a successful project?	**Major Concepts** • Code of cooperation • Foundations of Teaming and cooperation • Notebook and team building
1.3 Teaming Skills Standards NGSS HS-ETS1-3. ELA- SL.11-12.1d- SL.11-12.3-	**Essential Question:** What are the teaming skills that we will need to accomplish the projected service-learning project?	**Major Concepts** • Analyze a major global concern such as cancer with quantitative criteria • Building Self-Efficacy through cooperative learning strategies. • Application of Engineering to solve a real world problem. • Use of skills, interests and talents to serve the community. • Notebook and team building
1.4 Community, Engineering and our course Standards NGSS HS-ETS1-3. ETS1.b-	**Essential Question:** What are problems in the community that can be solved by skills you are learning in the classroom?	**Major Concepts** • Service-Learning in the community • Researching skills • Application of Engineering to solve a real world problem
1.5 Civic Engagement Standards NGSS HS- HS-ETS1-1. HS-ETS1-3 ELA- RST.11-12.9 -	**Essential Question:** Why is it important to give back to the community where you live with your time, talents and skills?	**Major Concepts** • Analyze a major global concern such as cancer with quantitative criteria • Building Self-Efficacy through cooperative learning strategies. • Application of Engineering to solve a real world problem. • Use of skills, interests and talents to serve the community. • Notebook and team building.

1.6.1 Creating a Backpack Prototype Standards NGSS HS- HS-ETS1-1-3 ELA- SL.11-12.1c SL.11-12.1d	**Essential Question:** Can I create a visual representation that will help me gather more information to be used in the project?	**Major Concepts** • Prototyping used in Engineering • Engineering design process • Building Self-Efficacy through cooperative learning strategies. • Notebook and team building.
1.6.2 Prototype to communicate Standards NGSS HS- HS-ETS1-1-3 ELA- SL.11-12.1c SL.11-12.1d	**Essential Question:** How can I use the backpack prototype as an interview tool to be able to determine the need of my partner? How do I figure out what we've missed?	**Major Concepts** • Communication with stakeholders • Speaking and listening skills • Building Self-Efficacy through cooperative learning strategies. • Notebook and team building
1.6.3 Testing Proof of Concept Prototype Standards NGSS HS- HS-ETS1-1-3 ELA- SL.11-12.1c SL.11-12.1d	**Essential Question:** What is an essential specification that I want to test to determine the success of the Proof of Concept Prototype?	**Major Concepts** • Prototyping used in Engineering • Engineering design process • Testing protocol • Evaluating data to drive design
1.7 EP Prior Art Eronomic Backpack Standards NGSS HS-ETS1-3. ETS1.b- ELA- SL.11-12.1d	**Essential Question:** What are the backpacks that are already on the market that might be used by the stakeholder? How does our design differ?	**Major Concepts** • Project Specifications • Analyzing information and determining measurable criteria • Project Flow chart
1.8 EP Specifications for Backpack Project Standards NGSS HS-ETS1-3. ETS1.b- ELA- SL.11-12.1d	**Essential Question:** What are the specification requirements for this backpack project and what is the prioritization of the tasks.	**Major Concepts** • Project Specifications • Analyzing information and determining measurable criteria • Project Flow chart
1.9 EP first Redesign Standards NGSS HS-ETS1-3. ETS1.b- ELA- SL.11-12.1c SL.11-12.1d	**Essential Question:** After evaluating the testing data and the information gained by interviewing the partner using the backpack prototype, what changes and modifications need to be made to make it more efficient and useful?	**Major Concepts** • Prototyping used in Engineering • Engineering design process • Testing protocol • Evaluating data to drive design
1.10 EP Presentation of Prototype Standards NGSS HS-ETS1-3. ETS1.b- ELA-SL.11-12.1c SL.11-12.1d	**Essential Question:** What are the compelling needs that I have discovered and how can I use the initial prototype describe that need to my peers, teachers and community?	**Major Concepts** • Demonstrating understanding of the needs of the partner • Organizing information. • Demonstrate and explain the Initial Prototype though Gate 0 • Prototype Testing procedures • Personal reflection on learning and presentation skills.
1.11 EP Engineering in the Community Standards NGSS HS-ETS1-3. ETS1.b- ELA-SL.11-12.1c SL.11-12.1d	**Essential Question:** What are the compelling needs that I have discovered and how can I use the initial prototype describe that need to my peers, teachers and community?	**Major Concepts** • Demonstrating understanding of the needs of the partner • Organizing information. • Demonstrate and explain the Initial Prototype though Gate 0 • Prototype Testing procedures • Personal reflection on learning and presentation skills.
1.12 EP Project Partners Standards NGSS HS-ETS1-3. ETS1.b- ELA-SL.11-12.1c SL.11-12.1d	**Essential Question:** Who are the people that can best be served by this project and are willing to commit to working with our group?	**Major Concepts** • Identify Project Partner demographics • Research and profile development • Building Self-Efficacy through cooperative learning strategies. • Notebook and team building.

1.13 EP Community Demographics Standards NGSS HS-ETS1-1 ELA- RST.11-12.7 Mathematical Practices- MP2	**Essential Question:** What are the demographics of my community? How will this information help me determine the needs of my neighborhood?	**Major Concepts** • Identify demographic factors that can determine needs • Building Self-Efficacy through cooperative learning strategies. • Notebook and team building.
1.14 EP Cultural Diversity Standards NGSS HS-ETS1-1. ETS1.b- ELA- SL.11-12.1c SL.11-12.1d	**Essential Question:** What are the different cultures in our community and what needs might Service-Learning project be able to fill?	**Major Concepts** • Impact of demographics, culture and traditions in a community • Create questions to ask family members and community partners to gather more information about possible needs in the community. • Building Self-Efficacy through cooperative learning strategies. • Notebook and team building.
1.15 EP Human-Centered Design Integration Standards NGSS HS-ETS1-3. ETS1.b- ELA- SL.11-12.1c	**Essential Question:** How can the Human-Centered design model help frame my project and how will all the information that we have collected fit into the process?	**Major Concepts** • Service-Learning components • EPICS Engineering Design mode • Notebook and team building
1.16 EP Project CharterCommunity Needs Review Standards NGSS HS-ETS1-3. ETS1.b- ELA- SL.11-12.1c SL.11-12.1d	**Essential Question:** How can I organize all of the information that I have gathered into a compelling document?	**Major Concepts** • Summarizing quantitative and qualitative data • Project Charter • Project Flow chart
1.17 EP Observation Human-Centered Design Tool Standards NGSS HS-ETS1-3. ETS1.b- ELA- SL.11-12.1c SL.11-12.1d	**Essential Question:** How can I use the field notes and observations of the community? After further research into my community, were there parts that I need to revisit or explore further?	**Major Concepts** • Observation of the Impact of demographics, culture and traditions in a community. • Observing in detail • Building Self-Efficacy through cooperative learning strategies. • Notebook and team building.
1.18 EP Pert chart and Project Managment Standards NGSS HS-ETS1-3. ETS1.b- ELA- SL.11-12.1c SL.11-12.1d	**Essential Question:** What are the elements that will help me organize the information we have gathered about our community to create our service-learning project plan?	**Major Concepts** • Project Management • Project Objectives • Project organization
1.19 EP Gantt Chart Standards NGSS HS-ETS1.1, 1.2, 1-3. ETS1.b- ELA- SL.11-12.1c SL.11-12.1d	**Essential Question:** How can I consolidate information that I have gathered to this point into a Gantt chart?	**Major Concepts** • Project Management • Project Objectives • Project organization • Gantt Chart
1.20 EP Designing a Budget Standards NGSS HS-ETS1-3. ETS1.b- ELA- SL.11-12.1c SL.11-12.1d	**Essential Question:** What are the projected costs of the project to complete and what will need to be purchased?	**Major Concepts** • Project Budget management • Analyzing information to determine cost
1.21 EP GATE 1 Standards NGSS HS-ETS1-3. ELA- SL.11-12.4 SL.11-12.5	**Essential Question:** What have I learned about the stakeholders in my community and what are my goals and objectives for the project along with constraints?	**Major Concepts** • Engineering Design process • Organizing information • Presentation skills • Design Documentation and prototyping • Personal reflection on learning and presentation skills.

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Year Long Curriculum Module 2- Specification Phase

Specification Development Phase Overview Statement: *The goal of this phase is to understand "what" is needed by understanding the context, stakeholders, requirements of the project, and why current solutions don't meet need, and to develop measurable criteria in which design concepts can be evaluated.*

The students will be evaluating their initial idea of a project that will meet the the needs of their community partners and will be developing specifications that will be used as a guide through this process. They develop an understanding of the users of the final product and under what conditions it will operate. The team will analyze:

- Who will use and benefit from the product – these people are called *the* ***users and beneficiaries.***
- When the users and beneficiaries present specifications– these are called ***customer requirements.***
- When the users and beneficiaries presents information to the designer concerning the function of the product including what the product looks like, how it works, what materials it can be built from, and how much it costs – these factors are called ***design constraints.***
- The guidelines already in existence listing engineering requirements referring to specific design, manufacturing, and safety rules for this kind of product – these guidelines are called ***engineering specifications.***
- How the final product will compare to other products readily available that do the job required – this is called a ***benchmark product comparison.***

What *specific* features and abilities of the product that have been determined, after other factors listed above have been considered – this is called ***determining design targets.***

	Overview and Essential Question	***Major Concepts and Materials***
2.1 EP Specifications for Project Standards ELA- WHST.9-12.7	**Essential Question:** What are the specification requirements for this project and what is the prioritization of the tasks.	**Major Concepts** • Project Specifications • Analyzing information and determining measurable criteria • Project Flow chart
2.2 EP Functional Decomposition on the Backpack Standards NGSS HS-ETS 1-1. 1-2. 1-3. ELA- SL.11-12.1d- SL.11-12.3	**Essential Question:** What is the process of a functional decomposition and how does it relate to the backpack project? Secondly, what is the most general task that my design must be able to accomplish?	**Major Concepts** • Functional Decomposition • Analysis and critical thinking • Application of knowledge to new situation. •
2.3 EP Revisit Project Charter Standards NGSS HS-ETS1-1 ETS 1.b. ELA- SL.11-12.1d- SL.11-12.1c	**Essential Question:** What do I need to add to the original Project Charter to continue to organize my project?	**Major Concepts** • Review and Summarizing additional quantitative and qualitative data • Project Charter update
2.4 EP Design process-specifications Standards NGSS HS-ETS1-3. ETS1.b- ELA- SL.11-12.1c	**Essential Question:** How can the EPICS Human-Centered design model help frame my project and how will all the information that we have collected fit into the process?	**Major Concepts** • Service-Learning components • EPICS Engineering Design mode • Notebook and team building

2.5 EP Developing Specifications through Interviews Standards NGSS HS- HS-ETS1-1. HS-ETS1b ELA- SL.11-12.1d- SL.11-12.1c	**Essential Question:** How can I use the Interview tool to be able to determine a specific need for a special needs stakeholder in the community? How do I figure out what we've missed?	**Major Concepts** • Impact of demographics, culture and traditions in the community related to special needs. • Create questions to ask family members and community partners to gather more information about possible needs in the community for special needs community members. • Building Self-Efficacy through cooperative learning strategies. • Notebook and team building.
2.5.5 EP Test Specs with Prototype Standards NGSS HS- HS-ETS1-1. HS-ETS1b *ELA- SL.11-12.*1d- SL.11-12.1c	**Essential Question:** Can I create a visual representation that will help me gather more information to be used in the project?	**Major Concepts** • Prototyping used in Engineering • Engineering design process • Building Self-Efficacy through cooperative learning strategies. • Notebook and team building.
2.6 EP Additional observations to develop specifications Standards NGSS HS- HS-ETS1-1. HS-ETS1b ELA- SL.11-12.1c SL.11-12.1d	**Essential Question:** After gathering more information about my community and having developed Specifications for my project, what information is missing that will help me further revise the project?	**Major Concepts** • Observation of the Impact of demographics, culture and traditions in a community. • Observing in detail • Building Self-Efficacy through cooperative learning strategies. • Notebook and team building.
2.7 EP Personas and Scenarios Stakeholder Analysis Standards NGSS HS-ETS1-3. ETS1.b- ELA- SL.11-12.1d	**Essential Question:** What tools can I use to better understand the stakeholders in my project?	**Major Concepts** • Analyzing Socioeconomic, demographic and cultural factors that can determine needs • Building Self-Efficacy through cooperative learning strategies. • Notebook and team building.
2.8 EP Engineering Applied to Everyday Life Standards NGSS HS-ETS1-1, HS-ETS1-2, HS-ETS1-3 ELA- RTS.11-12.7, RTS.11-12.9	**Essential Question:** What is technology and engineering that is not just a luxury but an essential piece of life?	**Major Concepts** • Examples of essential technology and engineering • Building Self-Efficacy through cooperative learning strategies. • Identification of Engineering design that serve the essential needs of the community • Notebook and team building.
2.9 EP Measurable specifications Standards NGSS HS-ETS1-3. ETS1.b- ELA- SL.11-12.3, SL.11-12.1d	**Essential Question:** How am I going to measure the specifications for the project?	**Major Concepts** • Project Specifications • Analyzing information and determining measurable criteria
2.10 EP Self Evaluation and Project Measurement Standards NGSS HS-ETS1-3. ELA- SL.11-12.3, SL.11-12.1d	**Essential Question:** What is the criterion that I will use to evaluation of my contributions to the project and how will we evaluate the progress of the project?	**Major Concepts** • Code of cooperation • Self-evaluation • Notebook and team building
2.11 EP Peer Evaluations Standards NGSS HS-ETS1-3. ELA- SL.11-12.3 SL.11-12.1d	**Essential Question:** What is the criterion that I will use to evaluation of my team members contributions to the project?	**Major Concepts** • Code of cooperation • Self-evaluation • Notebook and team building.

2.12 EP Feedback to individuals and teams Standards NGSS HS-ETS1-3. ELA- SL.11-12.3, SL.11-12.1d	**Essential Question:** What is true feedback and how can it help me learn?	**Major Concepts** • Quality Feedback • Assimilation of assessment information into an action plan for learning • Team Assessment
2.13 EP Benchmarking Prior Art Standards NGSS HS-ETS1-3 ETS 1.b ELA- SL 11-12.1b	**Essential Question:** What similar products are on the market or in use that might be used by the stakeholder and why would our design be of more use?	**Major Concepts** • Project Specifications • Analyzing information and determining measurable criteria • Project Flow chart
2.14 Identify Targets for design revisit Gantt chart Standards NGSS HS-ETS1-2. ETS1.3 ELA- SL.11-12.3 SL.11-12.1d	**Essential Question:** What are the target specifications for this project and how do they align to the Gantt Chart?	**Major Concepts** • Benchmarking Prior Art • Analyzing Specifications • Target Specifications
2.15 EP Functional Decomposition of the project Standards NGSS HS-ETS1-1. HS-ETS1-2. HS-ETS1-3. ELA- SL.11-12.1d, SL 11-12.3	**Essential Question:** How can I apply my knowledge of Functional Decomposition to my project? Secondly, what is the most general task that my design must be able to accomplish?	**Major Concepts** • Functional Decomposition • Analysis and critical thinking • Application of knowledge to a new situation
2.16 EP Revisit and Update Specifications for Project Standards NGSS HS-ETS1-1. HS-ETS1-2. HS-ETS1-3. ELA- SL.11-12.1d, SL 11-12.3	**Essential Question:** How can I take the information I have created and integrate it into documents that will give my project guidance?	**Major Concepts** • Functional Decomposition • Analysis and critical thinking • Application of knowledge to a new situation
2.17 EP Debrief Specification Phase Standards NGSS HS-ETS1-3. ELA- SL.11-12.4, SL.11-12.5	**Essential Question:** What information have I gathered that gives me a better idea of the needs of my stakeholders and the specifications and timeline for the potential project? How can I communicate that information in a clear and concise manner?	**Major Concepts** • Engineering Design process • Organizing information • Presentation skills • Design Documentation • Personal reflection on learning and presentation skills.
2.18 EP GATE 2 Specifications Phase Standards NGSS HS-ETS1-3. ELA- SL.11-12.4, SL.11-12.5	**Essential Question:** What have I learned about the stakeholders in my community and how can I express that information through an oral and written presentation?	**Major Concepts** • Engineering Design process • Organizing information • Presentation skills • Design Documentation • Project Specifications Development • Personal reflection on learning and presentation skills.

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Year Long Curriculum Module 3- Conceptual Design Phase

Conceptual Design Phase Overview Statement: *Goal is to expand the design space to include as many solutions as possible. Evaluate different approaches and selecting "best" one to move forward. Exploring "how".*

In this phase, the students will:

- *Determine the smaller functions of their product in order to complete its overall task, and create a diagram that compares these functions. For example, a team designing a bike fender might make the following functional decomposition diagram to show what smaller functions go into the fender's overall function of protecting the rider from water and dirt off the wheel. The process of making this chart is called* ***Functional Decomposition****. Later in the design process, the students will dissect this process in more depth and detail.*
- *Make a list of decisions to be made to determine how the product works and list the tasks in a sequence for an effective and efficient process.*
- *Decide how the stakeholders will interact with the product. For example, will they talk to it, push buttons, manipulate it another way, simply look at it? How will they tell the product what to do? How will the user's body fit on, around, or into the product?*
- *Evaluate possible solutions for how the product will work in general, comparing them against each other to find positive and negative aspects of each one.*
- *Choose the best solution from their potential options.*

	Overview and Essential Question	***Major Concepts and Materials***
3.1 EP Brainstorming Standards NGSS HS-ETS 1-3. ELA- RST.11-12.7- RST.11-12.9	**Essential Question:** Are there brainstorming techniques that will help me explore service-learning opportunities within my community?	**Major Concepts** • Brainstorming techniques • Metacognition and transfer • Notebook and team building
3.2 EP Idea List Standards NGSS HS-ETS 1-1. 1-2. 1-3. EST 1b ELA- SL.11-12.1d- SL.11-12.3	**Essential Question:** How can I generate a list of potential project ideas that will meet the needs of my stakeholder?	**Major Concepts** • Project Specifications • Analyzing information and determining measurable criteria
3.3 EP Brainstorming using SCAMPER Standards NGSS HS-ETS1-1 ETS 1.b. ELA- RST.11-12.7- RST.11-12.9	**Essential Question:** How can I use the brainstorming technique SCAMPER as a way to further refine my ideas for service-learning opportunities within my community?	**Major Concepts** • Brainstorming techniques • Metacognition and transfer • Notebook and team building.
3.4 EP Modified Brainstorming Standards NGSS HS-ETS1-3. ELA- SL.11-12.1c	**Essential Question:** How can I apply brainstorming techniques with my group to refine the ideas on my list?	**Major Concepts** • Brainstorming techniques • Metacognition and transfer • Notebook and team building.
3.5 EP Functional Decomposition with Brainstorming Standards NGSS HS- HS-ETS1-1. HS-ETS1b ELA- SL.11-12.1d- SL.11-12.1c	**Essential Question:** How will the information I have gathered through the brainstorming process influence the Functional Decomposition of the project?	**Major Concepts** • Functional Decomposition • Analysis and critical thinking • Application of knowledge to new situation

3.6 EP Decision Making tools Standards NGSS HS-ETS 1-1. 1-2. 1-3. EST 1b ELA- SL.11-12.1d- SL.11-12.1c Mathematics Number and Quantity HS Math- N-VM. 6.	**Essential Question:** Is there a way of evaluating the information that I have gathered to this point to be able to determine a good possible project to meet the needs of my community? How will I make those decisions?	**Major Concepts** • Decision making tools • Application of Engineering to solve a real world problem • Notebook and team building
3.7 EP Introduction of the Decision Matrix Standards NGSS HS-ETS 1-1. 1-2. 1-3. EST 1b ELA- SL.11-12.1d- SL.11-12.3 Mathematics Number and Quantity HS Math- N-VM. 6	**Essential Question:** Is there a weighting method I can use to make critical decisions about potential projects?	**Major Concepts** • Decision making tools • Application of Engineering to solve a real world problem • Notebook and team building
3.8 EP Application of Decision Matrix to Functional Decomposition Standards NGSS HS-ETS1-3. ETS1.b- ELA-SL.11-12.1d	**Essential Question:** Can I use the weighted decision matrix to make critical decisions with the information I have gathered from the Functional Decomposition?	**Major Concepts** • Decision making tools • Application of Engineering to solve a real world problem • Notebook and team building
3.9 EP Creating Multiple prototypes Standards NGSS HS-ETS1-1, HS-ETS1-2, HS-ETS1-3 ELA- SL.11-12.1d- SL.11-12.3	**Essential Question:** What is the purpose of creating multiple prototypes for our service-learning project?	**Major Concepts** • Prototyping used in Engineering • Multiple prototype ideas • Engineering design process • Building Self-Efficacy through cooperative learning strategies. • Notebook and team building. •
3.10 EP Prototype to communicate Standards NGSS HS-ETS1-3. ETS1.b- ELA-SL.11-12.3, SL.11-12.1d	**Essential Question:** How can I use the redesigned prototype as an interview tool to be able to determine a specific need for a special needs stakeholder in the community? How do I figure out what we've missed?	**Major Concepts** • Communication with stakeholders • Speaking and listening skills • Building Self-Efficacy through cooperative learning strategies. • Notebook and team building.
3.11 EP Prototype Feedback Standards NGSS HS-ETS1-3. ELA- SL.11-12.3, SL.11-12.1d	**Essential Question:** How can I take the information gathered from the interviews with multiple prototypes and create an action plan for a working prototype that will meet the needs of the stakeholders.	**Major Concepts** • Feedback analysis • critical thinking and problem solving • Application of knowledge to new situation.
3.12 EP Testing and Redesign of the Proof of Concept Prototype Standards NGSS HS-ETS1-1. HS-ETS1-2. HS-ETS1-3. ELA- SL.11-12.1d, SL 11-12.3	**Essential Question:** What is an essential specification that I want to test to determine the success of the Proof of Concept Prototype?	**Major Concepts** • Prototyping used in Engineering • Engineering design process • Testing protocol • Evaluating data to drive design
3.13 EP Modifying the budget for project Standards NGSS HS-ETS1-1. HS-ETS1-2. HS-ETS1-3. Mathematical Practices MP.2, MP.4	**Essential Question:** After revisions and the evaluation of the specifications and feedback from the stakeholders, what are the projected costs of the project to be completed and what will need to be purchased?	**Major Concepts** • Project Budget management • Analyzing information to determine cost

3.14 EP Revisiting timeline Standards NGSS HS-ETS1-3. ELA- SL.11-12.4, SL.11-12.5	**Essential Question:** What is the best way to update the Gantt Chart and create a plan to move into the Detailed Design Phase?	**Major Concepts** • Project Management • Project Objectives • Project organization • Gantt Chart
3.15 EP Debrief Conceptual Design Phase Standards NGSS HS-ETS1-3. ELA- SL.11-12.4, SL.11-12.5	**Essential Question:** What information have I gathered that gives me a better idea of the needs of my stakeholders and the specifications and timeline for the potential project so I can move to the Detailed Design Phase of the EPICS design model? How can I communicate that information in a clear and concise manner?	**Major Concepts** • Engineering Design process • Organizing information • Presentation skills • Design Documentation • Project Specifications Development • Personal reflection on learning and presentation skills.
3.16 EP GATE 3 Standards NGSS HS-ETS1-3. ELA- SL.11-12.4, SL.11-12.5	**Essential Question:** What information have I gathered that gives me a better idea of the needs of my stakeholders and the specifications and timeline for the potential project so I can move to the Detailed Design Phase of the EPICS design model? How can I communicate that information in a clear and concise manner?	**Major Concepts** • Engineering Design process • Organizing information • Presentation skills • Design Documentation • Project Specifications Development • Personal reflection on learning and presentation skills.

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Year Long Curriculum Module 4- Detailed Design Phase

Detailed Design Phase Overview Statement: The goal of this phase is to design a working prototype which meets the functional specifications.

They will need to:
Use the engineering specifications developed in phase two, to draw designs for every part of their product (and for the ways in which those parts will work together), starting with the simplest parts that need to be designed. Since this process uses specifications at the top of the functional decomposition chart to design starting with the functions at the bottom of the chart, it is called top-down specification/ bottom-up implementation.
Create a report that defends their design detailing how it will work and how the design constraints will be addressed. This report is called a proof-of-concept.
Create a prototype, test the product and ask targeted stakeholders to used it and give feedback on how well it works. Compile a detailed list of potential ways that the product could malfunction (these malfunctions are called design failures), and develop a list of solutions of how these failures can be prevented. The students will go through several iterations in this process, where they will cycle back through Phase 4, or even to Phase 3 until they are satisfied that all design failures have been addressed. Later in the design process the students will learn advanced skill for determining possible failures, called Design Failure Mode Effects Analysis (DFMEA).
Determine the information that they stakeholders need to know in or der to use the product.

Lesson	*Overview and Essential Question*	*Major Concepts and Materials*
4.1 EP DFMEA 1 Standards NGSS HS-ETS ELA NGSS HS-ETS 1-1. 1-2. 1-3. ELA- SL.11-12.1d- SL.11-12.3-	**Essential Question:** How can I anticipate possible failures in my design and what can I do to minimize the impact of these potential hazards?	**Major Concepts** • DFMEA • Analysis and critical thinking • Application of knowledge to new situation.
4.2 EP DFMEA Detailed Design Applied Standards NGSS HS-ETS1-1 , ETS 1-2, ETS 1-3 ETS 1.b. ELA- RST.11-12.8, RTS.11-12-9, RTS.11-12.7 Mathematical Practices- MP.2, MP.4	**Essential Question:** How can I take the information I have gathered about potential failures in the design and minimize the risks?	**Major Concepts** • DFMEA • Analysis and critical thinking • Application of knowledge to new situation.
4.3 EP Usability Test field testing Standards NGSS HS- HS-ETS1-1. HS-ETS1b ELA- SL.11-12.1d- SL.11-12.1c	**Essential Question:** How can I create reliability and usability test for the product that will help me determine how the product will be used in the field?	**Major Concepts** • Reliability • Testing protocol • Evaluating data to drive design
4.4 EP User Manuals and training materials Standards NGSS HS-ETS 1-1 ELA- W.9-10.4, W 9-10.5, W 9-10.6	**Essential Question:** What information will the community partners and stakeholders need to continue the project and or product after it is delivered? How will I create that document in a clear and concise manner?	**Major Concepts** • Engineering Design process • Organizing information • Design Documentation • Personal reflection on learning and presentation skills.
4.5 EP Materials list Standards NGSS HS- HS-ETS1-1.ETS 1.3 HS-ETS1b ELA- SL.11-12.1c SL.11-12.1d HS Math- N-Q.2	**Essential Question:** What are the materials that I will need to implement this project, what is the name of the merchant and the cost?	**Major Concepts** • Analyzing information and develop a list of materials that will be needed for the project and update the budget.

4.6 EP Redesign build and test cycle Standards NGSS HS- HS-ETS1-1. HS-ETS1b ELA- W.9-12.4, W 9-10.5, W 9-10.6	**Essential Question:** What information will the community partners and stakeholders need to continue the project and or product after it is delivered? How will I create that document in a clear and concise manner?	**Major Concepts** • Engineering Design process • Organizing information • Design Documentation • Personal reflection on learning and presentation skills. •
4.7 Materials list Standards	**Essential Question:** What are the materials that I will need to implement this project, what is the name of the merchant and the cost?	**Major Concepts** • Analyzing information and develop a list of materials that will be needed for the project and update the budget.
4.8 EP Safety Analysis Standards NGSS HS-ETS1-3. ELA- SL.11-12.3 SL.11-12.1d	**Essential Question:** Are there safety issues that we need to address with the development of the working prototype? If so how do we analyze the risks and minimize the possible hazards?	**Major Concepts** • Safety and Hazard analysis • Testing protocol • Evaluating data to drive design
4.9 EP Timeline check Standards NGSS HS-ETS1-3. ELA- SL.11-12.4, SL.11-12.5	**Essential Question:** What are the changes that I have to make to the timeline delivery of the project based upon prototype testing?	**Major Concepts** • Project Management • Project Objectives • Project organization • Gantt Chart
4.10 EP Updated Field Testing Standards NGSS HS- ETS1-1. ETS1-2, ETS1-3. ELA-RST.11-12.7, RST 11-12.8, RST 11-12.9	**Essential Question:** How can I create reliability and usability test for the product that will help me determine how the product will be used in the field?	**Major Concepts** • Reliability • Testing protocol • Evaluating data to drive design
4.11 EP Persona Evaluation Standards NGSS HS-ETS1-3. ELA- RST.11-12.7, WST.11-12.2, WST.11-12.3	**Essential Question:** What information have I learned about our stakeholders that I will need to update the Persona for this project?	**Major Concepts** • Analyzing Socioeconomic, demographic and cultural factors that can determine needs • Building Self-Efficacy through cooperative learning strategies. • Notebook and team building.
4.12 EP Peer Evaluation Standards NGSS HS-ETS1-3. ELA- SL.11-12.1.d SL.11-12.3	**Essential Question:** What is the criterion that I will use to evaluation of my team members contributions to the project?	**Major Concepts** • Review the Code of cooperation • Self-evaluation • Notebook and team building
4.13 EP Self Assessment and Project Assessment Standards NGSS HS-ETS1-3. ELA- SL.11-12.1.d SL.11-12.3	**Essential Question:** Using the criterion for the EPICS project, what are my contributions to the project and how will we evaluate the progress of the project?	**Major Concepts** • Review the Code of cooperation • Self-evaluation • Notebook and team building
4.14 EP Feedback to Individuals and Teams Standards NGSS HS-ETS1-3. ELA- SL.11-12.4, SL.11-12.5	**Essential Question:** What is true feedback and how can it help me learn?	**Major Concepts** • Quality Feedback • Assimilation of assessment information into an action plan for learning • Project assessment

4.15 EP Prep for Detailed Design Preview Standards NGSS HS-ETS1-3. ELA- SL.11-12.4, SL.11-12.5	**Essential Question:** What information have I gathered that gives me a better idea of the needs of my stakeholders and the specifications and timeline for the potential project so I can move to the Detailed Design Phase of the EPICS design model? How can I communicate that information in a clear and concise manner?	**Major Concepts** • Engineering Design process • Organizing information • Presentation skills • Design Documentation • Personal reflection on learning and presentation skills.
4.16 EP GATE 4 Standards NGSS HS-ETS1-3. ELA- SL.11-12.4, SL.11-12.5	**Essential Question:** What information have I gathered that gives me a better idea of the needs of my stakeholders and how I will be able to deliver the project in a timely and efficient manner?	**Major Concepts** • Engineering Design process • Organizing information • Presentation skills • Design Documentation • Project delivery process • Personal reflection on learning and presentation skills.

EPICS® HIGH

Year Long Curriculum Module 5- Delivery Phase

Overview Statement Delivery Phase: The goal of this phase is to refine the detailed design so as to design a product that is ready to be delivered! In addition, the goal is to develop user manuals and training materials.

In the final phase of the design process, teams will finalize all of the documentation for the project and prepare for a smooth delivery of the prototype.They will finalize the information from the Project Charter, Gantt Chart, the Specifications for the project, the decision matrics that were used to determine the design of the prototype. They will also include all of the testing data, the budget and materials list, the User's Manual and of course the working prototype.

Lesson	*Overview and Essential Question*	*Major Concepts and Materials*
5.1 Detailed Design Table Standards NGSS HS-ETS 1-3, ETS1.b ELA- SL.11-12.1c, SL.11-12.1d	**Essential Question:** After evaluating the testing data and the information gained by interviewing the stakeholder after using the prototype, what changes and modifications need to be made to the prototype to be able to deliver the project to meet the needs of the stakeholders.	**Major Concepts** • Prototyping used in Engineering • Engineering design process • Testing protocol • Evaluating data to drive design
5.2 EP Final Field Testing Standards NGSS HS-ETS 1-3. ETS1.b ELA- SL.11-12.1d- SL.11-12.3	**Essential Question:** How can I create a test for the final prototype that will help me determine if there are any major flaws in my working prototype?	**Major Concepts** • Reliability • Testing protocol • Evaluating data to drive design
5.3 EP Finalization of Project Charter other documents Standards NGSS HS-ETS1-1, ETS 1.b. ELA- SL.11-12.1d- SL.11-12.3	**Essential Question:** What do I need to add to the original Project Charter, Specifications Document and Gantt Chart to represent the progression of my project?	**Major Concepts** • Review and Summarizing additional quantitative and qualitative data • Project Charter update
5.4 EP Finalize Testing data Standards NGSS HS-ETS1-1, ETS 1.b. ELA- SL.11-12.1d- SL.11-12.3	**Essential Question:** What information can I give in the Design Review about the decisions that were made with our project through the analysis of the testing data?	**Major Concepts** ▪ Reliability ▪ Testing protocol ▪ Evaluating data to drive design
5.5 EP Finalize Budget and Materials documentation Standards NGSS HS- HS-ETS1-1. HS-ETS1-2. HS-ETS1-3. HS-ETS1b Mathematical Practices: N-Q.2 MP.2, MP.4	**Essential Question:** What is the final materials list along with the budget for the working prototype?	**Major Concepts** • Project Budget management • Analyzing information to determine cost
5.6 EP Finalize User Manuals Standards NGSS HS- HS-ETS1-1. ELA- W.9-12.4, W 9-10.5, W 9-10.6	**Essential Question:** Does my User's Manual reflect the information that is needed by the community partners and stakeholders to continue the project and or product after it is delivered?	**Major Concepts** • Engineering Design process • Organizing information • Design Documentation • Personal reflection on learning and presentation skills.
5.7 EP Analysis of user feedback on delivered project Standards NGSS HS- HS-ETS1-1.ETS 1.3 HS-ETS1b ELA- SL.11-12.1c SL.11-12.1d HS Math- N-Q.2	**Essential Question:** What is the criterion that I will use to evaluation of my contributions to the project and how will I use the feedback from the stakeholders to improve my next project?	**Major Concepts** • Project Evaluation • Customer feedback • Notebook and team building

5.9 EP Preparation for Design Review Standards NGSS HS-ETS1-3, ELA- SL.11-12.4- SL.11-12.5	**Essential Question:** What information can I gather that will help show the progression of the project from an idea through the testing and the redesigns to the working prototype? How can I communicate that information in a clear and concise manner?	**Major Concepts** • Engineering Design process • Organizing information • Presentation skills • Design Documentation • Personal reflection on learning and presentation skills.
5.10 EP Delivery Design Review Standards NGSS HS- ETS1-3. ELA-SL.11-12.4, ELA SL- 11-12.5,	**Essential Question:** What information can I gather that will help show the progression of the project from an idea through the testing and the redesigns to the working prototype? How can I communicate that information in a clear and concise manner?	**Major Concepts** • Engineering Design process • Organizing information • Presentation skills • Design Documentation • Project delivery process • Personal reflection on learning and presentation skills.
5.11 EP Reflection on Design Standards NGSS HS- ELA- SL.11-12.3, SL.11-12.1d	**Essential Question:** What have I learned about engineering design, my community and myself through this project?	**Major Concepts** • Self-reflection • Assimilation of assessment information into an action plan for learning • Team Assessment
5.12 EP Celebration of Delivery Debrief Standards NGSS HS-ETS1-3. ELA- SL.11-12.3 SL.11-12.1d	**Essential Question:** What have I learned about engineering design, my community and myself through this project?	**Major Concepts** • Self-reflection • Use of celebration • Team Assessment