Main Units

Spark! Robotics

Spark! Robotics	4th Grade
STEM	16 Weeks

Rationale/Purpose:

Robotics are found everywhere in today's world. You can find them in factories, hospitals, and even the home. Robotics are used to assist people in jobs that would otherwise be considered mundane, cost prohibitive, inefficient, or dangerous. Everyday, technologies such as robotics are becoming increasingly more advanced. More workers are needed to design, develop, and run them, but how will students prepare themselves? They need to be trained as flexible, innovative, and collaborative thinkers who can transfer the knowledge they learn to any situation. By participating in SPARK! Robotics students will not only gain exposure to the robotics that they could be working with in the future, but they will engage in developing stronger 21st Century and Design Thinking skills that can be used now and beyond.

Description:

In Spark! Robotics, you will be taking on the role of a robotics engineer. Using the Design Thinking Process and LEGO Spike Prime Robots, you will learn how to design, build, and program a robot. Then, you will participate in two robotic design challenges with a partner to show what you have learned. Let's make the world a better place through the use of robotics!

Enduring Understandings:

1. **Complex Reasoning**
    - EU 1.1 Decision making requires a process of gathering, analyzing, and applying information and ideas.
    - EU 1.3 The development of critical thinking skills and dispositions is a life-long endeavor.
    - EU 1.5 Through practice, we can grow in our ability to develop effective solutions to problems.

Essential Questions:

1. **Complex Reasoning**
    - EQ 1.1 How do I make and defend a well thought out and reasonable decision?
    - EQ 1.3 Why is it important to be able to solve problems and explain my reasoning?
    - EQ 1.5 How can I transfer my knowledge and skills to new situations?

MOGLO:

MOGLO **Domain: Complex Reasoning**	**Supported or Assessed**	**Enduring Understanding Alignment**
Communicate Ideas, Thoughts, and Messages	Supported	EU 1.5
Analyze Problem Situations and Identify Key Elements	Assessed	EU 1.1
Evaluate Options and Explain Reasoning	Supported	EU 1.1
Identify Possible Solutions and Success Criteria	Assessed	EU 1.4
Systems Thinking	Assessed	EU 1.5

Unit Know, Understand, and Do:

Know:

- How to effectively communicate complex ideas in a way that meets the need(s) of the intended audience.
- With guidance, how to support ideas, decisions, and opinion statements with facts tied to evidence from multiple sources.
- How to collect and analyze data to independently identify elements of issues.
- How to develop (a) possible solution(s) to problems.
- How to identify cause and effect relationships and complex connections within the system, and explain trends in systems.

Understand:

- Decision making requires a process of gathering, analyzing, and applying information and ideas.
- The development of critical thinking skills and dispositions is a life-long endeavor.
- Through practice, we can grow in our ability to develop effective solutions to problems.

Do:

- Defend a well thought out and reasonable decision/idea/opinion through the process of gathering, analyzing, and applying new information.
- Solve problems and explain reasoning through the use of critical-thinking skills.
- Grow in the ability to develop effective solutions to problems and transfer that knowledge to new situations.

Design Thinking Studio

Design Thinking Studio	4th Grade Gifted
Art & Science	16 Weeks Semester Course

Rationale/Purpose:

The DTS unit engages students in real world problem solving by emphasizing the 21st Century Skills of creativity, critical thinking, communication, and collaboration by promoting experiential learning utilizing the design thinking process and the Studio Habits of Mind. The unit encourages students to become part of a learning community. Students realize their ideas, perspectives, insights, and contributions benefit all members of our community. Students become active problem solvers and develop grit. Students develop in their ability to take risks, accept mistakes and failures as learning opportunities, modify prototypes/iterations, and a growth mindset. Students work as professional designers/ engineers/ artists making purposeful decisions when problem solving to communicate personal ideas/feelings/perspectives while simultaneously achieving a creative solution to a design thinking problem. Students become thinking and innovative problem solvers who are able to persevere with challenging tasks. They do not merely follow directions to achieve an end. Students learn to empathize and define a problem, pre-plan, ideate-brainstorm multiple ideas even wild ones, research, design and create/make, analyze projects/products, receive and implement feedback on projects, test and modify prototypes. Students will decide when they are completed with their tasks and have analyzed and modified sufficiently. Students will develop the real world professional skills needed to receive constructive feedback in their learning process and use it to continue to problem solve and modify their prototypes/solutions to problems. Students realize design thinking is a hands-on problem solving approach which utilizes collaboration with others, critical thinking, communication, teamwork, and reflection. These are skills necessary for succeeding in the workplace as well as navigating our globally diverse society and the problems in both arenas.

Description:

Design Thinking is a life skill for solving complex real world problems. In this class, students learned and applied the 8 Studio Habits of Mind, a Growth Mindset, constructive critique, peer collaboration, and the Design Thinking process to various teacher and student selected Makerspace challenges. This learning enabled students to answer the essential question: Why are exploration, collaboration, creation, failure, and attitudes essential to learning?

Unit Projects: Unit projects consist of teacher selected challenges: “Word of the Day”, “Exquisite Corpse”, Lego &/ Kinects Camera Holder, Tinkercad, Pipe cleaner, straw, & paperclip tower to support a golf ball, Replication of Paper Sculpture, Rocky Challenge, UNC 17 flood and Farming end Hunger, and Growth Mindset. The culminating final project was student selected.

4th Grade at a Glance

Enduring Understandings:

Overarching Question:

Why are exploration, collaboration, creation, failure and attitudes essential to learning?

1.1 How do I make & defend a well thought out & reasonable decision?

1.2 How do I use different strategies to effectively generate solutions that solve problems?

1.25 How do I collect and determine relevant data?

1.3 Why is it important to be able to solve problems and explain my reasoning?

1.4 How do my decisions impact the world?

1.5 How can I transfer my knowledge and skills to new situations?

1.6 How do I communicate my ideas effectively to an appropriate audience?

MOGLO:

Domain: Complex Reasoning

MO-GLO	SUPPORTED /ASSESSED	ENDURING UNDERSTANDING
Communicate Ideas, Thoughts, and Messages EQ 1.5 How can I transfer my knowledge and skills to new situations? EQ 1.6 How do I communicate my ideas effectively to an appropriate audience?	SUPPORTED	EU 1.5 Through practice, we can grow in our ability to develop and communicate effective solutions to problems.
Analyze Problem Situations and Identify Key Elements EQ 1.2 How do I use different strategies to effectively generate solutions that solve problems? EQ 1.25 How do I collect and determine relevant data?	ASSESSED	EU 1.1 Decision making requires a process of gathering, analyzing, and applying information and ideas.
Evaluate Options and Explain	ASSESSED	EU 1.3 The development of

Reasoning EQ 1.1 How do I make and defend a well thought out and reasonable decision? EQ 1.25 How do I collect and determine relevant data? EQ 1.3 Why is it important to be able to solve problems and explain my reasoning?		critical thinking skills and dispositions is a life-long endeavor. EU 1.4 There are different processes and strategies for solving problems. Being able to apply these processes and strategies may increase the probability of developing a successful outcome.
Identify Possible Solutions and Success Criteria EQ 1.2 How do I use different strategies to effectively generate solutions that solve problems? EQ 1.3 Why is it important to be able to solve problems and explain my reasoning?	ASSESSED	EU 1.4 There are different processes and strategies for solving problems. Being able to apply these processes and strategies may increase the probability of developing a successful outcome. EU 1.5 Through practice, we can grow in our ability to develop effective solutions to problems.
Systems Thinking EQ 1.4 How do my decisions impact the world? EQ 1.5 How can I transfer my knowledge and skills to new situations?	SUPPORTED	EU 1.2 The decisions that we make impact others. It is important to consider the implications and consequences of personal actions. 1.4 There are different processes and strategies for solving problems. Being able to apply these processes and strategies may increase the probability of developing a successful outcome.

Unit Know, Understand, and Do:

Know:

8 Habits of Studio Thinking(Studio Habits of Mind/SHOM): Develop Craft, Engage & Persist, Envision, Express, Observe, Reflect, Stretch &

Explore, Understand Arts (or other area) Community
Design thinking process: Empathize, Define, Ideate, Prototype, Test & Redesign
Creativity, Innovation, Imagination, Collaborations & Critiques
Reflection, Makerspace, Failures & Mistakes are opportunities to learn
Designers'/Engineers'/Artists' inspirations & influences
Creating in the arts/engineering/designers uses imagination, self-discipline, problem solving and experience.
Process impacts product.
Expression of designer's ideas and intent via creative choices
Growth Mindset, creating a community of learners, and teamwork principles
How to create an idea: Scamper

Understand:

Design thinking is a life skill for solving complex real world problems used by artists/designers/engineers.
Design Thinking is learning by doing.

Do:

Students, utilizing Studio Habits of Mind, and Design Thinking will be able to create unique, creative & innovative solutions to various artistic, design, engineering &/ passion challenges within the classroom Makerspace environment. Students will develop a growth mindset, grit, collaboration skills, and embrace mistakes and failures as opportunities for learning.

For a final project , students will choose an interest, an area of new learning and/or a problem to solve to pursue to apply their new learning to.

Thrills+Chills-Spills

Thrills+Chills-Spills	**4th Grade**
Science, Design Thinking Process, Math	16 Weeks
How can we develop an amusement park ride that meets the needs of all types of riders and is safe?	
Rationale/Purpose:	
Students will have a real world challenge…designing an amusement park ride that is safe and maintaining a high level of excitement using the Design Thinking Process.	
Description:	

Coaster Design Project-Students will analyze and apply information about physical forces to create cyber coasters. After experimenting with roller coaster factors, students will use facts and reason logically to explain the relationships and the effect on rides. Students will recognize and solve problems to create a working model of a roller coaster.

Designing an Amusement Park Ride Project-Students will gather and organize data about ride accidents, safety and different types of amusement park rides. Students will then use the Design Thinking Process to develop their own amusement park ride that embodies the importance of safety. Each student will also be given the challenge of developing a plan for a certain type of rider that they would not expect to ride their amusement park ride. The type of rider given to each student will be at the discretion of the teacher.

Enduring Understandings:

- EU 1.1 Decision making requires a process of gathering, analyzing, and applying information and ideas.
- EU 1.2 The decisions that we make impact others. It is important to consider the implications and consequences of personal actions.
- EU 1.4 There are different processes and strategies for solving problems. Being able to apply these processes and strategies may increase the probability of developing a successful outcome.
- EU 1.5 Through practice, we can grow in our ability to develop effective solutions to problems.

Essential Questions:

- EQ 1.1 How do I make and defend a well thought out and reasonable decision?
- EQ 1.2 How do I use different strategies to effectively generate solutions that solve problems?
- EQ 1.3 Why is it important to be able to solve problems and explain my reasoning?
- EQ 1.6 How do I communicate my ideas effectively to an appropriate audience?

MOGLO:

ASSESSED:

CR.A.1 - Collect and analyze data to independently identify elements of issues

CR.I.1 - Effectively communicate complex ideas in a way that meets the need(s) of the intended audience

CR.E.1 - Develop, test, refine prototypes as part of a cyclical design process with teacher-selected success criteria

SUPPORTING:

CR.B.1 - With guidance, develop success criteria for problem solutions

CR.C.2 -With guidance, support ideas, decisions and opinion statements with facts tied to evidence from multiple sources

CR.F.2 - Evaluate your personal decisions on issues in the larger perspective

Unit Know, Understand, and Do:

Know:

- Physics terminology, design components, mathematical formulas, and variables related to amusement ride engineering.
- Time management, group, and leadership skills
- Research skills (gathering & organizing) strategies for analyzing sources
- Data analysis terminology, strategies, and skills
- Planning strategies, presentation skills

Understand:

- In a complex system parts interact to produce an outcome
- Working successfully in a group takes work
- Sources can be analyzed to determine if the information they contain is meaningful and accurate
- Data can be used to support ideas, find patterns, and make informal decisions
- You can't solve a problem until you truly understand it
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Do:

- Create and explain a variety of coaster models that are consistent with the laws of physics
- Complete quality work individually, in a group, and as a leader
- Gather & organize current information about different types of amusement park rides and their safety features
- Present with a group final roller coaster designs
- Students create an amusement park ride of their choosing and incorporate ride safety that meets the needs of the target rider using the Design Thinking Process.
- Come up with a plan for a non-target rider that wishes to ride the student creation.

Ideation of Play

Ideation of Play	4th Grade Gifted
Science (DTP)	16-18 Days (1 lesson/week/semester)
Rationale/Purpose:	

Students need to not only understand, but actively engage, in problem solving processes. In this unit students have multiple opportunities to empathize and understand user needs through observation, research, and immersion; define problems and identify constraints to solving them; brainstorm multiple solutions and evaluate them to determine which is the best; create prototypes; and test their ideas by gathering feedback and continually improving their thinking and their product. These skills are necessary for navigating whatever the future holds for our students. We may not know what is around the corner, but we can help prepare students with strategies for tackling it by building their critical thinking and problem solving skills. This unit provides CCL students with these opportunities by giving them access to specialized instruction in the importance of play and the critical thinking, problem-solving, and design processes behind toy creation as students set and reflect on personal goals and make connections and draw conclusions based on information.

NEW - Used for blurb in curriculum newsletter:

The purpose of this unit is to help students not only understand, but actively engage, in problem solving processes through the lense of a toy designer. This unit presents students with multiple opportunities to empathize and understand user needs through observation, research, and immersion; define problems and identify constraints to solving them; brainstorm multiple solutions and evaluate them to determine which is the best; create prototypes; and test their ideas by gathering feedback and continually improving their thinking and their product before sharing it with others and justifying their design choices. Students discover the importance of play and the critical thinking, problem-solving, and design processes behind toy creation while setting and reflecting on personal goals, making connections and drawing conclusions based on information, and cycling through the design thinking process multiple times through various toy challenges. CCL focus standards: Empowered Learner, Knowledge Constructor, and Innovative Designer

Description:

Students will learn the purpose behind playing with a variety of toy types. They will understand that toys are categorized in different ways and learn how to analyze toys based on Piaget's Stages of Development as well as the Play Pyramid and the Scales of Play utilized by students in an engineering design course at MIT. Students will go through the DTP 4 times at a minimum as they learn about various categories of toys. They will set and reflect on goals. Students will also make connections and draw conclusions based on information they gather through observations, immersion experiences, research, and the analyzing of group data. The last project students work on will be to use the DTP as they work collaboratively to design a toy for a specific client using evidence to justify their design choices.

Enduring Understandings:

EU 1.1 Decision making requires a process of gathering, analyzing, and applying information and ideas.

EU 1.2 The decisions that we make impact others. It is important to consider the implications and

consequences of personal actions.

EU 1.3 The development of critical thinking skills and dispositions is a life-long endeavor.

EU 1.4 There are different processes and strategies for solving problems. Being able to apply these processes

and strategies may increase the probability of developing a successful outcome.

EU 1.5 Through practice, we can grow in our ability to develop effective solutions to problems.

Overarching question:
Why are exploration, collaboration, creation, failure and attributes essential to learning?

Essential Questions:

- EQ 1.1 How do I make and defend a well thought out and reasonable decision?
- EQ 1.2 How do I use different strategies to effectively generate solutions that solve problems?
- EQ 1.3 Why is it important to be able to solve problems and explain my reasoning?
- EQ 1.4 How do my decisions impact the world?
- EQ 1.5 How can I transfer my knowledge and skills to new situations?
- EQ 1.6 How do I communicate my ideas effectively to an appropriate audience?

Empowered Learner:

- How can I be an active learner?
- How does active learning help me grow?
- How can I use reflection to help guide my learning?
- How can I transfer my knowledge to a new situation?

Knowledge Constructor:

- How do critical thinkers make connections/draw conclusions that lead to open-ended inquiry?
- How do I determine relevant resources?
- How do I choose/determine relevant resources that impact my learning?
- How can I transfer my knowledge to a new situation?

Innovative Designer:

- How do effective problem solvers adapt their thinking?
- How do effective problem solvers navigate obstacles?
- How can I be innovative (create new, useful, and imaginative solutions)?
- How can I transfer my knowledge to a new situation?

MOGLO:

Standard Domin: Complex Reasoning	**Supported or Assessed**	**How Standard Aligns with Enduring understanding of the unit.**
Communicate Ideas, Thoughts, and Messages	**Assessed**	**EU 1.5 Through practice, we can grow in our ability to develop and communicate effective solutions to problems.**
Analyze Problem Situations and Identify Key Elements	**Supported**	**EU 1.1 Decision making requires a process of gathering, analyzing, and applying information and ideas.**
Evaluate Options and Explain Reasoning	**Supported**	**EU 1.4 There are different processes and strategies for solving problems.**

		Being able to apply these processes and strategies may increase the probability of developing a successful outcome. EU 1.3 The development of critical thinking skills and dispositions is a life-long endeavor.
Identify Possible Solutions and Success Criteria	**Assessed**	**EU 1.5 Through practice, we can grow in our ability to develop effective solutions to problems.**
Systems Thinking	**Supported**	**EU 1.2 The decisions that we make impact others. It is important to consider the implications and consequences of personal**

		actions.

Know:

- The Design Thinking Process is one of many types of thinking processes used to solve a problem.
- Problem solving processes can lead to a more effective solution.
- Identifying goals helps keep to a timeline.
- Adjusting goals as one works supports positive forward progress.
- Making connections and drawing conclusions helps to analyze and evaluate at a deeper level.
- How to transfer knowledge from one situation to another.

Understand:

Empowered Learner:

Active learning allows for personal and cognitive growth.

Knowledge Constructor:

Critical thinking allows for constructing meaning from learning experiences.

Innovative Designer:

Design thinking allows for problem-solving and innovative solutions.

Additional:

- There are different solutions to the same problem.
- Using a system to solve a problem is one effective strategy.
- One has to work within constraints to solve real-life problems.
- Feedback is an important part of gaining insight for necessary improvements.
- One may not always meet a goal and adjustments may be needed along the way.
- There are different ways to reach goals.

Do:

Empowered Learner:

- Create an appropriate, project-based, personal learning goal. - A
- Create a plan to achieve a goal - D
- Reflect on goal progress to improve learning. - A
- Adjust goal and/or strategies when needed. - D

Knowledge Constructor:

- Use research strategies to find resources and information on a topic. - D
- Determine if resources and information are relevant for my purpose. - D
- Determine the accuracy, perspective, and credibility of a resource. - I
- Use tools and methods to gather, select, and categorize information. - D
- Make connections and draw conclusions based on information. - A

- Acting as a professional in a discipline, to build knowledge by using open-ended inquiry to actively explore real-world issues and problems. - D

Innovative Designer:

- Follow a given design process to use in solving a problem. - A
- Select and use tools that help move through a design process. - D
- Identify the constraints and risks related to the process. - A
- Work within constraints to manage the process. - I
- Create and develop a new and purposeful solution/prototype. - A
- Test if a prototype is effective. - D
- Use feedback to improve a prototype. - D