BERKELEY HEIGHTS PUBLIC SCHOOLS
BERKELEY HEIGHTS, NEW JERSEY

GOVERNOR LIVINGSTON HIGH SCHOOL PRACTICAL ARTS DEPARTMENT

STEAM SEMINAR

Curriculum Guide

Date: April 2021
Updated: August 2022

Dr. Melisa Varley, Superintendent
Dr. David Greer, Assistant Superintendent
Mr. Andrew Ziobro, District Supervisor

Developed by:
Dan Guyton
Mike Maresca

This curriculum may be modified through varying techniques,
strategies, and materials, as per an individual student's
Individualized Educational Plan (IEP)

Approved by the Berkeley Heights Board of Education
at the regular meeting held on ⎯⎯⎯August 11, 2022⎯⎯⎯⎯⎯.

<u>VISION STATEMENT</u>

STEAM is the integrated approach to education in the areas of Science, Technology, Engineering, Arts and Mathematics. Instruction is student centered and driven by an iterative design process, exploratory learning, problem-solving, and engagement in authentic contexts.

Through the process of engaging in authentic, hands-on, open-ended design challenges, students will become familiar with the steps and processes associated with successful problem solving in the context of the engineering design process. Students will gain proficiency in the application of relevant Math, Science, and Technology concepts while expanding their comprehension and understanding of the human-designed world, the nature of technology and engineered systems, and the skills, knowledge, and attitudes necessary to become well-rounded and successful twenty-first century problem solvers and innovators.

MISSION STATEMENT

STEAM Seminar is a one semester class designed for 12th grade students at Governor Livingston High School that addresses 21st century skills and career ready practices. Students utilize the engineering design process along with design thinking in the development of a physical/conceptual product that satisfies a customer/client needs. Throughout the course, students will be engaged in refining and developing their solutions to an authentic problem working individually or as a team. Students will learn to utilize feedback from this process to revise and refine their designs and solutions. This course builds on the foundational knowledge and skills developed in previous STEAM courses.

COURSE PROFICIENCIES

COURSE OBJECTIVES

Students will learn and utilize the concepts of design thinking which is an orientation toward learning that encompasses active problem-solving and utilizing one's ability to create impactful change. It engenders a sense of creative confidence that is both resilient and highly optimistic. This is a cyclic process that students will utilize several times in order to refine and develop their final prototypes and solutions.

EMPATHIZE - Design thinking is a process of human-centered innovation, and empathy is its foundation. To empathize, you observe; you view users and their behavior in the context of their lives. You engage; you interact with and interview users through both scheduled and short encounters. You immerse; you put yourself into someone else's shoes and experience what they experience. As a human-centered designer you need to understand the people for whom you are designing. The problems you are trying to solve are rarely your own – they are those of particular users; in order to design for your users, you must build empathy for who they are and what is important to them.

DEFINE - During the define phase of the design thinking process, you develop a point of view statement, a guiding statement that focuses on specific users, insights, and needs that you uncovered during the empathy mode. The point of view statement is a clear and concise sentence that is referred back to as you move through a design challenge.

IDEATE - Ideation is the process of idea generation. Mentally it represents a process of "going wide" in terms of concepts and outcomes. Ideation provides the fuel for building prototypes and driving innovative solutions. You ideate in order to step beyond obvious solutions. You ideate to harness the collective perspectives and strengths of teams. You ideate to create fluency (volume) and flexibility (variety) in innovation options.

PROTOTYPE & TEST - Prototyping is getting ideas and explorations out of your head and into the physical world. A prototype can be anything that takes a physical form – be it a wall of post-it notes, a role-playing activity, a space, an object, an interface, or even a storyboard. Testing is the chance to refine prototypes and make them better. You place your low-resolution
prototypes into the hands of your user and observe. Prototypes that fail in the testing mode are just as useful as prototypes that succeed, because they all contribute to the understanding of how to make a good final product. You build by the saying "fail early and often" – by creating a lot of rough prototypes which are just barely good enough to get the essence of your idea across, you're able to get valuable feedback from users which can be used on another prototype. Going through a few rounds of the prototyping and testing process will give you an incredibly detailed and useful picture of what your final product needs to be.

STUDENT PROFICIENCIES

The students will be able to:

1. Utilize the design thinking process to create solutions to problems
2. Design solutions for their customers by understanding their needs and experiences
3. Create point of view statements
4. Work in groups using different brainstorming techniques to develop potential solutions
5. Communicate and develop solutions utilizing technology and other tools
6. Collect data from various sources in order to understand the problem, customer, socialial, environmental, economic, etc.
7. Utilize data and feedback to analyze solutions and make data driven decisions to revise and develop new solutions

METHODS OF EVALUATION

1. Engineering notebook
   a. Problem Statements
   b. Development of Testing Methods
   c. Data collection and Analysis
   d. Brainstorming sessions
   e. Customer/Client Information and feedback
   f. Patent Research and intellectual property protection
2. Data Evaluation
   a. Visual/Graphical Data Presentation
3. Final Design Presentation including process highlights and key learnings
   a. Final Design Prototype/Solution
4. Final Model
   a. Completed Physical or Conceptual model

MODIFICATIONS & ACCOMMODATIONS

Modifications and Accommodations for Special Education students, students with 504s, English Language Learners and Gifted and Talented students may include but are not limited to the following:

Special Education
- Individualized Education Plans (IEPs)
- Exemplars of varied performance levels
- Multimedia presentations
- Sheltered instruction
- Consultation with ESL teachers
- Manipulatives
- Tiered/Scaffolded Lessons
- Mnemonic devices
- Visual aids
- Modeling
- Guided note-taking
- Study Guides
- Modified homework
- Differentiated pre-typed class notes and example problems
- Use of the special education teacher to re-instruct in flexible small groups for the struggling learner
- Manipulatives
- Flipped Instruction
- Word banks
- Reduced choice on assessments
- Preferential seating
- Choice activities
- Modified time requirements
- Modified notes
- Modified lesson, assessment and study guide format
- Provide an enriched curriculum and activities
- Independent projects
- Contracts/behavior support plans
- Open-ended responses
- Project-based learning
- Group activities

- Guided Notes
- Functional learning incorporated into each lesson
- Exploration Activities
- Assessment read aloud
- Small group assessments
- Organizational Support
- Oral questioning assessments to supplement written response
- Pre-writing Structural Supports for extended writing tasks
- Ongoing teacher feedback as part of the writing process
- Interactive Study Guides
- Multi-sensory approach to instruction
- Written and spoken step-by-step directions
- Content-focused assessment (not grading for spelling/grammar)
- Graphic organizers
- Non-verbal cues to begin task/remain on task/refocus
- Individual monitoring for understanding/reinforced instruction
- Printed copies of class readings for application of Active Reading Strategies

Gifted & Talented
- Provide one-to-one teacher support
- Curriculum Compacting
- Advanced problems to extend the critical thinking skills of the advanced learner
- Supplemental reading material for independent study
- Elevated questioning techniques using Webb's Depth of Knowledge matrix
- Curriculum Compacting
- Flexible grouping
- Tiered assignments
- Topic selection by interest
- Manipulatives
- Tiered Lessons
- Flipped Instruction
- Multimedia Presentations
- Open-ended responses
- Project-based learning
- Group activities
- Guided Notes
- Conclusions and analysis of exploratory activities
- Career based learning incorporated into each lesson
- Exploration Activities

- Student choice

ELLs
- Exemplars of varied performance levels
- Multimedia presentations
- Sheltered instruction
- Consultation with ESL teachers
- Manipulatives
- Tiered/Scaffolded Lessons
- Mnemonic devices
- Visual aids
- Modeling
- Guided note-taking
- Study Guides
- Modified homework
- Differentiated pre-typed class notes and example problems
- Individualized instruction plans
- Manipulatives
- Flipped Instruction
- Words banks
- Reduced choice on assessments
- Preferential seating
- Choice activities
- Modified time requirements
- Modified notes
- Modify lesson, assessment and study guide format
- Provide an enriched curriculum and activities
- Contracts/management plans
- Open-ended responses
- Project-based learning
- Group activities
- Guided Notes
- Exploration Activities
- Assessment read aloud
- Small group assessments
- Oral questioning assessments to supplement written response
- Pre-writing Structural Supports for extended writing tasks
- Ongoing teacher feedback as part of the writing process
- Interactive Study Guides

- Multi-sensory approach to instruction
- Written and spoken step-by-step directions
- Graphic organizers
- Non-verbal cues to begin task/remain on task/refocus
- Individual monitoring for understanding/reinforced instruction
- Printed copies of class readings for application of Active Reading Strategies

504s
- Exemplars of varied performance levels
- Multimedia presentations
- Sheltered instruction
- Tiered/Scaffolded Lessons
- Mnemonic devices
- Visual aids
- Modeling
- Guided note-taking
- Study Guides
- Differentiated pre-typed class notes and example problems
- Manipulatives
- Words banks
- Reduced choice on assessments
- Preferential seating
- Modified time requirements
- Modified notes
- Modify lesson, assessment and study guide format
- Modified homework
- Independent projects
- Contracts/management plans
- Open-ended responses
- Project-based learning
- Group activities
- Guided Notes
- Exploration Activities
- Assessment read aloud
- Small group assessments
- Organizational Support
- Oral questioning assessments to supplement written response
- Pre-writing Structural Supports for extended writing tasks
- Ongoing teacher feedback as part of the writing process
- Interactive Study Guides
- Multi-sensory approach to instruction
- Written and spoken step-by-step directions
- Content-focused assessment (not grading for spelling/grammar)
- Graphic organizers

- Non-verbal cues to begin task/remain on task/refocus
- Individual monitoring for understanding/reinforced instruction
- Printed copies of class readings for application of Active Reading Strategies

<u>Students at Risk of Failure</u>
- Exemplars of varied performance levels
- Multimedia presentations
- Tiered/Scaffolded Lessons
- Modeling
- Guided note-taking
- Study Guides
- Differentiated pre-typed class notes and example problems
- Individualized instruction plans
- Words banks
- Reduced choice on assessments
- Preferential seating
- Choice activities
- Modified time requirements
- Modified notes
- Modified lesson, assessment and study guide format
- Modified homework
- Provide an enriched curriculum and activities
- Contracts/management plans
- Open-ended responses
- Project-based learning
- Group activities
- Guided Notes
- Exploration Activities
- Assessment read aloud
- Small group assessments
- Oral questioning assessments to supplement written response
- Pre-writing Structural Supports for extended writing tasks
- Ongoing teacher feedback as part of the writing process
- Interactive Study Guides
- Multi-sensory approach to instruction
- Written and spoken step-by-step directions
- Graphic organizers
- Non-verbal cues to begin task/remain on task/refocus
- Individual monitoring for understanding/reinforced instruction
- Printed copies of class readings for application of Active Reading Strategies

Diversity, Equity, and Inclusion Curriculum Statement

Berkeley Heights public schools are committed to recognizing diversity and promoting equity, tolerance, and inclusion in our classrooms. We encourage a safe, welcoming, and inclusive environment for all students regardless of race or ethnicity, sexual and gender identities, mental and physical disabilities, and religious beliefs. Our curriculum infuses teaching of these principles and addresses all associated standards and laws. This includes, but is not limited to:

C.18A:35-4.35 - History of disabled and LGBT persons

A board of education shall include instruction on the political, economic, and social contributions of persons with disabilities and lesbian, gay, bisexual, and transgender people, in an appropriate place in the curriculum of middle school and high school students as part of the district's implementation of the New Jersey Student Learning Standards.

18A:35-28. Instruction on Holocaust, genocides required in elementary, secondary school curriculum

a. Every board of education shall include instruction on the Holocaust and genocides in an appropriate place in the curriculum of all elementary and secondary school pupils.

b. The instruction shall enable pupils to identify and analyze applicable theories concerning human nature and behavior; to understand that genocide is a consequence of prejudice and discrimination; and to understand that issues of moral dilemma and conscience have a profound impact on life. The instruction shall further emphasize the personal responsibility that each citizen bears to fight racism and hatred whenever and wherever it happens.

Section: 52:16A-88: Responsibilities, duties of Amistad Commission

g. to develop, in consultation with the Department of Education, curriculum guidelines for the teaching of information on the African slave trade, slavery in America, the vestiges of slavery in this country, and the contributions of African-Americans to our country. Every board of education shall incorporate the information in an appropriate place in the curriculum of elementary and secondary school students;

Examples of how these concepts and principles are infused into this curriculum include:
- **STEM Jobs See Uneven Progress in Increasing Gender, Racial and Ethnic Diversity -**
- **https://www.pewresearch.org/science/2021/04/01/stem-jobs-see-uneven-progress-in-increasing-gender-racial-and-ethnic-diversity/**
- **The Startup Girl Foundation -** https://www.cnbc.com/2020/12/28/how-a-college-student-launched-jewelry-company-shiffon.html?__source=iosappshare%7Ccom.google.Gmail.ShareExtension , https://www.shiffonco.com/pages/story
- **10 Influential Women in Engineering -** https://www.asme.org/topics-resources/content/10-influential-women-in-engineering
- **The Untold History of Women in Science & Technology -** https://obamawhitehouse.archives.gov/women-in-stem

- **Famous Black Inventors -** https://www.black-inventor.com/
- **10 Black Innovators Who Have Made an Impact in STEM -** https://www.engineeringforkids.com/about/news/2021/february/10-black-innovators-who-have-made-an-impact-in-s/
- **LGBTQ+ People in STEM -** https://www.liverpoolmuseums.org.uk/stories/lgbtq-people-stem
- **Programming Pride: 10 LGBTQI+ Pioneers of Computer Science -** https://newrelic.com/blog/nerd-life/10-lgbt-computer-science-pioneers
- **Pride in STEM** - https://prideinstem.org/lgbtstemday/

Additionally, components of this are tagged throughout the curriculum as appropriate (i.e. standards, objectives, activities). Tagging convention is outlined below:
- DEI - Diversity, Equity and Inclusion Learning
- AM - Learning associated with Amistad
- HG - Learning associated with Holocaust and Genocide
- SEL - Social-Emotional Learning
- L+ - Learning associated with LGBTQ+ and Neurodiverse communities

Climate Change Curriculum Statement

With the adoption of the [2020 New Jersey Student Learning Standards (NJSLS)](#), New Jersey became the first state in the nation to include climate change across content areas. These standards are designed to prepare students to understand how and why climate change happens, the impact it has on our local and global communities and to act in informed and sustainable ways.

Districts are encouraged to utilize the NJSLS to develop interdisciplinary units focused on climate change that include authentic learning experiences, integrate a range of perspectives and are action oriented. While the [2016 NJSLS-English Language Arts (ELA) and Mathematics](#) do not have specific climate change standards, districts may want to consider how they can design [interdisciplinary climate change units](#) that incorporate relevant ELA and mathematics standards. Likewise, it may be helpful to review the [2020 NJSLS documents](#) to identify other relevant standards that might be incorporated as well as to understand the role of core ideas, performance expectations and practices in curriculum development and lesson planning.

Standards and/or activities addressed in this curriculum includes:
- 6.2.12.CivicsHR.6.b: Make an evidence-based argument on the tensions between national sovereignty and global priorities regarding economic development and environmental sustainability and its impact on human rights.
- 6.2.12.CivicsPI.6.a: Use historic case studies or a current event to assess the effectiveness of multinational organizations in attempting to solve global issues.

Components of this are tagged throughout the curriculum as appropriate: CC - Climate Change.

*** Climate Change Curriculum Statement section highlighted in yellow gets deleted (by the teacher or supervisor) if the course does not explicitly involve climate change units, activities, or standards. ***
This statement gets deleted on every curriculum guide upon completion.

Career Readiness, Life Literacies, and Key Skills Practices

Career Readiness, Life Literacies, and Key Skills Practices describe the habits of the mind that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increased college, career, and life success. These practices should be taught and reinforced in all content areas with increasingly higher levels of complexity and expectation as a student advances through a program of study.

2020 NJSLS - Career Readiness, Life Literacies, and Key Skills Practices	
CLKS-P1	Act as a responsible and contributing community member and employee.
CLKS-P2	Attend to financial well-being.
CLKS-P3	Consider the environmental, social and economic impacts of decisions
CLKS-P4	Demonstrate creativity and innovation.
CLKS-P5	Utilize critical thinking to make sense of problems and persevere in solving them.
CLKS-P6	Model integrity, ethical leadership and effective management.
CLKS-P7	Plan education and career paths aligned to personal goals.
CLKS-P8	Use technology to enhance productivity, increase collaboration and communicate effectively.
CLKS-P9	Work productively in teams while using cultural/global competence.

]

Pacing Guide

Unit Number	Unit Name	Suggested Pacing
1	Design Thinking Review/Development of the Design Brief	12-15 days, recurring as needed
2	Pricing/Budgeting/Revenue and Costs	12-15 days, recurring as needed

SCOPE AND SEQUENCE
COURSE OUTLINE/STUDENT OBJECTIVE

Unit 1: Design Thinking Review/ Development of the Design Brief DEI L+
Duration: 12-15 days focus and recurring as needed

Overview: Students will review design thinking and how they can be applied to their challenges.

Standards:
- MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP5. Consider the environmental, social and economic impacts of decisions.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP9. Model integrity, ethical leadership and effective management.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

Essential Questions:
- Does your design brief accurately define the problem for the customer/client?
- Does the design brief clearly define the problem?

Student Learning Objectives:
Students will know and be able to…
- develop empathy
- conduct an interview
- synthesize information
- brainstorm ideas
- build prototypes
- test prototypes

- share information

Possible Activities
- [UNDERSTAND MIXTAPE](#)
- [EXPERIMENT MIXTAPE](#)
- [IDEATE MIXTAPE](#)

Unit 2: Pricing/ Budgeting/ Revenue and Costs
Duration: 12-15 days focus and recurring as needed

Overview: Students will apply the steps of how products/solutions are priced. They will develop a business model and plan.

Standards:
- MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP5. Consider the environmental, social and economic impacts of decisions.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP9. Model integrity, ethical leadership and effective management.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

Essential Questions:

- How is this funded?
- What resources are needed?
- How will you deal with supply chain logistics?
- How is this appealing to the consumer?

Student Learning Objectives:
Students will know and be able to…
- Develop a pricing and marketing plan
- Research material and production costs
- share information

Possible Activities
- Development and documentation in the engineering notebook
- Analysis of existing proposals and business plans
- Interview of angel investors
- Shark Tank

SUGGESTED MATERIALS AND RESOURCES

Review of Prior skills and material use from other technology courses
https://dschool.stanford.edu/resources/design-thinking-bootleg

*Or other literature, video, or digital materials of equal academic worth