INVENTION PROJECT II™ STANDARDS

KEY CONCEPTS

- The sun's energy can be converted into heat and electricity.
- Not all people around the world have easy access to power.
- Solar energy can be used in many different types of technology as a power source.
- Entrepreneurship encompasses invention, innovation, economics, business, and marketing principles.
- Marketing is multifaceted information distribution about a product to the consumer.
- Advertisements promote a product and are used in marketing.
- Variables are aspects of an experiment that change; constraints are aspects of an experiment that remain the same.
- Multiple trials and data recording are important components of scientific investigation.
- Mixtures are substances made by mixing other substances together.
- A solution is a special type of mixture whose parts are evenly distributed.
- The form of delivery of a medicine can be just as important as the actual medicine.
- Medicine can be protected from the body's internal environment and delivered via nanorobots, hitching a ride on the body's innate cells, and on skin patches among other methods.
- Businesses have individuals who assume a variety of roles to help the business run smoothly.
- Entrepreneurs must create a business plan, which is used to outline the company's purpose, the short-term and long-term goals, and how the company plans to reach those goals.
- Clothing has chemical properties.
- Clothing has function, and can be designed to meet specific needs.
- Design engineering can be applied to clothing.
- Business is practicing and engaging in commerce.
- Profit is the amount of money that a business or individual earns after they deduct their expenses.
- Demand is the amount of products that consumers want to buy.
- Design thinking is a discipline that uses a designers' methods to match people's needs with what is technologically possible and what has market value.
- A "maker" is a do-it-yourselfer-type who makes or produces something-likely applying some creativity, curiosity,

problem solving, and technical tinkering along the way.

- There are many basic pieces of technology (e.g., circuit-making electronics, 3D printers, and routers) that can help everyday people to makers.
- Holograms are 3D images created by the interference patterns of laser light.
- Microscopes create 3D images created by the interference patterns of laser light.
- Microscopes create 3D floating projections using parabolic mirrors and reflection.
- Beta testing is a second quality control check, when the product is almost ready for release to market but needs to have a trial run with consumers to detect any last issues.
- There are on-line communities like Kickstarter(R), which have been created to help support creative projects through mass funding.
- Knowing your audience is a vital part of any successful business venture.
- In the electret microphone, thin sheets of polymer electret film are metal-coated on one side to form the membrane of he movable plate capacitor that converts sound to electrical signals with high fidelity.
- Ninety percent of today's microphones are electret microphones, and they are used in everyday items such as telephones, camcorders, and tape recorders.
- There is a connection between science, technology, and the invention process.
- Engineers, designers, and inventors all use creative problem solving.
- Inventions can be adapted and modified.
- Marketing highlights the best features of a product.
- Branding allows a product an identifier that is unique and distinguishes it from other products.
- An angel investor gives money to a company, entrepreneur, or inventor to help the company.
- Business is practicing and engaging in commerce.
- Assembly lines help improve efficiency.
- Profit is the amount of money that a business or individual earns after they deduct their expenses.
- Simple robots can be made using small motors and batteries.
- Counterbalance is a key component of motion in designing a vibrating robot.
- Every person has there own personality style when it comes to inventing.
- Individual styles are important in inventing and business, but so is teamwork. Individuals styles can be applied to teamwork to approach a project from many angles.
- Bioengineering is a growing industry with many practical applications.

- Simple machines include wedges, levers, and pulleys, which help make work easier and allow us to lift heavy loads and pry apart objects.
- The human body contains simple machines. Tendons, muscles, and bones work together to form levers and pulley systems. Fingernails and teeth operate as wedges.
- Valuation refers to how much a company is worth and is necessary to calculate when seeking money from investors.
- STEM (Science, Technology, Engineering, Mathematics) and the Arts work hand-in hand to enhance each other's efforts.
- Knowledge of the arts can be applied to inventions and make them more appealing.
- Arts integration develops creative thinking and confidence, skills that are beneficial for the invention process.
- Companies use problem solving and creativity to develop innovative solutions to business problems.
- A SWOT analysis helps companies make decisions to grow their business.
- Retailers use plannograms to organize the store's layout.
- Shelf appeal helps one product stand out visually when surrounded by competing products.
- Drones have a variety of uses for tasks that are difficult or dangerous for people to perform, including wildlife research.
- New inventions can be created by combining two or more existing inventions.
- Innovation involves failure and is supported through partners and teams.
- Cameras have been adapted over the years and become more sophisticated with each technical adaption.
- Adapting and reflecting on an invention is an important process when inventing prototypes.
- Entrepreneurs and inventors often look for outside funding to get their innovations to market.
- Flight is created when wings redirect flowing air downward, which then helps lift the object up. The trick is pushing the air downwards with enough force to generate force in the opposite direction that can lift the object.
- The Wright brothers used a counter-weight system to pull the airplane forward to help give it momentum during take off.
- Some companies submit request for proposals where they view proposals submitted by contractors to address their needs and then accept a bid,
- Remote-control is used to wirelessly operate an electronic device.
- The transmitter is used to give an operation to a device. The inner circuit converts and electrical signal to a radio wave and transmits it to the receiver.
- The receiver receives the radio wave sent from the transmitter, converts it into an electrical signal, and sends it to the motor.

- Creativity involves the novel (original) production of ideas to solving a challenge.
- Innovation is the process of introducing new ideas, products, systems, and processes.

OBJECTIVES

- Be introduced to the relationship between invention and entrepreneurship.
- Investigate solar cells and switches in circuits.
- Design prototypes of inventions that use solar power.
- Utilize design engineering.
- Market a product.
- Create advertisements using cool neon.
- Test out various experiments using step-by-step recipe cards.
- Design chemistry experiments.
- Create an innovative medicinal delivery system targeted for a specific patient.
- Practice business and entrepreneurship, assuming a business role as they design and build their prototype.
- Create a Mad Libs(TM) business plan.
- Discuss various types of clothing.
- Design clothing of the future.
- Explore entrepreneurship in tandem with invention, innovation, economics, business, and marketing principles.
- Increase their business's potential to make more profits.
- Practice design thinking as a discipline that uses a designers' methods to match people's needs with what is technologically possible and what has market value.
- Consider opportunities for making.
- Engage in an activity that explores the layering technology of 3D printing.
- Explore the joy of being makers as they choose the projects on which they want to work
- Create a set of holographic avatars for a new video game and project them using a 3D microscope.
- Develop a holographic video game concept and storyline.
- Start a mock-on-line community project to fund their video game, acquire backers, and giveaway rewards for backers.
- Explore the microphone.

- Create an invention that uses the microphone.
- Use design engineering.
- Apply design thinking.
- Communicate and collaborate within a team.
- Employ STEM.
- Design branding and advertisements that make others want to buy a product.
- Explore angel investing.
- Assemble a key chain that meets the quality control criteria.
- Compare the difference in time between assembling a key chain solo versus within an assembly line.
- Test and build small, vibrating robots on erasers.
- Explore the process of trial and error through changing variables of the E-Racer Bots.
- Take a personality quiz to find out their inventor style and which National Inventors Hall of Fame inductee's style they are most like.
- Receive a personalized invention challenge from Team TKAone, 2014 Collegiate Inventors Competition finalists and inventors of a device that detects infections in the knee after surgery.
- Work to design a biomechanical enhancement that includes one simple machine and would be a dream come true for an athlete in any sport of their choice.
- Calculate the valuation of their company and attempt to gain a famous sports endorsement.
- Explore the relationship between art and science, known as STEAM (Science, Technology, Engineering, Art, Math).
- Apply creative thinking skills to solve a business problem.
- Design and build mechanical sculptures.
- Work in teams to create a unique product.
- Explore entrepreneurship using a plannogram and SWOT analysis.
- Design packaging with shelf appeal.
- Discover many applications of drones.
- Receive a message about innovation from National Inventors Hall of Fame Inductee Steve Sasson, inventor of the digital camera.
- Brainstorm ideas for a hybrid drone invention for wildlife research.
- Take turns flying a drone, attempting to land it on targets, and shooting discs at a piece of paper the drown is

carrying.

- Build a hybrid drone prototype.
- Explore ways secure resources to fund their entrepreneurial endeavors.
- Hear of a company's request for proposal for a new type of rescue plane that meets a list of requirements.
- Construct prototypes of a new type of rescue airplane and submit them in response to a request for proposal in hopes of earning a bid.
- Watch a video of National Inventors Hall of Fame Inductee Orville Wright as he boards a biplane for a test flight in 1909.
- Try their prototypes out at a test flight facility as they tweak and modify their final submission.
- Explore the possibilities of remote control technology.
- Use technical instructions to build and operate an RC robot.
- Be introduced to Collegiate Inventors Competition Finalist George Korir.
- Explore their ideas for entertainment inventions that are missing in their lives or the world.
- Build prototypes.

COMMON CORE STATE STANDARDS FOR MATHEMATICS CONTENT ALIGNED TO INVENTION PROJECT II(TM) / 6-8

RATIOS AND PROPORTIONAL RELATIONSHIPS

- Understand ratio concepts and use ratio reasoning to solve problems.

  6.RP.3 Use ratio and rate reasoning to solve real-world and mathematical problems.

  b. Solve unit rate problems including those involving unit pricing and constant speed.

- Analyze proportional relationships and use them to solve real-world and mathematical problems.

  7.RP.2 Recognize and represent proportional relationships by equations. For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn

THE NUMBER SYSTEM

- Compute fluently with multi-digit numbers and find common factors and multiples.

  6.NS.2 Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

- Apply and extend previous understanding of numbers to the system of rational numbers.

6.NS.7 Understand ordering and absolute value of rational numbers.

b. Write, interpret, and explain statements of order for rational numbers in real-world contexts.

c. Understand the absolute value of a rational number as its distance form 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation.

- Apply and extend previous understanding of operations with fractions to add, subtract, multiply, and divide rational numbers.

7.NS.1 Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.

d. apply properties of operations as strategies to add and subtract rational numbers.

7.NS.2 Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

c. Apply properties of operations as strategies to multiply and divide rational numbers.

d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0's or eventually repeats.

- Know that there are numbers that are not rational, and approximate them by rational numbers.

8.NS.1 Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion, which repeats eventually into a rational number.

GEOMETRY

- Solve real-world and mathematical problems involving area, surface area, and volume.

6.G.4 Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in context of solving real-world and mathematical problems.

- Draw, construct, and describe geometrical figures and describe the relationships between them.

7.G.1 Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

STATISTICS AND PROBABILITY

- Summarize and describe distributions.

6.SP.5 Summarize numerical data sets in relation to their context, such as by:

a. Reporting the number of observations.

b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.

COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS CONTENT ALIGNED TO INVENTION PROJECT II(TM) / 6-8

SPEAKING AND LISTENING

- Comprehension and Collaboration

6.SL.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on grade 6 topics, texts, and issues, building on other's ideas and expressing their own clearly.

a. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.

b. Follow rules for collegial discussions, set specific goals and deadlines, and define individual roles as needed.

c. Pose and respond to specific questions with elaborations and detail by making comments that contribute to the topic, text, or issue under discussion.

7.SL.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly.

a. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.

b. Follow rules for collegial discussions, track progress toward specific goals and deadlines, and define individual roles as needed.

c. Pose questions that elicit elaboration and respond to others' questions and comments with relevant observations and ideas that bring the discussions back on topic as needed.

d. Acknowledge new information expressed by others and, when warranted, modify their own views.

8.SL1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacherled)d with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.

a. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.

b. Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed.

c. Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas.

d. Acknowledge new information expressed by others, and when warranted, qualify or justify their own views in light of the evidence presented.

- Presentation of Knowledge and Ideas

6.SL.2 Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.

6.SL.3 Include multimedia components (e.g., graphics images, music, sound) and visual displays in presentations to clarify information.

7.SL.2 Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.

7.SL.3 Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.

8.SL.2 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

8.SL.3 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.

STANDARDS FOR LITERACY IN SCIENCE AND TECHNICAL SUBJECTS

- Key ideas and Details

  6-8.RST.3 Follow precisely a multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks.

NEXT GENERATION SCIENCE STANDARDS ALIGNED TO INVENTION PROJECT II(TM) 6-8

MIDDLE SCHOOL PHYSICAL SCIENCES STORYLINE

- MS-PS1 Matter and Its Interactions

  Grade 2 - Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

  Grade 3 - Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

  Grade 4 - Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

  Grade 5 - Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.

  Grade 6 - Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by a chemical process.

- MS.PS2 Motion and Stability: Forces and Interactions

  Grade 1 - Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

  Grade 2 - Plan an investigation to provide evidence that the change in an objects motion depends on the sum of the forces on the object and the mass of the object.

  Grade 3 - Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

- MS.PS3 Energy

Grade 3 - Apply scientific principles to design, construct, and device that either minimizes or maximizes thermal energy transfer.

Grade 4 - Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

Grade 5 - Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

- MS.PS4 Waves and their Applications in Technologies for Information Transfer

Grade 2 - Develop and use a model to describe that waves are reflected, absorbed, ore transmitted through various materials.

MIDDLE SCHOOL LIFE SCIENCE STORYLINE

- MS.LS1 From Molecules to Organisms: Structures and Processes

Grade 6 - Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.

- MS.LS2.2 Ecosystems: Interactions, Energy, and Dynamics

Grade 2 - Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

Grade 3 - Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

Grade 5 - Evaluate competing design solutions for maintaining biodiversity and ecosystem system services.

- MS.LS4 Biological Evolution: Unity and Diversity

Grade 4 - Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

Grade 5 - Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.

MIDDLE SCHOOL EARTH AND SPACE SCIENCES STORYLINE

- MS.ESS2 Earth's Systems

Grade 1 - Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

Grade 4 - Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

MIDDLE SCHOOL ENGINEERING DESIGN STORYLINE

- MS.ETS1 Engineering Design Storyline

Grade 1 - Define the criteria and constraints of 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.

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

Grade 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.

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