Nova - Next Big Thing

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CHAPTER

ONE

WELCOME TO *NEXT BIG THING*

This Nova Award explores the world of product design, which involves balancing time, cost, and quality to create something new, usually a product that will be sold to consumers or other businesses.

Note: What is product design?

Industrial Designers work to make the objects in our lives more usable. We design for people, solving important problems with unexpected solutions. The very informative site diy.org offers a number of fun activities (of varying difficulties) to learn about product design.

How Product Design can change the world?

Warning: When completing this Award both the youth and involved adult leaders must obey all rules of Safe Scouting. This includes (1) Completing Cyber Chip training prior to starting this activity and (2) **ALWAYS** involve at least 2 adults in all your communications with a leader, including online. If you send an email to your counselor, always add the address of another adult leader or a parent/guardian. Never reply to a message sent by an adult leader unless another adult has been copied on the email. Report any issue to your parents/guardians!

1.1 Instructions

1. Identify a **Nova Counselor** either within your unit, district, or council.
2. This site provides you a platform for learning and you can easily follow all requirements using the navigation menu on the left.
3. Once you have identified a Counselor, you can start working on requirements.
4. The most important aspect in any scientific endeavor is to **properly document progress**. This will be done, here, using a google sheet as described in more details below.

1.2 Documenting your progress

0. You can use the template below to report completion. To work on this Nova Award, you can also use a detailed worksheet provided by the BSA. Click here to have access. The file below is used to record approval.
1. A template worksheet can be found here. This is a *Google document*. **You will not be able to modify it until you make your own copy as I will now describe for you.**
2. Once you have opened the file on google doc, go to `File` → `Make a Copy`.
3. Save the file with the following name: *Nova_designed_to_crunch_FIRSTNAME_LASTNAME*
4. You will use that file to enter your progress and share with your counselor.
5. **You can share your own copy of the worksheet with your counselor using the following procedure.**
    a) Click on the SHARE button on the top-right.
    b) Click on "get link".
    c) Send the link to your counselor.

Note: This document provides you a guide to complete the Nova award! All requirements are marked with the following symbol: $\boxed{\mathbb{REQ} \rightsquigarrow}$. In addition, a number of fun *Additional Challenges* are provided in boxes for your entertainment.

1.3 If you have any question

Contact your counselor or your scoutmaster! If you have questions about the program, contact Vincent Meunier by email (as usual, make sure you copy an additional adult to all your communications with a leader!).

CHAPTER

TWO

REQUIREMENT #1: RESEARCH AND READING

Note: What is a product? Until recently, the term was used only in relation to something material and often found in a retail store. Nowadays, it is coming to mean digital products as well. Apps and websites are modern products. When it comes to building great products, design is the most important "feature." We've moved into the stage where product design dominates — it's what sets companies apart and gives a real edge over competitors. Whether you're a designer, developer, product manager, program manager, marketing manager or project manager, it's essential to understand (and have a reference guide to) the product development process in order to create your best work (This note is inspired by this article).

$\boxed{\mathbb{REQ} \rightsquigarrow}$ Choose A or B or C and complete ALL the requirements.

A. Watch not less than three hours total of shows or documentaries that involve the creation of new products. This can include entrepreneurship, innovation, new technology, and/or engineering design. Then do the following:

   (1) Make a list of at least five questions or ideas from the shows you watched.

   (2) Discuss two of the questions or ideas with your counselor.

B. Read not less than three hours total about product design. Then do the following:

   (1) Make a list of at least five questions or ideas from the articles you read.

   (2) Discuss two of the questions or ideas with your counselor.

C. Do a combination of reading and watching, not less than three hours total. Then do the following:

   (1) Make a list of at least five questions or ideas from the articles you read or the shows you watched.

   (2) Discuss two of the questions or ideas with your counselor.

> **Tip:** Some examples include - but are not limited to - shows found on PBS ("NOVA"), Discovery Channel, Science Channel, National Geographic Channel, TED Talks (online videos), and the History Channel. You may choose to watch a live performance or movie at a planetarium or science museum instead of watching a media production. You may watch online productions with your counselor's approval and under your parent's or guardian's supervision.

Note: Here are some suggestions of documents to watch to learn more about Design.

#1: Indoor Skydiving: Human Flight, No Plane Required:7 steps to create a new product

#2: Signs that you have a good idea

#3: The First Step Every Inventor Should Take

#4: How to come up with a good idea

#5 The History of Thomas Edison - a Short Story

#6: Thomas Edison: Father Of Invention

Attention: Once you have completed this requirement, make sure you document it in your worksheet!

CHAPTER

THREE

REQUIREMENT #2: MERIT BADGE

$\boxed{\mathbb{REQ} \rightsquigarrow}$ Complete ONE merit badge from the following list. (Choose one that you have not already used for another Nova award.) After completion, discuss with your counselor how it relates to fluid dynamics.

- American Business
- Architecture
- Composite Materials
- Digital Technology
- Drafting
- Electronics
- Engineering
- Inventing
- Model Design and Building

Attention: Once you have completed this requirement, make sure you document it in your worksheet!

CHAPTER

FOUR

REQUIREMENT #3: HANDS-ON ACTIVITIES

$\boxed{\mathbb{REQ} \rightsquigarrow}$ **Complete four of the activities below.**

A. **Explore product innovation**

Examine one product and at least two different versions of that product. Create a list of the differences between the designs. Discuss with your counselor the differences and what you think each difference is trying to solve.

Tip: What is innovation?

Innovation is a new or improved product or process (or a combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process) (according to this site.)

There are different types of innovations (check out the site referenced above for more information):

- **Organizational innovation**: development of a new organizational strategy that will change business practice (for example, the adoption of a 4-day workweek).
- **Process innovation**: implementing a new or improved production or delivery approach (for example, using statistical data to decide on train schedule).
- **Product innovation**: introduction of a new or improved good or service (for example, the first electric vehicles).
- **Marketing innoation**: developing a new marketing strategy that produces changes in the way a product is designed or packed.
- **Eco-innovation**: innovation resulting in significant progress towards the 2030 goals sustainable development established by the United Nations

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B. **Research prototyping methods**

Find and explain the differences between a "works-like" and "looks-like" prototype. Learn the reasons and applications where one method would be chosen over the other. Research different ways and costs of having a product professionally prototyped. Explore the reasons why one method would be chosen over another. Discuss and explain your findings with your counselor

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Tip: What is prototyping?

According to the Interaction Design Foundation, prototyping is an experimental process where design teams implement ideas into tangible forms from paper to digital. Teams build prototypes of varying degrees of fidelity to capture design concepts and test on users. With prototypes, you can refine and validate your designs so your brand can release the right products. Learn more by visiting the site!

C. **Market research**

Research and understand the terms: market size, business plan, value proposition, elevator pitch, cost-effective design, and ethnographic research ¬specifically in reference to product design. Discuss with your counselor what these terms mean and why they are important for a product designer to understand, and how they affect the design of a product.

D. **Practice brainstorming**

Examine different brainstorming methods. Choose a product you have used or a situation you have experienced. Using one method you found, brainstorm various ways to improve the product or situation. You do not have to brainstorm designs, just ways to improve the design. Present your list to your counselor and discuss.

Tip: What is brainstorming?

E. **Learn about and practice "Painstorming"**

Research "painstorming": what it is and how it is done? Choose a product you have used or a situation you have experienced and "painstorm" for at least 15 minutes. Do not think of designs to solve the pains, just list as many pains as you can. Present your list of pains to your counselor and discuss.

Tip: What is *painstorming*?

According to this website, painstorming is a method of brainstorming problems and pains in an industry, environment, activity, or within a group of people and then generating business ideas that solve those problems.

Basic process:: think of a specific subject or area, come up with all the things you hate about that subject/activity/etc., and come up with solutions to those pains.

Fig. 1: Image downloaded from this website. Check it out for more information on the painstorming technique!

F. **Inventors**

Choose a historical or modern inventor who interests you, and research them and their inventions. If possible, learn about the iterations their product went through before it became successful. Discuss with your counselor the researcher and their inventions, as well as why you chose that person.

Tip: Thomas Alva Edison (February 11, 1847 – October 18, 1931) was an American inventor and businessman who has been described as America's greatest inventor. He developed many devices in fields such as electric power generation, mass communication, sound recording, and motion pictures.

One of the most famous and prolific inventors of all time, Thomas Alva Edison exerted a tremendous influence on modern life, contributing inventions such as the incandescent light bulb, the phonograph, and the motion picture camera, as well as improving the telegraph and telephone. (source: here, check it out for more information)

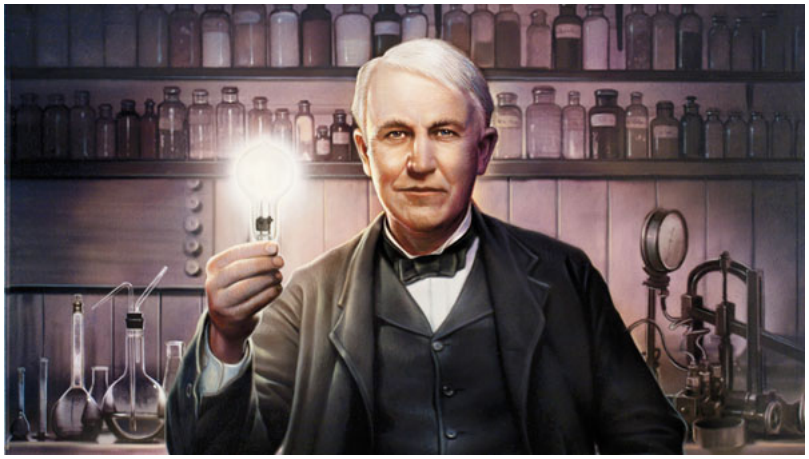


Fig. 2: Image published by this site. The site discusses 10 of the most important inventions made by Edison.

Note: Why should you always prototype multiple designs?

As explained on this site, 5,127 is the number of prototypes that James Dyson claims to have created trying to perfect his bagless vacuum cleaner. Five thousand, one hundred and twenty seven. You see designing stuff is a messy business. Some ideas work out, some don't. It's only through a certain amount of trial and error (or in James Dyson's case, a lot of trial and error), that you end up with a great design. This is why it's so important to always, always prototype and user test multiple designs.

Fig. 3: It took James Dyson 5,127 attempts to get his bagless vacuum cleaner design right! (image copied from this site)

Attention: Once you have completed this requirement, make sure you document it in your worksheet!

CHAPTER

FIVE

REQUIREMENT #4: PRODUCT DESIGN

$\boxed{\mathbb{REQ} \rightsquigarrow}$ Do ALL of the following requirements.

A. Using either "painstorming" or brainstorming, design a new product. Create a 3D model of your design with modeling software or sketch your design. Some common CAD programs with free student versions include Autodesk Inventor, Catia, CREO, Google SketchUp, and Solid Works.

B. Discuss your design and reasons for your choices with your counselor. Explain your 3D model or sketches, and what your next steps would be to make the product a reality.

Hint: Free resources from Creo. OnShape is a pure Cloud based 3D modeling tool that will run on anything - laptop, Chromebook, tablet. Great way for kids and teachers to learn modeling. There is a free version for students and teachers you can find here.

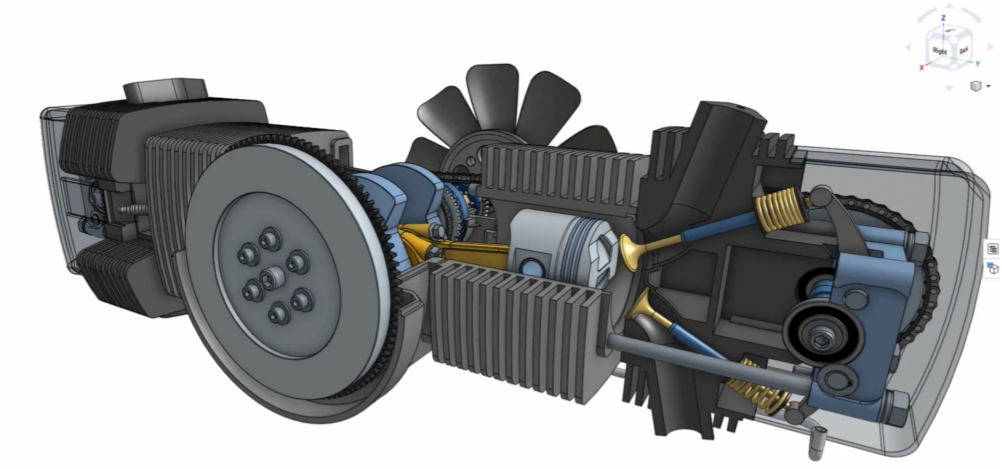


Fig. 1: Example of onshape screenshot, image obtained from onshape.com.

Note: What is CAD? CAD stands for Computer Aided Design.

Here is a very quick introduction to what CAD is.

Attention: Once you have completed this requirement, make sure you document it in your worksheet!

CHAPTER

SIX

REQUIREMENT #5: VISIT

$\boxed{\mathbb{REQ} \rightsquigarrow}$ Do ALL of the following requirements.

A. Visit a company/school/institution where new products are being developed.

B. Talk to someone there about how they use product design in their work. Prepare at least five questions to ask the person you talk to, and discuss their answers with your counselor.

C. Discuss with your counselor how products are being designed at the destination you

Note: The most amazing innovations of all time: a great 7-minute video presentation!

Attention: Once you have completed this requirement, make sure you document it in your worksheet!

CHAPTER

SEVEN

REQUIREMENT #6: PRODUCT DESIGN @ LIFE

$\boxed{\mathbb{REQ} \rightsquigarrow}$ Reflect on your experiences during the completion of these requirements with your counselor. Discuss with your counselor how product design affects your everyday life, and what you have learned while working on this Nova.

Steps to increase your creativity in everydya life!

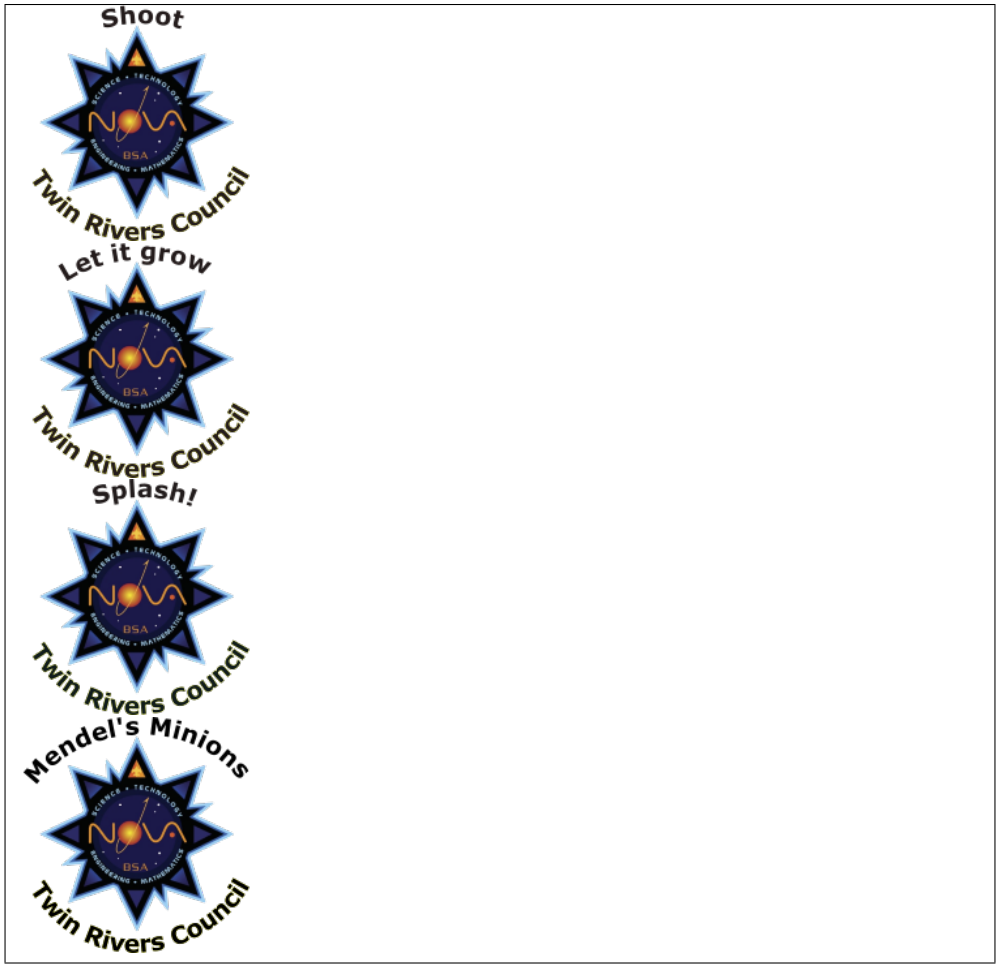
Attention: Once you have completed this requirement, make sure you document it in your worksheet!

CHAPTER

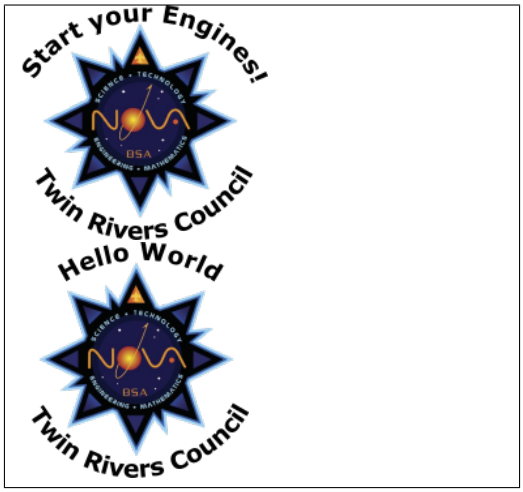
EIGHT

OTHER NOVA MODULES IN THIS SERIES

Science



Technology



Engineering

Math


Designed to crunch
Twin Rivers Council
BSA

CHAPTER

NINE

ABOUT THE AUTHOR

These pages were written by Vincent Meunier, the Chair of the STEM committee of Twin Rivers Council in New York State.

Vincent Meunier is a Professor of physics at Rensselaer Polytechnic Institute. If you have any questions, feel free to contact him by email.

Note: Most of the material used here was obtained from a number of external scouting sources, including scouting.org

Note: Product design describes the process of imagining, creating, and iterating products that solve users' problems or address specific needs in a given market.

The key to successful product design is an understanding of the end-user customer, the person for whom the product is being created. Product designers attempt to solve real problems for real people by using both empathy and knowledge of their prospective customers' habits, behaviors, frustrations, needs, and wants (text adapted from this site)

Fig. 1: Product designer at work. Image copied from this site.