SOMETHING FROM NOTHING NOVA AWARD FOR VENTURERS

Additional checkoff sheets and helps are available from ScouterMom.com.

This module is designed to help explore 3D printing, and how it is becoming prevalent in everyday life.										
1. Choose A or B or C and complete ALL the requirements.										
1A. Watch not less than three hours total of shows or documentaries related to 3D printing, additive manufacturing, CAD modeling, and other related fields. Then do the following:										
1A-1. Make a list of at least five questions or ideas from the show(s) you watched.										
1A-2. Discuss two of the questions or ideas with your counselor.										
1B. Read not less than three hours total about anything related to 3D printing, additive manufacturing, and CAD modeling.										
1B-1. Make a list of at least five questions or ideas from the material you read.										
1B-2. Discuss two of the questions or ideas with your counselor that relate to 3D printing and other additive manufacturing processes.										
1C. Do a combination of reading and watching not less than three hours. Then do the following:										
1C-1. Make a list of at least five questions or ideas from each article or show.										
1C-2. Discuss two of the questions or ideas with your counselor.										
2. Choose ONE STEM field of interest from the following list. Complete ALL the requirements for a Venturing STEM exploration in that field. (If you have already completed a Venturing STEM Exploration in one of these fields, please choose a different field for this award.)										
CAD Modeling										
Additive Manufacturing										
Polymers and Plastics										
Modern Manufacturing										
Inventing										
Sculpting										
Wood Carving										
Wood Working										
3. Choose three activities from the following list and complete all of the requirements										
3A. Design a Model										
3A-1. Design a model of your choosing in a CAD program. Some common CAD programs with free student versions include Autodesk Inventor, Catia, CREO, Google SketchUp, Solid Works and Tinkercad.										

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3A-2. With your counselor discuss what you designed and what its purpose was. Discuss what modifications you could make to the design to make it easier to 3D print.										
3B. Investigate Model Orientation										
3B-1. Using either the model you made in part A or a different model, load it into the 3D printing software of your choice. Adjust the orientation of the print, and note how the print time changes and how much support material is needed at each orientation.										
3B-2. Discuss with your counselor why the orientation changes the print time required, as well as the amount of support material required. Does the fastest print time require the most support material? What is the best orientation for your specific design? Why does the support material change with different orientations, which gives the most efficient results? Why does print time change with different orientations, which gives the fastest results? Why would you not use the orientation with the fastest print time or lowest material cost?										
3B-3. Print your model.										
3C. Investigate Model Settings										
3C-1. Using either the model you made in part A or a different model, load it into the printing software of your choice. Adjust the model wall thickness, infill, and layer thickness, and note any changes in the amount of material used and build time.										
3C-2. Discuss with your Counselor how each setting affects the print times, what causes the least or most amount of print time. Is there a linear relationship between the settings and print time as the values are increased. Similarly, discuss how the model settings affect the amount of material. What combination of settings would you use for different projects? What other settings are there that were not investigated?										
3C-3. Print your model on any setting you wish.										
3D. Research different printing materials										
3D-1. What different plastics are commonly used in 3D printers and what are their main differences? What sort of projects would each material be needed for? Which material is most common and how does the pricing vary between the materials?										
3D-2. Investigate different metals used in 3D printing and how the layers are deposited. What companies currently use metal 3D printing and in what sort of products is this process used?										
3D-3. Research other non-metal/non-plastic materials used in 3D printing. What are they used for and how wide spread is their use? (Novelty or Professional)										
3D-4. Share your findings with your counselor.										
3E. Research different printing methods										
3E-1. Identify 3 different methods of 3D printing (these do not all have to apply to plastics and desktop printers).										

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3E-2. Determine what material is used for each printing method. Compare the methods against each other in terms of time to print, cost of print, pre-work, and post-work. What method is preferred for different printing jobs?										
3E-3. Share your findings with your counselor.										
3F-1. Identify 4 key parts of a 3D printer.										
3F-2. What do they do and how do they contribute to the function of the printer?										
3F-3. Report your findings to your counselor. Explain which component of a 3D printer you think is the most important.										
3G. Investigate different printers and compare them										
3G-1. Research at least 3 different 3D printers. Take note on the different materials that each printer can use, as well as the different layer height, method of printing, and available resources. Some examples include:										
3G-1a. Stratasys										
3G-1b. Ultimaker										
3G-1c. Makerbot										
3G-1d. FormLabs										
3G-1e. Lulzbot										
3G-2. Discuss with your counselor which printer you would purchase and why.										
4. Choose ONE option and interview a person involved with the field. If possible, visit them in that environment to see what they do. Prepare at least five questions, and share what you learn with your counselor. If you take a virtual tour, with your parent or guardian's permission you can contact the organization with your questions. If that is not possible, you can discuss them with your counselor. Some possible destinations are listed below.										
4A. Professional 3D Printing/Prototyping Lab										
4B. University/High School 3D Printing/Prototyping Lab										
4C. Lawrence Livermore National Laboratory 3D Printing Labs Virtual Tour (online)										
4D. Interactive Tour of a "Form Lab" Printer										
5. Discuss with your counselor how 3D printing affects your everyday life and what you have learned by working on this NOVA.										
Completed										
Presented										