2015 HCPS STEM 3D Printer Initiative RHS Freshmen

A 3D printer is an additive manufacturer that makes 3D solid objects from a CAD file. 3D printers can be used in society to achieve the following:

prototypes of inventions, artifacts are modeled so they may be touched of completed, 3D artwork, modified or replacement parts for any types of machines such as cars, architecture, replacement body parts/ prosthetics, space and battlefield needs can be met onsite, decrease shipping fees by printing products at facilities closest to buyer, modeling small and large objects

By combining Biology, Math, and Art we will have our students print a large lily and a honeybee in order to study to reproductive organs of plants.

* flower structure requirements: roots, stems, leaves, stamen, pistil, ovary, petals, sperm, egg, sepal, filament, anther, style, stigma
* bee structure requirements: head, thorax, abdomen, wing, compound eye, mandibles, proboscis, antenna, legs

They will then use the 3D printed bees as inspiration to design a robo bee in order to combat plant reproduction problems caused by the declining bee population. The robo bee has to be capable of spreading pollen and must be approximately the size of a honey bee.

Standards:

Bio:

[SC.912.L.14.7](http://www.cpalms.org/Public/PreviewStandard/Preview/1949) Relate the structure of each of the major plant organs and tissues to physiological processes.

[SC.912.L.16.10](http://www.cpalms.org/Public/PreviewStandard/Preview/2021) Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.

[SC.912.L.17.20](http://www.cpalms.org/Public/PreviewStandard/Preview/2043) Predict the impact of individuals on environmental systems and examine how human lifestyles affect sustainability

Alg 2:

[MAFS.912.A-CED.1.1](http://www.cpalms.org/Public/PreviewStandard/Preview/5554) Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational, absolute, and exponential functions.  
[MAFS.912.A-REI.3.7](http://www.cpalms.org/Public/PreviewStandard/Preview/5564) Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line y = 3x and the circle x + y = 3.  
[MAFS.912.A-REI.4.11](http://www.cpalms.org/Public/PreviewStandard/Preview/5568) Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

Art:

[VA.912.F.1.1:](http://www.cpalms.org/Public/PreviewStandard/Preview/4880) Use divergent thinking, abstract reasoning, and various processes to demonstrate imaginative or innovative solutions for art problems

[VA.912.F.1.2:](http://www.cpalms.org/Public/PreviewStandard/Preview/4881) Manipulate or synthesize established techniques as a foundation for individual style initiatives in two-, three-, and/or four-dimensional applications.

[VA.912.F.1.4:](http://www.cpalms.org/Public/PreviewStandard/Preview/4883) Use technological tools to create art with varying effects and outcomes.

Future applications: Our students will also design a structure to help combat human pollution (windmill, water flow device, etc), and will present a model of the structure along with an explanation as to how the structure will aid in decreasing negative human effects on our environment. In addition, we will allow our students to design any tools they feel will aid in labs. We will use a 3D printer to allow our students to print the four essential macromolecules, so they have a better understanding of the structure and function of these molecules as well as print cell models. Our students will also 3D print human organs in order to analyze blood flow through the heart, oxygen flow through the lungs, and cancer formation in an organ of their choice. The students will work closely with the biology teacher to ensure scientific accuracy, with the math teacher to apply mathematical equations to every design, and will work with the art teacher in creating visually appealing printed objects.

RHS students will complete the above tasks in groups and will be required to collaborate with their biology, math, and art teacher. The teachers will work together to create rubrics for the projects.