The grant asked for low word count responses, so there are definitely WAY more opportunities out there to integrate the two technologies (Makerbot 3D Printer and Cricut) into everyday learning.

"One example of this transformational approach to content could be through utilizing problem-based learning. Students could be posed with the challenge of designing a product to support a developing economy. Utilizing Standford's Design Thinking Process, students would understand the problem, ideate, evaluate, and design a product as a possible solution (NGSS MS.ETS1.1 Science and Engineering Practices). Throughout this process, students are researching and comparing texts from content-based and technical resources (CCSS.ELA-LITERACY.RH.6-8.5 Literacy in History, CCSS.ELA-LITERACY.RI.6.4). When students are ready to utilize the design app, they would apply their mathematical and scientific understanding to turn two dimensional shapes into three dimensional products (CCSS.MATH.CONTENT.7.G.A.3). Throughout the design process, students would also apply visual arts knowledge in the form and aesthetic design of their product. Students would then print their prototype using the 3D printer or craft cutter and present their findings to the class.

Some of the standards addressed in the above example lesson design:
We purposely selected standards from various grade levels to show how it applies across our buildings.

- NGSS MS.ETS1.1 Science and Engineering Practices: "Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions."
- CCSS.ELA-LITERACY.RH.6-8.5 Literacy in History: "Describe how a text presents information (e.g., sequentially, comparatively, causally)"
- CCSS.MATH.CONTENT.7.G.A.3: "Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids."
- CCSS.ELA-LITERACY.RI.6.4: "Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings."
- CCSS.ELA-LITERACY.SL.8.1.B: "Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed."
- CCSS.ELA-LITERACY.SL.8.5: "Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest."

The above lesson summary is an example of how these tools can transform learning. Never before would students be able to move from conceptual understanding to a solution resulting in a tangible outcome. The end result requires real world application, heightening the analytical thinking and innovation.

Our ultimate is goal is that this equipment reaches beyond one-project use and becomes an integral part of our learning environment. In addition, these two technologies will be the tools at the heart of our middle school makerspaces that we are working towards developing. Through our makerspaces, students will have access to these technologies daily. In collaboration with teachers listed in the grant, we have identified example learning opportunities that tie into the curriculum that can be addressed with these tools:

All of the examples below can be used with either the Makerbot or Cricut. Teachers and students would determine what product to use with the design they are striving for.

Science
- Chemistry: Creating 3D models of atoms for various elements students are studying
- Genetics: Creating 3D models of DNA strands
- Earth Science: Creating topographic maps
- Planetary Science: Making a scaled solar system
- Simple Machines: Explore simple machines by designing and building their own
- Complex Machines: Analyze how the Makerbot and Cricut operate due to simple machines being paired together to create more complex machines. Examining how things work!
- Biology: Creating models of animal and plant cells

Language Arts
- Students determine a literary symbol from their reading and design a tangible artifact (ex., Students read "Hunger Games" and have to abstract a visual representation of what symbolizes the district or the main moral of the story)
- Students create their own media for storytelling and reader's theater.
- Create a 3D model of a new product designed to benefit society or a specific population. They will use the Stanford Design Thinking process to design and create a model of their product. Students complete the process by writing a funding proposal based on the KickStarter model.

Social Studies
- Students design their own game (think of the game "Risk") based off of the unit of study and they would create historically accurate game pieces and figurines.
- When studying a geographic location, students can recreate it by designing and building scaled-down monuments and geographic land features.
- Students can use the Cricut to cut vinyl or paper and create cultural clothing.

Math
- Working in groups, students write the formula for scaling down/up an object. As groups put the formula into a design, the class will have a complete set of objects that can be analyzed to determine if the increment was calculated correctly. If not, students would determine where their calculations were at fault and work towards a solution.
- Students discover real-world applications of the Pythagorean Theorem by creating objects using the formulas they learn in class.
- Graphing and plotting coordinates on a grid. 3D printing allows students to not only graph to the X, Y axis (2D), but to the Z axis (3D) as well.
- Students create their own tangrams and math manipulatives.

Visual Arts
- One of our art teachers took a 3D printing art class through the Art Institute of Chicago and has the idea to have students bring a physical object from home and render a design to recreate an artistic representation of the object.
- Creating an ink stamp and paint stamp in the style of an artist student is studying in class. They can use the stamp to design the cover of a book or a postcard."