

## End of Summer Report

The purpose of this project is to give the students an opportunity to learn about different topics related to the fields of manufacturing and engineering while still getting core information and learning key concepts. The reason I choose this project is because during the research experience we learned a lot of information through presentation, but it wasn't until we were given tools to use with our hands I got excited about the work. I will take the experience I learned working in the lab and integrate it throughout this project.

*§111.28. Grade 8, Adopted 2012. (b)(1) (B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;*

*(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;*

*(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;*

*(E) create and use representations to organize, record, and communicate mathematical ideas;*

### **Major Concepts:**

- Data analysis
- Charts
- Reasoning
- Organization of Ideas

### **Other concepts:**

- The Design Process
- 3D printing

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**Lecture:**

The teacher will give a quick lecture of the types of 3D printing that are available to us today and what each type of printing is good for and take the students to see the 3D printer on their campus to observe the printing process. The teacher will then pass out parts (printed with the on-campus 3D printer) and allow students to observe their parts. Students will record observations in their notebooks.

**Group Discussion:**

The students will discuss in groups the purpose for the part, and if it could be made better, the dimensions of the part. They will measure their parts for all dimensions and share measurements with their table groups to compare and analyze each other's information. They will then sketch their parts to scale to help get a better visual for others. Once students have a good idea of where their parts came from and the measurements on their parts the teacher will talk about some guiding questions that will help the students determine what their parts were made for. If they change the dimensions would it be better? Is there part better than their peers part? Why? Is there a better design for a part that plays this role?

**Lecture:**

Teacher will give a brief overview of the design process and have the steps on the board for students to review while they complete the assignment. Students will have to think through the design process in order to analyze what the part they were given could be used for. They will think through the process backwards in a way deconstructing why their part was made and for what purpose and then be challenged to come up with something better.

**Project:**

Once they come up with a better design the final project will be to create a presentation with charts and data that they will have to get up and present to their small groups and eventually to the whole class and the teacher. These projects will be graded analytically for accuracy, content knowledge, concepts, data, and charts.

**Support:**

The only support I would need to implement this type of lesson would be from the school administrator because often core classes are given guidelines of what they should teach and coming up with something a little abstract may make them not want to allow that lesson.

**Materials:**

The materials needed would be at least 30 (enough for each student to have their own) 3D printed parts with varied uses as well as at least 30 digital calipers for measurements. The digital

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calipers should be available online to order, but as far as the printer I would need a campus with a 3D printer on site or the campus would have to inquire about getting a 3D printer.

Students should gain a better understanding of the field of manufacturing and engineering. They will know by hands on experience how to take measurements of parts and how to record this information to communicate it clearly. They will learn to sketch with accuracy and to scale. Most importantly they will understand all of the math that goes into real world jobs today and understand further a very important field of study.

### **Pre-Test:**

When the students come into class they will take a quick kahoot in order to see where they all are as a class on data, charts, printed parts, and the design process. The questions will include pictures of various pieces of materials, charts, and data for the students to answer. The data gathered from the pre-test will determine length and depth of lesson to be taught before the project is assigned.

### **Post-Test:**

The post-test will be the student's presentation to the classroom. They can use any visual they choose, but it must include printed charts and data in some form. This will serve as the final grade for the students. Each week the teacher will present a new part of the project to work on and students can spend the week mastering this concept or moving on if they have mastered it and spoke with the teacher about further in-depth concepts.

After the completion of the project when students' projects are returned with feedback the teacher should allow some time for students to review comments and then as a class will talk about things that were done really well, what concepts may have been missed, what can be changed to make the project more beneficial to the students, what the students enjoyed most about the project. After the students have had time to reflect, the teacher will then remind them that what they are doing right now is part of the design process and that almost anywhere you look you can see the design process at work. The teacher will then allow for students to share further reflections or career plans with the class.

### **Conclusion:**

This research experience has opened my eyes to so much information that I did not even realize was out there. I came into this program with a very small understanding of engineering and manufacturing, but after the presentations, the experiences in the labs working with master's students conducting real research, and being able to design a part and see the finished product I feel I have a much better understanding of both subjects. I plan on sharing the design process and really trying to implement that kind of thinking to the classrooms. I want to challenge teachers to use different approaches when teaching math and science in middle grades and to allow students to play a role in their own learning process. I think that if we allow students to come up with

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their own solutions and revise them they will learn a problem-solving mindset through experience. I believe this will aide in scaffolding middle grade learning to higher level thinking.