Understanding Science and Its Use in Industrial and Product design

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This curriculum unit is recommended for:
Scientific Visuals I & II Game Art Design/Science and Technology Education/9-12

Keywords: Scientific Visuals, Design, Game Art, Molding, Casting, 3D Printing, 3D modeling, Graphic Design, Chemistry, Physics, Biology, Design.

Teaching Standards: See Appendix 1 for teaching standards addressed in this unit.

Synopsis: With the growing interest in products and technology, an appreciation for the use of the product, style, function and form can become a more immersive experience with the support of the understanding of how it was made. Students can find a deeper understanding of the importance of science and technology. More often than not you can speculate that our understanding of aesthetic design vs functional design are far apart. By taking part in the design process while using the scientific method, students can gain a deeper appreciation for the scientific field and its contribution to the advancement of technology. Understanding how the world works scientifically will helps them to understand a deeper meaning of the "why" in design. Students can take the sketching practices from art, to brainstorm their ideas, use technology and engineering to design their product in CAD software, print their design out in a 3D printer or milling machine, and reproduce that product through a chemical process by making plastics and creating molds to replicate their results. Students can also use the scientific method to test their products durability, function, and appeal based on their hypothesis and can reflect on the results.

I plan to teach this unit during the coming year 70 students in In Scientific Visuals 1, Scientific Visuals 2, and Game Art Design.

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Curtis L. Overton Jr.

Introduction

To understand the fundamentals of product design, one must take time to understand human psychology. Why do people choose certain colors shapes and sizes? Could it be because of their own anatomy? Maybe a person chooses a cell phone that is much smaller than another person's choice. The choice depends on the person's intent, maybe they want to carry the phone around in their pocket and easily take it out? Maybe the person's intent is to consume media and wants the largest display possible. Maybe the person's intent is to have a smaller device because their hands are small. Maybe people choose the colors of a device or product based on their relationship to that color whether it's symbolic or aesthetic. To understand your approach in design you must first understand how people think, feel, and behave. There have been many case studies, research and statistics based on the preferences people have. To some degree, there is a scientific explanation or to better state it, there is a scientific approach to understanding why we choose the products we choose. The intent and purpose of my curriculum unit is to address the misconceptions that design, art and technology are unrelated to the science disciplines. Yes, if we purchased the latest iPhone at this point in time, it would be the iPhone 8 or the iPhone x. How often do we sit back and consider the materials that it takes to actually create the phone itself? What elements are actually used inside of the phone whether it be gold and copper traces to transfer data, silicon used in chips, or even the plastics molded to make the cell phone more scratch resistant and drop safe. What is apparently aware is that science and technology go hand-in-hand when trying to push for the next relevant products.

Science has proven to be a relevant practice by analyzing something in extreme detail. What is interesting about scientific research is understanding that sometimes it takes meticulous practice to explore all possibilities for achieving the next plateau in scientific discovery. I understand this from my own scientific research and experience from direct practice working both in a physics and biology laboratory. Your research is a contribution for other researchers projects. With this understanding, the often routine sequences of experiments and data collection mean much more when understanding can translate into the foundation of the next major evolution in technology, which will impact the society we live in.

This is the understanding that I hope to bring through my curriculum unit. It is based on industrial design and the understanding of sciences in many disciplines. I hope this curriculum unit will enlighten my students and others helping them to gain a solid understanding. Even though they may not choose science as a career path, it is a necessity to understand the molecular makeup of life and what that consists of. Just like nature has his own way of creating things, we too as human beings have the desire to create. All science disciplines - whether biological, chemical, physical, geological or astronomical- can and will be used in products, technology, and industrial design.

Background

I have worked in a research lab in different disciplines. I have worked at Elizabeth City State University as a lab assistant and part-time researcher under Hirendenath Banerjee on astrocytoma and gastric cancer, I have also done research in a botany lab dealing with algal cell research under Jeffery Rousch. The latter projects have been published and presented at Johnson C Smith University for the algal cell research. My third experience was at UNC Charlotte, using spectroscopy to determine and identify cancerous cells. I have a poster published through CTI Charlotte at UNCC. This background of experience, which includes my B.S. degrees in biology and graphic design and masters in media design and technology has allowed me to become an ideal candidate for teaching Scientific Visuals and Industrial Design.

I teach Scientific Visuals at West Mecklenburg High School within the Charlotte Mecklenburg School district. We currently have about 1700 students. Eighty percent of the students that attend West Mecklenburg High School identify as Black or Hispanic. All students are eligible for free and reduced lunch. Most of the kids at my school are considered below poverty standards and a portion of the students have social, economic, emotional, and physical obstacles to overcome while attempting to be successful in school. Understanding the social and financial disparities that prohibit students like these from becoming successful motivates me more to provide a curriculum that would at least spark interest of the students and, at most, create a desire to enter the sciences and technology career pathways. I teach about 72 students per semester. Scientific Visuals I focuses on several careers in SCI-VIS in which the discipline creates images and interactive media and products through different areas of technology. Scientific Visuals II is 50% cognitive and 50% performance. This means that in this course students are required to create more products while using their design skills. The students in these classes range from 9th grade to 12th grade.

From my understanding what translates across financial barriers, social barriers, and cultural barriers is the way we function in everyday life. For example, we all have the need for clean drinking water. But, how we drink that water may differ. If you look at the evolution of bottle design, you will see a change in bottle shape, bottle material, and the advertisement of how the bottle of water is sold. What are the methods that were taken to create the bottle? What are the differences in plastics and how they were shaped and formed into their final design? What also has to be analyzed is the aesthetic aspect of the bottle and the form and function of that bottle?

Asking these types of questions is the way I would like my students to approach the everyday products they use. The way we think influences what products we choose. Analysis requires my students to ask questions and gather data, which will influence and determine how they design their products through the scientific method and the design cycle. More over, the intent of my curriculum is to create an awareness initially, but eventually, I hope students will create their own system and methodology to approach design concepts and initiatives. Also, I would like students to understand how science can influence trends. What causes popularity of the items we choose, such as rubber bracelets that have different sayings on them? A bracelet is a simple way to create visual communication through a molded rubber product that is inexpensive to manufacture.

Objective

The purpose of this unit is for students to develop their skills in analysis to allow for the development of higher quality products and designs. They will use the scientific method and industrial design methods to achieve this goal. Students will analyze one to three aspects of a product, which will improve their product design. Of these three, I will limit them to product quality, product appeal, and product innovation.

Content Research

In the fundamentals of product design by Richard Morrison, there was a case study done based on the Letherman Skeletool. Akito Morito chairman of Sony says" my job is to make our products obsolete before our competitors do" (page 47). By reading this statement I realized how important innovation is and the method used to achieve that innovation can give you a competitive edge in the design market. The objective is to create something new and then make it obsolete, which will help you gain control over the market. These statements are an example of how I would like my students to approach design. This is what was applied in the Lethermans Skeletool (figure 1).

Another example I can also pull from the fundamentals of product design is Moixa Energy ltd. This is an innovative example of taking rechargeable batteries and incorporating a USB connector on the end of them (figure 3). This alleviates the need for a charger (page 50). Sometimes, the motivation behind the product is not merely innovation but could be driven by safety. In the fundamentals of product design page 76 talks about the safe sippy (figure 4) in which some plastics have harmful chemicals in them. Poly-carbonate uses bis-phenol-a which can harm the human body. Becasue the sippy safe is made from stainless steel, and the grips have plastic this ensures that no harmful leakage of chemicals ends up in a child's drink (page 76).

Other concepts from this book includes Nokia's morph device concept (figure 2). In order to achieve a flexible cell phone, innovation in chemical and physical sciences need to be made to have a deeper understanding of how to achieve this concept. Some of the concepts that will be achieved by this phone are flexible materials, transparent electronics, self cleaning services, and the ability to harvest its own energy. (Page 91)

Aesthetic design is very important when producing a great product. Joseph Cadek decided to take a unique approach on designing a folding bike that uses concentric circles in the fold (figure 5). This not only creates a unique look but a functional design. The Locust folding bike design uses CAD software to develop the concept. The question to ask is, “what was Joseph’s scientific and design process?”. Also, “how will manufacturers and technologists take a design like this and begin to develop it?” Will they use aluminum, resins, or a new alloy invented by a chemist at UNC Charlotte? Quoting from Joseph’s response in his design approach," …it's like solving an equation with a limited number of unknowns. It is impossible to solve these unknowns in one go..." This is an example of how I would like my students to mentally approach a design situation thinking about all of the possibilities. I would also take into consideration their own style and methodology for achieving their goal in the end products.

An interesting designer has an approach that considers function as important as form. It is Sir James Dyson with his vacuum cleaner designs (figure 7). He explains Hoover and his methods to extract sand from oil or gas from crude oil in the North Sea based on separation technology. This is another example of how science and the understanding of elements are very important when creating a functional product. Hoover used many of Dyson's patented designs when creating their vacuums.

One of my personal favorite designers are the creators of Legos, father and son Ole Kirk and Godtfred Christensen. This is a beautiful example of how a carpenter lost his company and then created a billion dollar product. During the world's economic crisis in the 1930's, Danish cabinet maker Ole Christensen made wooden toys for local farmers. The reason why Legos were so successful is because it created a system in which one block could stick onto another sturdily, and separate easily. With the combination of primary and bright colors and the methods of milling, molding, and casting they were able to create what eventually became the most popular building toy in the world. I liken this story to the poverty situation of my students. Ole Kirk overcame many obstacles like his house buring down and the death of his wife. However, he faced these issues and became the creator of Legos. The most important concept I would like my students to gain is the legacy he passed down to his son, and the millions of people he has helped through Legos. (Page 116 and 117 of Icons of Design of the 20th Century by Reyer Kras)

One major scientist that bridges the gap between industrial design and science is none other than Lonnie Johnson, the creator of the Nerf guns and Super Soaker guns (figure 8). What initially started as a design for hydraulic systems turned into the million-dollar device known as the Super Soaker. Lonnie Johnson has over 100 patents and is currently working on a battery that is 3 times more efficient than lithium-ion batteries and will be used in Tesla vehicles. Lonnie Johnson is not only an example of someone who uses the scientific method to approach design, he exemplifies understanding interdisciplinary science. (Lonnie Johnson at Biography.com)

Rationale

These are several examples of people who use design in concurrence with science to create a revolutionary product. My students at West Mecklenburg High School will take the ideas they have to approach everyday problems and use the science, mathematics and technology they have access to in order to solve these problems. Often times, students dread they have to solve a very difficult algebraic equation or conduct a laboratory experiment. They may be apprehensive to do it because they are scared they may mess something up. The objective of the curriculum unit is to break apprehension while enlightening them of the importance of understanding science in applying the scientific method to make products inventions much better in aesthetics and performance.

In my scientific visuals class, students create a model of an animal cell and a plant cell. The students could use the concept of a system of linking the different organelles together just like in the example of the Legos. They could use the consideration of materials like in the example of the sippy safe. They could use the concepts in design by determining the shapes and the colors in the overall fit and finish like the Locust concentric circle bike used in the previous example. They would use the ides for example that when you place the blocks of organelles in the wrong place a voice will say "that is incorrect!"

Students will have to use the scientific method (question, hypothesis, experiment, observe and record, analyze, and observation of results) in conjunction with the engineering design process (identify the needs and constraints, research the problem, develop possible solutions, select a promising solution, build a prototype, test and evaluate the prototype, redesign as needed). Using these two methods of experimentation will allow students to achieve their goal. They will analyze their product and improve upon their product in a manner that will be substantiated from data collected through experiments.

The purpose is for students to gain an appreciation through scientific research and appreciation in their contribution for a direct impact in their immediate society. Knowing that they can help someone with something they create can drive a student to become more creative and determined to perform better. One example of a need-based design is the wheel chair walker designed by elementary student Sandy. It's called the "Walker Wheeler." Sandy has cerebral palsy. She decided to combine a wheel chair and walker into one. She used the design process to fulfill a need. (http://pbskids.org/designsquad/video/kid-engineer-walker-wheeler/)

Students will identify a legitimate problem and begin to brainstorm an effective solution to that problem. They will sketch and prototype ideas on that solution, and then build on that solution, and test to see whether the prototype that they have created is the best possible answer. Finding the most potential is the rationale behind my curriculum unit.

Instructional Implementation

Students understand how to take information and transform it into a visual piece. However, many students don't get a chance to deviate from the regurgitated routine of information and expected outcomes. Students will have to research based on their topic. The research intent is to enlighten and inform students of what has been done and of what the leaps and bounds of science and technology are being pushed. Students will be given a scenario in which they must figure out the best way to approach the situation. The scenario will be based on the product and real-life scenarios, which real scientists and engineers face while trying to gain funding or support for the next revolutionary product and/or invention.

Students will be given tiered rubrics based upon the topics chosen. The product may change, but the underlying principles remain the same. Students will use the industrial design process, as well as, the scientific method to determine how they will go about creating their ideas. Initially, students will start off with the scenario and problem. Once the problem and or scenario are identified, students will come up with a proposed solution based upon research, which will start the beginning of their project.

Initially, students will have to approach the first three steps of the engineering design process by identifying the needs and constraints researching a problem and developing possible solutions to that problem. During these three initial steps, students will be doing observation in their groups and discussing using think pair share, cubing, and question choices. Students will do close reading during the research step to gain as much information about their objective while designing their product. Students will use Mini white boards and literature circles to brainstorm a possible solution to the problem before they begin to design.

Out of the many possible solutions they brainstorm, students will use discussion and assessment to decide on one solution to the scenario or problem. Once students have the solution, they will go about gathering materials, sketching, and designing their models in CAD software. Students in this case scenario will be familiar because of the objectives of scientific visuals and game art design. Once the plan is decided, students will begin to 3D print, mold and cast, and use recycled materials on the CNC milling machine. The CNC mill can carve shapes in many different materials. So, students can bring everything from cardboard to plastics to make their parts.

This part can be replicated for a teacher that does not have access to either. Students can use isometric paper, graph paper, or printed plans to use as a template, and then cut with hand tools in this specific material. A more practical commonly found material, that is sturdy and easy to cut, is a cardboard box. They are plentiful and free. The objective is for students to begin to practice the scientific method and engineering design process using their ideas and everyday access to materials that they may have.

The student designs will be made in such a way that they will be able to replicate and recreate their design easily. To do this, students must consider creating some type of system that will allow the building process to be easily done using different types of materials. Students will use the objectives in scientific visuals to create and explain a process, which can be easily understood by most high school students who will be approaching the same type of project. Not only will students approach a scenario, but they will create a system based on that scenario that can easily be replicated. Students will gather with their team to build and test their prototype. Students will test and evaluate their prototype in three major categories. These categories are functionality, aesthetics, and creativity. Subtopics to consider are perspective material designs, innovation, practicality, and usability. Students should also consider the longevity of their design, function, and design.

Although student designs may be innovative, they may be lacking in aesthetics, which affects the longevity of the product, and vice versa. Students will test and evaluate their prototype based on group feedback (from other groups) and through unbiased assessments from cross-curricular subjects and classes (provided by classes who will give feedback based on products related to their subjects). In other words, having outside opinions from other disciplines will help to improve the quality of their products.

Once they gained feedback, which will be qualitative through gallery crawls and point evaluation, they will also gain quantitative data based on how well they score per category. This will allow students to go back to the drawing board and improve their overall design. Since the design process cycle and scientific method are very similar, there will be only minor additions based upon science. This may include any biological chemical or physical logical aspects that would apply two to their product design.

Teaching Strategies

Students will be given a task and a scenario that will require them to use critical thinking skills to create a practical and unique product. Students will be given resources such as articles, video documentaries, and graphics to help them understand how other designers approach their project tasks. During this time, they will work in independent groups and delegate roles based upon the project needs. Students will have to come up with a design, prototypes and sketches, a presentation, research paper, and the final product. The project's timeline will be anywhere from 3 to 12 days. During this time, the project will be broken up into four different phases. In the first phase, we will be planning and researching. The next phase will be the prototyping and test phase. Then, the third phase will be finalization of the product. Last, we will be in the presentation and assessment phase, which will include a gallery crawl.

Project Phase 1

Teaching strategies include close reading, think pair share, and mini whiteboards. Students will gather information based on their scenario. Students will receive their project requirements and rubric at this time, which will require them to complete several tasks amongst their group. (see Appendix 3) Students will delegate rolls based on the four phases of the project. Students will assess the strengths and weaknesses of each team member and assign roles based upon them.

Classroom activities will be annotating and highlighting key points in articles related to their topic, pairing this information with their specific scenario, and sketching and planning ideas with their group using drawing tools and mini white boards. Towards the end of this phase, there will be a qualitative assessment through discussion amongst individual groups and other groups to narrow decisions based on hypothesis and research. Other activities to assist with this are think pair share and heads together.

Phase 2

Prototyping the Design

During this time, teaching strategies will be tutorial, tiered activities, and hands-on learning. Students will begin to measure and apply practical knowledge in learned and core subjects (I.E. science, math, and technology). Students who have access to 3D printers, laser cutters, and CNC machines will begin to cut their parts which are finalized in design in CAD software. The sketches that were designed in Phase 1 will now turned into solid concept jewel designs in Phase 2. In this phase, students would apply designs, test for any faults, and prepare for the final product design. If teachers and or students do not have access to this machinery, for this step, they will use paper and common materials that are easy to cut, glue, and assemble to build off their patterns. Students can also use markers, paints, and/or printed graphics to create their designs.

Phase 3

Product Finalization

Teaching strategies will be carton based instructions through Socratic seminar in which scientific visual content is tied into designing their product. Students will be engaged in guided practice on precision and quality control based on industry standards. During this time, they will also be considering the innovations that have taken place in science and technology and how their product can push the envelope. Students will also be prepared to present any shortcomings or perspective highlights their product may have. This requirement will help them to visualize what the product could be.

Classroom activities will be 3D modeling, graphic design, 3D printing molding and casting, instructional design (with image references and instructions), PowerPoint presentation design, packaging design, and product design.

Phase 4

Proposal and Presentation Phase

Teaching strategies during this phase will be a gallery crawl and question choices. During the very last day of this phase, students will have to prepare their products and presentations for final assessment. Student assessments will be based upon their presentation, and a tallying of how well they did in their categories. This tally will be based on unbiased opinions.

Classroom activities will include a gallery crawl that is closed to the students participating. Students will place stickers on categories they believe had the best performance. Students will be able to assess how well they did per category and how well they did overall, based upon cross curriculum and their unbiased opinion. Once the gallery crawl is done, there will be a discussion amongst different peers and classes that have courses tied into their curriculum and hours. This will invoke higher-level thinking, questions, and thought that will to improve the product and the overall concept of the scientific method and industrial design process. By doing this, it creates a level of accountability along with the practical application of design and the real-world situation, which makes their product meaningful. Combining these three will ensure that students understand the relevance of why there are learning math science and technology.

Appendix 2 (Diagrams)

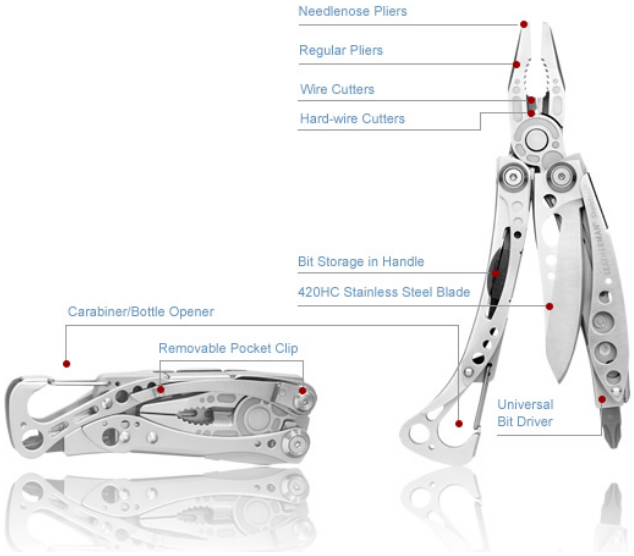

Figure 1. Letherman "Skeletool"

Figure 2. Nokia "Morph"

Figure 4. Sippy Safe

Figure 3. Moixa "Usb Battery Cell"

Figure 5. Joseph Cadek “Locust”

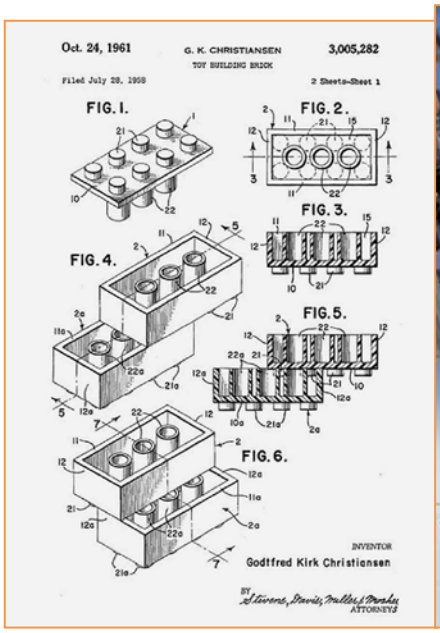

Figure 6. Ole Kirks “Lego System”

Figure 7. Dysons “Vacum System”

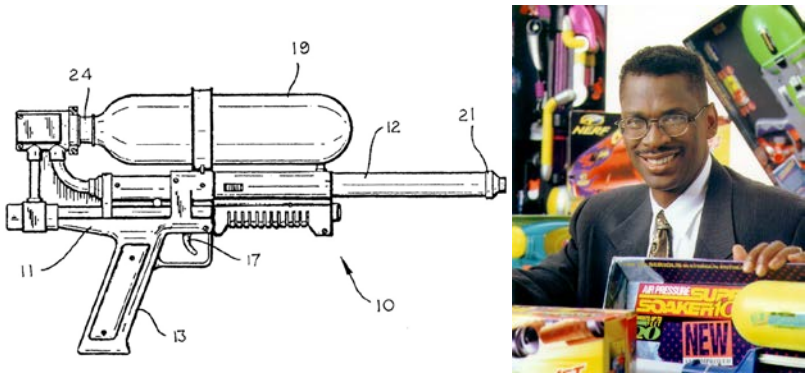

Figure 8. Lonnie Johnson Original Patent Diagram “Super Soaker”

Appendix 3: Project Worksheet

Project: Create a new cellphone case design.
Due Date:12 days from start date.

Scenario:




Hologlyph is a mobile accessory company that is looking to market a premium cell phone case. This company is looking to make a significant profit from their investment. They are looking for a case design that is innovative and can be marketed to one of three target market areas that include sports and medical, entertainment and gaming, and art, photography and design. The case must do 3 things 1) add new functionality, features and value to any cell phone. 2) look new and aesthetically appealing. 3) have 1 new and innovative feature that sets the case above the rest and can compete with other case companies. Please consider these 3 categories carefully, as they will determine who will get the contract. This company is willing to **invest 1million dollars in a design that can win their interest.**

Your objective is to **design and create a cell phone case** that will win you a contract with Hologlyph Designs.

Things to consider:

- How do you intend to add value to any cell phone with your case design?
- Which market you plan to appeal to (Medical/Sports, Entertainment Gaming, Art/Design)?
- What features will you include to appeal to each market (heart rate monitor, pedometer, holographic and virtual reality features, stylus art features)?
- What new innovative feature will you add to your case design?
- How will you use science and technology to create an edge in your cellphone case design when deciding on what features you will include?
- Do the features flow together into one solid package?

Items Due Per group

1. **Sketches and prototyping documents**
2. **1 page research paper (teacher delegates content and requirements per subject)**
3. **CAD Drawings and Models**
4. **5 slide presentation highlighting features and sales pitch for Hologlyph. (teacher delegates content and requirements per subject)**
5. **Finalized prototype with instruction manual and or product sheet.**

Roles per group member:

A. Researcher
B. Designer
C. Builder
D. Presenter

Project Phases:1-4 (over a 12 day span)

Phase 1(Design Cycle 1-3) 3 days
Address the problem, research the problem, and discuss possible solutions.
Due during Phase 1 = planning documents and 1 page research paper,

Phase 2(Design Cycle 4-5) 3 days
Select a possible solution and begin to design and build a prototype.
Due during this phase: Prototype sketches, CAD drawings, and rough prototype.

Phase 3(Design Cycle 5-6) 3 days
Build prototype, test and assess prototype
Due: Refined prototype and finalized product.

Phase 4(Design Cycle 7) 3 days.
Improve as needed
Due: Packaged product, 5 slide presentation highlighting features
Diagrams with instructions in the form of product sheet or manual.

Teacher Note!!!:
Please ensure that students are using their cellphones to take pictures and document every step of their project.

Supply List

This supply list includes separate lists for classes that may not have advanced tooling, software equipment in order to achieve the same end result conceptually.

Supply List A (Advanced Class)	Supply List B (Basic Class)
Supplies	Supplies
Wood, Acrylic, Aluminum Sheets, PVC or Plastic Sheets, 3D Filaments, Molding Silicon and Casting Resin and Basic class supply list.	Cardboard, Thin Plastics, Tape, glue sticks, Construction paper, Markers, Color pencils, Pens, Scrap Magazines, News Paper, stickers of any type(preferably small stickers) and or paper mache. regular paper
Printing Equipment	Printing Equipment
3D Printer, Standard Printer, Wide Printer	Standard Printer
Machinery	Machinery
3D Printer, CNC Machine	Not Required, Glue Gun
Software	Software
Adobe Suite (Photoshop and Illustrator specifically) 3DS Max and or Equivalent to create 3D Print Files PowerPoint and Google slides or docs.	**Free alternatives** Gimp, Inskscape, Blender, MS Paint, PowerPoint **Online Alternatives** TinkerCAD(3D Designing) and Pixlr (2D Designing) Google Docs/Slides.

Research Topics

These are helpful topics that will assist in making the project easier to understand.

Research Paper
Leading Companies in cell phone design, science and technology in product design, leading cell phone accessory companies. Any related topics.
Designing Diagrams and Prototypes
Design Cycle, Scientific Method How to Videos and articles using digital imaging and CAD Software
Prototyping and Bulding
Diy Holograms, Diy projector, DIY Cellphone case, cardboard projects, 3D printing and cellphone topics. Package design, Product design etc.

Project Rubric and Procedures (Qualitative & Quantitiative):

Teacher will assess each group individually post Gallery Crawl with this rubric.

	Poor 0-4	Moderate 5-8	Average 9-12	Good 13-15	Excellent 16-20
Project Requirements Per Item	Group did not meet requirements	Group achieved some of the requirements	Group Met Majority of the Requirements.	Group Has met the Requremen ts	Group met and Exceeds Project requiements. Shows Rigor.
Research Paper 1 Page (5 paragraph requirement)	Group did not meet requirements	Group achieved some of the requirements	Group Met Majority of the Requirements.	Group Has met the Requremen ts	Group met and Exceeds Project requiements. Shows Rigor.
Presentation 5 slide requriement	Group did not meet requirements	Group achieved some of the requirements	Group Met Majority of the Requirements.	Group Has met the Requremen ts	Group met and Exceeds Project requiements. Shows Rigor.
Prototype Working Prototype	Group did not meet requirements	Group achieved some of the requirements	Group Met Majority of the Requirements.	Group Has met the Requremen ts	Group met and Exceeds Project requiements. Shows Rigor.
Final Product Packaged finalized Product.	Group did not meet requirements	Group achieved some of the requirements	Group Met Majority of the Requirements.	Group Has met the Requremen ts	Group met and Exceeds Project requiements. Shows Rigor.

Gallery Crawl Assessment (Qualitative & Quantitative)
Print this out and post 1 of these pages per group. Use stickers and hand them out with directions for each classroom and group of students that will assess your students' work. Allow the students to present their projects and show their cell phone case design. Leave the room with your class and allow the gallery crawl to begin. Once it's done, share out with both or multiple classes per content based/ prepared questions referencing objectives from course blueprint. Give each group their sheets with stickers on it to analyze how they performed.
These are the categories with big spaces on the page to place stickers.

Innovation:

Creativity:

Presentation: Aesthetics:

Practicality/Usefulness:

Appendix 4: Sample of Project (Procedure - Final Product)

Phone Research

By: Jason Kongkham

The largest reason both companies became so successful, was through the integration of the latest technology, the touchscreen. The touchscreen allowed users to simply touch the screen to interact with their phone, instead of pressing buttons that usually involved numbers. Both had designs that were large enough for people's hands, and be able to interact with it's UI. Apple had released their first handheld device, the iPhone 2G, in 2007 as an extremely innovative product. Soon a year after, the Galaxy phone line had been released by Samsung, utilizing the windows OS.

Apple's iPhone design had been inspired by the Newton MessagePad, back in the mid-1900s. At the time, PDAs and Tablets were more in demand but Steve Jobs believed that the phones would become more prevalent in the near future. In June 29th, 2007, the first iPhone had been released after a design that was similar to the previous design had been released, forcing a redraw. As the year went on, iTunes and Safari were ways to receive apps and access the internet. Lastly, as a way to respond to large initial popularity, Apple required third party production in order to meet demand, which utilized a Taiwanese company, Hon Hai.

Samsung had first utilized the touch screen feature, back in October 2001 through the SPH-l300 but had complaints about not being able to feel the buttons. But Samsung began using the windows OS in the Omnia SCH-i910, but with so many integrations, it had failed to integrate the touch sensor for users. In 2011, Samsung had created 3-4 different phone lines based on different carrier companies, but most notably the Galaxy S II gained extreme popularity for it's design. As an attempt to create a work like phone that is able to take notes (no pun intended), the Galaxy Note was created but was extremely large for it to be a phone. Lastly, the Galaxy S III was released with extremely excellent commercial success with it's navigation menu and the integration of the Microsoft operating system at the same time.

In conclusion, Both Samsung and Apple have had extreme commercial success through it's curvature design and the use of the touch sensor to interact with the screen. Apple continues to create a single line of products that update and upgrade with every generation. But as they continue, Samsung continues to design multiple lines of phone products that are designated to different audiences. Though another difference in both phones are the OS, where Apple utilizes their own UI and OS but Samsung continues to operate under the Microsoft OS.

Student Presentation

The P.E.O.P.L.E and the Flip2Go phones

By: Jason K.
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What is the P.E.O.P.L.E and the Flip2Go?

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- For one, the P.E.O.P.L.E is the phone that an everyday person would want, because it would be them. The Flip2Go is the new way, for corporate citizens to work without having to bring a large tablet or even a laptop.

- Secondly, the P.E.O.P.L.E are interchangeable, not everyone may be the same, so you may have different accessories to your liking. With the Flip2Go, you have a duplicate screen, that you may move from your main screen to an extended screen if you so desire.

- Lastly, the P.E.O.P.L.E combines today's newest technology, the surface charging, where you place it on the charging technology and it charges. With the Flip2Go, you may add different technologies to improve your experience or needs towards the occupation you need.

What allows me care about the P.E.O.P.L.E phone?

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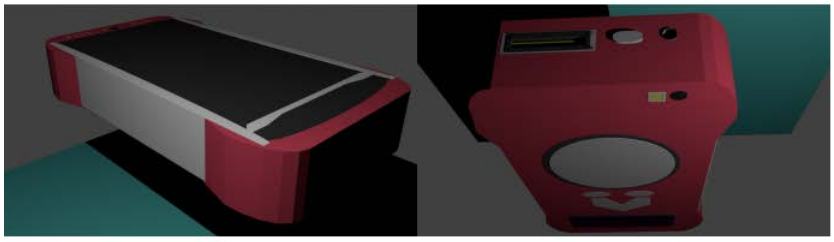
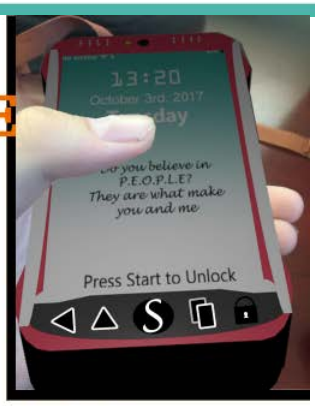
The P.E.O.P.L.E phone is named, as a tribute to it being for the people. And taking it into a question, what makes a person different from the people? Individuality, the word that, if combined, establishes the stronger people. With this phone, it as you see fit and what makes you. If you are a photographer, you can add extra external storage and other accessories. The possibilities may be endless, and suggestions of accessories are advised and accepted.

But what is ON the P.E.O.P.L.E





- [ ] Interchangeable navigation menu (Can be changed through Setting)
- [ ] Surface charger on the back
- [ ] External hard drive area at the bottom
- [ ] Accessory connector at the top

But what is so unique about the Flip2Go?

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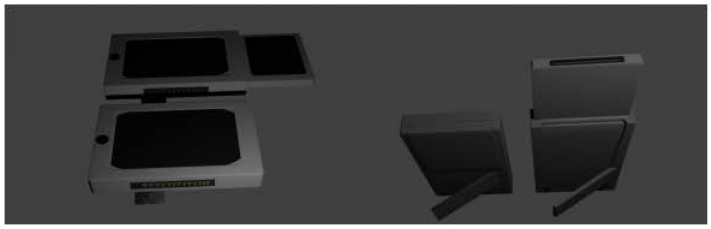
- First off the Flip2Go is primarily a work phone, for those that require multi-tasking without exiting out of the previous app or program. Not only that, you may interact with both screens at the same time if you so choose to do so.

- Secondly, the Flip2Go can utilize multiple accessories to enhance your experience, such as an attachable keyboard or hard drive. A new setting that may be introduced, is the hovering system, where you don't have to touch your screen to interact.

- Lastly, comes attached with a stand and a 4k camera, that comes with a free stylis pen for precision drawing or interaction. Furthermore, a mini-usb charger on the side alongside stereo audio.

What is ON the Flip2Go?



- ☐ Flippable dual screen that utilizes extension interaction.
- ☐ Attachable extension at the side of phone and extension screen.
- ☐ Stand to hold up phones vertically.
- ☐ 4k Camera (Front and back)
- *WARNING* using dual screen may cause increased power usage; in beta

What is the conclusion supposed to be?

The P.E.O.P.L.E phone is to be targetted towards the everyday person, to be what they want it to be and how it should be. The Flip2Go is the working citizen's phone that they are able to multitask well with. Both designed to keep in mind what the user wants and how they want it. Any accessories may be made from either the company itself, or through a third party company.

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Appendix 1: Teaching Standards

V201.02 Prepare an extemporaneous technical presentation.

V204.01 Summarize advanced 3D modeling.

V203.04 Demonstrate advanced presentation techniques.

V205.09 Create an advanced visualization.

Teacher and Student Resources

Teacher Resources:

Teacher:Design Cycle
https://www.teachengineering.org/activities/view/ucd_kite_activity1

smooth on Youtube Channel
https://www.youtube.com/user/SmoothOnInc

I like to make stuff molding and casting
https://www.youtube.com/watch?v=jZSMWmevFBo

Tested Molding and Casting (play this one for your students)
https://www.youtube.com/watch?v=J1jDaZX6PCk

Students:
3d hologram from coke bottle
https://www.youtube.com/watch?v=8OPhsXvRjSQ

Silicon Cellphone case
https://www.youtube.com/watch?v=uHgs8B_6c7I

Hot glue Cellphone case
https://www.youtube.com/watch?v=FJRTxgzTrGc

CardBoard Case Design

https://www.youtube.com/watch?v=oifX0kd9MOI

VR Cardboard
https://www.youtube.com/watch?v=asITXtq3iEg

smartboard projector
https://www.youtube.com/watch?v=Tx4vPeL9y2g

DIY Cell Phone Cases
https://www.youtube.com/watch?v=F65bWAGxEbE

Bibliography

Albus, Volker, Reyer Kras, and Jonathan M. Woodham. Icons of design: the 20th century. Munich: Prestel, 2004.

This book details daily items used that were in designed in a unique way to set them above normal status to gain iconic status over the 20th century. Watches, furniture, and many other items are outlined in this book. This book outlines the thinking and mindset of the designers and this book can be used as a tool to express innovation an thinking as a reading resource for both the teacher and students.

Allwood, Julian M., Jonathan M. Cullen, and Mark A. Carruth. Sustainable materials: with both eyes open. Cambridge: UIT Cambridge, 2012.

This book is broken into five parts. The main aspects to take away from this book are its explanation of efficiency and use of materials. Talks about plastics, cements, and paper, also metals and the uses of energy. This will be a good resource to understand materials when building or designing during the project.

Bruens, Ger. The Essence of Cool. Hague: Eleven International Pub., 2012.

This brings a solidarity in defining what "cool" is. As this concept and term in design is essential and vital ingredient to make your designs stand out. This is to add essentially an edge or the unique element to your design. Students can understand these concepts from a design standpoint.

Guidot, Raymond. Industrial design techniques and materials. Paris: Flammarion, 2006.

This book talks about the history of design materials and how it effected the industrial revolution. This book highlights the uses of materials in the future, and outlines design considerations. This book has great illustrations and good as a reflection on the industrial revolution.

Heskett, John. Toothpicks and logos design in everyday life. New York: Oxford University Press, 2002.

This book places emphasis on the every day impact design has on our lives. The every day items we use. This places emphases on the cultural influences of designing, this may help the students think about their needs, and cultural influence on what they design.

Heath, Adrian, Aage Lund. Jensen, Snorre Læssøe. Stephensen, and Ditte Heath. 300 years of industrial design: function, form, technique: 1700-2000. New York, NY: Watson-Guptill Publications, 2000.

This book takes a look at design over a 300 year span. They detail each item in scaled drawings photographs and catalog them so that we can gain a detailed view of the disciplines and importance of them. This will give both the teacher and students an idea of the change over time of design and its evolution.

Morris, Richard. The fundamentals of product design. London: Fairchild Books, 2016.

This book details in short form very innovative designs, and the designers explain their inspiration behind it. This book has good photographs and is a modern example that students can relate and identify with while they design.

Wood, Kristin L., and Kevin N. Otto. Product design. Upper Saddle River, NJ: Prentice Hall, 1999.

This book gives the details of the actual practice of industrial design from start to finish. everything from robust design, to completing your portfolio is included. This will be good for the students to use during the entire project process.