

Fashion Engineering (Crowdsourced Content)

STEM.org¹

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Figure 2: Fashion Engineering Proficiency Badge

Resumen

¿Alguna vez has pensado en la moda como un tipo de tecnología? Este curso único es divertido y educativo tanto para profesores como para estudiantes, y hace que la tecnología y la ingeniería sean divertidas y accesibles para personas con intereses en arte, artesanía y diseño visual. El curso comienza con la introducción de los estudiantes a profesionales que trabajan en la moda y carreras relacionadas, como la arquitectura y la ingeniería. Se anima a los estudiantes a establecer conexiones entre estos campos, antes de embarcarse en un viaje de diseño de moda propio. Los estudiantes aprenderán enfoques técnicos de diseño y composición; aplicar las habilidades básicas de medición y matemáticas; considerar patrones y problemas geométricos; aprender los procedimientos metodológicos utilizados en ingeniería, arquitectura y otras artes especializadas; y participar en la investigación social y publicitaria. Finalmente, los estudiantes desarrollarán sus propias ideas y diseños, participando en proyectos de equipos prácticos y en una competencia de pasarela. Áreas STEM: ciencia, tecnología, ingeniería y matemáticas.

Lesson 1: What is Fashion Technology?

Suggested Time: 60 minutes

Overview

Students will gain exposure to design professionals from area schools, learning about fashion design as a form of technology and considering available careers in the field.

Vocabulary

- Fashion
- Design
- Technology

- Engineering

Objectives

- Students will interact directly with fashion designers and learn about careers in the industry.
- Students will direct their own learning by brainstorming questions.
- Students will consider the relationship between technology, design, engineering, and artistic/creative design in the arts.

Next Generation Science Standards

- MS-PS-1, MS-PS-4. Developing and Using Models.
- MS-PS1-3. Obtaining, Evaluating, and Communicating Information.
- ETS1.A, B, and C. Defining and Delimiting Design Problems, Developing Possible Solutions, and Optimizing the Design Solution.

Required Project Materials

- Speakers/panelists from area schools, such as the College for Creative Studies [http:// www.collegeforcreativestudies.edu](http://www.collegeforcreativestudies.edu) ; International Academy of Design and Technology <http://www.iadt.edu/Detroit>; and the Art Institute of Michigan [http:// www.artinstitutes.edu/detroit/fashion-702.aspx](http://www.artinstitutes.edu/detroit/fashion-702.aspx).

Multimedia Resources

- Fashion Illustration: Inspiration and Technique . Anna Kiper. [http://amzn.com/ 0715336185](http://amzn.com/0715336185) (one book per student)
- Designer Doodles: Over 100 Designs to Complete and Create . Nellie Ryan. [http:// amzn.com/0762437618](http://amzn.com/0762437618) (one book per student)

Optional Multimedia Resources

The following resources are great as reference materials throughout the course, or to build in lectures or group work about architecture, the social and ecological factors of design, and more:

- Design for Kids . Peter Exley, Sharon Exley, Daniel Vieyra. <http://amzn.com/1864701803> Note: this book can only be bought from third party sellers at a reasonable price.
- Playground Design (Architecture in Focus) . Michelle Galindo. [http://amzn.com/ 3037681098](http://amzn.com/3037681098) Note: due to its price, I would recommend purchase of one copy of this book for use in the classroom.

Before the Lesson/ Background Information

- Contact local creative and design schools to locate fashion designers and people in related fields. You can also find people in other disciplines like architecture and engineering. Try to secure two to four speakers to make up an interactive panel. Each panelist should bring an object that has something to do with their profession/ presentation. It's even better if it's interactive.

The Lesson

Part 1: Introduction (15 mins)

1. Tell the class that they will be learning from real designers today. Work with them to relate fashion design to other types of design, such as architecture, engineering, and interior decorating. What are some skills that are necessary for all of these professions?
2. Have the students develop some questions to ask the designers.
3. Introduce the designers.

Part 2: Designer Career Panel (40 mins)

1. Have the designers sit in front of the class, like a panel.
2. Each designer should spend five to ten minutes presenting about his or her profession.

3. Have the class ask the designers questions.

Part 3: Peer Review (5 mins)

1. Let the class know that during this course, they will learn and practice the elements of design, and become designers themselves by practicing drawing and designing clothes. Then they will engage in a fashion design competition, just like “Project Runway”!
2. Distribute the supplementary materials Fashion Illustration: Inspiration and Technique and Designer Doodles: Over 100 Designs to Complete and Create that students will use throughout the course, and assign homework from these materials.

Homework Due Next Class

- Work through a section of Fashion Illustration: Inspiration and Technique and Designer Doodles: Over 100 Designs to Complete and Create .
- Tell students to bring their homework from Fashion Illustration: Inspiration and Technique and Designer Doodles: Over 100 Designs to Complete and Create to the next class session.

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Lesson 2: Design, Pattern, and Color

Suggested Time: 60 minutes

Overview

In workshop style, students will experiment with shapes and color, object drawing (using examples from architecture and engineering), figure drawing, and drawing action and mood— superhero style! This lesson builds drawing and diagramming skills while appealing to a wide variety of ages, backgrounds, and skill levels.

Vocabulary

- Diagram
- Blueprint
- Design
- Perspective
- Symmetry
- Asymmetry

Objectives

- Students will gain practical skills that are used in a wide variety of design-based fields.
- Students will learn and explore at their own pace while also engaging in challenging group work.

Next Generation Science Standards

- MS-PS-1, MS-PS-4. Developing and Using Models.
- MS-PS1-3. Obtaining, Evaluating, and Communicating Information.
- ETS1.A, B, and C. Defining and Delimiting Design Problems, Developing Possible Solutions, and Optimizing the Design Solution.

Required Project Materials

- Sketch paper
- Color pencils
- Sewing kits (for optional sewing group)
- Wide variety of fabric from thrift stores and/or Jo-ann Fabrics' discount fabric and remnants bin (for optional sewing group)

Multimedia Resources

- Outside the Lines: an Artist's Coloring Book for Giant Imaginations . Souris Hong- Porretta. <http://amzn.com/03991620>
- Figure it Out! The Beginner's Guide to Drawing People . Christopher Hart. [http:// amzn.com/1933027800](http://amzn.com/1933027800)
- Draw Comic Book Action . Lee Garbett. <http://amzn.com/1440308136>
- Fashion Illustration: Inspiration and Technique . Anna Kiper. <http://amzn.com/0715336185> (one book per student)
- Designer Doodles: Over 100 Designs to Complete and Create . Nellie Ryan. [http:// amzn.com/0762437618](http://amzn.com/0762437618) (one book per student)

Optional Multimedia Resources

- How to Draw: Drawing and Sketching Objects and Environments from Your Imagination . Scott Robertson and Thomas Bertling. <http://amzn.com/1933492732>
- Sewing Basics: All You Need to Know About Machine and Hand Sewing . Sandra Bardwell. <http://amzn.com/1584799471>
- How to Use, Adapt, and Design Sewing Patterns: from Store-Bought Patterns to Drafting Your Own: a Complete Guide to Fashion Sewing with Confidence . Lee Hollahan. [http:// amzn.com/0764144251](http://amzn.com/0764144251)

- Design for Kids . Peter Exley, Sharon Exley, Daniel Vieyra. <http://amzn.com/1864701803> Note: this book can only be bought from third party sellers at a reasonable price.
- Playground Design (Architecture in Focus) . Michelle Galindo. <http://amzn.com/3037681098> Note: due to its price, I would recommend purchase of one copy of this book for use in the classroom.

Before the Lesson/ Background Information

- Print several engineering and architectural drawings from online, or use How to Draw: Drawing and Sketching Objects and Environments from Your Imagination . This is an advanced book featuring fun engineering drawings, as well as information on perspective and depth. It can be used throughout the course to provide interesting homework assignments and group activities.
- An architecture group could also be formed around Design for Kids and Playground Design (Architecture in Focus).
- Make copies of pictures in Outside the Lines: an Artist's Coloring Book for Giant Imaginations and the drawing books as necessary to make sure that everyone has access to them and can work on their own within groups.

The Lesson

Part 1: Design, Pattern, and Color Workshops* (50 mins)

1. Separate the students into three groups. Each group will work on a different skill—coloring (practicing with various shapes and patterns); drawing human figures (first, rudimentary figures, then figures in action); and copying and playing with architectural and engineering designs.
2. The coloring group will use Outside the Lines: an Artist's Coloring Book for Giant Imaginations. The drawing group will use Figure it Out! The Beginner's Guide to Drawing People and progress to Draw Comic Book Action with each individual working at their own pace. The object design group will work with the drawings you've provided, the architecture books, and/or How to Draw: Drawing and Sketching Objects and Environments from Your Imagination.
3. Individual students should work on their own, incorporating their own homework into their designs, but consulting with and learning from other group members as well.
4. Every twenty minutes, groups should rotate tasks, so that everyone gains practice in each area.

***If you have many students, or students that are particularly interested in textile design, you can have another group work on making a small quilt. They will cut out squares of fabric and hand-sew them together. This is another way of experimenting with pattern and color combinations.**

Part 2: Discussion (10 mins)

1. Reserve a few minutes at the end of class to discuss the importance of working with drawings, diagrams, patterns, and colors in design fields. How are these skills used in engineering? In architecture? In fine arts?

Homework Due Next Class

- Work through a section of Fashion Illustration: Inspiration and Technique and Designer Doodles: Over 100 Designs to Complete and Create .
- Tell students to bring their homework from Fashion Illustration: Inspiration and Technique and Designer Doodles: Over 100 Designs to Complete and Create to the next class session.

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Lección 3: Las matemáticas están de moda.

Tiempo sugerido: 60 minutos

Visión general

Para practicar la medición de longitudes y unidades de conversión, los estudiantes visitarán una tienda de telas y descubrirán la cantidad de tela que necesitan para completar los patrones de tamaño completo. Practicarán la conversión de unidades dentro del mismo sistema, luego considerarán cómo sería trabajar con sus diseños en un entorno internacional, donde tienen que usar el sistema métrico.

Vocabulario

- Moda
- Diseño
- Pulgada
- Pie
- Yarda
- Pie cubico
-

Si compra tela, asegúrese de que los estudiantes compren pequeños cortes, ya que solo estarán vistiendo a sus modelos pequeños.

Tarea para la próxima clase

- Los estudiantes deben completar cualquier problema de conversión de unidades sin terminar y entregarlos durante la próxima sesión de clase.
- Trabaje a través de una sección de Fashion Illustration: Inspiration and Technique y Designer Doodles: Más de 100 diseños para completar y crear.
- Dígalos a los alumnos que traigan su tarea de Fashion Illustration: Inspiration and Technique y Designer Doodles: Over 100 Designs to Complete and Create para la próxima sesión de clase.

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Lesson 4: The Geometry of Fashion

Suggested Time: 60 minutes

Overview

Students will learn about various two-dimensional and three-dimensional shapes, and learn why fashion design is really applied geometry! Then they will practice actually sewing garments for their small models.

Vocabulary

- Fashion
- Design
- Shape
- Pattern
- Square
- Rectangle
- Circle
- Cylinder
- Protractor
- Ruler

Objectives

- Students will apply geometry to work with existing patterns and adapt their own.
- Students will conduct measurements to practice tailoring designs to fit a model.

Next Generation Science Standards

- MS-PS-1, MS-PS-4. Developing and Using Models.
- MS-PS 1-3. Obtaining, Evaluating, and Communicating Information.
- ETS1.A, B, and C. Defining and Delimiting Design Problems, Developing Possible Solutions, and Optimizing the Design Solution.

Common Core Mathematical Standards

- G.GMD. Visualize Relationships Between Two- and Three-Dimensional Objects
- G.MG. Apply Geometric Concepts in Modeling Situations
- G.CO. Make Geometric Constructions
- NBT. Number and Operations in Base Ten
- NF. Number and Operations—Fractions

Required Project Materials

- Construction paper in various shades
- Craft glue
- Safety pins, adhesive velcro squares, and double-sided tape
- Sewing kits (for upper-middle and high school students)
- Wide variety of fabric from thrift stores and/or Jo-ann Fabrics' discount fabric and remnants bin
- Patterns (many free patterns can be found online)

Multimedia Resources

- How to Use, Adapt, and Design Sewing Patterns: from Store-Bought Patterns to Drafting Your Own: a Complete Guide to Fashion Sewing with Confidence . Lee Hollahan. [http:// amzn.com/0764144251](http://amzn.com/0764144251)
- Sewing Basics: All You Need to Know About Machine and Hand Sewing . Sandra Bardwell. <http://amzn.com/1584799471>
- “Weights and Measures.” BarCharts Incorporated . <http://amzn.com/1572225483>

Optional Multimedia Resources

- None

Before the Lesson/ Background Information

- Print out a variety of patterns to use during class. Make sure and include both boys' and girls' clothes.
- Choose adaptable patterns that will lend themselves to solving geometry and measurement problems.

The Lesson

Part 1: Math is in Fashion (10 mins)

1. Collect homework and review lessons learned from the measurement exercises the class conducted during the last session.
2. Have the class identify what shapes they are wearing. For example, most shirts are basically three cylinders sewn together: one for the torso, and two for the sleeves. What about the round openings of the sleeves: what shapes are those? Let the students have fun identifying shapes in each other's clothes.

Part 2: Construction Paper Clothing (15 mins)

1. Using the protractor, ruler, and other tools, the students will cut out perfect geometric shapes from the construction paper and shape basic clothing items.
2. For example, students will need to cut out a rectangle to make a cylinder.
3. Next, the students will make mini clothing items from the shapes they cut out. They should try to dress the small models with their construction paper clothing. Of course, the pieces won't fit together quite right!
4. Have the students experiment with cutting the joining parts of shapes so that they fit together better.

Part 3: Patterns and Sewing (35 mins)

1. The students will now work on making cloth items for the small models.
2. Separate the class into groups. Distribute several patterns of different types to each group. For example, one group might get a pattern for a dress, a hat, and a tie.
3. Next, each group will select fabrics and materials to use. Then they will work on cutting out the patterns (on a much smaller scale, of course). For reference, they can use *How to Use, Adapt, and Design Sewing Patterns: from Store-Bought Patterns to Drafting Your Own: a Complete Guide to Fashion Sewing with Confidence*.
4. Finally, the groups will sew their items for the small models, using *Sewing Basics: All You Need to Know About Machine and Hand Sewing* as a guide. Encourage the students to try a variety of stitches found in the book.

Homework Due Next Class

- Work through a section of *Fashion Illustration: Inspiration and Technique* and *Designer Doodles: Over 100 Designs to Complete and Create*.
- Remind students to bring their work from *Fashion Illustration: Inspiration and Technique* and *Designer Doodles: Over 100 Designs to Complete and Create* to the next class session.

Lesson 5: Inspiration and Innovation

Suggested Time: 60 minutes

Overview

Students will learn about inspiration and innovation in design and how copyright flexibility and market practices may affect the design process. Students will then consider how innovations in engineering and science compare with innovations in fashion. Then they will scout about for their own inspirations, copying a design challenge found in Season 2 of Project Runway!

Vocabulary

- Inspiration
- Innovation
- Utilitarian
- Copyright
- Engineering
- Biomimicry

Objectives

- Students will engage in a critical thinking exercise by learning about the lack of copyright regulation in the fashion industry and discussing the effects of copyright on innovation.
- Students will explore different sources of inspiration and innovation, including the needs of users.
- Students will identify sources of inspiration for their next project.

Next Generation Science Standards

- MS-PS-1, MS-PS-4. Developing and Using Models.
- MS-PS1-3. Obtaining, Evaluating, and Communicating Information.
- ETS1.A, B, and C. Defining and Delimiting Design Problems, Developing Possible Solutions, and Optimizing the Design Solution.

Required Project Materials

- Several digital cameras
- Computer with photo sorting program and live connection to the internet

Multimedia Resources

- “Lessons from Fashion’s Free Culture.” Johanna Blakley. Ted Talks. Video (15.36) [http:// www.ted.com/talks/johanna.blakley_lessons_from_fashions_free_culture](http://www.ted.com/talks/johanna_blakley_lessons_from_fashions_free_culture)
- “Architecture.” National Geographic . [http://education.nationalgeographic.com/ education/topics/architecture/?ar_a=architecture](http://education.nationalgeographic.com/education/topics/architecture/?ar_a=architecture)
- “Inspiration.” Project Runway Season 2 Episode 8.

Optional Multimedia Resources

- Design for Kids . Peter Exley, Sharon Exley, Daniel Vieyra. <http://amzn.com/1864701803> Note: this book can only be bought from third party sellers at a reasonable price.
- Playground Design (Architecture in Focus) . Michelle Galindo. [http://amzn.com/ 3037681098](http://amzn.com/3037681098) Note: due to its price, I would recommend purchase of one copy of this book for use in the classroom.

Before the Lesson/ Background Information

- None

The Lesson

Part 1: Inspiration and Innovation (25 mins)

1. After checking homework, show “Lessons from Fashion’s Free Culture.” Review Johanna Blakley’s main points.
2. If possible, arrange the class in a semi-circle to facilitate discussion, so that there is no front or back row.
3. Discuss with the class whether they think lack of copyright helps designers innovate, or whether restrictions and constraints actually help them more.
4. Ask the students if they agree with Blakley’s assessment that a free market and desire to distinguish oneself drives innovation.
5. Work with the class to come up with a list of conditions that may drive innovation in ALL fields. The list might include:
6. User need or desire for a particular service or function (simple examples of this might include bridges because people needed to move themselves and large loads efficiently across water bodies; or phones having GPS capabilities so that people don’t have to bring maps with them or ask directions)
7. Traits found in nature (biomimicry)
8. The desire to create something with a beautiful form
9. Point out that even in fields with copyright protection, such as architecture and engineering, practitioners often draw inspiration from their predecessors and reflect trends that have worked for a long time. Raise the point that copyright protections often expire or only cover recent inventions, so that old work is considered public domain. Ask the class to name some beautiful old things. Look through National Geographic Education’s “Architecture” website to find pictures of venerated old buildings and other structures that may continue to inspire new designs.
10. Summarize that architects, engineers, and fashion designers all draw inspiration from many sources, including old works, nature, and the needs and desires of users.

Part 2: Finding Inspiration (35 mins)

1. Show excerpt from Project Runway’s Season 2 Episode 8, “Inspiration.” Let the students know that they will be replicating the Project Runway Experiment, only instead of photographing buildings, they will bring something from home as an inspiring object.
2. Just to practice, have students tour the school grounds looking for inspiration for an outfit. They should take one to three photos of things that inspire them. (If you are short on time, just have them look around the classroom.)
3. After 15 minutes, students should come back and upload the photos. Look at the photos with the class and discuss what each photo means to the photographer.

Homework Due Next Class

- Students will need to find an inspirational object from outside the class. It can be a photograph, something from nature, or something from home. They will use this object as an inspiration to design and build a small outfit.
- Encourage students to use their supplementary workbooks to try out various designs inspired by their inspiration! Of course, they should bring these to the next class.

Lesson 6: Practicing Inspired Design

Suggested Time: 60 minutes

Overview

Students will use their inspirational objects to come up with a design for an outfit. Using the small models and materials provided in class, they will make a list of materials and draw a design for the outfit. Then they will cut and shape the fabrics on the small models. Finally, they will parade them for the class, just like in Project Runway!

Vocabulary

- List of materials * Design sketch

Objectives

- Students will practice rudimentary planning and design skills used in all design-based disciplines, including engineering and architecture.

Next Generation Science Standards

- MS-PS-1, MS-PS-4. Developing and Using Models.
- MS-PS1-3. Obtaining, Evaluating, and Communicating Information.
- ETS1.A, B, and C. Defining and Delimiting Design Problems, Developing Possible Solutions, and Optimizing the Design Solution.

Required Project Materials

- Safety pins, adhesive velcro squares, and double-sided tape (sewing kits can be used for high school students)
- Wide variety of fabric from thrift stores and/or Jo-ann Fabrics' discount fabric and remnants bin
- A wide variety of items, such as buttons, glitter, threads of various colors, sequins, stickers, odd items that can be made into hats and other accessories, etc.

Multimedia Resources

- “Inspiration.” Project Runway Season 2 Episode 8.

Optional Multimedia Resources

- Design for Kids . Peter Exley, Sharon Exley, Daniel Vieyra. <http://amzn.com/1864701803> Note: this book can only be bought from third party sellers at a reasonable price.
- Playground Design (Architecture in Focus) . Michelle Galindo. <http://amzn.com/3037681098> Note: due to its price, I would recommend purchase of one copy of this book for use in the classroom.

Before the Lesson/ Background Information

- None

The Lesson

Part 1: Inspiration Show (20 mins)

1. Show the remainder of Project Runway's “Inspiration”. Have fun showing this—it draws laughs!
2. Have each student introduce his or her inspiring object and describe what is inspiring about it.

Part 2: Sketch the Design (40 mins)

1. Each student should now go to the “Fabric Store”—the collection of items you got from the thrift store and/or Jo-ann Fabrics' discount bin—and pick out what fabrics and items they want to use.

2. Students should now write a list of materials.
3. Next, they will sketch the design. Hopefully, they've begun this process already!
4. Finally, students will cut out their design and attach or sew the pieces onto their small model. Encourage them to include accessories as well.
5. Time each task. Just like "Project Runway", the students will have to show whatever they were able to finish!

Homework Due Next Class

- Work through a section of Fashion Illustration: Inspiration and Technique and Designer Doodles: Over 100 Designs to Complete and Create .
- Tell students to bring their homework from Fashion Illustration: Inspiration and Technique and Designer Doodles: Over 100 Designs to Complete and Create to the next class session.

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Lesson 7: Sports Engineering

Suggested Time: 60 minutes

Overview

Students will examine how clothes and accessories are designed for the needs of athletes, and consider how they would design items for their favorite sports. Then they will engage in a fun exercise in which they design their own shoes!

Vocabulary

- Problem
- Research
- Solution
- List of Materials
- Design Sketch
- Prototype
- Testing
- Evaluation

Objectives

- Students will practice rudimentary planning and design skills used in all design-based disciplines, including engineering and architecture.
- Students will combine aesthetics with the functional attributes of engineered design features.

Next Generation Science Standards

- MS-PS-1, MS-PS-4. Developing and Using Models.
- MS-PS1-3. Obtaining, Evaluating, and Communicating Information.
- ETS1.A, B, and C. Defining and Delimiting Design Problems, Developing Possible Solutions, and Optimizing the Design Solution.

Required Project Materials

- Sketch paper and pencils for concept designs
- Copies of National Geographic’s “Engineering Process” worksheets (provided)
- Computer lab

Multimedia Resources

- The Kids’ Guide to Sports Design and Engineering (SI Kids Guide Books). Thomas K. Adamson and Robert L. McConnell. <http://amzn.com/1476551871>
- “A Cross Culture Study on Phone Carrying and Physical Personalization.” Yanqing Cui, Jan Chipchase, and Fumiko Ichikawa. Nokia study. Article provided and available at <https://research.nokia.com/files/45590483.pdf>

Optional Multimedia Resources

- None

Before the Lesson/ Background Information

- Copy excerpts of The Kids’ Guide to Sports Design and Engineering to pass out to the class.
- Print out copies of “A Cross Culture Study on Phone Carrying and Physical Personalization” to hand out in class as homework.

The Lesson

Part 1: Considering Sports Design (20 mins)

1. Read The Kids' Guide to Sports Design and Engineering with the class, engaging the students with reading sections of the material.
2. Go around the room and ask the students to declare their favorite sport. Then have the students consider difficulties or obstacles related to that sport. Can they identify a problem that needs to be solved? Discuss ways of solving each problem.

Part 2: Design Your Own Kicks* (40 mins)

1. Now the students will work on designing their own sports shoes. Tell them to consider both function and form in the design.
2. As the students develop the design, have them fill out a National Geographic "Engineering Process" worksheet.
3. The next step is to perform any necessary research on the product in the computer lab.
4. Finally, the students will complete a sketch and color it. They should label any important details, then present the design to the rest of the class.
5. Time each task. Just like "Project Runway", the students will have to show whatever they were able to finish!

Homework Due Next Class

- Students should think of a need that is not well served by an item of clothing—and how they would solve that need. They can think about problems they have encountered, or problems they've heard about from family members.
- Students should read "A Cross Culture Study on Phone Carrying and Physical Personalization" to prepare for the next class.

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Lesson 8: Social Research

Suggested Time: 60 minutes

Overview

Students will learn about how companies study the habits of consumers in order to develop or improve product lines and associated advertising. Sometimes designers work to solve existing needs; other times, they create needs that consumers didn't know they had. In this session, students will explore a Nokia study on how people carry and customize their cell phones. Using the results of the study as a foundation, students will build their own study on how clothing options may affect how people carry phones and other objects.

Vocabulary

- Social Study
- Hypothesis
- Ethnography
- Observation
- Interview
- Qualitative
- Quantitative
- Interpretation
- Statistics

Objectives

- Students will plan an original study to identify a need and come up with their own solutions.

Next Generation Science Standards

- MS-PS-1, MS-PS-4. Developing and Using Models.
- MS-PS1-3. Obtaining, Evaluating, and Communicating Information.
- ETS1.A, B, and C. Defining and Delimiting Design Problems, Developing Possible Solutions, and Optimizing the Design Solution.

Common Core Mathematical Standards

- S.ID. Interpreting Categorical and Quantitative Data
- S.IC. Making Inferences and Justifying Conclusions
- NBT. Number and Operations in Base Ten
- NF. Number and Operations—Fractions

Required Project Materials

- Sketch paper and pencils for concept designs
- Copies of National Geographic's "Engineering Process" worksheets (provided)
- Computer lab

Multimedia Resources

- "A Cross Culture Study on Phone Carrying and Physical Personalization." Yanqing Cui, Jan Chipchase, and Fumiko Ichikawa. Nokia study. Article provided and available at <https://research.nokia.com/files/45590483.pdf>

Optional Multimedia Resources

- None

Before the Lesson/ Background Information

- Read “A Cross Culture Study on Phone Carrying and Physical Personalization” and summarize main points.

The Lesson

Part 1: Finding Questions (20 mins)

1. Go over main points from “A Cross Culture Study on Phone Carrying and Physical Personalization”. Help the students to understand terms and concepts that are new to them. One strategy is to begin from the conclusion of the study, which is a nice concise summary.
2. Work with the students to summarize the research process used in the study. Encourage them to relate the study to personal observations they’ve made. How do people they know carry their cell phones?
3. Encourage them to look around the room. How are other students carrying their cell phones? What would happen if they replicated the same study here in class?
4. The study found that in most cases, males are more likely to carry their phones in their pockets, while females usually use purses or handbags. Ask the class why they think this is the case. Introduce the idea of a hypothesis.
5. Perform a mini-study. Out of the students carrying their phone in a purse or handbag, how many of them have pockets on their clothes? How many students who have pockets use them to carry their phones? What are some possible reasons for the results?
6. Introduce the following questions:
7. If one were to develop a women’s clothing line specializing in having usable pockets, what would it look like?
8. If one were to develop an accessory line appealing to male users (replacing the function of a purse or handbag), what would it look like?
9. Divide the class into two mixed-gender teams, one for each question.

Part 2: Designing the Study (40 mins)

1. Each team will try to figure out how to design a clothing or accessory line that people will use. They will each identify important questions, interview members of the other team, and use their results to design a product line will fulfill needs directly identified by research participants.
2. Students will first discuss what they need to know in order to design their product line. They should come up with a list of questions and use these to design an interview. The interview should focus on the user’s personal experience. Students should figure out how to adjust the questions for gender or existing phone-carrying habits.
3. Arrange the students in pairs, consisting of one person from each group, and have them interview each other. They will alternate roles as the researcher and the user.
4. Students should return to their groups and compile the results in a spreadsheet.
5. Help the students arrange and analyze the data.
6. Based on the data, what is an idea for a product line that will fulfill needs directly identified by research participants?
7. Each group should present the results of the data. They can use National Geographic’s “Engineering Process” worksheets to organize the information if they like.

Homework Due Next Class

- Tell students to think of a radical product line that presents an out-of-the-box solution to the two main questions discussed during this class. How would they promote such a solution? They should write out their ideas for the next class.
- Each student should pick a public place and spend at least 30 minutes observing how people carry important items on their person. They should take notes and bring them to the next class.
- Students can use Fashion Illustration: Inspiration and Technique and Designer Doodles: Over 100 Designs to Complete and Create to help develop their ideas. They should bring their designs with

them to the next class session.

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Lesson 9: Social Engineering

Suggested Time: 60 minutes

Overview

Students will expand on their work from the previous session, presenting a more radical, out-of-the-box clothing or accessory line. Now they will work to actually design their fashion idea, promote it, and apply it to their models!

Vocabulary

- Social Study
- Hypothesis
- Ethnography
- Observation
- Interview
- Qualitative
- Quantitative
- Statistics

Objectives

- Students will use the results from their own studies to design a fashionable solution.
- Students will collaborate to produce the most innovative idea and promote it to their peers.
- Students will evaluate each others' work, engaging in a kind of peer review process.

Next Generation Science Standards

- MS-PS-1, MS-PS-4. Developing and Using Models.
- MS-PS1-3. Obtaining, Evaluating, and Communicating Information.
- ETS1.A, B, and C. Defining and Delimiting Design Problems, Developing Possible Solutions, and Optimizing the Design Solution.

Common Core Mathematical Standards

- S.ID. Interpreting Categorical and Quantitative Data
- S.IC. Making Inferences and Justifying Conclusions

Required Project Materials

- None

Multimedia Resources

- “A Cross Culture Study on Phone Carrying and Physical Personalization.” Yanqing Cui, Jan Chipchase, and Fumiko Ichikawa. Nokia study. Article provided and available at <https://research.nokia.com/files/45590483.pdf>

Optional Multimedia Resources

- None

Before the Lesson/ Background Information

- None

The Lesson

Part 1: Workshop of Radical Ideas (45 mins)

1. Check in homework and have students begin work on their radical product lines.

2. Divide the class into the original two teams: one to work on pockets for women, the other to work on handbags for men.
3. Students within each group should present their ideas for radical solutions as well as any drawings they made at home. The group should then vote and pick the top idea to develop, or combine individuals' ideas into one.
4. For each idea, students will need to complete the following tasks by the end of the class session. Students should construct:
 5. A vision for their product line
 6. A series of at least five drawings of different items within the product line
 7. At least one advertising message or gimmick, to promote the idea that this is the best solution to an identified problem
 8. A completed outfit or accessory, to be demonstrated on a small model (the students may complete more than one outfit or accessory if there is time)
 9. The best way to do this may be for each team to divide into smaller groups (such as an advertising group, the creative/design group (to produce the drawings and the final outfit for presentation), and the writers (to write the vision).

Part 2: Fashion Show (15 mins)

1. Each team will present their final product(s) by having their “model” walk down the runway! A member or members of each team will present their vision, the drawings, and the advertising message as well.
2. Each team will judge the other team’s work and performance and offer feedback.

Homework Due Next Class

- At home, each student should design a series of outfits to compete in the Unconventional Materials Challenge. The outfits will fit the small models. Students should plan and design the outfits at home, and bring their own materials to assemble them in class. Remind them to think of a cohesive “vision” for their entire product line. Let the students know that the idea is to recycle everyday materials, so the outfit can be made out of any materials that might otherwise be thrown away! (Examples include bubble wrap, styrofoam, aluminum foil, bone.) They should bring their designs with them to the next class session.

Lesson 10: Unconventional Materials Competition Grade Level: Middle and High School (Adaptable)

Suggested Time: 60 minutes

Overview

Students will arrive to class with their product designs and unconventional materials. During the first half of the class, they will assemble their designs using the small models. Then they will show off their product lines, Project Runway style, and judge each other's work!

Vocabulary

- Recyclables
- Ecology
- Carbon Footprint

Objectives

- Students will practice the research, inspiration, and design process on their own, then apply what they've learned in the classroom setting.

Next Generation Science Standards

- MS-PS-1, MS-PS-4. Developing and Using Models.
- MS-PS1-3. Obtaining, Evaluating, and Communicating Information.
- ETS1.A, B, and C. Defining and Delimiting Design Problems, Developing Possible Solutions, and Optimizing the Design Solution.
- ESS3.C. Human Impacts on Earth Systems.

Required Project Materials

- Certificates of completion or badges, to be distributed to designers at the end of the course.

Multimedia Resources

- None

Optional Multimedia Resources

- None

Before the Lesson/ Background Information

- Set up the class for a "Project Runway" style competition.
- Provide some "unconventional materials"—such as bubble wrap, aluminum foil, etc.—so that students may use them to supplement their own materials or to build accessories.

The Lesson

Part 1: Working with Unconventional Materials (30 mins)

1. After checking in homework and materials, host a brief discussion about the importance of using ecologically friendly materials.
2. Let the students begin work on putting together their outfits.
3. Remind the students to create an entire product line, including any accessories.
4. Students should also think about how to express their vision to the rest of the class. What makes them unique as designers?

Part 2: Fashion Show (30 mins)

1. Each student will present their final products by having their models “walk” down the runway!
2. Afterwards, the student should answer any questions posed by other students in the class.
3. Students should evaluate each product line as presented and offer constructive comments.
4. At the end of the fashion show, pass out certificates of completion!

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Optional Lesson: Biomimicry in Fashion

Suggested Time: 60 minutes

Overview

Students will explore the field of biomimicry in engineering. Then they will apply what they learned to thinking about clothes that already engage in biomimicry—such as fake fur. Finally, they will think about and design their own clothes that mimic a trait found in nature.

Vocabulary

- List of materials * Design sketch

Objectives

- Students will practice rudimentary planning and design skills used in all design-based disciplines, including engineering and architecture.

Next Generation Science Standards

- MS-PS-1, MS-PS-4. Developing and Using Models.
- MS-PS1-3. Obtaining, Evaluating, and Communicating Information.
- ETS1.A, B, and C. Defining and Delimiting Design Problems, Developing Possible Solutions, and Optimizing the Design Solution.

Required Project Materials

- Safety pins, adhesive velcro squares, and double-sided tape (sewing kits can be used for high school students)
- Wide variety of fabric from thrift stores and/or Jo-ann Fabrics' discount fabric and remnants bin
- A wide variety of items, such as buttons, glitter, threads of various colors, sequins, stickers, odd items that can be made into hats and other accessories, etc.

Multimedia Resources

- “Inspiration.” Project Runway Season 2 Episode 8.

Optional Multimedia Resources

- None

Before the Lesson/ Background Information

- None

The Lesson

Part 1: Inspiration Show (20 mins)

1. Show the remainder of Project Runway's “Inspiration”. Have fun showing this—it draws laughs!
2. Have each student introduce his or her inspiring object and describe what is inspiring about it.

Part 2: Sketch the Design (40 mins)

1. Each student should now go to the “Fabric Store”—the collection of items you got from the thrift store and/or Jo-ann Fabrics' discount bin—and pick out what fabrics and items they want to use.
2. Students should now write a list of materials.
3. Next, they will sketch the design. Hopefully, they've begun this process already!

4. Finally, students will cut out their design and attach the pieces onto their small model. Encourage them to include accessories as well.
5. Time each task. Just like Project Runway, the students will have to show whatever they were able to finish!

Homework Due Next Class

- Students should think of a need that is not well served by an item of clothing—and how they would solve that need. They can think about problems they have encountered, or problems they’ve heard about from family members.
- Tell the students to practice design solutions in their supplementary workbooks.

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Optional Lesson: You Can Do Anything With Duct Tape

Suggested Time: 60 minutes

Overview

Students will pick major construction projects to test the saying “You can do anything with duct tape.” Working in teams, students will build and test objects, then decide whether the saying is true or false. Finally, they will see examples of amazing things that have been built or done with duct tape, and consider the physical and chemical properties of this versatile adhesive.

Vocabulary

- Duct Tape
- Elasticity
- Adhesive
- Mesh
- Rubber
- Polyethylene

Objectives

- Students will learn about the composition of duct tape, the source of its composite materials, and the sustainable rubber industry.
- Students will consider the physical properties that make duct tape so versatile.

Next Generation Science Standards

- MS-PS-1, MS-PS-4. Developing and Using Models.
- MS-PS1-3. Obtaining, Evaluating, and Communicating Information.
- ETS1.A, B, and C. Defining and Delimiting Design Problems, Developing Possible Solutions, and Optimizing the Design Solution.
- PS1A. Structures and Properties of Matter.

Required Project Materials

- Large quantities of duct tape
- Various found objects that might be found on an island, such as sticks and large leaves
- World map

Multimedia Resources

- For inspiration: “Duct Tape Island.” Mythbusters. Episode 179. Air Date Mar 25 2012.
- “How is Duct Tape Made?” Sally Tan. Yale Scientific. <http://www.yalescientific.org/2008/11/how-is-duct-tape-made/>
- “Top Ten Uses For Duct Tape.” Science Channel. <http://www.sciencechannel.com/science-technology/10-uses-for-duct-tape.htm>
- “Adhesive Tape: Tiny Bits of Tacky Tape Hold Together Modern Life.” Rachel Petkewich. Chemical and Engineering News (85:42). Issue Date Oct 15 2007. <http://cen.acs.org/articles/85/i42/Adhesive-Tape.html>
- “Rubber Tree.” Rainforest Action Network. <http://www.rainforest-alliance.org/kids/species-profiles/rubber-tree>
- “The Elastic Tree.” DuckODuck Productions. Youtube video (5.21) <http://youtu.be/zRWxPMj9OXY>

Optional Multimedia Resources

- “Rubber Technology Guidelines: Rubber Tapping Practice.” World Agroforestry Centre.

- “Visiting on a Rubber Tree Plantation.” Justusosaa. Youtube video (2.10). <http://youtu.be/6iphRu8qWw0>
Note: not in English, but great visual footage.

Before the Lesson/ Background Information

- Acquire sticks, palm leaves, and other materials that might be found on an island. Alternatively, select an outdoor space where students can find useful materials.
- List locations where rubber is farmed.

The Lesson

Part 1: Introduction (5 mins)

1. This is an excellent outdoor activity. If possible, teach the class in an outdoor location.
2. Ask the students to think of wacky things duct tape can do as well as things it can't do.
3. Separate the class into three teams. Let them know that they are all stranded on an island with no other land in sight and they have to come up with ways to survive.

Part 2: Duct Tape Designers (30 mins)

1. Give each team a different object to design, such as: a small boat that can carry an object and float; a small shelter or piece of furniture; and clothing. These items should be models. In other words, they will be smaller than the actual item would be, but have the same shape and properties as a life-size item.
2. Each team should spend a few minutes planning how they are going to build the item and assign tasks to team members.
3. Teams may use other materials in their constructions to provide solid structure, but duct tape must be a key element of the item.

Part 3: Duct Tape Trial (25 mins)

1. Now it's time to test the wonders of duct tape! Have the student teams test each other's objects. Those testing the boat model should try to float it on water, then add objects to see how much weight it can hold. The structure or furniture builders should also test their models with weight and forces resembling the elements. Clothing should be tested for durability. Let the students have fun with this part, but instruct them to be fair to each other's objects...
2. Use the articles to discuss the properties of duct tape, including how it's made. Interactively, work with the students to identify the important physical properties of duct tape.
3. Ask the students to identify the natural resources that are used to make duct tape. Introduce students to the rubber tree using the student-made video, “The Elastic Tree”, and information from the Rainforest Action Network. Make sure and work with the students to identify locations on the world map where rubber is produced.

Homework Due Next Class

- None