

Electronic Textiles

Grade level: 6-10

Summary of lesson:

Students first learn how batteries generate electricity and build their own battery cells using sanded pennies and a vinegar solution. Students also learn about conductors and insulators to guide them toward an understanding of open and closed circuits. They will build simple circuits in their design guides using conductive copper tape and surface-mount LEDs. Students will learn how to handsew for the purpose of using conductive thread in a textile design. Finally, they will create a wearable light-up textile using conductive thread and felt. Students will devise their own invention using electronics in the final meeting.

Time/Duration:

Each unit is designed to be 90 minutes. Teachers break down the lesson based on schedule minutes and available time. Example: 7th-8th grade science teaches 1 unit a week, and he meets 3 days a week, once for 55 minutes and twice for 90 minutes. It depends on deep educators who want to take it.

Learning Principles by Subject Area:

- Design Process
- Electronics
- Circuitry
- Batteries
- Materials
- Hand Sewing

Subject areas/Standards:

Electronic Textiles Next Generation Science Standards - Middle School

Meeting	Core Ideas	Engineering Standards	Cross-Cutting Concepts	Practices
Meeting 1: Invention Introduction	ETS1.A ETS1.B	MS.ETS1-1 MS.ETS1-2	Structure & Function	- Asking questions and defining problems. - Constructing explanations and designing solutions. - Obtaining, evaluating, and communicating information.
Meeting 2: Batteries 101	ETS1.B ETS1.C		- Influence of Sciences, Engineering, and Technology on Society & the Natural World - Cause & Effect - System & System Models	- Asking questions and defining problems. - Planning and conducting investigations. - Constructing explanations and designing solutions. - Obtaining, evaluating, and communicating information.
Meeting 3: Copper Tape Designs	ETS1.A	MS.ETS1-1	Influence of Sciences, Engineering, and Technology on Society & the Natural World	Asking questions and defining problems.
Meeting 4: Sewing & Electronic Textiles	ETS1.A ETS1.B	MS.ETS1-1 MS.ETS1-2	- Structure & Function - System & System Models	- Planning and conducting investigations. - Constructing explanations and designing solutions. - Developing and using models.
Meeting 5: Finish Textiles & Get Feedback	ETS1.A ETS1.B	MS.ETS1-1 MS.ETS1-2	- Influence of Sciences, Engineering, and Technology on Society & the Natural World - Structure & Function - System & System Models	- Asking questions and defining problems. - Planning and conducting investigations. - Developing and using models. - Constructing explanations and designing solutions. - Obtaining, evaluating, and communicating information.
Meeting 6: Invention Extension	ETS1.A ETS1.B	MS.ETS1-1 MS.ETS1-2	- Influence of Sciences, Engineering, and Technology on Society & the Natural World - Structure & Function	- Developing and using models. - Asking questions and defining problems. - Constructing explanations and defining solutions.

Standards alignment conducted by graduate students at Boston College's Lynch School of Education

Electronic Textiles
Next Generation Science Standards - High School

Meeting	Core Ideas	Engineering Standards	Cross-Cutting Concepts	Practices
Meeting 1: Invention Introduction	ETS1.A ETS1.B	HS.ETS1-3	Structure & Function	- Asking questions and defining problems. - Constructing explanations and designing solutions. - Obtaining, evaluating, and communicating information.
Meeting 2: Batteries 101	ETS1.B		- Influence of Sciences, Engineering, and Technology on Society & the Natural World - Cause & Effect - System & System Models	- Asking questions and defining problems. - Planning and conducting investigations - Constructing explanations and designing solutions. - Obtaining, evaluating, and communicating information.
Meeting 3: Copper Tape Designs	ETS1.A ETS1.C	HS.ETS1-1	Influence of Sciences, Engineering, and Technology on Society & the Natural World	Asking questions and defining problems.
Meeting 4: Sewing & Electronic Textiles	ETS1.A ETS1.B	HS.ETS1-2 HS.ETS1-3	- Structure & Function - System & System Models	- Planning and conducting investigations - Constructing explanations and designing solutions. - Developing and using models.
Meeting 5: Finish Textiles & Get Feedback	ETS1.A ETS1.B	HS.ETS1-1 HS.ETS1-3	- Influence of Sciences, Engineering, and Technology on Society & the Natural World - Structure & Function - System & System Models	- Asking questions and defining problems. - Planning and conducting investigations. - Developing and using models. - Constructing explanations and designing solutions. - Obtaining, evaluating, and communicating information.
Meeting 6: Invention Extension	ETS1.A ETS1.B	HS.ETS1-2 HS.ETS1-3	- Influence of Sciences, Engineering, and Technology on Society & the Natural World - Structure & Function	- Asking questions and defining problems. - Developing and using models. - Constructing explanations and designing solutions.

Breakdown of lessons:

1. Invention Introduction

Introduction to invention and JV InvenTeams. Students do warm-up activities and discuss invention. Students play “Four Corners” to help the educator assign diverse teams.

2. Batteries 101

Students learn about batteries and the flow of electricity. They undertake a penny battery project.

<https://lemelson.mit.edu/resources/curricula>

For more information, contact info-lemelson@mit.edu

3. Copper Tape Designs

Students practice building a simple circuit using copper tape and surface-mount LEDs in their guides.

4. Sewing & Electronic Textile Activity

Students watch a sewing tutorial and practice sewing using thread. They design an electronic textile project and begin sewing their project.

5. Finish Textiles & Get Feedback

Students continue sewing their electronic textile project. They brainstorm a new invention using their new skills in the latter half of the meeting. Optional meeting(s) between 4 and 5
Educators can learn how to use Arduino, an open source electronics platform of hardware and software, then they can teach students how to use it.

6. Invention Extension

Students conceptualize a new invention in small teams using minds-on and hands-on skills from this unit.

Materials: [Link to List](#)

