



Project Overview:

In this TI-Innovator project, students are given the challenge to design and build a digital mood ring using a pipe cleaner that fits snugly on their finger. Placement should be similar to any ring worn on the finger. Students should be sure the flat part of the temperature sensor is touching their skin.

Note: This project is considered the entry point for the “STEM Projects using TI-Innovator™ Technology”. It is strongly suggested that if your students do not have much familiarity with the coding on the TI calculator, they start with this project to build skills and confidence, and then progress to more complex projects like the Pet Car Alarm, or Smart Water projects.

Students will accomplish the following Student Tasks as they design a digital mood ring:

- ✓ Write a program that displays a text message on the calculator using the Disp command.
- ✓ Write a program that explores the different colors produced on the Hub RGB LED by setting the red, green and blue components with the COLOR command.
- ✓ Write a program that reads and displays your skin temperature every second when the sensor is attached to your finger. Do this by reading the temperature in a For loop with a Wait, then use the Disp command to display the value read from the sensor.
- ✓ Write a program that sets at least three different colors depending on your skin temperature. Use the Disp command to display the mood each temperature represents.
- ✓ Use your creativity to modify the ring and the program to make a better mood ring!

Compatible TI Technologies and Materials:

The Mood Ring project is compatible with the following technologies:

- TI-Nspire™ CX Handhelds, or
- TI-84 Plus CE calculators, and
- TI-Innovator Hub (sketch vs. 1.3) (1 per group of 2-3 students)
- *Optional-* TI-Nspire Teacher Software, TI-Nspire Navigator Software or TI-Connect CE computer software (to lead and guide students through typing code in to the calculators)

In addition to the above TI technology, the following materials are also required:

- Temperature Sensor (1 per group of 2-3 students)
- Cellophane tape
- Colored pipe cleaner, or chenille stem
- A mood to be measured!

For more information on the TI-Innovator and accessories technology required, visit <https://education.ti.com/en/products/micro-controller/ti-innovator?category=accessories>



Standards:

NGSS 3-D Standards:

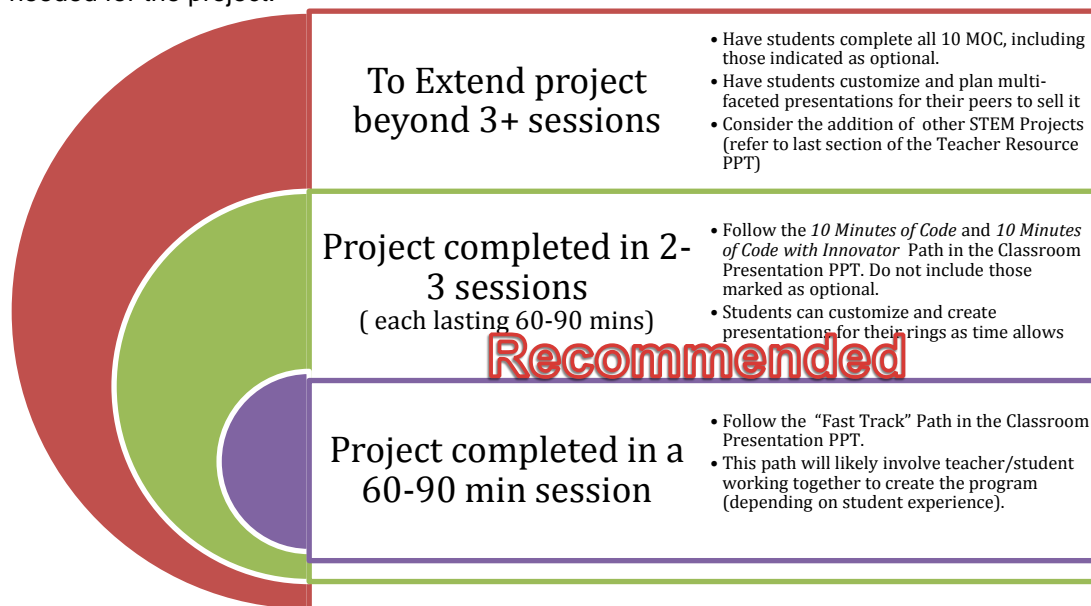
- MS-PS1-1 Matter and its Interactions
 - PS1-A Structure and Properties of Matter- solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals)
- Science and Engineering Practice:
 - Developing and using Models
 - Develop a model to predict and/or describe a phenomenon
- Crosscutting Concept:
 - Within a natural system, the transfer of energy drives the motion of matter

Recommended Grade Level and Experience:

- Introductory level project accessible to both Middle and High school students.
- No prior coding experience required, although familiarity with the TI graphing calculator(s) is essential.

Pacing Guide:

The project can be adapted for a variety of time lengths and environments including, but not limited to, after school clubs, project-based STEM camps, in-class special projects, etc. Depending on the duration and number of planned working sessions designated for this project, it can be completed in a single 60-90 minute session, or can be broken out into several after school working sessions. If students do not have much previous experience with coding, the teacher may choose to give them parts of the program(s) to modify, to reduce the amount of class time needed for the project.





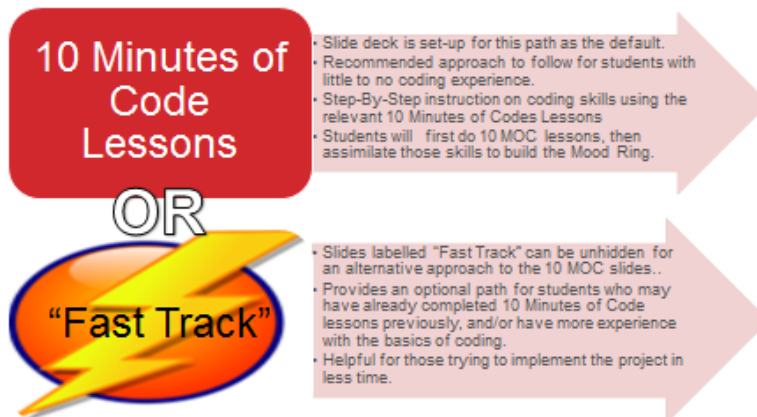
Project Outline, Description of Student Tasks, and Classroom Presentation:

The following slides have been taken from the **Mood Ring Classroom Presentation PPT**. The Classroom Presentation PPT is designed to be used in the classroom/camp to guide students through the tasks they will complete. Although it is strongly recommended that students begin with 10 Minutes of Codes lessons identified in the presentation, also note that there are optional hidden slides labelled “Fast Track” to offer an alternative path if students already have a basic understanding of coding, and do not necessarily need the instruction provided in the 10 Minutes of Code lessons.

1: Project Overview and Intro to Programming <ul style="list-style-type: none">• Overview• Supply List• Classroom Presentation	2: Introduction to the TI-Innovator Hub <ul style="list-style-type: none">• Classroom Presentation	3. Input and Output <ul style="list-style-type: none">• Exploring Sensors:<ul style="list-style-type: none">• Brightness• Temp Sensor
4. Putting it all together: DIY Mood Ring <ul style="list-style-type: none">• Students assimilate the skills learned, and create their own digital mood ring.• Extensions/Get Creative!	5. Presentation: Sell your product (optional) <ul style="list-style-type: none">• Personalize your product• Create a presentation to sell your unique design to your classmates	6..Completed Sample code <ul style="list-style-type: none">• Sample program(s) for DIY: Mood Ring• Additional Coding Reference



Note to the Teacher- This slide deck offers two different paths for the Classroom Presentation:





1. Project Overview and Introduction to Programming

Summary: Students are acquainted with the Mood Ring project and the graphing calculator platform. It is recommended that students work through the designated 10 Minutes of Code lessons to build a foundation in basic coding skills. Note that there is also a “Fast Track” alternative slide path that instead gives “Student Tasks” that can be used to shorten the classroom presentation. If students do not have much experience with coding, this path is not recommended.

- ✓ Have students complete the following Units and lessons from the *10 Minutes of Code*. This should take students around 60-90 minutes to complete, but can be less if students don't complete the optional lessons

- **For TI-84 technology:** <https://education.ti.com/en/activities/ti-codes/84/10-minutes>

- Unit 1: Program Basics and Displaying on the Screen
 - SB 1: Using Program Editor and Syntax
 - SB 2: Editing the Programs Clearing the Screen
 - SB 3: Output to the Home Screen *(optional)*
 - Application: Create a Title Screen *(optional)*
- Unit 3: Conditional Statements (If...)
 - SB 1: Conditions and the If Statements
 - SB 2: If...then...end and compound conditions
 - SB 3: If...then...else statements *(optional)*
- Unit 4: Repetition
 - SB 1: For...Next...statements

- **For TI-Nspire CX technology:** <https://education.ti.com/en/activities/ti-codes/nspire/10-minutes>

- Unit 1: Program Basics
 - SB 1: Introducing the Program Editor
 - SB 2: Arguments and Expressions
- Unit 3: Conditional Statements
 - SB 1: Request and If
 - SB 2: If... Then... Statements
 - SP 3: If...Then...Else...Statements
- Unit 4: Repetition
 - For...Next...Statements

2. Introduction to the TI-Innovator Hub

Summary: Students are acquainted with the TI-Innovator Hub. Students will create and execute a program using COLOR command to display different colors using the Red-Green-Blue LED

- ✓ Have students complete the following Units and lessons from the *10 Minutes of Code for the TI-Innovator Hub*. This should take students around 90 minutes to complete, but can be less if students don't complete the optional lessons



- **For TI-84 Plus CE technology:** <https://education.ti.com/en/activities/ti-codes/84/10-minutes-innovator>
 - **For TI-Nspire CX technology:** <https://education.ti.com/en/activities/ti-codes/nspire/10-minutes-innovator>
 - Unit 1: Getting Started with TI-Innovator Hub
 - SB 1: Your first program!
 - SB 2: Input and Color
 - SB 3: Request/Input and Sound (optional)
 - Application: Traffic Light (optional)
 - Unit 2: For Loops with TI-Innovator Hub
 - SB 1: Blink the Light
 - SB 2: Loop Through Colors
 - SB 3: Loop through the musical notes (optional)
- ✓ (optional) Science background slides in the Teacher Resource PPT contain information/web resources on the electromagnetic spectrum and how the eye perceives color if you choose to review this with students, as an extension to the coding instruction.

3. **Input and Output- Using Brightness, and Temperature Sensor**

Summary: Students are acquainted with using the internal Brightness sensor on the Hub as well as how to connect an external Temperature sensor.

- ✓ Have students complete 10 Minutes of Code Unit 3 for the TI-Innovator Hub. This should take students around 45 minutes to complete.
- **For TI-84 Plus CE technology:** <https://education.ti.com/en/activities/ti-codes/84/10-minutes-innovator>
 - **For TI-Nspire CX technology:** <https://education.ti.com/en/activities/ti-codes/nspire/10-minutes-innovator>
 - Unit 3: BRIGHTNESS, IF and WHILE with TI-Innovator Hub
 - SB 1: Brightness measurements
 - SB 2: Brightness & Light with IF, WHILE (optional)
 - SB 3: Brightness and Color (optional)

4. **Putting it all Together: DIY Mood Ring**

Summary: Students will now assimilate the coding skills learned to write a program, and create their own digital mood ring.

- ✓ Have students write a program that sets at least three different colors depending on your skin temperature. Use the Disp command to display the mood each temperature represents.
- Teacher Resource PPT contains planning templates students may find helpful to use when planning and writing their program code.
 - Sample code has been provided in the Classroom Presentation PPT to help remind students of commands learned in the 10 Minutes of Codes lessons.



- There are ‘Hints’ slides provided if students are struggling.
- Extension slide presents additional challenges for students.

5. **Presentation: Sell your product! (optional)**

Summary: If time allows, encourage students to get creative, allowing them to customize their products, as well as creating a presentation to “sell it” to their peers. It is always good practice for students to speak in front of their peers, and make a persuasive presentation.

- ✓ Have students get creative and further “personalize their ring designs. Make sure to have additional supplies available including beads, gems, various colors of pipe cleaners, etc.
- ✓ Have students “sell it!” and present their rings for sale to their classmates, emphasizing the uniqueness of their creation, and the functionality of how it works.

Description of Additional Teaching Resources & Lesson Materials:

Title	File Format	Intended Audience	Description
Mood Ring Classroom Presentation	PPT	Student	Used by teacher to Lead students through the flow of the project, 10 Minutes of Codes lessons, and/or tasks.
Mood Ring _Student	DOC/ PDF	Student	Student handouts are technology specific and will include sample code snippets for students.
Teacher Notes (you are reading these now!)	PDF	Teacher	Essential guide for teaching the activity.
Mood Ring Teacher Resources	PPT	Teacher	Additional resources for the teacher to prepare, and teach the project including sample programs,



			background content
Sample Program(s) for completed project code.	TNS .8xv	Teacher	Completed programs ("answers" for teacher's reference)

Additional Web Resources and References:

- Reference on how eyes perceive color
 - <http://www.cyberphysics.co.uk/topics/light/colorAddition.html>
- Reference on Color Blindness and Traffic Signals
 - <https://midimagic.sgc-hosting.com/sigvison.htm>
- Accessible Pedestrian Signals for the blind
 - http://apsguide.org/chapter_overview.cfm
 - http://www.apsguide.org/chapter4_walkindication.cfm
- Use of sensors in traffic control systems
 - <https://www.youtube.com/watch?v=aMBYXBgxBRs>

If you are interested in other STEM projects using TI-Innovator, check out these related projects:

Suggested Sequence of TI STEM Projects

