Invention Engine Lessons Unit 3

Looking for trouble

Teacher guide

Invention Engine

The fun of inventing is the journey

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II. Teaching using Invention Engine

Welcome! Thank you for choosing Invention Engine!

In this unit, your class will undertake a project. The project journey is rewarding because it gives students the opportunity to investigate in depth worthwhile interests, solve relevant problems and represent significant findings through their inventions.

There are no set projects for this unit, to allow students to dive deep into solving a problem of their choosing. The suggested time for the project is 6-8 weeks adjustable based on class schedule and the complexity of the projects.

In this unit, students will continue to develop a robust process for engineering, making, tinkering, and inventing, whilst developing advanced coding skills.

Importantly, during this unit the journey of inventing will nurture a wide range of 21st-century skills such as critical thinking, creativity, collaboration, adaptability, problem-solving, communication, technological literacy, ethical considerations, project management, and innovation. These skills are increasingly important in today's fast-paced and technology-driven world, making design thinking, coding, and engineering valuable educational and professional pursuits.

Tip: In computer science, engineering, and design thinking, there are many ways to solve a problem. Encourage students to develop their own solution and approach.

III. Class culture

Foster a shared culture that encourages creativity and celebrates generating ideas.

Declare that in your class, we (as a class) embrace challenges, praise effort, display persistence, focus on the process not the result, seek feedback and see failure as an opportunity to grow.

Remind students that learning is supposed to feel uncomfortable. Provide your own examples. It is brave to try new things, and to learn new skills.

IV. Project work

A project is an extended study of a topic. The study is an investigation into various aspects of a topic that is of interest to the student.

The aim of the project is to engage students in hands-on, real-world projects that are designed to help them learn key concepts and skills while solving complex problems.

You may choose to deliver the concepts that are required to connect the project to the curriculum first and then let students develop the concepts further. This approach supports students in getting the basic skills and project works to apply the skills in meaningful contexts.

Projects are a great way to integrate multiple subjects or disciplines. This helps students see the connections between different areas of knowledge to find solutions to a problem.

A. Setting the course

1. Choose your own adventure

You can choose to encourage students to find their own projects. This, supports students to take charge of their learning and pursuing a subject that is interesting to them.

It may look like this:

Project Title: "Tech for Good: Innovate for Impact"

Project Overview: In this project, you will have the opportunity to identify a real-world problem or challenge that you are passionate about and that you can solve inventing a solution using Invention Engine.

Use the Student Invention Engine Journal to design, code, and prototype a solution to address the problem. Throughout the project, you will also consider the ethical, social, and environmental implications of your solution.

2. Set a theme or direction

An alternative approach to teaching this unit is to explore solutions while keeping to a particular curricular theme.

When setting a theme for the project, it is helpful to give it a title and a direction or prompt.

When developing a direction or prompt, remember that it should be clear, concise, and ambiguous; that is, it leaves ample room for students to take several different directions and approaches.

Seek inspiration from:

- field trips! Visit an elderly home, a nursery, a farm, etc
- search the newspapers for a specific topic; climate change, homelessness, food security, etc.
- A book or a movie. For example, as a class watch 'The boy who harnessed the wind' and find alternative solutions that may have helped that community.

B. Getting started

Whether students are pursuing their own interests in a project, or choosing a project in line with the set theme, it is a good idea for students to develop a project proposal. This ensures that that the curricular elements of the unit are being met.

When accepting a project consider:

a) Curricular needs

- Ensure that the project aligns with the learning objectives and curriculum standards of the subject you're teaching. The project should offer opportunities for students to apply and deepen their knowledge, skills, and understanding.
- Define clear and achievable objectives for the project. What do you want students to learn or accomplish through this project? Objectives could include mastering specific concepts, developing skills, or applying critical thinking.

b) Relevance

- Strive for projects that connect to real-world scenarios or issues. This makes the project more engaging for students as they see the practical relevance of what they're learning.
- Consider the interests, passions, needs and learning styles of your students. A project that resonates with them is more likely to capture their attention and motivate their participation.
- Encourage students' creativity and innovation by designing projects that allow for multiple approaches and solutions.
- Consider the diverse learning needs of your students. Provide options for students to approach the project in ways that suit their strengths and preferences.

c) 21st century skills

- Look for projects that present challenges or problems to solve. Problem-solving tasks encourage critical thinking, creativity, and innovative solutions. Think about how the skills, knowledge, or experiences gained from the project will contribute to students' long-term growth and learning.

- Design projects that require students to collaborate, share ideas, and communicate effectively. Group projects or tasks that involve presenting findings can enhance teamwork and communication skills.

d) Constraints

- Projects often begin with problem statements. If the project is to solve a problem consider that the problem needs to be solvable with the resources the students have at hand.
- Assess the availability of resources, materials, and equipment needed for the project. Ensure that the project is possible within the constraints of your classroom and school environment.
  - Consider the time available for the project. The project should be achievable within the allotted timeframe without overwhelming students.
  - Consider any ethical, social, and environmental implications of the project. Ensure that the project promotes positive values and does not offend or harm any individuals or groups.
  - Ensure that the project is inclusive and accessible to all students, regardless of their background, abilities, or experiences.

C. Project ideas

Here are some ideas for projects:

- Developing a low-cost, easy-to-build playground for a local park.
- Designing a pedestrian-friendly route to school, complete with safety measures.
- Designing a device that reminds people to maintain good posture while working or studying.
- Creating a game that encourages physical activity through gamification.
- Designing an interactive educational game to teach younger students about a specific subject.
- Developing a simple communication tool for individuals with speech disabilities.
- Creating a device to help visually impaired individuals
- Creating a system to automatically turn off lights and electronics when not in use.
- Designing a bird feeder with built-in protection from squirrels and other pests.
- Creating a shelter for stray cats or dogs in the community.
- Designing a device to alert people about potential natural disasters.
- Designing a wheelchair-friendly ramp for a local building that lacks proper accessibility.
- Creating tools to assist people with limited mobility in daily tasks.

The key is to choose problems that are suitable in scale and complexity for students, while still being meaningful and impactful.

V. Suggested delivery

When inventing, students should follow the steps in the Invention cycle and record their work in the Invention Journal.

Journaling is an important part of the process because it helps students document the process of inventing. The journal and the invention are both; proof of the learning journey and the outcome achieved.

Week 1: Introduce students to new coding concepts and new bits. Use this opportunity to review some of the other bits, and previously learnt coding knowledge.

Week 2: Problem Identification and Research

Introduce the project by discussing the importance of solving real-world problems through innovation and technology.

Engage students in a brainstorming session to find potential problems they are passionate about.

Tip

Brainstorming in group or solo?

Our creativity seems to peak when we alternate between conditions. Solo brainstorming allows the brain to wonder however, working with a team supports connections to form and new information from other people to inspire more ideas.

Students then can conduct research and gain a deep understanding of the chosen problem and its impact.

Students should present their chosen problem, the reasons for their selection, and initial research findings to the class or to you.

Week 3: Solution Design and Planning

Revisit the steps in the Student Invention Engine Journal. If necessary, revisit Invention Engine Unit 2.

Encourage students to collaborate and share ideas with peers to enhance their solutions.

Ask student to spend a little more time sketching and conceptualising their solution. This will help students have a clear idea of their solution before they build it.

Week 4: Coding

Provide coding guidance and encourage students to test their code using the bits before they start attaching the bits to their cardboard invention.

Week 5: Building

Students should only move on to building their cardboard prototypes once their code is working as intended.

Help students in building physical invention and combining their bits with the cardboard.

Week 6-7: Solution testing and iterating

Encourage continuous testing and iteration as students refine their inventions.

Encourage students to document their development process, including challenges faced and changes made in their journal.

Week 8: Presentation and Showcase

Students create presentations, posters, and showcase their inventions as solutions to a problem.

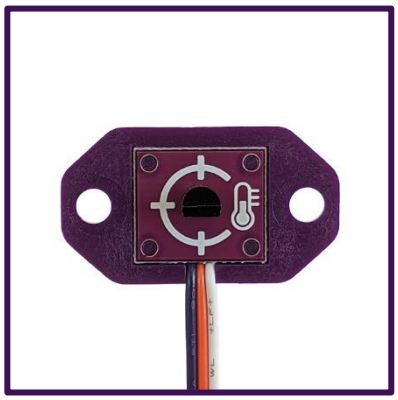
Organize a class showcase event where each student presents their project to the class, explaining the problem, solution, and the technology used.

Encourage students to provide feedback and ask questions about their peers' projects.

VI. New bits in this unit

Encourage students to look at the bits datasheets for more information on the following bits:

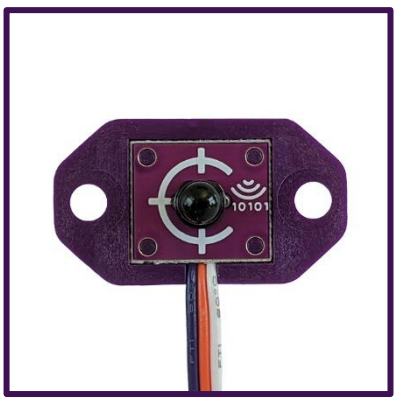
1. The temperature sensor bit



The temperature sensor is an input bit that reads the temperature of the air surrounding the sensor.

Generally, the temperature sensor is used in a conditional statement. For example, if the temperature is higher than 25°C then turn the light on.

2. The IR transmitter bit

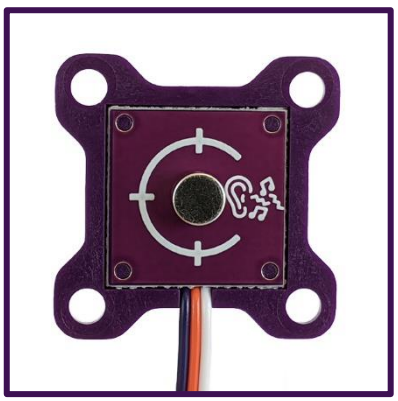


The IR transmitter bit is an output bit that sends data via an infrared (IR) light signal. The IR receiver bit is required to receive the data.

The IR transmitter bit almost looks identical to the LED bits however, the IR LED has a blue tint

When programming the infrared transmitter bit, it can send a constant (or fixed number) or a variable.

3. The noise sensor bit



The noise sensor is an input bit that detects loud sounds.

When a loud sound is detected the red LED on the noise sensor bit briefly turns on. During this brief time the noise sensor bit also sends the hub a signal that a loud sound has been detected.

The noise sensor is a sensing block so it must be used with control blocks.

4. The motor bit

The motor bit is an output bit that rotates an output shaft continuously. For precise angular movements refer to the servo bit.

The motor bit can rotate the output shaft within a range of speeds (1 to 10) in either a clockwise or anticlockwise direction.

VII. Assessment

Assessment will be based on multiple components:

- Problem Identification and Research (10%)
- Solution Design and Planning (15%)
- Prototyping and Coding (20%)
- Solution Development and Testing (25%)
- Presentation and Showcase (20%)
- Collaboration and Participation (10%)

A. Suggested rubric

Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)
Problem Identification	The problem is clearly defined and its significance is well-explained. Extensive research shows a deep understanding of the issue.	The problem is well-defined with an explanation of its importance. Adequate research demonstrates a good understanding of the issue.	The problem is defined with some explanation of its importance. Research is present but lacks depth.	The problem is vaguely defined with limited explanation. Research is minimal and lacks thoroughness.
Solution Design	The solution is highly innovative, creative, and well thought-out. It addresses the problem comprehensively.	The solution is innovative and well-designed, directly addressing the problem.	The solution is practical and reasonably designed to address the problem.	The solution is somewhat practical but lacks thorough design.
Prototyping and Coding	A functional prototype is developed, showcasing advanced coding skills. Code is clean, efficient, and effectively contributes to the functionality of the prototype.	A functional prototype is developed, showcasing proficient coding skills. Code is well-organized and contributes to the functionality of the prototype.	A prototype is developed with basic coding skills evident. Code is somewhat organized and functional.	A basic prototype is developed, with limited coding skills evident. Code may be disorganized or partially functional.
Solution Development	The solution is thoroughly developed, tested, and refined. Iterations are well-documented,	The solution is developed and tested, with some iterations documented.	The solution is developed and tested to some extent, with limited	The solution is minimally developed and testing is limited.

Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)
	showing clear progress.		documentation of iterations.	Iterations are unclear.
Reflection	Reflection is insightful and comprehensive, discussing lessons learned, personal growth, and areas of improvement.	Reflection demonstrates a good understanding of the project journey, highlighting key insights and areas for growth.	Reflection discusses the project journey with some depth, mentioning insights and potential improvements.	Reflection is brief and lacks depth, offering limited insights into the project experience.
Presentation and Showcase	Presentation is engaging, well-organized, and effectively communicates the problem, solution, and development process.	Presentation is clear and organized, effectively conveying the problem, solution, and development process.	Presentation is mostly clear and organized, but some aspects are not effectively communicated.	Presentation lacks organization and clarity in conveying the problem, solution, and development process.
Collaboration and Participation	Actively contributed to group discussions, supported peers, and effectively collaborated throughout the project.	Collaborated well with peers, participated in discussions, and contributed positively to the group.	Participated in discussions and group activities, but collaboration could be more proactive.	Minimally participated in group discussions and activities, limited collaboration.
Overall Quality	The project demonstrates exceptional effort, creativity, and execution, exceeding expectations.	The project demonstrates good effort, creativity, and execution, meeting expectations.	The project demonstrates satisfactory effort and execution, with room for improvement in certain areas.	The project demonstrates limited effort and execution, requiring significant improvement.

Criteria	**Excellent (5)**	**Good (4)**	**Satisfactory (3)**	**Needs Improvement (2)**
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