TECHNOLOGY AND THE SKILLED TRADES, GRADE 9, TAS1O PROJECT PLAN 2026

The Ontario Science Centre and the Ontario Council for Technology Education, with support from the Ontario Ministry of Education, are pleased to present this project plan for Technology and the Skilled Trades (TAS1O).

Project Plan Introduction

This resource is designed to support educators in implementing TAS1O: Technology and the Skilled Trades in accordance with the expectations outlined in the 2024–25 Technological Education curriculum. The learning experiences herein reflect the curriculum's emphasis on hands-on, experiential learning, technological problem solving, and real-world applications of technology.

In this course, students will engage with the Engineering Design Process (EDP) and related skills, as well as fundamental technological skill development, the impacts of technology, and career exploration. Through practical, project-driven activities, learners will explore the engineering design process, apply safe and effective use of tools and technologies, and develop foundational technological skills that support effective problem solving across the 10 broad-based technology areas.

This resource includes structured activities that align with course expectations and support students as they:

- apply the engineering design process to design, build and evaluate solutions to authentic real-world challenges
- develop technical and communication skills using appropriate tools, equipment and techniques
- examine the impacts of technology on society, the environment and the economy
- investigate career opportunities in technology and the skilled trades, including education and training pathways
- integrate STEM knowledge with hands-on design, fabrication and innovation practice

The sequence of tasks will encourage learners to connect classroom learning to real-world contexts, build confidence in technological proficiency, and consider how their work contributes to sustainable, ethical and effective solutions. The aim is to enable students to see themselves as capable contributors to technological innovation, skilled practice and future career pathways in a rapidly evolving world.

The Ontario Science Centre (OSC) and the Ontario Council for Technology Education (OCTE) remain committed to providing educators with curriculum-aligned, practical resources that support meaningful implementation of TAS1O across diverse learning environments.

All projects in this resource are grounded in a consistent engineering design process framework. This approach will allow all students, in any broad-based technology (BBT) area, to develop curiosity for BBT, engage in a structured cycle of understanding, ideation, iteration and prototyping. Through this process, learners will apply appropriate tools, terminology and safety practices, while developing the fundamental technological concepts and skills expected across all BBT programs.

Included in this document are sample activities designed to serve as a practical framework for classroom use. Given the broad scope of the TAS sectors, this resource is intentionally flexible. It can be implemented as written or adapted to align with specific classroom equipment and student learning goals.

For a broader library of project ideas, educators are encouraged to visit the Ontario Council for Technology Education website at **OCTE.ca**.

Cycle 1: Technology, Society and Sustainability

In this cycle, students will pull back the curtain on the technology that surrounds us — from the gadgets in our pockets to the industrial tools in our shops. By investigating the life cycle of items like cellphones, stand mixers or cordless drills, students will uncover the environmental and social costs of modern manufacturing. To share these hidden impacts, students will choose their medium: designing a digital infographic, mapping a physical storyboard or building an art installation from upcycled tech materials.

The journey will continue with the "Mobile Service Challenge," where students will use the engineering design process to build a service on wheels. Students will be able to design anything from cuisine hubs to mobile repair clinics, ensuring their service is accessible, ethical and reflects their own community's needs.

Students will then connect with a job from their "tech classroom" that has a connection to environmental waste, climate change or recycling within the area of a BBT. Students will share their findings in a career-fair-style presentation. This will increase students' thoughtfulness around consuming and purchasing products that can be neither reused nor recycled.

Cluster 1: The Secret Life of Tech

Technology is everywhere, but what's actually inside the gadgets we use? In this activity, students will investigate the life cycle of a common tool — whether it's a cellphone, a kitchen stand mixer or a cordless drill. Students will consider the environmental factors and the evolution of technology. They'll follow the journey from mining the rare earth minerals needed for production to the mountains of e-waste left behind when these items are discarded.

Resource:
The Secret Life of Tech

Lesson Overview

Waste happens everywhere. For example, shipping containers are widely used in global trade. When they reach their final destination, it is often cheaper to leave them than return them. As a result, architects and builders have begun repurposing them into homes, bunkies, offices and community spaces.

Hair salons create thousands of kilograms of waste a day. Hair, hair colour, foils and other materials can be repurposed. Construction companies discard materials at a job site. What materials are disposed of every day in your local school and community e-waste disposal or recycling programs? How might we identify and extend the lifespan of a technological device?

Students will:

- research the raw materials used in a chosen tool (for example, lithium in drills, stainless steel in mixers, cobalt in phones) to identify environmental or social impacts
- investigate and evaluate their local school and community e-waste disposal and recycling programs to analyze how local actions impact the global e-waste crisis
- present their findings and impacts of technology on the environment and society
- identify and explain at least one strategy to extend the lifespan of a technological device

Overall Expectations

A1. Initiating and Planning
A2. Designing and Performing
B1. Fundamentals of Technological Development
B2. Impacts of Technology

Lesson Plan

Lesson 1: Introduction Phase (1-2 class periods)

- Students will research what becomes e-waste in a particular BBT.
- Students will consider the questions: What is sent to e-waste facilities? Why can't it be used? Where does it go? What is the impact of the e-waste or waste?
- Students will consider connecting with the local e-waste or waste in their community to discuss what is recycled, how it is recycled, the costs incurred for recycling, and some of the recycling or upcycling challenges.

Lesson 2: Research Phase (2 class periods)

- Students will describe the different types of recycling and upcycling within the BBT.
- Students will identify what tools or other resources or materials are not recycled or upcycled.
- Students will collect ideas and display them in a visual format.

Lesson 3: Design Phase (2-3 class periods)

- Students will identify what can be upcycled.
- Students will brainstorm and sketch ideas using the engineering design process.
- The teacher will review and give feedback before students move to the next step of the engineering design process.

Lesson 4: Prototyping Phase (3 class periods)

- Students will develop and create prototypes of designs.
- Students will use cardboard, wooden craft sticks, iterative drawings, loose part materials and any other tools to create prototypes.

Lesson 5: Testing and Feedback (1-2 class periods)

- Students will present ideas to classmates or community partners to receive feedback on finished prototypes.

Cluster 2: The Mobile Service Challenge

In this cluster, students will explore the environmental, social and ethical impacts of mobile technology and services through the lens of sustainability. Using the "Food Truck" as a familiar and engaging entry point, students will analyze the life cycle of mobile service units, identify efficient and accessible design features, and examine how skilled trades are evolving to address climate change and community needs. Throughout the cycle, students will apply the engineering design process, communicate ideas through technical documentation and digital media, and connect their hands-on learning to real-world career pathways.

Lesson Overview

This project will introduce Grade 9 students to a variety of BBTs and emphasize the use of the engineering design process. Students will design a mobile service that solves a real-world problem within a community context. The task will integrate design thinking, safety awareness, basic cost estimation, spatial planning and communication skills.

Students will:

- design branding for a mobile service, such as an e-waste collection hub, mobile tech repair lab, or a pop-up tool library
- use a variety of digital or physical tools to design a scaled floor plan for a mobile service unit or pop-up shop
- develop a plan for startup costs (vehicle or trailer purchase, tools required and business licences) and operational expenses
- justify their choice of power sources (for example, solar arrays, battery banks) and interior materials, prioritizing sustainability for their mobile operation
- participate in a “Service Simulation” where peers act as clients with specific needs

Overall Expectations

A1. Initiating and Planning
A2. Designing and Performing
A3. Analyzing and Refining
B1. Fundamentals of Technological Development
B2. Impacts of Technology

Lesson Plan

Lesson 1: Identify the Problem (1 class period)

- The teacher will define the initial problem that students need to consider when designing a mobile service.
- Students, with help from the teacher, will identify the key components and constraints of the project.

Lesson 2: Generate and Evaluate Ideas (2 class periods)

- Students will research needs within their community that a mobile service business could support.
- Students will brainstorm potential solutions and start developing concept drawings.

Lesson 3: Detailed Design and Layout (2-3 class periods)

- Students will use technical drawing techniques to represent their ideas and prepare for the next step.
- Students will use CAD software, sketch or other design tools to create a 3D model of their mobile service vehicle.

Lesson 4: Financial Considerations (2 class periods)

- Students will calculate the financial costs of starting and maintaining a successful mobile service business.

Lesson 5: Sustainable Energy (1 class period)

- Students will investigate sustainable energy sources that will allow mobile service to sustain an off-grid, reliable operation.

Cluster 3: The Green Career Expo

This culminating cluster will shift students into thinking about professional roles as they investigate how skilled trades are evolving to solve global environmental challenges. Students will research a specific sustainable trade or technology pathway and present their findings in a simulated career expo.

Lesson Overview

In this project, students will investigate a technology-related career connected to sustainability and emerging technologies. Through research, analysis and visual communication, students will explore how technology careers contribute to environmental sustainability, climate change mitigation or responsible resource management. Students will identify the various pathways and skilled trades opportunities and consider how to enter a particular pathway.

Students will:

- research a sustainable skilled trade or technology-related career, including pathways (apprenticeship, college or university, workplace), required skills and earning potential
- analyze how the chosen career contributes to environmental sustainability, climate change mitigation or resource conservation
- create a visual aid using correct technical terminology and effective visual communication
- participate in a role-play career expo, explaining their career choice, answering questions and informing their peers of its relevance and importance

Overall Expectations

A1. Initiating and Planning
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B1. Fundamentals of Technological Development
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B3. Careers and Pathways in Technology and the Skilled Trades

Lesson Plan

Lesson 1: Technology Research (1 class period)

- Students will select a technology connected to sustainability or emerging technologies.
- Students will research and answer specific questions related to their chosen piece of technology.
- Students will identify the limitations, restrictions and benefits of their technology in the career sector.

Lesson 2: Sustainability Analysis (1 class period)

- Students will determine whether the technology helps or hinders sustainability within its sectors.

Lesson 3: Technology Case Study (1 class period)

- Students will select one specific technology, system or machine used in this field and explain: Why was it developed, how does it work, and how is it used in industry?

Lesson 4: Career Pathways (1 class period)

- Students will consider three career opportunities related to this technology.
- Students will analyze typical career statistics for each of the careers.
- Students will research the effect this technology has on the labour market.
- Students will identify the various ways to enter the career, from apprenticeship, college, university and workplace pathways.

Lesson 5: Impact on Society and Environment (1 class period)

- Students will determine the use of this technology and if it ultimately helps or hinders society and humanity. Students will explain their position using evidence from research.

Lesson 6: Visual Communication Artifact and Career Expo (3 class periods)

- Students will create a professional visual communication artifact that would be appropriate for a career expo booth.
- Students will participate in a simulated career expo. Each student will act as a professional representing their chosen career and present their display to classmates.

Cycle 2: Critical Thinking, Problem Solving and Researching

Designers and technologists use creative and critical thinking to understand problems and develop effective solutions. Research, experimentation and iteration play a key role in shaping how products, structures and systems are designed, informed by a wide range of perspectives and experiences. Design challenges will provide students with opportunities to explore how ideas evolve through testing and refinement, while considering factors such as user needs, materials, sustainability and real-world constraints. As a result, students will demonstrate their learning by creating, testing and improving solutions that reflect purposeful decision making, thoughtful use of resources and an understanding of real-world constraints.

Cluster 1: School Improvement and Critical Thinking

In this cluster, students will examine everyday challenges within the school environment and explore how the engineering design process can be used to improve spaces, systems or experiences. Students will investigate consumer needs, constraints and existing solutions to develop well-reasoned design proposals for change.

Resource:
School Improvement Design Challenge

Lesson Overview

In this project, students transition from observing technology in society to actively applying engineering principles to their immediate environment. Using the 5S system (sort, set in order, shine, standardize, sustain) from lean manufacturing and universal design principles from construction and tech design, students will identify a "pain point" within the school (for example, a disorganized shop, an inaccessible entrance or an inefficient cafeteria layout).

Students will act as “industrial design consultants” to audit the space, interview stakeholders and develop a professional proposal that includes scaled technical drawings, a maintenance and standard operating procedures (SOP) and a sustainability analysis.

Students will:

- use the engineering design process to investigate challenges within the school environment and explore ways to improve spaces, systems or experiences
- connect with members of the school community who apply critical thinking and problem solving
- research existing solutions from a variety of communities that could help inform improvements
- investigate a specific school-based challenge, ideate and evaluate solution ideas and use sketches, diagrams or a prototype or model to represent and revise their solution throughout the design process

Overall Expectations

A1. Initiating and Planning
A2. Designing and Performing
B1. Fundamentals of Technological Development
B2. Impacts of Technology

Lesson Plan

Lesson 1: The 5S Audit and Problem Identification (2 class periods)

- Students will be introduced to the 5S framework.
- Students will discuss how organization affects speed and safety.
- Students will assess an area of the school that needs improvement.
- Students will analyze findings and create a problem statement.

Lesson 2: Client Interviews and Constraints Mapping (1 class period)

- Students will interview a staff member who will serve as their client.
- Students will apply universal design standards to ensure their school improvement works for everyone, regardless of age or physical ability.

Lesson 3: Researching Standards — Accessibility and Ergonomics (2 class periods)

- Students will research the materials necessary for their solution.
- Students will identify the tools needed and the safety hazards associated with them, ensuring their proposal is grounded in real-world construction and manufacturing.

Lesson 4: Ideation, Sketching and Peer Feedback (2 class periods)

- Students will use "thumbnail sketching" and "technical annotation" to visualize solutions and produce three distinct design concepts that address the 5S audit (activity 1) and the client needs (activity 2).
- Students will evaluate concepts to select the one they will move forward with to create their final scale drawing.

Lesson 5: Final Scaled Drawings and Maintenance Plan (3 class periods)

- Students will produce a formal, scaled floor plan of their school improvement proposal in its environment. Students will learn how to use architectural scales, represent objects from a "bird's eye view" (plan view), and provide a clear legend for their 5S organizational features.

Lesson 6: Final "Proposal" Gallery Walk (2 class periods)

- Students will compile audit, research and scaled drawing into a final "school improvement proposal." Students will participate in a gallery walk, where they act as "project managers", presenting their solutions to "stakeholders" (their peers and teachers).

Cluster 2: Sustainable and Responsible Problem Solving

Students will study issues related to environmental impacts in their community. Students will investigate how systems and processes can be redesigned to reduce waste and improve sustainability.

Lesson Overview

Students will act as “environmental design consultants.” Using the principles of green industries and sustainable construction, they will identify a local environmental "pain point" (for example, a lack of pollinator habitats, poor stormwater management in a parking lot, or an "urban desert" lacking shade).

Students will apply the engineering design process to create a functional "green feature" (such as a bioswale, a modular vertical garden or a solar-shaded seating area) that improves both the ecology and the social utility of a community space.

Students will:

- investigate issues related to everyday activities and explore ways to reduce waste and improve sustainability
- analyze how systems, processes and products can be redesigned to achieve more sustainable outcomes using the engineering design process
- research existing practices, policies and strategies that promote sustainability and consider their usefulness in new contexts
- evaluate the effectiveness of their proposed solutions and justify design decisions based on impacts to the environment, society and economy

Overall Expectations

A1. Initiating and Planning
A2. Designing and Performing
B1. Fundamentals of Technological Development
B2. Impacts of Technology

Lesson Plan

Lesson 1: The Eco-Audit and Community Mapping (2 class periods)

- Students will explore the concept of green infrastructure vs. grey infrastructure.
- Students will conduct a "site audit" of the school's exterior or a nearby park.
- Students will use Google Earth or printed maps to identify "hot spots" (areas with no shade or poor drainage).
- Students will deliver an annotated community map and a sustainability problem statement.

Lesson 2: Stakeholder Needs and Environmental Impact (1 class period)

- Students will identify who "lives" in the space (humans, pollinators, local wildlife).
- Students will apply sustainable design standards (for example, using native plants to reduce water waste).
- Students will deliver a "user and nature" chart.

Lesson 3: Researching Sustainable Materials and Methods (2 class periods)

- Students will research "low-impact" materials (recycled composites, permeable pavers, drought-resistant flora)
- Students will identify the specialized tools needed for outdoor installation (for example, transit levels, specialized hand tools) and the associated safety hazards (PPE for outdoor work or heavy lifting).

Lesson 4: Ideation, Sketching and Peer Feedback (2 class periods)

- Students will produce three distinct "green concepts" (for example, concept A: water collection; concept B: pollinator support; concept C: solar integration).
- Students will provide peer feedback, focusing on the environmental return on investment (ROI).

Lesson 5: Final Site Plans and Life Cycle Analysis (3 class periods)

- Students will produce a formal site plan at a 1:100 or 1:200 scale.
- Students will create a life cycle chart for their primary material (answering such questions as: Where did it come from? Where does it go when it breaks?).

Lesson 6: The "Community Pitch" Gallery Walk (2 class periods)

- Students will present a "green proposal" to class.

Cluster 3: Everyday Product Redesign

In this cluster, students will apply the engineering design process to analyze and redesign an existing everyday product. Students will research user needs, materials, fundamental concepts and environmental impacts to develop and refine a product-based solution.

Lesson Overview

Students will select an "everyday object" that is either broken, difficult to use or environmentally harmful. Using the engineering design process, they will perform a "product autopsy" to see how it's made, research the user's physical needs (ergonomics) and develop a refined version.

The result will be a technical design package that includes an "exploded view" drawing and a "sustainable material swap" analysis.

Students will:

- evaluate everyday products to identify problems they are designed to solve, considering user needs, function and environmental impact
- conduct research on materials, manufacturing processes and existing product designs to consider improvements on design and environmental impact
- apply the engineering design process to develop improved product solutions
- create prototypes of their redesigned product and reflect on the fundamental concepts, their effectiveness, usability and environmental impact

Overall Expectations

A1. Initiating and Planning
A2. Designing and Performing
B1. Fundamentals of Technological Development
B2. Impacts of Technology

Lesson Plan

Lesson 1: The Product "Autopsy" and Analysis (2 class periods)

- Students will bring in a simple "pain point" product (for example, a poorly designed manual can opener or a bulky phone case).
- Students will list every component and material it's made of, and identify three specific areas for improvement.

Lesson 2: Ergonomics and User Testing (1 class period)

- Students will be introduced to anthropometrics (measuring the human body).
- Students will measure their hands or reach to determine the "ideal" size for their product's handle or interface.

Lesson 3: Material "Swap" and Sustainability (2 class periods)

- Students will research the original material (for example, ABS plastic) vs. a sustainable alternative (for example, bioplastic or aluminum).
- Students will discuss planned obsolescence vs. durability.

Lesson 4: 3D Ideation and Form Studies (2 class periods)

- Students will create "lo-fi" prototypes using cardboard, clay or foam to test the feel of their redesign.

Lesson 5: Orthographic and Exploded View Drawings (3 class periods)

- Students will understand the standard for manufacturing — orthographic projection — by drawing the top, front and right-side view of their redesigned product to scale.
- Students may also create an exploded view to show how the parts fit together.

Lesson 6: The "Product Launch" Gallery Walk (2 class periods)

- Students will display original objects alongside redesigned drawing and 3D prototype.
- Students will reflect on how industrial designers can make our lives easier based on product improvements.

Cycle 3: Technical Skills, Tools and Fabrication

The objects in our modern world are designed and fabricated using countless materials and processes. Understanding material properties and how to manipulate them using different tools and techniques is essential. During this cycle, students will work through a series of activities that build on previous learning to develop and hone their technical skills.

Cluster 1: Machine Safety

Students will develop an understanding of safe work practices and demonstrate their ability to safely use the tools and equipment in the teaching space.

Resource:
Shop Readiness: Are You Shop Ready?

Lesson Overview

Students will understand and explore what it means to be prepared to go into the shop, kitchen, salon, greenhouse and lab or studio. Students and teachers will reflect on safety questions and case studies to gain a better understanding of the requirement to be "shop ready." Students will understand when and how to wear the appropriate PPE, depending on the task, project, or operation in a tech classroom, based on school board policies and procedures.

Students will:

- explore various processes and gain an understanding of how to protect themselves in the workplace
- work with different materials and tools or equipment that are used in industry
- identify different careers and personal protective equipment in different technological fields
- demonstrate knowledge of their learning environment, which includes identifying equipment and egress routes, listing emergency procedures and general classroom routines

Overall Expectations

A2. Designing and Performing
A4. Following Health and Safety Practices
B1. Fundamentals of Technological Development
B2. Impacts of Technology
B3. Careers and Pathways in Technology and the Skilled Trades

Lesson Plan

Lesson 1: Mindset and General Knowledge (1 class period)

- Students will use the "Shop Readiness: Are you Shop Ready?" presentation to explore the importance of maintaining a safety mindset.
- Students will participate in discussion and self-reflection and examine why safety rules exist.
- Students will understand the importance of knowing their own limitations and identify situations in which they should stop and seek assistance from the teacher.
- Students will complete a brief self-assessment to identify their current understanding of health and safety expectations within the technology classroom.

Lesson 2: Personal Protective Equipment and Materials Safety (1 class period)

- Students will investigate the purpose and appropriate use of Personal Protective Equipment (PPE).
- Students will examine WHMIS symbols, Safety Data Sheets (SDS), and procedures for the safe handling, storage and disposal of materials.
- Students will work through stations and scenarios, determine appropriate PPE and safety precautions for various workplace situations.

Lesson 3: Understanding Safety Rules and Emergency Procedures (1 class period)

- Students will review and demonstrate an understanding of classroom safety rules and emergency procedures.
- Students will examine WHMIS symbols to develop an awareness of material safety.
- Students will identify common safety signs and explain their meanings.
- Students will complete a safety assessment.

Lesson 4: Equipment, Tool and Documentation Safety (1 class period)

- Students will develop safe work habits related to the use of tools and equipment.
- Students will learn how to inspect tools prior to use, identify damaged or locked or tagged-out equipment, recognize the importance of machine guarding, and perform basic pre-operational checks.
- Students will familiarize themselves using safety passports, authorization forms or other documentation processes to track equipment training and safe operation within the classroom.

Lesson 5: Conduct and Teamwork (1 class period)

- Students will examine how one's behaviour influences the safety of themselves and others within technological learning environments.
- Students will discuss and collaborate to demonstrate appropriate conduct by respecting peers, tools, equipment and classroom procedures.

Lesson 6: Shop Ready Case Studies and Sign-Off (1 class period)

- Students will apply their knowledge of health and safety practices to authentic workplace scenarios drawn from the presentation.
- Students will use critical thinking and problem-solving skills to identify hazards, recommend appropriate PPE and safety procedures, and justify decisions using evidence from the course.
- Students will reflect on and receive teacher sign-off indicating they have demonstrated an understanding of the foundational concepts required to be considered "Shop Ready."

Cluster 2: Competency in a Skill

Students will begin to develop a health and safety mindset through the demonstration of fundamental concepts and the use of a variety of equipment, materials and techniques. Please note that comprehensive competency skills are not listed since each broad-based technology subject area has specific health and safety requirements.

Lesson Overview

Students will apply the fundamental concepts to develop hairstyling recommendations based on face shape and hot-tool techniques.

Students will:

- practise techniques to develop competency in a variety of equipment or tools
- design a prototype or service, demonstrating an appropriate selection of materials, equipment and techniques
- investigate and apply a variety of project management strategies to address barriers to successful completion of a project

Overall Expectations

A1. Initiating and Planning
A2. Designing and Performing
A3. Analyzing and Refining
A4. Following Health and Safety Practices
B1. Fundamentals of Technological Development
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Lesson Plan

Lesson 1: Hairstyling Face Shape Planning Worksheet (1-2 class periods)

- Students will become familiar with various face shapes and client scenarios.
- Students will analyze mannequin features and plan an appropriate style.
- Students will sketch the hairstyle and record the tools used.

Lesson 2: Hairstyling Log Sheet (2-3 class periods)

- Students will practise styling techniques on a mannequin.
- Students will use hot tools safely and effectively.
- Students will participate in peer check-in and photo documentation.

Lesson 3: Student Reflection (2-3 class periods)

- Students will complete final styling.
- Students will present and explain styling choices.
- Students will complete reflection and evaluation.

Cluster 3: Consolidation

Students will demonstrate their understanding of technical skills through a self-directed project.

Lesson Overview

Students will demonstrate their understanding of industry practices and technical skills through a self-directed project. Students will use the engineering design process to design and create a table centerpiece with messages encoded for guests to try to solve.

Students will:

- identify project criteria and demonstrate their understanding of safety protocols and procedures
- demonstrate measurement skills by ensuring their project conforms to their proposed prototype plans
- critically analyze their project and reflect on possible alternatives, improvements or both
- identify technical and transferable skills they have demonstrated and investigate career paths that are aligned with these skills

Overall Expectations

A1. Initiating and Planning
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Lesson Plan

Lesson 1: Overview of the Engineering Design Process and Constraints (2 class periods)

- Students will use the engineering design process to evaluate and refine a process or product. In this activity, the focus will be on the engineering design process instead of the final product to allow students to iterate on their designs.
- Students will review the engineering design process and focus on the constraints.
- Students will clearly understand the build and coding portions of the project.
- Students will focus on the process rather than the product, particularly with the iteration and reiteration stages of the engineering design process.
- Students will consider a variety of ways to complete their designs.

Lesson 2: Types of Encoded Messages (2 class periods)

- Students will explore simple encoding schemes, such as Binary, Octal, Hexadecimal, a1z26, Rot13, Caesar Cipher.
- Students will investigate and identify the different types of code.
- Students will consider the different ways each code could be implemented.
- Students will use necessary software (for example, CAD, graphic design) to create designs.
- Students will practise codes to understand which code might work best for their design.

Lesson 3: The Build (2 class periods)

- Students will consider a design for the encoded message. What is the theme, what is the best way to display the message and how will the message and the build connect?
- Students will use tools for measuring or cutting materials (for example, utility knives, scissors, hand saws), drilling tools and fastening supplies (for example, glue, tape, fasteners).
- Students will research the different platforms that can be used to deliver their message.
- Students will consider the different materials that can be used.
- Students will learn and follow any rules regarding materials (for example, no open flames, specific plastics, allergens), size limitations, weight limits and assembly requirements at the event venue.

Lesson 4: Bringing It All Together (2 class periods)

- Students will bring together the code and build.
- Students will use tools and software to create a final design.
- Students will reflect on the iterations and the final design to see improvements.

Cycle 4: Final Design Project and Communication

The final cycle of this course focuses on the transition from conceptual design to professional delivery. Students will have spent the semester learning the "how-to" of specific skills and processes in class: preparing final products, presenting their ideas, organizing their time effectively and using the engineering design process. This cycle will challenge them to apply those skills to solve a complex problem and communicate their solution.

Cluster 1: Design Pitch and Failure Log

Students will develop a prototype, identifying the user problem, material constraints and target audience.

Resource:
Final Design "Design Pitch and Failure Log"

Lesson Overview

Students will explore solutions for their school or community, including designing a prototype, considering sustainability, and developing and presenting a "design pitch and failure log" to an audience. This will foster empathy by understanding the real-world problems in their school or community. Students will identify the transferable skills used and built while working through their solutions.

Students will:

- identify a problem for a specific user and conduct research to develop a solution to address their needs using the engineering design process
- validate their material choices by testing prototypes against user problem requirements and the impact of the design's functional integrity
- communicate their results, insights and key learnings into a pitch

Overall Expectations

A1. Initiating and Planning
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Lesson Plan

Lesson 1: Empathy Phase (1 class period)

- Students will discuss and give examples of some challenges that students may have in their school or community.
- Students will introduce the constraints and considerations students may have to investigate.

Lesson 2: Research Phase (1-2 class periods)

- Students will interview students or people in the community to understand some problems that need to be solved.
- Students will research existing solutions found in other schools and communities to help with solution ideas.

Lesson 3: Design Phase (1-2 class periods)

- Students will brainstorm and sketch ideas for the solution to their product or service.
- The teacher will review sketches for feasibility, effectiveness, sustainability and will help identify transferable skills.

Lesson 4: Prototype and Testing (3-4 class periods)

- Students will design a prototype for their product or service.
- Students will build and test small-scale models or simulations of their designs or services.
- Students will test prototypes with target audience and gather feedback for improvements.

Lesson 5: Presentation and Reflection (1-2 class periods)

- Students will present final designs and prototypes using the pitch criteria.
- Students will incorporate failure log in pitch to demonstrate how they failed forward and used that information to improve their product or service.
- Students will present ideas to classmates or community partners to receive feedback on their design.

Cluster 2: Polished Prototyping

Students will define their design and prepare it for production. They must demonstrate an understanding of materials, techniques and project management skills.

Lesson Overview

Students will use the engineering design process to create a Rube Goldberg machine that requires a complex chain reaction using everyday objects to complete a simple task.

Students will:

- convert their designs into a working prototype
- evaluate the effectiveness of their prototype using qualitative and quantitative methods
- demonstrate a safety mindset and apply necessary project management skills to ensure a safe work environment

Overall Expectations

A1. Initiating and Planning
A2. Designing and Performing
A3. Analyzing and Refining
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B1. Fundamentals of Technological Development

Lesson Plan

Lesson 1: Discovery (.5 class period)

- Students will consider the constraints and criteria of the project.
- Students will develop an understanding that 50% of the materials must come from offcuts and the other 50% can come from anywhere provided it is not an existing toy or tool.

Lesson 2: Research (.5 class period)

- Students will research and understand how a Rube Goldberg machine works.
- Students will ensure the project will incorporate the six simple machines.

Lesson 3: Design (1 class period)

- Students will create a design for a Rube Goldberg machine and consider how this connects with their BBT.

Lesson 4: Prototype and Testing (2 class periods)

- Students will develop the prototype and continue to test.
- Students will document the modifications made on their machines.

Lesson 5: Presentation and Reflection (.5 class period)

- Students will present final designs to the class and highlight iterations.

Cluster 3: The Trade Show Showcase

Students will create a professional display to showcase their designs and explain their design process.

Lesson Overview

Students will develop a "pitch" of their design. Why did they decide on this prototype? What is special about it? Consider its usage: Is it inclusive, barrier-free and diverse? Does it meet the end user's needs? Using the challenge question, complex process, pitch strategy and the rubric, students will understand the steps of technical documentation starting from a challenge question through the completion of a final "pitch."

Students will:

- demonstrate communication and documentation strategies in a short pitch situation
- develop a brief technical document of their project that includes all necessary information
- analyze the life cycle of materials and the accessibility of their design for diverse users

Overall Expectations

A1. Initiating and Planning
A2. Designing and Performing
B1. Fundamentals of Technological Development
B2. Impacts of Technology
B3. Careers and Pathways in Technology and the Skilled Trades

Lesson Plan

Lesson 1: The Design Challenge (1 class period)

- Students will define the design problem by considering stakeholder needs and ensuring accessibility and inclusivity for diverse users.
- Students will need to consider the stakeholder needs and accessibility including the following questions:
  - How does your design account for diverse users?
  - How is it accessible for all people?

Lesson 2: The Complex Process (2-3 class periods)

- Students will outline and sequence the key steps required to create their solution, including preparation, fabrication and assembly processes.
- Students will summarize the complex steps required to create their solution (for example, wiring a parallel, using a plasma cutter or programming a micro:bit).
- Students will consider each step: Preparation, Fabrication, Assembly.

Lesson 3: The "Pitch" Strategy (1-2 class periods)

- Students will craft a concise stakeholder pitch that explains the problem's importance, presents the designed solution and highlights its impact in meeting client needs effectively.
- Students will draft a 30-second verbal summary for their stakeholder including:
  - Hook: Why does it matter?
  - Solution: What did you build or design?
  - Impact: How does it meet the client's needs efficiently?