<u>Manufacturing Technology:</u> *Creating Assistive Devices*

Empathy Development
Designing assistive devices requires students to consider the specific challenges faced by seniors. Through this process, students gain insight into the difficulties of limited mobility or dexterity. This hands-on activity encourages innovative thinking while fostering empathy by focusing on enhancing seniors' independence and quality of life.

Course Codes	
TMJ 3M/3C/3E TMJ 4M/4C/4E	
Grade 7 & 8	Science - A1. STEM Investigation and Communication Skills D2. Exploring & Understanding Structures and Mechanisms

Partners
❖ Local Manufacturing Companies ❖ Local Welding Companies ❖ Secondary Manufacturing Classes

Sample Lesson Plan

Manufacturing Technology - Creating Assistive Devices

Lesson Plan: Creating Assistive Devices

Objective: Students will design and manufacture assistive devices to help seniors with daily tasks and activities using 3D printing or other manufacturing techniques. This will foster empathy by creating devices to aid seniors in their daily lives. Students can learn about product design and development focused on the needs of the elderly.

Materials: Prototyping materials (3D printer, plastic, metal, etc.), Design / CAD software, manufacturing tools and safety equipment

Activities:

- **Introduction (1 class):**
  - Discuss the needs of seniors and the role of assistive device technology for seniors' independence.
  - Introduce basic principles of design and manufacturing.
- **Research Phase (2 classes):**
  - Students will interview seniors to identify areas where assistive devices could improve their quality of life.
  - Research existing assistive devices and their limitations.
- **Design Phase (2-3 classes):**
  - Students use CAD software to design their assistive devices.
  - Students will brainstorm and sketch ideas for assistive devices.
  - Teacher will review designs for feasibility and effectiveness.
- **Prototyping Phase (3 classes):**
  - Students will develop and create prototypes of their designs.
  - Students will use 3D printers and other tools to create prototypes.
- **Testing and Feedback (1-2 classes):**
  - Test devices with seniors and gather feedback for improvements.

Assessment:

- **Prototype Evaluation:** Evaluate the functionality and innovation of the assistive devices.
- **Reflection Assessment:** Assess reflections on students' understanding and empathy.

Empathy Development:

- Designing and testing assistive devices requires students to deeply understand the daily challenges faced by seniors, fostering empathy and problem-solving skills.

Worksheet

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1. **Design Planning:**
    - Sketch your initial design ideas for an assistive device. Label key features and include annotations and measurements to illustrate its functionality.
    - Explain how your device will assist seniors with a specific daily task. What are the key features and benefits?
    - List three specific needs or challenges faced by seniors that your device aims to address.
2. **Prototyping and Testing:**
    - List the materials and tools needed to manufacture your device. How would you test its usability and effectiveness?
    - Outline the steps involved in prototyping your assistive device. What materials and tools will you need?
    - Conduct a simple test of your prototype. What were the results, and how could you improve the design?
3. **Collaboration and Communication:**
    - Describe your role within the project team. How will you contribute to the design and development of the assistive device?
    - How will you communicate effectively with team members to ensure progress and collaboration?
4. **Reflection:**
    - Reflect on the process of creating an assistive device. What challenges did you encounter, and how did you overcome them?
    - How do you envision your device making a positive impact on seniors' lives? What improvements would you make in future iterations?

Guide for Long-Term Care Home Residents

Manufacturing Technology - Creating Assistive Devices

Guide for Long-Term Care Home Residents:

1. **Introduction to Assistive Devices:**
    - Learn about the purpose and benefits of assistive devices for seniors.
    - Understand how these devices can enhance daily living and independence.
2. **Feedback and Input:**
    - Provide insights into your daily challenges and needs that could be addressed with assistive devices.
    - Collaborate with students to brainstorm ideas and features for device prototypes.
3. **Observation and Testing:**
    - Observe the design and prototyping process of assistive devices by students.
    - Offer feedback on usability, comfort, and effectiveness during testing phases.
4. **Using Assistive Devices:**
    - Test and provide feedback on prototypes to improve their design and functionality.
    - Experience firsthand how these devices can improve your quality of life.

Reflection - What, So What, Now What?

The **Reflection Choice Board** can be used at any time as an individual, small group, or whole class reflection strategy.

Additional routines that would work well for this project:

- ➢ **Journaling** throughout the project
- ➢ **Plus/Delta** for mid-way check-ins
- ➢ **Benefits to Society** as a final whole-group reflection and debrief

Reflection - Assessment *AS* Learning

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Reflection Worksheet

Name: _____
Date: _____

1. What assistive device did you create? Describe its purpose and key features.

2. What challenges did you face in designing and manufacturing the device?

3. How did you ensure the device was functional and met the needs of seniors?

4. What skills did you develop through this project?

5. Reflect on the impact of the assistive device on the seniors. How did it improve their daily lives?

6. How did this project influence your understanding of assistive technology and its importance?

7. If you were to redesign the device, what changes would you make?

8. Overall, how do you feel about the final outcome of your assistive device? Why?

Ideas for Next Steps

- **Share the designs on a public forum so others can benefit from their use**
- **If the project fits, consider accessing Entrepreneurial Funding from the school board to see if this idea/concept can be expanded into a start-up business.**
- **Pathways Considerations:**
    - **Specialist High Skills Major (SHSM) -** Provide students with information on a *Manufacturing* SHSM if applicable.
    - **Dual Credit** - Explore the possibility of related courses at a local post-secondary institution (e.g. basic welding and fabricating, powerline awareness and safety, intro to HVAC, etc.)
    - **Co-Operative Education** - If students enjoyed this process, encourage them to investigate a co-op in a long-term care home, a business that focuses on manufacturing, associated trades, or in a pathway/field they are considering pursuing post-secondary
    - **Field Trip** - Take the students that participated in this activity to visit a community partner to learn more about Manufacturing. One example of this may be a local College or Welding Business to see what is involved in a career in welding.
    - **Online Career and Individual Pathways Plan (IPP) Tools** - Use the IPP software your school board has licensed (myBlueprint, Xello, etc.) to explore post-secondary options that suit your skills, interests and future plan that are a natural extension of this project.
    - **Skilled Trades** - Encourage career exploration of Skilled Trades that connect to the *Manufacturing* BBT, such as:
        - Metal Fabricator (Fitter)
        - Tool and Die Maker
        - Welder
- **UN Sustainable Development Goals (SDGs) -** Consider having students complete a parallel project to raise awareness around and promote the action for the SDG of their choice. For this project, Goal 10: Reduced Inequalities fits well.
- **TMJ 3C/4C: Fire Piston Project** (from octe.ca) - This project is designed as a grade 11 beginner project. The purpose of this practical assignment is to teach metal lathe basics such as end facing, parallel turning, drilling, threading, turning grooves, and turning angles on a manual metal lathe.
- **TMJ3C/4C: Plug Weld** (from octe.ca) - Students will develop knowledge and skills related to product design, fabrication, blueprint reading, and weld quality. Students will learn the fundamentals and process applications related to plug welding using the GMAW process and apply it manually.
- **TMJ3M/4M: Injection Mould Manufacturing** (from octe.ca) - This project will look at the automotive industries use of injection moulding to manufacture parts, with a focus on the electric vehicle manufacturing sector.
- **STEM TakeTech Challenge Kit - Manufacturing** (Gr. 7 & 8)

Sample Rubric

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Rubric:

Criteria	Excellent (Level 4)	Good (Level 3)	Satisfactory (Level 2)	Needs Improvement (Level 1)
Needs Assessment	Thorough and insightful assessment of seniors' needs.	Good assessment of seniors' needs.	Basic assessment of seniors' needs.	Incomplete or inaccurate assessment of seniors' needs.
Design Quality	Designs are highly innovative, functional, and feasible.	Designs are functional and feasible.	Designs are somewhat functional but may lack feasibility.	Designs are poorly thought out and unfeasible.
Prototyping Skills	Demonstrates excellent prototyping skills and attention to detail.	Demonstrates good prototyping skills and attention to detail.	Demonstrates basic prototyping skills with some errors.	Demonstrates poor prototyping skills with many errors.
Testing and Feedback	Tests prototypes thoroughly and incorporates feedback effectively.	Tests prototypes and incorporates feedback.	Tests prototypes with some feedback incorporation.	Poor testing of prototypes and little feedback incorporation.

Empathy and Understanding	Shows deep empathy and understanding of seniors' needs.	Shows good empathy and understanding of seniors' needs.	Shows some empathy and understanding of seniors' needs.	Lacks empathy and understanding of seniors' needs.
Reflection Quality	Reflection is insightful and deeply connected to the experience.	Reflection is thoughtful and connected to the experience.	Reflection shows some connection to the experience.	Reflection is shallow and disconnected from the experience.

Teacher Observation Checklist

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Teacher Observation Checklist

- **Needs Assessment**
  - ☐ Students conduct thorough assessments of seniors' needs.
  - ☐ Assessments show a deep understanding of their challenges.
- **Design Quality**
  - ☐ Assistive device designs are innovative and functional.
  - ☐ Designs demonstrate a strong understanding of assistive technology.
- **Prototyping Skills**
  - ☐ Students demonstrate excellent prototyping skills.
  - ☐ Attention to detail is evident in the prototypes.
- **Testing and Feedback**
  - ☐ Prototypes are thoroughly tested.
  - ☐ Feedback is incorporated effectively, leading to improvements.
- **Empathy and Understanding**
  - ☐ Students show empathy towards seniors' challenges.
  - ☐ Assistive devices are highly functional and meet seniors' needs.
- **Reflection Quality**
  - ☐ Students provide insightful reflections on their experience.
  - ☐ Reflections highlight the impact of assistive technology.

Teacher Comment Bank

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- **Strengths:**
  - Your designs were innovative and effectively met seniors' needs for improved functionality.
  - Prototypes were well-crafted, demonstrating attention to detail and usability.
  - You collaborated effectively with team members to refine designs based on feedback and testing.
- **Areas for Improvement:**
  - Consider exploring additional assistive technologies or features to further enhance device functionality.
  - Continue to refine your prototyping skills to optimize manufacturing processes and materials usage.
  - Reflect on challenges encountered during the design and manufacturing phases to identify lessons learned for future projects.