

Problem Solving and Design Skills

Design / Build a Marketable Picture Frame Using Scrap Wood Flooring

Introduction and Overview

Info in red font is for the benefit of the teacher (ideas for differentiated learning etc). Delete text in red font from the copies that are distributed to students. In a document / template that is intended to be "filled in" by students for assessment / evaluation purposes, the Version History table can be retained for students to use. Making an improved version is great learning.

Version History:

V #	Date	Author	Short Listing / Description of Changes
1	Apr. 30/12	D.B. McCowan	Initial Version -- uploaded to OCTE Safety Portal
2	June 5/12	D.B. McCowan	Changes in yellow font – to OCTE portal on June 8

Notes to Teacher:

1. This two week unit reinforces the Design Process, using recycled or scrap wood flooring as both a hands-on project and critical thinking practice.
2. Throughout this unit, Safety is to be treated as paramount. Material and Fabrication are the other fundamental concepts of technology that are most stressed. Several other fundamental concepts of Technology should also become apparent to students, and these observations should be reinforced by the teacher. For example: Structure (eg is the frame resistant to a twist test?); Function (eg does the frame design easily accommodate and hold a photograph?); Sustainability (eg re-use flooring salvaged from a house that was torn down).
3. It is a good idea to first review where the students are currently at in the course and why you are taking them in this Design Process direction. It is assumed that, at the start of the course, the course curriculum expectations were distributed to the class along with the course outline. Most of the Tech Design Fundamentals (the section A Expectations) should have been at least introduced by the time this project is started. Of course, there will be reinforcement of the fundamentals throughout the course. A review of the fundamentals is in the second document in this package. **It is also assumed that students have already had introductory lessons in CAD and that measurement-related expectations have already been met.**
4. The information in this and subsequent documents should be discussed with the class, for example, in a question / answer format. If students request a summary, the teacher may give them this (and other) document(s) and they can compose their own summary. Having students write their own summary is "information processing" in the Thinking

Achievement category (see the Front Matter of the Technological Studies Curriculum document).

5. While all students should be constantly challenged to go beyond the minimum or basic requirements and to think critically every single day... in this unit, the following abbreviations relate to Differentiated Learning / Instruction.

Differentiated Learning	
Abbrev	Description / Notes
DL-L	For students with lower abilities
DL-M	For students with moderate / mid-range abilities. This should generally be the default, always involving some level of critical thinking.
DL-H	For students with higher abilities or, ideally, "for any students who want to do more".

1 Curriculum Expectations and What You Will Do in This Unit

Note to Teacher -- Differentiated Learning / Instruction:

1. There are several alternative approaches to launching this design skills unit for students of differing abilities.
 - a. **DL-L:** Tell the students exactly what they will be doing and why – see Table 1 below. That is, give them both columns 1 and 2 of Table 1 as is. This approach largely short-circuits critical thinking, but would be appropriate if students have seldom been asked to think critically about the significance of the curriculum expectations (ie the government-mandated "*what to learn*").
 - b. **DL-M:** In table 1, delete the text pertaining to, say, 5 of the Expectations, but leave in the corresponding points in column 2. Ask students to find the expectation in the curriculum that relates most closely to the given activity in column 2. Take up in class.
 - c. **DL-M:** Include a matching exercise, either on paper or in a system such as Moodle: "*Match this Activity to the Curriculum Expectation*". Take up in class.
 - d. **DL-H:** Delete most of the entries in column 2 of Table 1 below -- **retain a few of the points as samples if you wish, such as those in green font.** Tell the students that they will be designing and making a marketable picture frame using scrap wood flooring. Then, for each Expectation row in Table 1, the students will add any other items under "*What You Will Do...*" that they can think of in the context of that particular expectation and this picture frame project. This exercises both critical and creative thinking skills. Take up in class.

e. Other ideas for Differentiated Learning are shown in column 2 below (DL-L etc.)

Design / Build a Marketable Picture Frame Using Scrap Wood Flooring	
1 Curriculum Expectation <i>In this unit the student will demonstrate / practise the following:</i>	2 Activity -- What You Will Do in this Unit DL-H: Items in Green Font can be Distributed as "Teacher Samples"
B1.1 -- gather and use pertinent information	-research key properties of wood and how to inspect, prepare and work with salvaged wood parts -research fabrication techniques and design strategies for using scrap or salvaged wood flooring to make a picture frame
B1.2 -- plan and organize projects and related activities using a design process and appropriate methods and tools	-create, improve and follow a step-by-step fabrication procedure for making a picture frame DL-L: These students may prefer to simply follow the teacher`s demonstrated procedure. The written procedure should be handed out ahead of time. DL-M: The teacher`s written procedure should at least deliberately "miss" one important step. Ask students to make at least one improvement to the written procedure. DL-H: These students should be expected to blend good ideas from a variety of possible construction strategies and procedures, thus resulting in an improved fabrication process for a more 'custom' picture frame.
B 2.3 -- produce hand-drafted and / or computer-based technical drawings of design solutions using standard drafting tools and conventions	-use a computer aided design application to make fully dimensioned drawings of each of the wooden parts of the picture frame -produce a complete and accurate parts list DL-L: May prefer to only do conventional drafting DL-H: Will probably want to use the assembly functionality of a 3D CAD application
B3.1 -- use appropriate tools, equipment and materials to create design models and / or prototypes	-produce a picture frame of a marketable quality -development of hand skills will be stressed in this project because it is early in the course -DL-H: Perhaps make wooden pins from scrap and use these pins to add strength to the picture frame joints
B3.2 -- use appropriate measuring methods and scales when creating models and prototypes	-the picture frame must be a product that makes the student proud and could fetch a reasonable price in the marketplace -test a square for accuracy -use simple laws of geometry to lay out 90° and 45° angles
B3.3 -- assess models and / or prototypes on the basis of prescribed criteria	-judge the product against student-generated criteria including aesthetics, accurate dimensions, square-ness, flat-ness (no twist), strength, finish -for example, the class will agree on the allowable tolerances on linear dimensions DL-L: Requirements for, say, aesthetics, could be relaxed

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1 Curriculum Expectation <i>In this unit the student will demonstrate / practise the following:</i>	2 Activity -- What You Will Do in this Unit DL-H: Items in Green Font can be Distributed as "Teacher Samples"
B4.2 -- report and reflect on their experience with the design process using a suitable oral and / or written format	- write a research report regarding wood and fabrication of a wood product (see B1.1) -write a requirements document which will form the basis of a test / assessment plan (see B3.3)
C1.2 -- describe and apply best practices for conserving energy and other resources during the design process	-re-use salvaged wood construction materials after a thorough inspection -use hand tools instead of power tools that draw 10 amps
D1.2 -- demonstrate an understanding of and follow personal and environmental health and safety procedures with respect to processes, materials, tools, equipment, and facilities throughout the design process and related activities (e.g., use protective equipment; set tool and equipment guards properly; ensure adequate ventilation and ergonomic seating and other workplace arrangements; follow safe operating procedures; keep work areas clean and organized; store materials and dispose of wastes properly).	- learn about, understand and appreciate some important principles of safety and working safely -know when to wear gloves and ear protection -in the shop wear safety glasses ALWAYS -know how to hold and practice using hand tools (saw, hammer, wood chisel) to prevent injury / damage -choose the right tool for the job (hand saw; wood chisel) -inspect a hand tool (saw, chisel, hammer, screwdriver) for safety problems before using it - set up and operate a drill press -tidy up your work space before you start using it -clean up your work space when you are finished using it -treat all tools with respect and keep them in their “known location” -activate the dust extraction system and adjust necessary dampers DL-H: Help enforce best practices for shop safety
D2.5 -- demonstrate an understanding of the work habits that are important for success in the technological design industry, as identified in the Ontario Skills Passport (e.g., working safely)	-be a proactive member of the shop safety team -DL-L: Focus on Working Safely and Organization -DL-M: Focus on Working Safely, Organization and Reliability -DL-H: Focus on Working Safely, Organization, Reliability and Initiative -DL-H: Be a “working safely” leader

Table 1: What You Will Do and Why

2 This Design Skills Learning Unit is Extremely Important Because...

It's all about you...

CRITICAL / CREATIVE THINKING QUESTION:

Pick a career that interests you. Select the three Tech Design Curriculum Expectations that you believe to be most critical to your personal career goals at this stage. Now discuss a few additional requirements that you, personally, will set for your own learning in this project, based on those three Expectations. For instance, as an aspiring engineer, you may choose one particular work habit and one particular essential skill and the safe and efficient use of one particular hand tool – you want to go above and beyond the teacher's requirements. Set your standard higher. Explain what you will do in the next two weeks to advance toward your career goals. Go ahead... take the initiative!

3 Safety Reminder

You are the product designer – you are responsible for assuring the safety of the users of the product.

4 Self and Peer Assessment

NOTE: In the feedback, the Peer Assessor must “make the student think” – not give the student the answer! Be sure to include comments justifying the assessment value that you are giving. Peer Assessor must put his / her comments in red font.

Assessor's Name and Additional Notes:

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