



WoodLINKS

Wood Products Manufacturing Curriculum

January, 2000

WoodLINKS

2900 – 2424 Main Mall, Vancouver, BC V6T 1Z4

Tel: (604) 822-1693 Fax: (604) 822.3062

E-Mail: admin@woodlinks.com

www.woodlinks.com



Introduction to Wood Products Manufacturing

**Learning Outcomes, Instructional Strategies,
Assessment Strategies, Learning Resources**

Introduction to Wood Products Manufacturing: Fundamentals

Learning Outcomes

It is expected that students will be able to:

- investigate and analyze the Wood Products Industry

- explore career paths within the Wood Products Industry

- identify and apply appropriate computer software and skills to prepare reports and demonstrations

Suggested Instructional Strategies

Students completing Introduction to Wood Products Manufacturing must have a broad overview of the entire industry. They must appreciate the full range of opportunities and challenges in the industry. Communications, computer and safety skills are essential attributes of all future employees or entrepreneurs.

- Several field trips to a range of wood products sites, possibly including an older mill or a portable bandsaw mills, will provide students with the range of production strategies. Prepare students by introducing flow charting in the context of a mill that you will visit. Explain the key functions (like log sort, chip'n saw, edging, planing, etc.) and have groups of students assigned to each major function. On return from the field trip, each group will provide details on their segment and all groups will produce simple flow charts of the mill.
- On mill field trips, arrange with the mill to have 1 or 2 employees available for short "career" presentations explaining what they do in their current jobs, what jobs they have had leading up to the current one and what training they have had. All students would then provide a 1 page report on each person's career path.
- Within your local area, use flow charting to show the relationships that exist between the wood products manufacturer, their suppliers, and their service firms. The aim is to show that a single mill is the focus of a large number of enterprises as well as being a supplier itself to its own markets.
- Form students into groups with each group studying one historical phase of the forestry-wood products industry from horse and ox logging to modern harvesting and production techniques. Students should produce their final report using a slide show program (i.e., Microsoft Powerpoint) if possible.

Suggested Assessment Strategies

Student reports and demonstrations should be evaluated with a mix of: self evaluation, peer evaluation and teacher evaluation. All evaluations should be based on a set of criteria set out by the class as part of the preparation for the full project. The teacher should have an idea of what a good: report, demonstration, or flow chart looks like, but in the initial work with students have them come up with most of the criteria and use those throughout the course.

Criteria to include for both reports and demonstrations:

- All critical operations must be represented
- the order of operations must be correct.
- Important waste product lines should be included.
- Rework or recursive processes need to be represented.
- Correct flow charting symbols should be used to indicate operations.
- Labels and information should use correct wood products terms as well as be clear, legible, and spelled correctly.

Refer to the sample “Field Trip Report”, and “Guest Speaker Report” criterion documents in “WoodLINKS Sample Lesson Plans”.

However DO NOT simply copy these examples and tell students this is their evaluation process, take the time (typically 30 to 60 minutes) to have the students generate their own version of each evaluation instrument simply making sure that their version includes the crucial points. Students will then have a much better idea of what is expected of them and will be more likely to produce quality work.

Learning Resources

Print

- WPTLG A-1, A-3
- *FOREM modules 7-10, 13-15, 18*
- *Forestopia: A Practical Guide to the New Forest Economy* WIB
- *An Annotated Bibliography to Value-Added Wood Products Research* WIB
- *FRBC Value-Added Strategy* WIB
- *B.C.’s Value-Added Strategy* WIB
- *British Columbia Forest Industry Conference: Price Waterhouse*
- *WIB: WoodLINKS Sample Lesson Plans*
- *A New Taxonomy for Wood Products* WIB
- *Introduction to the Wood Products Industry – Teacher Guide / Student Workbook.* WIB
- *The World’s Need for Wood* WIB
- *Opportunities for Horizontal Diversification in Manufacturing* WIB
- *WoodLINKS Wood Products Manufacturing Resource Guide, Introduction*

- WPTLG A-1
- Loewen Windows Brochure

- WPTLG I-1

Video

- *Introduction to Sawmills*
- *A Question of Balance: Canfor*
- *The Dynamic Forest*
- *The Miracle Resource*
- *Growing Jobs*
- *The Circle of Life*

- *WoodLINKS Careers in Wood Kit*
- *AWI Career information*

Learning Outcomes

It is expected that students will be able to:

- identify the high technology aspects and trends in the wood products industry
- survey law and environmental issues and their impact on the wood products industry

Suggested Instructional Strategies

The Woodlinks CD ROM can be used to introduce the high technology aspects of this industry. The teacher should arrange several hours of computer lab time, grouping students 2 or 3 to a computer to use the CD ROM as “data” for investigation.

- Groups of students should each report back to the class on the range of technology in each aspect of a mill (log processing, board production, kiln drying, sorting, grading, and packaging).
- Individual students can be assigned a specific mill or a specific career and use the CD ROM as data to investigate.
- Once several projects have been completed, a general class discussion on the direction technology is taking would then be useful. What does it mean for some categories of jobs? What skills does high technology demand of a worker? How can this benefit them?
- With continuing tours of local mills as well as determining the production structure, students should be pointing out in their reports and demonstrations what technology could be applied in local plants along with an evaluation in what that would mean for employment and training.

Environmental issues and the local regulatory policies are crucial issues for the wood products industry. The issues are so complex; however, that it is not clear even to many professionals what the long term impacts will be. Focus the work that you do on the local situation that your industries face and on every field trip and with every guest speaker make sure these two areas are investigated by students.

- Have students compare and contrast the opinions of several of the local guest speakers on environmental and regulatory impacts to the local area.

Suggested Assessment Strategies

The Reflective Journal

Though discussed here in the context of high technology and environmental issues the reflective journal should be used by students for all aspects of their work in wood products.

Such a journal should be a thoughtful recording of the students' ideas, questions and developing understanding as the course progresses. Students should be required to complete a journal entry for each class session indicating: what they worked on, how they felt about the work, how they felt about their contributions, what could have been done better, and how to improve for next time. When plant tours are completed, more time should be given for the journal so that students can record impressions about the level of technology, the kind of work atmosphere and whether they feel they could function in such an atmosphere, the kind of work challenges that the workers face, and the opportunities for learning and advancement.

- Reports on the level of technology for each tour should be required of students; but often groups of students should work on a more detailed report or demonstration of a specific area of the plant and then all students share their demonstrations for a full view of the plant.
- If available, compare and contrast mills doing similar production but from either end of the dollars scale: plants that spend lots of money on the most up-to-date equipment and plants that make do and invent what they need. Does the added expense mean better production? Is the investment paid back? Is it safer? Do the "figure it out ourselves" plants have a different working "culture"? Is it more fun to work in such a place? Is it more dangerous?

Learning Resources

Print

- *Wood Technology Clinic & Show Proceedings* WIB
- *Computer Control Systems for Log Processing and Lumber Manufacturing* WIB
- WoodLINKS ROI Report
- Introduction to the Wood Products Industry, Instructor's Guide / Student Workbook WIB
- Furniture Manufacturing Equipment WIB
- WPTLG A-3, A-6
- *Proceedings of Wood Building Design and Construction Conference: UBC 1996*

- Forestopia: A Practical Guide to the New Forest Economy WIB
- WPTLG A-7, L-1
- Environmental Effects of Building Systems WIB
- Introduction to the Wood Products Industry, Instructor's Guide / Student Workbook WIB

Video

- Automated Handling Systems – Ligmatech
- Lug Feeder – Westech
- Multicraft
- Mastercam
- Koetter Kilns
- Joinery Machines – Hundegger
- CNC Shaper – Unique Machines
- Computer Technology vs Manual Labour Canwood
- Finger Jointing System – Conception RP

- The Miracle Resource
- The Circle of Life
- The Dynamic Forests
- WoodLINKS Careers in Wood Kit

Trade Publications

- *Forest Products Journal* WIB
- *Wood & Wood Products* WIB
- *Wood Digest* WIB
- *Wood Technology* WIB

Learning Outcomes

It is expected that students will be able to:

- communicate effectively in the workplace

Suggested Instructional Strategies

The wood products industry feels strongly that their current employee candidates are lacking in listening, oral and written communications skills. The WoodLINKS CheckLIST sections on communications are a good outline of the skills to be focused on. Much of the work will be in the teacher's expectation of student's daily classroom interaction. Students should be expected to behave and communicate as if they were on the job site.

- Provide a short lecture/demonstration on the 3 part communications process: listen, confirm what you heard, ask questions to clarify. Follow this up with some short role-play situations so students can practice and then use on a daily basis as students interact.
- Provide a short lecture/demonstration on a conflict resolution model (i.e., Getting to Yes). Students should understand that conflict will occur on the job site but that good communications can solve most problems. Again, role plays can help students practice the material and then follow up by using the techniques during the year.
- Case studies of various work situations can be presented to students for evaluation and their analysis of what could be done to improve the outcome. For example, a very common situation is the implementation of new technology. In many companies, this results in serious employee stress and concern that drops production, lowers morale, and lowers quality production. If possible, contact local companies to see if they have gone through one of these and use it for student analysis.

Suggested Assessment Strategies

- Students could be given a daily mark indicating their communications skills. (A simple checklist is used and a score of 10 given.) Such work should be given a weighting of 10 - 20% of the term.
- In your local industry, ask key individuals if they would research and report local conflicts and how they were resolved. You might want to get a number of companies together for an afternoon conference to help develop local role play, conflict resolution and case study material.
- Student reports should be expected to be submitted in computer formats, requiring good technical writing and formatting:
 - * clear introduction outlining both topic and intended audience
 - * clear breakdown of topics and use of subheadings
 - * logical development of topic
 - * good grammar and spelling
 - * clear and effective conclusion with recommendations if required
- Students should be introduced to the WoodLINKS CheckLIST, and the teacher should begin to use the checklist to indicate to students their current standing.

Learning Resources

Print

- WPTLG E-1, E-2
- *Applied Math unit on Flow charting*

Software

- *Microsoft Office Suite*

Learning Outcomes

It is expected that students will

- apply wood products vocabulary and terminology
- apply wood products mathematics
- investigate and apply industry safety strategies and techniques

Suggested Instructional Strategies

- In each introductory phase, provide students with a list of the vocabulary they will be expected to understand and use by the end of the project.
- Students should be encouraged to ask guest speakers vocabulary questions, to get clear explanations of any technical terms that a speaker uses. Such terms should be explained in a students' reports on the speaker.
- Depending on your local situation, you can work students through a modified form of log scaling, calculating volumes
- Also depending on your local situation, the Canadian Lumber Grader's manual will provide good practice in both wood quality determination and knot percentages in wood.
- Students should either be checked off on a Level I First Aid course or if many students require the training, provide it in workshop format over 1 day.
- Students should complete OSHA (WHMIS) training.
- Book the local WCB representative, if possible, and have the representative provide students with an overview of WCB, workplace safety and their workplace rights to safety.
- Provide a speaker from a local wood products plant who focuses on the safety issues of that plant. A sawmill presentation would emphasize lockout procedures before servicing machinery, safety awareness and procedures with cutting tools, cleanup, machinery safety covers, personal safety gear (hard hat, ear protectors, no loose clothing, steel toes, etc.). A pulp mill presentation would cover much the same but add the chemical safety aspects as well as safety processes during an alarm.

Suggested Assessment Strategies

- Students successfully completing the First Aid test will be given credit for this aspect of wood products.
- Students should be required to take and pass an OSHA (WHMIS) program.
- Using the school shop and every plant tour, students should be required to complete a written “safety audit” of each site:
 - * indicate any problem areas they observe
 - * report on any questions they asked plant representatives about the potential problem
 - * suggest possible solutions
- Students should be provided with the opportunity to write at least a fraction of a log scaling or lumber grading test to gauge their current level of achievement.
- All reports should use correct wood products technical vocabulary and where appropriate, students should include a definition for such terms either following the word in brackets or in an appendix.
- Test wood products vocabulary with multiple choice or short answer quizzes on a monthly basis.
- Require safety demonstrations by groups of students where the group sets up a situation (physical demonstration, case study or visual presentation) and the other students locate the problem and report why it is a safety problem.
- The WoodLINKS CheckLIST contains a section on safety attitudes and behaviors. Students should be evaluated both in class and on field trips and get frequent feedback on current standing.

Learning Resources

Print

- WPTLG A-4
- Introduction to the Wood Products Industry, Instructor’s Guide / Student Workbook WIB
- New Taxonomy of Wood Products WIB
- Canadian Woods – Properties and Uses WIB
- Lumber Manufacturing and Recovery WIB
- The State of Canada’s Forests WIB
- Wood Quality Attributes WIB
- Timber Drying, Kilns, and Kiln Drying WIB
- Wood Reference Handbook WIB
- WIC – Lumber Grades Information WIB
- Wood Handbook – Wood as an Engineered Material WIB
- WoodLINKS Wood Products Manufacturing Resource Guide, Introduction

- WPTLG C-1, C-2,
- Applied Mathematics WIB
- Canadian Lumber Grading Manual WIB
- WoodLINKS Careers in Wood Kit Teacher’s Guide
- WPTLG E-3, E-4,
- WPTLG H-1, H-2, H-3
- *Mechanical Trades Safety Manual* WIB
- Worksafe Report – Fatalities and Serious Injuries in Sawmills WIB

Video

- WoodLINKS Careers in Wood Kit and Website
- WMIA Safety Video WIB
- WCB videos
 - * After Lock Out —Then What
 - * Lock Out and Tag Procedures
 - * Locking out Accidents
- *Winning the Safety Game* WIB
- *Band Saw Operation and Safety*
- *Table Saw & Accessories— Operation and Safety*
- *Radial Arm Saw — Operations and Safety* WIB

Learning Outcomes

It is expected that students will be able to:

- interpret and produce common industry reports: blueprints, flowcharts, technical drawings and reports, spreadsheets, etc.

Suggested Instructional Strategies

These “graphic organizers” represent more than just a “picture”. They are ways of thinking about the technical problems and of solving those problems.

The blueprint is an essential communications tool in the construction industry. Students must be skilled in their use.

Students must be both competent “readers” and “creators” of flow charts. The flow chart is a convenient method for summarizing the entire activity of a manufacturing process and is related to the technical blueprints of the plant, the blueprint illustrating the “flow” pattern.

- If available and appropriate, use material on flow charting from the Applied Math curriculum to expose students to the concepts, but alter any assignments to represent wood products plants or processes
- Present a range of blue prints from simpler wood projects, though residential housing and commercial plants. Though deep detail is not required for commercial plants, students should recognize common electrical, mechanical and plumbing symbols and be able to explain each part of a drawing.
- Students should create a flow chart of each wood products plant that they tour, with the level of detail specified by the instructor before hand. For example, the key processing and handling systems must be noted but perhaps the waste handling lines need not be done in detail. The opposite might be true of another plant, where students have become familiar with the standard operations and systems and the terms of reference would then be to carefully track the reworking and waste processing systems.

Suggested Assessment Strategies

- Develop a criterion document for flow charts of wood products plants that includes elements of:
 - * all essential or emphasized operations are shown
 - * connections and flow of material
 - * correct symbols
 - * recursive/rework lines
 - * clear printing of text
 - * appropriate images or drawing where appropriate
- Student groups should create question sets for each mill that they visit. Each group is required to develop 10 short answer-essay questions and 10 multiple choice questions. They can practice in class time and then the teacher will select from the full set the questions that will go on the test.
- Students should practice and then be prepared to complete a rough sketch flow chart of any plant they have recently visited.

Learning Resources

Print:

- WPTLG D-1
- Drafting text books in the Technology Department

Software

- Video

Introduction to Wood Products Manufacturing: Manufacturing

Learning Outcomes

It is expected that students will be able to:

- examine and analyze manufacturing processes

Suggested Instructional Strategies

- Set up three groups each assigned the task of investigating the basic functions of:
 - * manufacturing enterprises
 - * service companies
 - * components / parts companiesStudents should use a specific local firm as their example in each of the groups, looking at how each connects to the other and how they complement each other.
- Lead a discussion, mapping session, of the various companies in the area and show how they are linked together. If possible have one of the executives of a manufacturing company visit the class to discuss the broad outline of their processes and then the linkages they have to various local, provincial and international companies.
- Choose a local company's product, preferably one that you have already toured or are able to tour, and with students develop a flow chart of the manufacturing steps necessary to create the final product. Was the product created to use a specific wood fibre source? Was the supply of suitable wood fibre a significant problem for the manufacturer? What problems did the manufacturer have in setting up their processes to create a quality product? Does the company have a "quality" program to maintain the product? If so, how does that affect the manufacturing process?
- In a set of groups have students "invent" a theoretical product, develop the manufacturing steps necessary, create a flow chart to show those steps, investigate marketing possibilities, and present their manufacturing plan to the rest of the class.
- Whenever guest speakers from companies come to the school, students should be encouraged to ask questions about the companies' processes. Whenever possible with speakers, have them outline process problems that the plant has encountered and how they were solved.

Suggested Assessment Strategies

With group projects it is important to clearly define the criteria used to evaluate a group report and presentation. Individuals within the group should recognize that the instructor reserves the right to lower an individual grade from the group's overall grade, based on observation of the effort put in by each group member.

Student demonstrations of the company types should include:

- a minimum one page written handout for each class member outlining the key aspects of the company, how it is organized and how it relates to the other types of companies
- a flow chart that shows the company's processes whether they are for a manufacturing plant or an accountant's office. How is work handled? Where are decisions made? How does work pass from process to process (person to person)?
- a question answering sessions where class members can investigate further ideas
- a look at the issues that the company faces over the next few months and years

One of the "tests" during this time period should be a one hour "Manufacturing Design" test.

Provide students with a sample wood product (a stand-alone CD rack, do-it-yourself solid wood table, Swedish storage bench, entertainment center, etc.) and ask them to:

- do a rough sketch of the product (not marked on artistic quality but on how clearly it shows each of the parts of the product)
- provide a manufacturing flow chart for the product
- provide information on target market and possible price range
- discuss major problems and issues with manufacturing the product

Learning Resources

Print:

- A Reality Check on the Expansion Potential for Secondary Manufacturing, 1996 WIB
- WPTLG A-3, A-5, A-6
- Composites WIB
- Introduction to the Wood Products Industry, Instructor's Guide / Student Workbook WIB
- Furniture Manufacturing Processes WIB
- Furniture Manufacturing Equipment WIB
- Timber Drying, Kilns, and Kiln Drying WIB
- MDF, Particle Board Production and Residual Wood
- New taxonomy of Wood Products WIB
- Opportunities for Horizontal Diversification WIB
- Lumber Manufacturing and Recovery WIB
- *Directory to Secondary Manufacturing of Wood Products in B.C.* WIB
- *Williston, Value-Added Wood Products* WIB
- *WoodLINKS Sample Lesson Plans* WIB

Video:

- Quality Joinery – Paliser
- Profits from Plywood – Canadian Plywood Association
- OSB – Performance by Design
- Finger Jointing System –Conception RP
- CNC Shaper – Unique Machine
- Joinery machines – Hundegger
- Lug Feeder – Westech
- Automated Handling Machines – Ligmatech
- WoodLINKS Careers in Wood Kit and Website

Learning Outcomes

It is expected that students will be able to:

- describe key historical developments in the wood products manufacturing field
- summarize the future trends that are most likely to change manufacturing processes
- compare different forms of company ownership
- explain long term planning issues for wood products manufacturing companies

Suggested Instructional Strategies

Organize a tour of an older bush mill and a new portable mill. This will provide students with some perspective on basic lumber manufacturing. No matter what processes are instituted by a modern mill, the goal is to create a rectangular “beam” which is then processed into boards.

- Using pictures, text material and classroom demonstrations, discuss the movement from the home based cottage industry to the factory and then to automation. Look at the key technological breakthroughs that made each step possible and also the social consequences.
- Briefly review CNC (Computer Numerical Control) technology and scanning technology. If possible tour a site that contains some of these features and make sure the tour guide explains the technology.
- Invite a guest speaker to explore how their manufacturing site has “upgraded” over the past few years and what that has meant in terms of technology and employment.
- Arrange for a panel of 3 guest speakers, one from each of: sole proprietorship, partnership, and corporation. Have each describe how their company operates, and how decisions are made. Students should provide a brief technical report for each covering:
 - * capital investment
 - * technology upgrading
 - * employee hiring, training, retaining
 - * government relationships
- When students have an opportunity to attend a Wood Forum or conference or trade show they should have at least one assignment that requires them to interview a range of the companies on:
 - * long term raw material (wood fibre) supply
 - * employee training / retention
 - * technological change
 - * investment plans
 - * environmental and government regulations issues

Suggested Assessment Strategies

When a local event (Wood Forum, conference, trade show) is planned, students should first participate in a design workshop to determine what projects and what information they need to obtain from the event participants. Build a criteria worksheet that requires some of the following:

- an interview with a company on hiring policy
- a discussion with at least one company on the work scheduling and flexible task policy at the company
- an understanding of one company's raw material supply and how that affects long term planning
- information on how a company is handling their waste material
- at least 2 products that are being featured at the event
- the level of technology in a company's plant and what might be planned over the next 5 years.

Stage 1: Guest Speaker

Evaluate students' guest speaker reports in at least 2 stages. For the first few speakers provide a one page outline guide to all students that they can use for notes and to prompt them to ask good questions. The completed document, with both the questions they asked and the notes they took from the speaker, is part of the mark. Also require a 1 page report built from the sheet. Evaluate in terms of completeness, interest, ability to summarize what the speaker said and organization (a single page should have at least 2 to three subheadings to guide the reader rather than just one huge block of text).

Stage 2: Speaker's Report

Require a report from each student that covers:

- the speaker's current position, what they like about it, what they would like to see changed, and what has changed over the past 5 years
- a brief description of the speaker's career path: training, various positions, retraining, current plans
- a summary of key issues

Learning Resources

Print:

- WoodLINKS Wood Products Manufacturing Resource Guide, Introduction
- A Reality Check on the Expansion Potential for Secondary Manufacturing in the Canadian Forest Products Sector WIB
- Introduction to the Wood Products Industry, Instructor's Guide / Student Workbook WIB
- *Making Wood Work: A Survey of Value-Added Policies and Programs* WIB
- *A Strategic Framework for Growth in BC.'s Forest Industry* WIB
- *WoodLINKS Sample Lesson Plans* WIB

- Forestopia. A Practical Guide to the New Forest Economy WIB
- Introduction to the Wood Products Industry, Instructor's Guide / Student Workbook WIB
- How to Write Business Plans for Forest Products Companies WIB
- A Guide to Writing a Business Plan WIB

Video:

- WoodLINKS Careers in Wood Kit and Website

Learning Outcomes

It is expected that students will be able to:

- develop and illustrate a theoretical manufacturing process for different wood products
- identify safe and proper set-up and use of cutting tools, hand and machine, in manufacturing processes.

Suggested Instructional Strategies

- Have students use the WIB information on Japanese wood products technology and then compare and contrast that material with the plants that they have already toured.
- Assign students material out of WIB: Engineered Wood Systems requiring analysis of how engineered wood systems are increasingly being used in residential, commercial and business sites.
- Through some shop work on basic projects, students should have familiarity with the standard shop tools (drills, planer, table saw, radial arm saw, band saw, etc.). WIB videos on specific machines are available. During class discussions of manufacturing sites, relate the basic tools to the high speed tools, recognizing; for example, that the band saw (often in parallel sets) is one of the keys to modern lumber manufacturing.
- Either within a specified location or in the local area, have students “collect” an inventory of the cutting tools used in the various plants. They can work in groups to split up the work but the class should construct an overall inventory of each cutting tool, how many places use the tool and how many machines, what part of the process it functions in, the reason that tool is used and not another, the approximate costs and how it is operated (CNC, hydraulics, sensors or humans).
- Using “WoodLINKS Internet Sites” have students investigate the technology and equipment companies and provide a report.

Suggested Assessment Strategies

The major assessment will be the successful checking off of machine competencies for students on the WoodLINKS Practical Skills Checklist. Have students keep a rough draft of the checklist (the Instructor retains the formal checklist) in their notebooks to guide their training.

Evaluate the cutting tool inventory based on :

- details provided for each machine
- how the machine functions in the manufacturing process, what down time on the machine means for overall production
- initial and operating costs, if available
- the level of training required to both operate and also to maintain the machine

Learning Resources

Print:

- WPTLG A-5, A-6
- WPTLG B-1 to B-10
- Introduction to the Wood Products Industry, Instructor's Guide / Student Workbook WIB
- Furniture Manufacturing Processes WIB
- Furniture Manufacturing Equipment WIB
- WoodLINKS Wood Products Manufacturing Resource Guide, Introduction
- Opportunities for Horizontal Diversification WIB
- MDF / Particle Board Production WIB
- Timber Drying, Kilns, and Kiln Drying WIB
- Composites WIB
- *Japanese Laminating Technology* WIB
- *Wood Machining Technology in Japan* WIB

- Furniture Manufacturing Processes WIB
- Furniture Manufacturing Equipment WIB
- WoodLINKS Wood Products Manufacturing Resource Guide, Introduction

Video:

- *Band Saw*
- *CNC Routers*
- *Jointer/Surfacer*
- *Radial Arm Saw*
- *Wood Lathe*
- *Table Saw*
- WoodLINKS Careers in Wood Kit and Website

Suggested Assessment Strategies

- Student wood structure projects would be evaluated based on:
 - * classroom presentation of ideas
 - * ability to answer questions
 - * handout sheets for students
 - * a set of multiple choice test questions provided both for practice and from which the project test would be constructed by the teacher
- Using the wood grading kit, provide each student with a set of “boards” and determine how accurately they can grade them. All students should work at grading until they can pass the practical exam at 80% accuracy.

Learning Resources

Print:

- Introduction to the Wood Products Industry, Instructor’s Guide / Student Workbook WIB
- WoodLINKS Wood Products manufacturing Resource Guide, Introduction
- Composites WIB
- *Haygreen and Bowyer, 1996. Forest Products and Wood Science* WIB
- A discussion of Wood Quality Attributes and their Practical Implications WIB
- Canadian Lumber Grading Manual WIB
- WPTLG A-2, A-4, A-5, A-6
- MDF / Particle Board Production WIB
- Wood Reference Handbook WIB
- Canadian Woods – Properties and Uses WIB
- New Taxonomy for Wood Products WIB
- Wood Handbook – Wood as an Engineered Material WIB
- Plywood Handbook: Why Plywood? WIB
- Lumber Manufacturing and Recovery WIB
- WIC – Lumber Grades Information WIB
- Lumber manufacturing and Recovery WIB
- Canadian Woods – Properties and Uses WIB
- Wood Handbook – Wood as an Engineered Material WIB
- Wood Reference Handbook WIB
- Canadian Lumber Grading Handbook WIB

Video:

- OSB – Performance by Design
- Profits from Plywood

Multimedia & Internet:

- Woods of the World. Pro Internet Tree Talk Inc. CD ROM
- BC Ministry of Forests
- BC Wood Fibre Network
- Canadian Wood Council
- Louisiana Forest Products Laboratory

Learning Outcomes

It is expected that students will be able to:

- explain wood seasoning, wood conditioning and wood drying processes

Suggested Instructional Strategies

Correct, adequate, and efficient seasoning, conditioning and drying of the raw material used to manufacture wood products is thought by many to be the backbone of the wood products manufacturing industry.

- Provide an introduction to standard wood kiln technology and its effect on wood structure. If not already part of the tours you have completed, try to tour a plant that has wood kilns in operation to talk to the operators and technicians.
- For basic lumber manufacturing, indicate where in the kiln drying process takes place and what kind of considerations go into implementing kiln drying:
 - * plant design, move the wood to the kiln (what does that require), move the kiln to the wood (possible? room? safety issues?)
 - * rework and planing
 - * packaging
- Assign students to read and report on ForestNet's "Dry Kiln Tour", an Internet interactive presentation. (See "WoodLINKS internet sites" for address.)
- Explore a variety of options (work experience, job shadowing, field trips, etc.) that will involve each student in all of the components of a complete kiln cycle for a single charge of raw material.

Suggested Assessment Strategies

- Provide students with extra time for journal work during this project and use their journals as one of the key assessment tools. (Are they “thinking” about what they are seeing on tours? Do they create questions that they later ask or investigate?)
- Students should complete a short test that focuses on a sketch of the particular plant and the location of the wood kilns plus several paragraph answers on the seasoning process.

Learning Resources

Print:

- Timber Drying, Kilns, and kiln Drying WIB
- Lumber Drying Workbook WIB
- WPTLG A-3
- WoodLINKS Wood Products Manufacturing Resource Guide, Introduction
- Wood Handbook – Wood as an Engineered Material WIB
- Canadian Woods – Properties and Uses WIB
- Vital Importance of Kiln Drying in Solid Wood
- *Dry Kiln Operators Manual* WIB
- *Binder: Technical Information, Drying and other Equipment* WIB
- *Drying Pacific Northwest Species for Quality Markets* WIB

Suggested Assessment Strategies

Student field trip notes can be assessed using criteria such as:

- completeness of sections, including price, coverage, availability
- carefulness in observation and notes
- locating and reporting on new products
- participation in the development of classroom database
- sample promotional material provided

The classroom spreadsheet report for each group should be assessed on:

- clear outline of products
- ease of access for finding a specific product
- ability to cross check costs of the same product in several stores columns to allow easy reading

Wood fibre sources could be tracked and presented in a matrix sheet something like:

<u>Kitchen</u>	<u>Industrial</u>	<u>Architect</u>	<u>Commercial</u>
own mill			
local			
province			
Canada			
USA			
import			

Learning Resources

Print:

- WPTLG A-2, A-3, A-5, A-6
- WoodLINKS Wood Products Manufacturing Resource Guide, Introduction
- Canadian Woods – Properties and Uses WIB
- New Taxonomy of Wood Products WIB
- MDF / Particle Board Production WIB
- Composites WIB
- Introduction to the Wood Products Industry, Instructor's Guide / Student Workbook WIB
- *Rising to the Challenge* WIB
- *Canadian Wood Council Publications* WIB
- Plywood handbook WIB
- Western Red Cedar Builders Guide WIB
- Wood Reference Handbook WIB
- Wood Handbook – Wood as an Engineered Material WIB

- Introduction to the Wood Products Industry, Instructor's Guide / Student Handbook WIB
- Wood Handbook – Wood as an Engineered Material WIB
- *Wood and Plywood from B.C.* WIB
- *North American Forest Products Survey* WIB

Video:

- OSB – Performance by Design
- Profits from Plywood
- WoodLINKS Careers in Wood Kit

Learning Outcomes

It is expected that students will be able to:

- apply product design factors to wood products
- define product development steps
- create a business plan for a product

Suggested Instructional Strategies

The aim of the “Product” curriculum organizer is to provide students with both the theoretical and practical ability to develop wood products. In many classes this will take the form of developing a specific product, either as a group or as a whole class and manufacturing that product for local sale.

- **Product Profile:**
In small groups students should brainstorm until they come up with a wood product that they think they would like to consider for production. The overall class strategy may be for all group presentations to be given and then the class as a whole picks one of the products for the production effort. Depending on shop availability and resources, perhaps all of the groups will take their product into manufacturing. Each group therefore needs a product profile, an initial look at the outlook for the product:
 - * market considerations
 - * product considerations
 - * financial considerations
- **Product Development**
Now students must be responsible for a document that considers:
 - * market research: Will people want this product? Students will need to do some interviews with family and at the mall to test the local market for their new product.
 - * process planning: What is required to produce this product? Where is the raw material coming from? What operations need to be performed?
 - * refining the product: using product engineering, detailed drawings and specifications
- **Product decisions:** Is this a viable project? Do we have the production facilities? Can we build it for a profit? Can we build it safely?
- **Build a prototype.**
- **Make a product presentation and “pitch” the product to an audience.** From there decide on production.

Suggested Assessment Strategies

Student's product profile should include the 3 categories:

- Market considerations
 - * consideration of demographics
 - * look at international marketing
 - * pricing point for maximum penetration of market
 - * major competitors
- Product considerations
 - * design considerations and impact on cost
 - * manufacturing processes
 - * life cycle of product
- Financial considerations
 - * cost out manufacture
 - * look at financing for theoretical mass production

Final report on product development needs to include the 3 major sections: market research, process planning and refining the product and criteria such as:

- clear drawings of process
- good market research and interviews
- consider all possibilities

Learning Resources

Print:

- *Design Guide to Temperate Hardwoods* WIB
- WoodLINKS – Design Idea Handbook (fall '00)

- WPTLG E-2
- WPTLG I-1
- Furniture Manufacturing Processes WIB
- Furniture Construction WIB
- Furniture Manufacturing Equipment WIB

- A Guide to Writing a Business Plan WIB
- How to Write Business Plans for Forest Products Companies WIB

Learning Outcomes

It is expected that students will be able to:

- manufacture a product

Suggested Instructional Strategies

- **Manufacturing methods:**
Either as production groups or as a single class production unit students now need to prepare for actual manufacture of a product or products. The key decision will be whether the product can be set up for a form of mass production or whether it will be a custom process for each item. Discussion combined with shop experimentation will help the groups to decide on the basic parameters.
- **Time schedule:**
Students should produce a reasonably detailed time schedule (possibly as a Gant chart, if several different groups are working on different aspects of a single project) to organize the manufacturing. Using a flow chart to outline each step in the manufacturing process, the time schedule should outline each activity, who is responsible, and what materials are needed.
- Have students do a safety audit of their manufacturing plan, noting process steps that are of particular concern and emphasizing safety procedures for each of the processes.

Suggested Assessment Strategies

The time schedule should be detailed enough so that it can direct the work of the class:

- step by step outline of setting up for manufacturing
- include date, approximate length of time, person who is responsible
- outline materials needed
- machine considerations

The flow chart outline of the manufacturing process should include:

- each processing station
- show machine operation, product flow
- definition of quality, possibly a prototype of the finished stage for that station
- safety concerns

Use the WoodLINKS CheckLIST (machine skills sections), during this working period. The objective would be to sign off each skill for each student.

Learning Resources

Print:

- WPTLG B-1 to B-10
- WPTLG E-2
- *Performance of Value Added in B.C. WIB*
- *Examination of OSB & MFD Production in B.C. WIB*
- Introduction to the Wood Products Industry, Instructor's Guide / Student Handbook WIB
- WoodLINKS Wood Products Manufacturing Resource Guide, Introduction WIB
- Uses of Wood WIB
- Furniture Manufacturing Processes WIB
- Furniture Manufacturing Equipment WIB
- Furniture Construction WIB
- Make it Stick – The Basics of Glue and Gluing WIB
- Tips on Edge Gluing WIB
- Flat-Line Finishing WIB
- Binks Spraying Techniques WIB
- Basic electrostatic Spray Finishing WIB

Video:

- WMIA Safety Video

Learning Outcomes

It is expected that students will:

- describe product marketing steps and strategies
- define product life cycles
- describe inventory systems and controls
- describe wood commodity product pricing

Suggested Instructional Strategies

- As production continues, students need to consider the marketing of the product. The group needs to brainstorm marketing aspects such as:
 - * the target audience
 - * test marketing to the target
 - * packaging
 - * advertising
- Select a wide range of wood products and then have students develop a marketing plan for each of them, indicating the target market and the overall marketing strategy.
- Over a 2 week period, have students keep an advertising log, noting each time that they hear or see an advertisement of a wood product along with an evaluation of the ad.
- Have students prepare reports on several prominent wood products, noting the product life cycle of each.
- Use WIB documents and COFI “BC Forest Facts” to investigate the major markets for BC Softwood products.

Suggested Assessment Strategies

Product marketing reports should contain sections on:

- identification of customers/end users, the target market
- outline distribution methods
- research existing products that would compete with theirs
- determine pricing
- advertising strategy and budget
- research locations for marketing
- evaluation of the marketing plan if applicable

Product life cycles can be investigated based on known products. Reports need to consider each stage:

- introduction
- growth
- maturity
- decline

Reports should pay particular attention to strategies for the introduction phase and then look at their own product pricing strategy.

Learning Resources

Print:

- The Vital Importance of Kiln Drying in Solid Wood Marketing WIB
- Introduction to Wood Products Manufacturing, Instructor's Guide / Student Workbook WIB
- WoodLINKS Wood Products Manufacturing Resource Guide, Introduction WIB
- *A Marketing Guide for Manufacturers and Entrepreneurs of Secondary-Processed Wood Products in Northeastern United States* WIB
- *Opportunities for Canadian Exporters of Value-Added Wood Products in the Southwestern United States* WIB
- *So you Want to Export* WIB
- *Western Red Cedar Market Potential in Europe* WIB

- WPTLG L-1
-

Introduction to Wood Products Manufacturing: Industry Issues

Learning Outcomes

It is expected that students will be able to:

- define the role of organized and unorganized labour in the wood products industry
- present both management and labour perspectives on key issues in the wood products industry
- explain rotation and non-rotation of types of work schedules for various manufacturing enterprises
- describe the education and training required for entry level, technical, professional and management positions

Suggested Instructional Strategies

- Invite a management and labour speaker from the same pulp mill. Students should be set up into groups to develop a one page “Issue Sheet” on one or two of the issues below after hearing and questioning the speakers. Have them outline the current issues in the mill including:
 - * technological change
 - * quality production
 - * scheduling of work
 - * flexibility of work tasks
 - * safety in the workplace
 - * outside contractors
- Set up a role play — simulation for a larger company where the students occupy supervisory and management positions and have a problem to solve. Students should brainstorm the general situation and then each student needs to define their role. Once the basic research is done spend a class session in the simulation. During the next class talk about the kinds of decisions that need to be made and how the students felt about the simulations.
- Research different management systems. Where possible, interview managers and have the class create a display of management systems, their advantages, and disadvantages.
- Lead a class discussion on: hiring procedures, interviews, employment equity standards, salaries, and safety.
- Have students investigate and report in groups on the scheduling options used within their community, regardless of the business.

Suggested Assessment Strategies

Role play situations should be evaluated based on a specific set of skills. They do not have to be long term roles but should be based on a specific set of skills students can practice and that classmates who are watching can readily score.

Listening skills:

- accepting body language, lean towards speaker
- make eye contact
- affirmative head nods
- appropriate and encouraging facial expressions
- avoid distracting gestures
- ask questions
- paraphrase understanding

Conflict resolution skills:

- dealing directly with the conflict
- find the real source
- empathize with the other person
- use appropriate strategy:
 - * avoiding (trivial issue or too high emotions for constructive work)
 - * accommodation (other person's need is more important than yours)
 - * forcing (satisfies your needs, important issue needing quick response and other's cooperation is not key to success)
 - * compromise (each give a little)
 - * collaboration (win-win, interests of both are met)

Learning Resources

Print:

- WPLTG A-1
- WPLTG E-3, E-4
- Loewen Windows Corporate Brochure

- **Video:** Website
- Build a Better Future – Catawba Valley
- Camosun College
- Industry and Education – A Partnership
- Wood Technology – Pittsburg State

Learning Outcomes

It is expected that students will be able to:

- describe the effect of supply and demand of raw materials on the wood products industry
- analyze forest harvesting methods in relation to product manufacturing
- explain the impact of regional regulatory issues relative to the wood products industry
- outline the effects of politics, economics, and environmental concerns on the supply of raw material for the wood products industry

Suggested Instructional Strategies

Resource management is a large field of study on its own and this set of outcomes does not imply that the instructor must provide a detailed look at resource management in the region as it relates to the wood products industry. It is important for students to recognize the interrelationships involved in a manufacturer identifying a raw material source. For example, a company harvesting wood in a given area will be affecting the tourism potential, the water resource, wildlife habitat, and perhaps range land and mining exploration/development.

- Provide students with a project on sustainable forest resource management and the logic of the annual allowable cut. If possible, have some speakers in to discuss the allowable annual cut in your local region, how wood blocks are offered to companies and how the government monitors those projects.
- Have students do Internet resource projects using the outline from “WoodLINKS Sample Lesson Plans”.
- Look at local regulatory policy and interview local companies on what it means in practice. Develop a comparison document between policy and local compliance.
- Investigate what any recent changes to the regulatory policy have meant to several local companies.

Suggested Assessment Strategies

Student reports could be set up as “conference documents”. Students would need to provide for the conference:

- research paper
- overheads or PowerPoint presentation
- audience notes
- five minute talk on the topic (not simply reading their paper)

The conference would be held over probably 2 periods.

Students who are not presenting would be required to play the role of reporters. For each presentation they would need to file a report to the newspaper including:

- all important ideas
- headline for piece
- details on one specific idea to give depth to the coverage
- brief evaluation of content
- snappy finish

Learning Resources

Print:

- Forestopia. A Practical Guide to the New Forest Economy WIB
- Introduction to the Wood Products Industry, Instructor,'s Guide / Student workbook WIB
- WoodLINKS Wood Products Manufacturing Resource Guide, Introduction
- *A Strategic Framework for Growth in BC.'s Forest Sector* WIB
- *British Columbia Forest Products Industry: Production, Markets, Competition and Competitiveness* WIB
- *Canada's Forest Industry: A Strategy for Growth* WIB

- WPTLG L-1
- *Selected Forestry Statistics Canada* WIB
- Introduction to the Wood Products Industry, Instructor,'s Guide / Student workbook WIB
- WoodLINKS Wood Products Manufacturing Resource Guide, Introduction

- Forestopia. A Practical Guide to the New Forest Economy WIB

- WPTLG A-7
- WPTLG L-1
- Forestopia. A Practical Guide to the New Forest Economy WIB

Video:

- The Circle of Life
- Dynamic forests
- WoodLINKS Careers in Wood Kit

Internet:

- WoodLINKS Website
- FERIC Website



**Advanced
Wood Products Manufacturing
Learning Outcomes, Instructional Strategies,
Assessment Strategies, Learning Resources**

Advanced Wood Products Manufacturing: Fundamentals

Learning Outcomes

It is expected that the student will be able to:

- describe quality control processes in the wood products industry

Suggested Instructional Strategies

Students will be responsible for a broad based understanding of the manufacturing processes as well as quality control methods. At the beginning of the course, arrange for a set of plant tours that cover the full range of manufacturing applications from high technology, to the one-man cottage model shop. The tours, along with the ones they took in Introduction to Wood Products Manufacturing, will form the basis of several research projects throughout the term.

- In groups, have students compare and contrast the quality control programs in several of the manufacturing plants that have been toured. Students should look at:
 - * training of employees
 - * technological change and quality
 - * grading technology and application
 - * sensor technology
 - * employee buy-in
- Develop quality control standards for your own production shop and group projects. Build a basic document that shows the placement of quality control steps within the manufacturing processes you develop. Where are the checks made? Who makes them? What standards do they follow? How do you define standards?

Suggested Assessment Strategies

- Reflective Journals: Once again, ask students to keep a reflective journal that outlines their observations, thoughts, reactions and feelings about the work that they are doing. These journals are to be checked perhaps twice a month with the mark being based solely on the quality and quantity of ideas that the students have developed. Some students might be more comfortable thinking of them as work logs or lab notebooks, but the whole point is to have students regularly recording their thoughts, thinking about what they have seen and done.
- The shop and project quality control documents should clearly show:
 - * a flow chart of the manufacturing process with quality checks built in and highlighted
 - * a working definition of what quality means for a particular phase of the project, students may well opt to create a “template” or “prototype” of a quality project for each checking stage.
 - * students DO NOT have to make dozens of check points. Rather they need to choose crucial points in the manufacturing process where the quality of the component can affect the final product.
 - * working diagrams, samples or photographs of the project at each checkpoint
 - * a brief training schedule that outlines how to train workers to both manage the quality checks and to pay attention to quality at all times
 - * comparison and contrast research documents should focus on both the similarities between plants and the reasons for the differences. Technology is often a factor as well as the end market for the products.

Learning Resources

Print:

- WPTLG L-1 WIB
- *Selling Science to Students. A Guide for Front-runners and Innovators in the Schools* WIB
- *An Annotated Bibliography to Value-Added Wood Products Research* WIB
- *Directory to Secondary Manufacturing of Wood Products in British Columbia* WIB

Video:

- *Tiger Stop. Precision Automation*
- *Pathways to Success. Center of Learning and Competitiveness*

Learning Outcomes

It is expected that students will be able to:

- evaluate recent high technology manufacturing plant upgrades in the local community

Suggested Instructional Strategies

- Set up a mentor program for the AWPM class that will hook up each student or small group of students with a mentor at one of the manufacturing plants in your area. The mentors ideally would come to a “panel” workshop morning with the class to meet and discuss current upgrades in each of their sites. Over the year or semester the individuals or small groups would spend time with the mentor at the job site, shadowing the mentor and reporting back to the class on the current projects.
- Students should complete short technical reports on the plant upgrades they have researched. Reports should include both the reasons for the upgrade and the wide-ranging effects.
- The class should construct an overall picture of the types of technological changes that have taken place throughout the community over the past few years. Students should look for patterns in what companies are doing and then project those patterns into the near future to estimate possible trends.
- With the group or class production project, students should do a class brainstorm and report on what the project would look like if all the high technology applications they have seen or heard of were applied to manufacturing their project. Do a flow chart of the manufacturing process and consider quality control systems as well. What would the plant look like? What would be a minimal workforce? Where would the major markets be? If feasible, a small group might put together a scale model of the production facility.

Suggested Assessment Strategies

- When looking at manufacturing plant upgrades student reports, consider:
 - * the reason for the technological upgrade
 - * the impact on employment and job descriptions
 - * the impact on maintenance skills and schedules
 - * the training considerations for employees in both operations and safety
- The technological change document should be completed with whole class participation and then small group completing of each segment. The key is to focus on the kind of changes that are taking place in the working “culture” of the community and the kinds of education that is required to maintain the changing trends.

Learning Resources

Print:

- WPTLG A-3, L-1 WIB
- Furniture Manufacturing Processes WIB
- WoodLINKS Wood Products Manufacturing Resource Guide, Introduction
- *Matching Innovative Panel Processing Technologies with Japanese Market Requirements* WIB
- *Evaluation of Products and Technology for the Secondary Wood Processing Industry* WIB
- *Wood Machining Technology in Japan* WIB
- *Wood Technology: Portland Show 1997* WIB

Video:

- WoodLINKS Careers in Wood Kit
- Ligmatech - Return Conveyors
- UCC – Examples of Robotics

Learning Outcomes

It is expected that students will be able to:

- communicate effectively in the workplace

Suggested Instructional Strategies

Communications skills need strong emphasis throughout the course. This learning outcome is repeated in this course because wood products manufacturing industry representatives view it as a critical component to insure that communications skills are mastered. Much of the “instruction” simply needs to be the instructor insisting that students treat the classroom as a workplace and model their behavior appropriately. The teacher can communicate appropriate levels of communications skills using the WoodLINKS Skills CheckLIST.

- Present conflict resolution steps to students and then have them practice some of the techniques in role play situations.
- When guest speakers are available, some of the student questions should be on the type of conflicts the speaker has encountered on the job and how they were handled. Explore the whole topic of accurate business communications with speakers to get some of their insights.
- A major part of early communications in the course will be the decision on the manufacturing project for the year. Rather than simply dictating the project, the instructor should allow groups of students to investigate potential projects from a provided suggested list, and then put together a brief business case for the project the group wants to do. Within each group and then with the class as a whole, there will certainly be conflicts and the instructor can carefully focus student attention on the resolution process.

Suggested Assessment Strategies

Conflict resolution, team skills and leadership skills should be a part of the communications training for the AWPM students. Use the WoodLINKS Skills CheckLIST to identify and discuss criteria with students. You could build a classroom criteria like the one below for effective team meetings:

Team Meetings

- agenda (with time estimates)
- roles
 - * meeting leader
 - ◊ opens meeting
 - ◊ facilitates problem solving
 - ◊ help develop decisions
 - * note taker
 - ◊ key points covered
 - ◊ reports decisions
 - ◊ one report to everyone
 - * time keeper
 - ◊ tracks each agenda item
 - ◊ requires decisions on time limits, finish or spend more time
- evaluate each meeting, look at time use, decision process
- outcomes:
 - * list of ideas or options
 - * shared understandings
 - * priorities
 - * decisions
 - ◊ action plans

Learning Resources

Print:

- WPTLG E-1 WIB
- WoodLINKS Skills CheckLIST
- Peer Counseling or Peer Mediation training often available from school counselors

Learning Outcomes

It is expected that students will be able to:

- apply appropriate safety regulations and standards
- assess a manufacturing operation to determine if the safety of any of the operations can be improved
- apply appropriate equipment safety in the production shop

Suggested Instructional Strategies

- Invite a Professional Health and Safety speaker to address the class and, in addition to the standard presentation, request that they relate a wide a range of manufacturing accidents and problems, looking at the mistakes made and the best solutions.
- In groups, have students do a safety audit of all shops in the school and from that work build a single “shop safety guide” for the school noting the most important precautions and procedures for each shop.
- Discuss with local manufacturers what they use as a safety course with new employees and if possible, have your students take one of the courses, either on site or in the classroom with the industry trainer.
- In a classroom discussion have students develop a “safety screen”, a set of questions that a person can apply to any piece of equipment, in order to check out the level of safety and safe procedures. Once developed, then have students apply the screen to their proposed manufacturing process highlighting the most dangerous locations
- Depending on student experience (some of them may not have taken Introduction to Wood Products Manufacturing or any other wood working course) provide time for students to review various Health and Safety videos and/or Wood in the Box equipment videos.

Suggested Assessment Strategies

- Emphasize to students that throughout the course, but more particularly when dealing with safety issues, you will expect to find safety ideas and issues in their reflective journals.
- Use the rough draft of the WoodLINKS Skills CheckLIST that each student has in order to “sign off” student competence and safety knowledge for each machine.
- Shop safety audits should be written up as short technical reports with:
 - * clear indication of shop covered and time
 - * extensive use of subheadings to make the documents accessible
 - * good descriptions of each shop situation and any safety problems associated with those machines
 - * suggestions for improvement in problem situations
- If students are able to take a manufacturer’s safety course, and if there is a test, have the students complete the test and discuss their achievement.

Learning Resources

Print:

- WPTLG B-1 through B-10 WIB
- *Mechanical Trades Safety Manual* WIB
- WPTLG H-1 through H-3 WIB
- Worksafe Report – Fatalities and Serious Injuries in Sawmills WIB

Video:

- WMIA Safety Video WIB
- WCB videos, (see IWPM resources)
- Wood in the Box videos on specific machines, (see IWPM resources)

Advanced Wood Products Manufacturing: Manufacturing

Learning Outcomes

It is expected that students will be able to:

- describe the major shifts in the manufacturing of products since the industrial revolution

- define productivity

Suggested Instructional Strategies

How instructors and students approach the major shifts in manufacturing will depend on the specialization the instructor has chosen for the class:

- furniture/kitchen cabinet manufacture
- value added manufacturing of wood
- standard wood production (sawmill, pulpmill, plywood, composites)
- entrepreneurship

Though most of the changes are related to automation and new technology each specialization has experienced these changes in different ways and at different times. One of the best ways to “capture” the major shifts is to invite in older guest speakers, from the area of specialization, to review the changes they have seen and to get their evaluation of those changes.

- The use of waste products is a major feature of the changes and should be directly covered. What did mills do with their wastes in the 1950s? What do they do with their wastes now?
- Productivity is generally seen as the number of units produced per employee, therefore, as you increase technology and automation you have fewer employees but greater output of product and therefore greater productivity.
- What are some of the consequences of fewer people on the plant floor? What kind of work atmosphere or culture is developed? Students should try to interview or bring in a series of retired employees to gauge their evaluation of the changes.
- After guest speakers have been covered, present students with a summary task of deciding how “productivity” affects the quality of products.

Suggested Assessment Strategies

Evaluate students' information from guest speakers based on their reflective journals and on one to two page reports for each guest speaker. The reports should cover the essential information the speaker brought to the class as well as the more human aspects of the presentation.

- Guest Speaker reports should:
 - * clearly identify the speaker and their role in their company
 - * summarize each of the major points the speaker presented
 - * contain several questions the student would now like to ask the speaker
 - * provide a brief overview of the speaker's career and training
 - * evaluate the speaker's contribution in terms of the major concepts under consideration such as automation or quality production

- It may be useful to combine students' investigations of productivity into a large group poster. Set up several groups to develop various parts of the poster and evaluate based on:
 - * ease of reading, good use of highlights and clear printing (preferably computer printed and pasted)
 - * use of diagrams and charts to illustrate concepts and provide visual interest
 - * logical and defensible conclusions

Learning Resources

Print:

- WPTLG L-1 WIB
- *Evaluation of Products and Technology for the Secondary Wood Processing Industry* WIB

- WPTLG J-1 WIB
- Furniture Manufacturing Processes WIB
- *Impacts of the Value-Added Wood Products Sector in Northern British Columbia* WIB

Learning Outcomes

It is expected that students will be able to:

- explain the free enterprise system in relation to the global wood products industry
- describe the characteristics of an entrepreneur
- present steps for starting a business and participate in a business enterprise

Suggested Instructional Strategies

Within both the local community and specialization plants you will find manufacturers whose product is primarily developed for a foreign market. Standard sawmill and pulpmill production is highly tied to the U.S. economy since some 60% of production is sold into the U.S. Students need to investigate these linkages and understand the complexity of product pricing.

- Have student groups investigate the marketing of local manufacturing products. Each group could cover one type of product or plant. Pull the whole set together with a PowerPoint presentation of global marketing in wood products manufacturing.
- Continue the above project by building a model of the business and personal interactions that radiate out from the manufacturing plants in your community (or a subset if you have a large number). Students would investigate suppliers, money spent by employees throughout the community, services that are in place because of the employees, all within the context of a free enterprise system.
- Build some short biographies of major entrepreneurs in your area. What do they have in common? (enthusiasm, leadership, hard working, self confident, see the potential in ideas, not easily discouraged, etc.). Have students place into their journals at least one “scenario” where they would be entrepreneurs, explaining the idea and how it would develop into a successful enterprise.
- Invite a speaker from the Chamber of Commerce, Youth Internship, local, regional or national agency, or another organization talk about starting a business and the necessary steps. Have students complete a start-up business plan for an enterprise they would like to run.
- Lead the class in a discussion of the class manufacturing business when that has been decided and work through the startup phase.

Suggested Assessment Strategies

- Student presentations on the global nature of the wood products industry can be assessed looking at:
 - * concise, applicable language using wood products vocabulary where it is sensible
 - * well organized, each idea logically following the one before, good transitions when required between topics
 - * all ideas and concepts relevant to the global economy and free enterprise
 - * good attention to details (spelling, correct spelling in company names, consistent use of cues)
- Students completing reports on local entrepreneurs should be evaluated based on criteria like:
 - * good outline of career and training
 - * emphasis on personality and work characteristics that allow the person to be successful
 - * reflection on how such people “create” community wealth
- Students own entrepreneurial “dreams” do not need to be as detailed as an actual business plan but they should be firmly attached to reality. The SWOT format can be a useful organizer for such student projects (Strengths, Weaknesses, Opportunities, Threats). Each can form one section of the report.

Learning Resources

Print:

- *Industrial Competitiveness: A Sectoral Perspective* WIB

Multimedia:

- WoodLINKS Careers in Wood Kit

Learning Outcomes

It is expected that students will be able to:

- select appropriate wood seasoning, wood conditioning and wood drying processes for products
- identify different materials for a variety of wood products
- conduct destructive and non-destructive materials testing
- analyze wood by-products and their potential uses

Suggested Instructional Strategies

It is important that students recognize that in order to be used in a quality fashion, wood must undergo some conditioning process in order to control for shrink, cracking and warping. Though all of the resources discuss technological conditioning, many small scale furniture manufacturers still use careful, covered stacking of wood over several seasons. Depending on the resources and equipment available in the school, some of these outcomes will be covered in greater depth in some regions than in others (regional specialization). All students should actively participate (work experience, field trip, on-line or virtual, etc.) in all of the components of at least one kiln charge prior to achieving WoodLINKS certification.

- Tour wood kiln operations and provide students with a clear outline of what happens when wood is kiln dried. Have students provide examples of the kind of problems that can be expected if people use green lumber instead of kiln dried lumber in various applications.
- Provide students with a list of a wide range of products and have them indicate what wood or composite material should be used to produce the product. Each choice should be justified in terms of both quality and potential market.
- Students should research various testing methods applied to wood products and wood laminates and should then look at replicating those tests in their own shop. Stress tests of both wood structural integrity and wood joints (both glued and mechanical) should be carried out.
- Manufactured boards (oriented strandboard and medium density fibre board) are both built from wood by-products. Discuss how they have become important parts of the wood products industry and encourage students to look at other wood by-products that could be better utilized.

Suggested Assessment Strategies

In a brief report indicate information gained on wood kilns. Cover:

- wood characteristics and drying
- how various species dry
- what problems result from SPF bundling (spruce-pine-fir) of species in the mill
- kiln drying as a value-added service for specialty markets

The OSB and MDF investigation should contain at least:

- why they are taking over the sheathing and furniture market from plywood
- what are the raw material requirements for
 - * plywood
 - * OSB
 - * MDF

Learning Resources

Print:

- Canadian Woods – Properties and Uses WIB
- *Drying Pacific Northwest Species for Quality Markets* WIB
- Lumber Drying Kiln Workbook WIB
- *Dry Kiln Operators Manual* WIB
- Timber Drying Kilns and Kiln Drying WIB
- Wood Handbook WIB

- WPTLG A-3, A-5, A-6 WIB
- Introduction to the Wood Products Industry, Instructor's Guide / Student Workbook WIB
- Furniture Construction WIB
- Wood Handbook WIB
- Canadian Woods - Properties and Uses WIB
- *A Discussion of Wood Quality Attributes and their Practical Implications* WIB
- *British Columbia Kiln Directory, Coast and Southeast Regions* WIB

- Machining and Related Mechanical Properties of 15 BC Wood Species WIB

- Introduction to the Wood Products Industry, Instructor's Guide / Student Workbook WIB
- WoodLINKS Wood Products Manufacturing Resource Guide, Introduction
- Wood Handbook WIB
- Canadian Woods - Properties and Uses WIB

Video:

- Kiln Drying for Quality

Learning Outcomes

It is expected that students will be able to:

- differentiate between types of wood joints
- classify assembly methods, components and adhesives
- describe and apply finishing processes
- use appropriate furniture fixtures, fasteners and display products

Suggested Instructional Strategies

- Have students investigate the historical use of wood joints for both industrial and cabinet products. This could involve Internet research as well as library research. What type of wood joints are currently used when done:
 - * entirely by hand tools
 - * by hand power tools
 - * by specialty shop machines
- Have students investigate, and bring in, if possible, a variety of assembly components used in the RTA (Ready to Assemble) sector. How does the Swedish RTA leader, IKEA, assemble furniture? Do they use joints? Why, or why not?
- Break the class into four groups and have each of them use the WIB videos to start their investigation of each finishing technique:
 - * staining wood
 - * lacquers and varnishing
 - * oil shellac & wax
 - * painting

Student teams should investigate various fastener systems and display products and their application and report their observations to the class both orally and in written format.

- Have students canvas the local furniture and manufacturing sites, along with hardware stores (with an appropriate letter from the principal and instructor and perhaps a previous phone call) in order to gather samples of all possible cabinet and furniture fixtures used in manufacturing. As a whole class, have students create a display of these materials and a “test kit”. The display is used for instruction and learning, while the test kit can be used to test students’ recognition of the object as well as the technology it represents.

Suggested Assessment Strategies

Results of students' investigations of wood joints, fasteners, display products could be reported through the use of PowerPoint presentations. Use presentation criteria such as:

- effective use of color (not too much)
- ease of reading text
- no more than 5 points per slide
- effective use of graphics
- quality of the handout

Joint content can be evaluated on:

- ease of producing the joint
- "manufacturability" of the joint
- quality control
- customer satisfaction

The RTA sector is one of the major competitive strategies, providing quality furniture at significantly reduced prices since the user does the assembly. Criteria for RTA report:

- range of assembly strategies
- security of assembly methods
- ease of assembly
- market penetration
- demographic targets of RTA manufacturers

Learning Resources

Print:

- Furniture Construction WIB
- Wood Handbook WIB
- Tips on Edge Gluing Wood WIB
- Making it Stick – The Basics of Glue and Gluing WIB
- Furniture Manufacturing Equipment WIB
- Wood Handbook WIB
- Canadian Woods – Properties and Uses WIB
- WoodLINKS Wood Products Manufacturing Resource Guide, Introduction
- *An Examination of Japanese Wood Laminating Technology* WIB
- *Matching Innovative Panel Processing Technologies with Japanese Market Requirements* WIB
- Wood Handbook WIB
- Furniture Manufacturing Processes WIB
- Basic Electrostatic Spray Finishing WIB
- Operator Finishing Techniques WIB
- Wood Handbook WIB
- Furniture Construction WIB
- Furniture Manufacturing Processes WIB
- Furniture Manufacturing Equipment WIB
- WoodLINKS Wood Products Manufacturing Resource Guide, Introduction

Video:

- *Gluing and Clamping*
- *Jointer / Surfacer*
- *Plywood Grades and Properties*
- *Wood Finishing Protection: Staining Wood*
- *Wood Finishing Protection: Lacquers & Varnishes*
- *Oil, Shellac & Wax*
- *Preparing & Repairing*
- *Painting Wood Furniture*

Suggested Assessment Strategies

One of the skills that need to be taught and practiced is the combination of good active listening and good questioning as students tour plants and as guest speakers attend. Questioning can be assessed and students can help define criteria such as:

- * relate their questions to the specific topic
 - * avoid use of cliches, jargon, buzzwords
 - * use industry standard vocabulary where appropriate and ask for definitions of wood products vocabulary from guest speakers
 - * where possible follow a planned, logical set of questions
 - * consistently focus on the stated purpose of the tour or of the guest speaker's topic
 - * try to ask questions that help to make connections between the current situation and the overall wood products industry
- Have students canvas the local furniture and manufacturing sites, along with hardware stores (with an appropriate letter from the principal and instructor and perhaps a previous phone call) in order to gather samples of wood or composites used in manufacturing. As a whole class then have students create a display of these materials and a "test kit", the display being used for instruction and learning, while the test kit can be used to test students' recognition of the object as well as the technology it represents.

Learning Resources

Print:

- WPTLG A-6 WIB
- Furniture Construction WIB
- Furniture Manufacturing Processes WIB
- Furniture Manufacturing Equipment WIB
- Wood Handbook WIB
- WoodLINKS Wood Products Manufacturing Resource Guide, Introduction WIB
- *Making Wood Work: A Survey of Value-Added Policies and Programs* WIB
- *Interior Wood Finishing* WIB

- Wood Handbook WIB
- WoodLINKS Wood Products Manufacturing Resource Guide, Introduction WIB
- Wood Handbook – Wood as an Engineered Material WIB
- Wood Reference Handbook WIB
- Introduction to the Wood Products Industry, Instructor's Guide / Student Handbook WIB
- New Taxonomy of Wood Products WIB

Video:

- Profits from Plywood
- OSB – Performance by Design
- *Canwood Furniture*
- *Construction of Engineered Wood Roofs*
- *Koetter Woodworking "A Tradition of Quality"*
- *Orientation of the Fine Furniture Program: Camosun College, 1994*
- *Wood Fasteners*

Multimedia:

- WoodLINKS Careers in Wood Kit

Learning Outcomes

It is expected that students will be able to:

- conduct market research for a product
- create and implement a business plan for a wood product
- design a product

Suggested Instructional Strategies

The class, or several teams, design, manufacture and market a product. The intention of the Wood Products Manufacturing curriculum is not just the development of wood products skills but also of business skills. The wood products industry needs entrepreneurs who can see a marketing opportunity and then have the skills necessary to build a company that can manufacture and market that product, or an employee who can persuade management to undertake a new product line.

- As student groups prepare their case for a product the class or group will create both the market research and the business plan for the product. These will be major tools for them as they present their case.
- Initial stages of product design should also consider the design of the manufacturing facilities in your wood shop including rough drawings of the jigs that would be used.
- Since students will be working in groups, the instructors role will be to manage those groups and keep them on task. Do not spend too long on the initial decision making. Get students committed to a specific product and its manufacturing within 5 to 10 hours.

Suggested Assessment Strategies

Student marketing research reports should reflect the following criteria:

- Problem definition: How did students set out their marketing problem?
- Exploratory research: What initial small steps did they use to look at how the product might be received? (family, friends, local mall, etc.)
- Formal research design: What method was used to get consumer response: mail-out, interviews? (the basic outline of the interview scripted along with drawings or prototype)
- Data collection : Records of how and where students applied the research design
- Interpretation: Is the product viable? What would be the target market?

Students need to be aware of the ideal market research process and then adapt it to their own local conditions. Students should create an interview script and interview in several different venues, as the most cost effective and time effective method, but they should be aware that market research can be much more complex and thorough.

Student work in groups should be an explicit part of their mark for the course. We are training them in team work. The WoodLINKS Skills CheckLIST contains a “Team skills” component which should be used early in the course. You could develop a set of criteria with students that looks at how students:

- Make suggestions in the group both on content and on how the group works
- Put forward tentative ideas that invite response and considerations.
- Encourage other students and help to build on their ideas.
- Ask questions to clarify and build understanding.
- Offer relevant feedback to others.
- Accept relevant feedback from others.
- Meet deadlines for their part of the group work.

Learning Resources

Print:

- WPTLG D-1, E-2, I-1 WIB
- Marketing Guide for Manufacturers and Entrepreneurs WIB
- *Western Red Cedar Market Potential in Europe* WIB
- *So You Want to Export : Foreign Affairs and International Trade* WIB
- *A Marketing Guide for Manufacturers and Entrepreneurs of Secondary-Processed Wood Products in Northeastern United States* WIB
- *Opportunities for Canadian Exporters of Value Added Wood Products in the Southwestern United States* WIB
- *A Market Study of Indonesia and Malaysia*
- *The Japanese Market for Manufactured Building Products* WIB

- Secondary Manufacturing – Guide to Writing a Business Plan
- How to Write a Business Plan for Forest Products Companies WIB
- A Guide to Writing a Business Plan WIB

- WoodLINKS Design Idea Book

Learning Outcomes

It is expected that students will be able to:

- manufacture a wood product
- use CAD/CAM equipment to manufacture a product or component
- select testing systems for wood products

Suggested Instructional Strategies

This is the core of Advanced Wood Products Manufacturing. Some projects may create opportunity for the creation of a small businesses where students manufacture products, sell them, participate in juried competitions or shows, and receive a part of the profits. This manufacturing and business experience is an ideal learning environment for future entrepreneurs, employees, and employers.

- Discuss and develop as appropriate the two manufacturing methods: mass production and custom production. Most class projects will be a mix of custom and mass production .
- Demonstrate and develop several options for the design of a plant using floor plans and scale outlines of machinery. Make sure that safety issues and productivity are considered in layout.
- Develop a time schedule for mass production portions of the class project. Include information about each activity and individual responsibilities.
- Students develop a flow chart of the sequence of manufacturing the product.
- Students participate in the development and design of jigs, fixtures, patterns and gauges for quality control.

Suggested Assessment Strategies

The major evaluation tool during the design and production phase of the class project will be the WoodLINKS Skills CheckLIST. Students will be responsible for individual skills at various machines and for various processes. Students will be evaluated on their teamwork skills and their contribution to the whole project. During this time, most of the WoodLINKS Skills CheckLIST skills will be signed off by the instructor indicating that the students have proficiency in the practical skills developed by the course and they then need only pass the exam for full certification.

Learning Resources

Print:

- WPTLG B-1 through B-10 WIB
- WPTLG E-2 WIB

- WPTLG I-1 WIB
- Furniture Manufacturing Equipment WIB
- *British Columbia Forest Products Industry: Production, Markets, Competition and Competitiveness* WIB

Video:

- *CNC Routers*
- *Construction of Engineered Wood Roofs*

Learning Outcomes

It is expected that students will be able to:

- create a marketing plan for a wood product
- design advertising for a wood product
- select packaging for a wood product
- examine and develop inventory systems for wood products
- explain wood commodity and product pricing

Suggested Instructional Strategies

- Part of the marketing plan should be a sales presentation for their product. Discuss body language and clear communications. Have the students sell their product to classmates around the school.
- Develop a marketing plan that incorporates production and labour costs, operating budget, and advertising costs and present it to the class.
- Students should research packaging and advertising in the wood products industry. Based on this research they then need to identify the considerations in package selection and design. Have small groups of students develop an advertising strategy for their product.
- Develop a practical inventory system for the class product taking into account storage space and ordering information.
- Consider entering a juried wood products competition. Develop the project with cooperation between Technical Education and Business Education departments in the school.

Suggested Assessment Strategies

The real assessment for the class product and for the marketing plans is if the class can sell a number of the products. It is a simple assessment that students clearly understand: someone has purchased their product.

In day to day terms there are several venues for sales that will prove most valuable to the students:

- Juried competitions: Almost always such competitions result in sales of at least a few products.
- Wood Products/Forestry Forums: There are several target audiences here that are more likely to want to purchase wood products.
- Local malls - especially at Christmas if your product is suitable and ready

The key to these sales, if you do not have a large inventory, is a system of taking careful orders (name, address, phone, etc.), perhaps a small deposit, and sending the product shortly after returning to school and manufacturing the necessary number (a good example of JIT “just in time” inventory and manufacturing). Your major distribution system locally will be student or teacher delivery while regionally the bus system seems to be the fastest and most cost effective.

Learning Resources

Print:

- check with the Business Education department in your school for resources in terms of marketing products
- How to Write a Business Plan for Forest Products Companies WIB
- Secondary Manufacturing – Guide to Writing a Business Plan WIB
- A guide to Writing a Business Plan WIB
- *Marketing Forest Products* WIB
- *Performance of the Value-Added Wood Products Industry in British Columbia* WIB

- WPTLG I-1 WIB

- WPTLG I-1 WIB
- Furniture Manufacturing Processes WIB

- WPTLG I-1 WIB
- Furniture Manufacturing Processes WIB

Advanced Wood Products Manufacturing: Industry Issues

Learning Outcomes

It is expected that students will be able to:

- analyze management and labour perspectives associated with various situations and issues

- investigate and evaluate rotation and non-rotation work schedules for various manufacturing enterprises

Suggested Instructional Strategies

- Have students research the responsibilities and qualities of a good manager. Encourage students to identify appropriate guest speakers and invite them to class.

- Review evaluation procedures and associated standards used by different businesses, professionals (teachers, lawyers, doctors) or by trades training boards.

- Develop a class resource that looks at causes and procedures for termination (progressive discipline, corrective action, severance pay).

- Investigate local plants and report on work scheduling and job definitions in each plant. Have a class forum that considers the reasons, advantages and disadvantages of each system.

Suggested Assessment Strategies

- When looking at management situations some criteria for action are:
 - * recognize interconnectedness between situations
 - * understand employment equity issues
 - * look at contracts and their systems for dealing with problems
 - * progressive discipline
 - * personality and character traits important in management

Learning Resources

Print:

- WPTLG E-3, E-4 WIB
- Forestopia. A Practical Guide to the New Forest Economy WIB

Multimedia:

- WoodLINKS Careers in Wood Kit

Suggested Assessment Strategies

- For student debates, first determine the criteria for evaluation such as:
 - * on topic comments
 - * clear presentation of initial ideas
 - * good communication strategies rather than only confrontation
 - * back up of concepts with research or practical examples
 - * accuracy of information
 - * ability to respond to questions
- Resource investigations should be recorded in students reflective journals and evaluated based on criteria like:
 - * relating concepts to local situations
 - * consideration of both sides of the issue
 - * recognition of the larger community aspects (native land claims, tourism, ecological preservation, government regulation, industry health etc.)
 - * thoughtful reflections on what it might mean for their careers.

Learning Resources

Print:

- WPTLG A-7, L-1 WIB
- Introduction to the Wood Products Industry Instructor's Guide / Student Workbook WIB
- Forestopia. A Practical Guide to the New Forest Economy WIB
- *A Strategic Framework for Growth in British Columbia's Forest Sector* WIB
- *Canada's Forest Industry: A Strategy for Growth* WIB
- *Canada's Forest Inventory 1991-1994* WIB
- *The Forest Industry in Canada* WIB
- *The State of Canada's Forests: 1995-1996* WIB

Multimedia:

- WoodLINKS Careers in Wood Kit