AN ROINN OIDEACHAIS AGUS EOLAIOCHTA

THE JUNIOR CERTIFICATE

MATERIALS TECHNOLOGY (WOOD) SYLLABUS

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1. RATIONALE

The educational philosophy of the course is concerned, with the development of qualities which will emphasise the pupil's role in making and shaping their environment. The pupil will be encouraged to develop the ability to solve practical problems in an innovative and creative manner through the application of appropriate knowledge and skills. Solutions should be devised and executed in an analytic and systematic manner through the mechanism of the design process.

The course will encourage the pupil to employ practical problem solving skills which will promote the application of scientific and technological knowledge. The variety of tasks undertaken by pupils will follow the "project" mode. Manipulative skills will be developed through the processing of materials in the context of making or executing an artefact or project. While the principal medium for these activities will be wood, the knowledge and use of other materials are encouraged in order to broaden the educational experience and to allow greater flexibility in the solution of problems encountered in project and design activity. With the development of the pupil's design sensitivity and an awareness of the problems associated with design the classroom activity should be pupil-centered and the gradual development in factor-of-difficulty of the design/project briefs should, where appropriate, see the teacher as a facilitator of the learning experience.

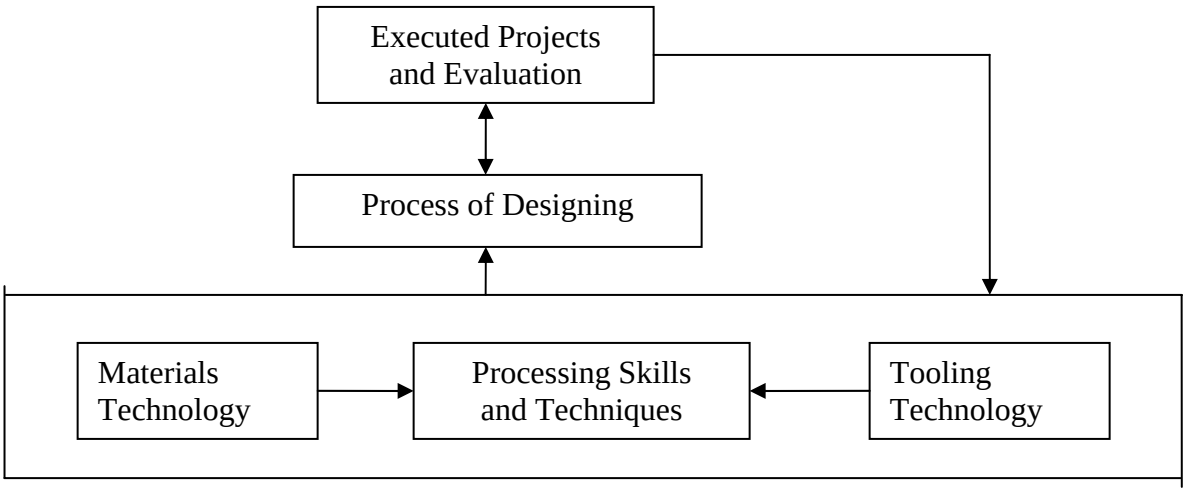
The finished artefacts should reflect the pursuit of excellence in craft skills. However, it is recognised that the experience of the project and design activity and the flexibility of approach used in developing the pupil's creativity will maximise the educational benefits of a dynamic and developmental learning experience. The course is seen as contributing in a unique and significant way to the development of the pupil's autonomy. Nevertheless, the value of group-activity in developing social skills is recognised as important. The course also sets out to promote desirable entrepreneurial, recreational and other life-skills so relevant in contemporary society.

An integral part of the course will be the development of the pupil's appreciation of the significance ecologically, environmentally and economically of the principal raw material s/he uses in the classroom. This may be supported by appropriate field trips and through project work.

2. COURSE STRUCTURE

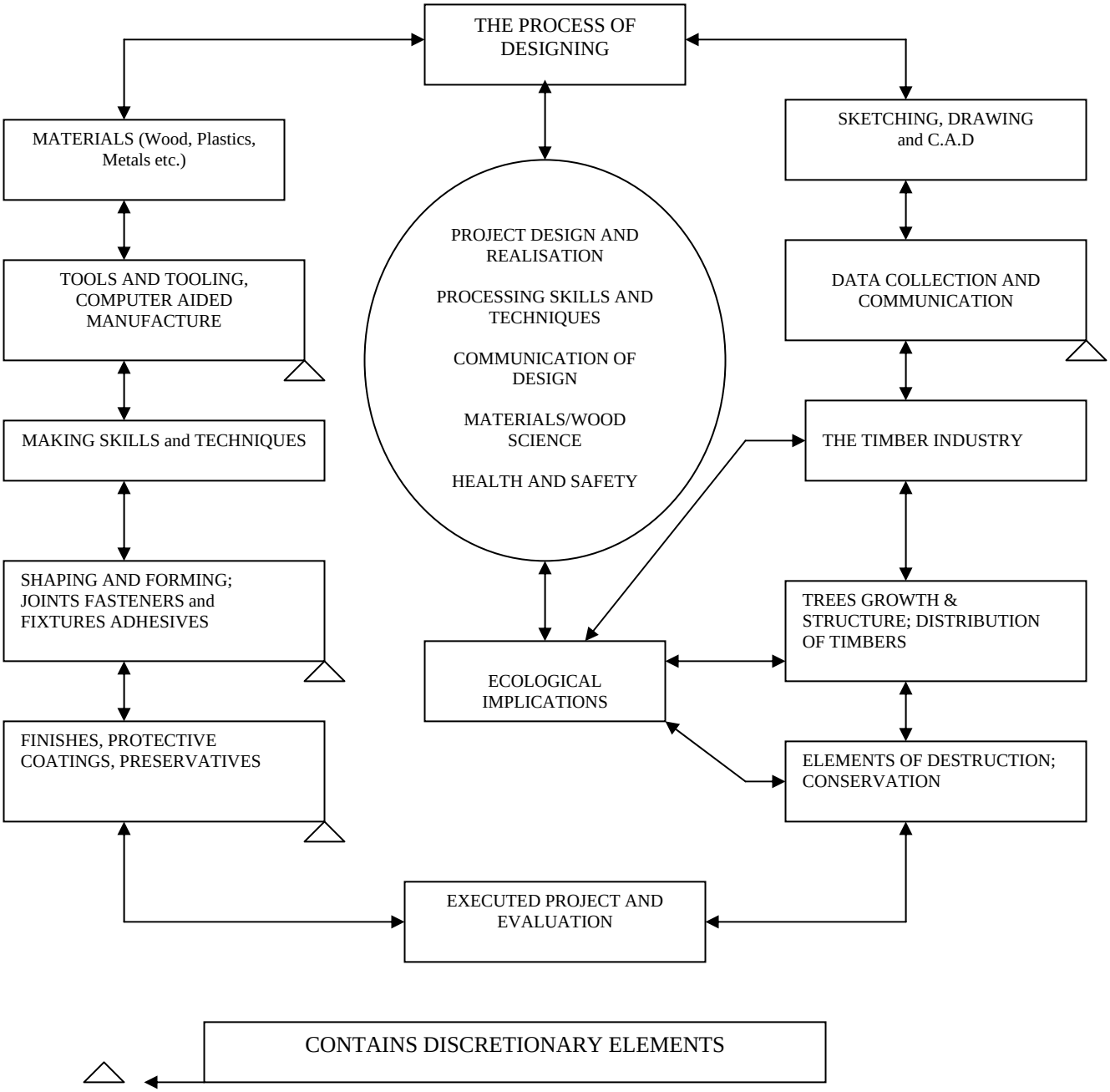
The course is structured around a core of essential components which extend to interrelated elements, some of which are discretionary. The skills of making and producing are interfaced with the design process and the whole builds upon a developing appreciation of materials and associated technologies. The major portion of student work will be expressed through individual and group projects. While the principal means of communication of design will be through graphics and text other appropriate media may be employed. The safe use of tools, equipment and materials will continually be stressed and demonstrated but an appreciation of the broader implications of safety in relation to personal health and environmental effects of materials and equipment should be developed in tandem. The course is designed to cater for all levels of ability. The inter-relationship of the various areas is shown diagrammatically in Figure 1. while Figure 2 is an expansion which shows a flow diagram of the course content.

FIGURE 1



SCHEMATIC DIAGRAM OF COURSE STRUCTURE

FIGURE 2
Flow Diagram of Course Content



2.1 Aims of the Course

(a) To develop a creative approach to problem solving in the design process through designing, making and evaluating, and to promote initiative, enquiry and discrimination

(b) To stimulate the development of a range of manipulative skills through processing wood and other materials

(c) To contribute to the development of graphic and other appropriate communication skills

(d) To promote technological awareness and the exercise of value judgements of an aesthetic, technological and economic nature.

(e) To encourage self-confidence, enthusiasm and a sense of achievement, through the design and execution involved in practical project work

(f) To encourage the acquisition of a body of knowledge appropriate to wood craft and technology through analysis, synthesis and realisation.

(g) To contribute to the pupil's appreciation of ecological and environmental factors and use of natural resources.

2.2 Course Objectives

Pupils will:

- Acquire knowledge and understanding of the problems associated with the process of designing.
- Work within imposed or recognised constraints of materials, cost, time, resources and skills
- Derive satisfaction and confidence from designing, making and evaluating projects
- Acquire knowledge and skills associated with jointing techniques, fasteners, fixtures and adhesives.
- Display appreciation for the character of wood and other materials through appropriate selection and processing.
- Interpret given data and demonstrate graphical and other appropriate communication skills relating to artifacts or systems using appropriate media
- Plan the production of specified and non-specified solutions
- Appropriately finish artifacts in both surface and applied finishes.
- Appreciate the inter-relationship between wood-technology and the environment and technology in general and be aware of relevant technological developments
- Have a knowledge and appreciation of trees in relation to climate, the eco-system and the environment
- Apply safety standards in planning, experimenting and making and in the use of hand and powered tool, equipment and materials.

3. COURSE CONTENT/PREAMBLE

Preamble

The course content is laid out under a variety of headings. General indications of the depth or breadth of study in any area are given. Some of the contributing material under the various sub-headings may appear more than once; this is not intended as an additional emphasis but reflects the close inter-relationship of the elements.

Many of the component elements will recur in spiral fashion over the three years. Their treatment will broaden and deepen according to pupil experience and ability and to the demands of projects undertaken. The content which follows are not necessarily expressed sequentially.

3.1 Project Design and Realisation

This is concerned with solving practical problems in a manner which reflects individuality and creativity. Pupils will achieve the objectives related to this through following the process of design. This process is seen as the basis for all project work undertaken by the pupils. Most of the other activities planned should contribute to this “area” and design is seen as a means to an end rather than an end in itself. Most of the activity will revolve about group and individual project work which in the main will be of a practical nature but may of necessity often be augmented by project work of an investigative kind (e.g., “Which adhesive or finish suits a particular material?” or “How do Irish softwoods compare with imported softwoods for either internal use or external use?” etc.). Not all projects will need to have wood as a base material and pupils will be encouraged to be discriminating in their selection of materials for a particular use. The classroom environment should facilitate critical appraisal of pupils’ design solutions and those of others.

3.1.1 Design Briefs/Appraisal

Fitness for purpose
Aesthetics
Choice of materials, etc.
Basic ergonomics

3.1.2 The Process of Design

Identification of problem/s
Constraints/Limitations
Investigation
Choice of solutions/prototypes

Project planning
Selection of materials
Working drawings, sketches, Computer Aided Design
Execution
Evaluation

3.1.3 Communication of Design

While the principal method of communication will be through working drawings, other methods are to be encouraged which will either replace or complement the drawing. All drawings need not be compiled using instruments. Freehand sketching should be encouraged because of its importance in the thought process in the evolution of a design or problem solution. Sketching is also a means of enhancing details for making or modifying and is a medium of inter-communication of ideas between pupils, peers and teacher.

All pupils are encouraged to use computer software to generate drawing, and where possible and practicable, to apply this to computer assisted manufacture (lathe or router).

An important element of this topic is the interpretation of independently prepared graphical data.

The required skills should not be taught as a separate module but should be developed (and become more sophisticated) as the course progresses. Neither should this area be seen as a course on its own but as an integral part of project and design activity.

3.1.3.1 Freehand Drawing

Freehand 2D sketching, including outline
Sketching 2D reproduction of basic drawings;
3D sketching shading and colouring
Procedural sketches

3.1.3,2 Drawing with Instruments

Use of drawing instruments
Scaling and measurement
Planes of reference
Orthographic projection
Dimensioning
Pictorial drawing
Working drawings
Schematic drawings

Computer Aided Design
Interpretation of independently prepared graphical data

3.1.3.3 Data Bases

Use of catalogues and technical data
Reference books
Electronic data bases (magnetic media)
People sources

3.1.3.4. Report Writing and Presentation

The principal emphasis here will be on how to log processes and experiments and present a report or brief on the projects undertaken. It is not intended that there be a "taught" module on, for instance, model-making or photography but that the pupils have the option of using these as media which support the presentation or describe a process by photographing various stages, for example:

Layout and production of reports
Graphical data (including Computer Graphics)
Photographs
O.H.P. slides
Models, etc
Bar and pie charts etc

3.2 Materials

This area is intended to give a "working" knowledge of the materials used, their makeup and characteristics, appropriate and economic use, etc. Wood should be dealt with in a manner which will develop in the pupil a "feel" for the material and empathy with its use and limitations. The ancillary materials listed below do not require an in-depth knowledge but should follow a "need-to-know" approach. The underlying knowledge should allow pupils to decide with some confidence on the suitability of selected materials.

3.2.1 Wood

Pupils should through macroscopic examination be able to identify common species of hardwoods and softwoods. For example through weight, colour, grain figure etc, identify oak or pine, or identify species through inspection of leaves and seeds. The pupils should also have some knowledge of the microscopic features of the material, such as cell structure and its bearing of properties and use etc.

Growth and structure of trees
Classification of hardwoods and softwoods
Characteristics and properties of woods
See also Finishes, Adhesives, and the Timber Industry.

3.2.1.1 Elements of Conservation and Destruction

This area relates closely to the study of wood as a material in its in-use environment, as well as environmental and ecological considerations and as an integral part of finishes and surface treatment. Therefore the areas for consideration listed hereunder may be dealt with under other associated headings.

Wet and dry rot)
Insect attack) Elements of Destruction
Humans)
Climate)

Preservation of Wood
Conservation of Trees

3.2.2 Metals

Classification, ferrous and non-ferrous
Properties of metals
Finishing

3.2.3 Plastics

Classification; thermoplastics and thermosetting plastics
Glass reinforced plastics
Plastic finishes

3.2.4 Ceramics

Glass, tiles, cement, etc.
Note: see also finishes.

3.2.5 Surface and Applied Finishes

Selection of surfaces and applied finishes will of necessity be influenced by the knowledge of materials. Some of the finishes listed hereunder may not be used while others may be added

at the teachers' or pupils' discretion. It will be necessary, however, for pupils to understand the makeup and character of these finishes in order to facilitate appropriate selection and application.

Burnishing (Wood and Metal)
Preparation for applied finishes
Stains and dyes
Waxes and oils
Lacquers
Varnishes
Paints and preservatives

3.2.6 Adhesives

Developing technology in glues and adhesives has particular relevance to wood technology. Wile a basic knowledge of the chemical elements of adhesives is desirable, again a need-to-know approach will be sufficient for all but the commonly used adhesives. Care of skin and eyes and protection from inhalation are essential. Not all adhesives mentioned need be used and others may be added. A knowledge of the character and application of adhesives will allow pupils to select those suitable for particular purposes, taking factors like environment into account.

Protein Adhesives

Casein Glues
Animal Glues

Synthetic Resin Adhesives

Urea formaldehyde resin
Epoxy resin
Polyvinyl acetate, etc

Impact Adhesives

Normal contact glues
Cyanoacrylate (*Superglues*)

"THERMO" GLUES

3.3 The Timber Industry

Forestry and forest-based enterprises are re-establishing themselves as an important element of the Irish economy. Pupils will need to be familiar with forest development and timber supply to wood-based industry, and with their associated technologies.

Felling and conversion (including sizing)
Seasoning
Grading
Manufactured Boards
By-products
Marketing
Transporting and storage

3.4 Distribution of Timbers

Pupils should have an overview of tree species, their national and world distribution and of the significance of trees and forests to the environment and the ecology. Project work in this area is to be particularly encouraged and pupils should undertake field trips and, where possible, tree-planting at home and in the community or school environment.

Common species
National distribution
World distribution
Trees and forestry in Ireland
Climatic and environmental (including aesthetic and wildlife) effects of trees and on trees.

3.5 Tools & Tooling.

3.5.1 Hand Tools

All pupils will use a range of hand tools as appropriate to the process or operation. Pupils are not limited to the range of existing tools and are encouraged to use any suitable new tools as they become available. Safe use of tools should be stressed at all times. Pupils should understand the concepts of tooling, and the design rationale of tools and it is desirable that they be involved in tooling by making simple jigs and fixtures appropriate to projects being undertaken.

The following are tool categories which will be used in the various processes.

Boring tools
Cutting tools
Paring tools
Shaping tools
Setting-out tools
Fastening tools
Jigs & Fixtures

3.5.2 Power Tools

Hand power tools will be used as appropriate to pupil experience and to the processing of materials. For example, a drill and jig-saw may be the only power tools used in first year. Other power tools, such as the lathe or chisel morticer, would be used by late second year or third year students. It is expected that all pupils will have some experience in the use of power tools.

While the following recommendations are not all-embracing and other or different tools may be included, the principle of using only “safer” tools should be followed

Jig saws
Drills
Sanders (belt and disc)
Lathe (bench model or other)
Chisel Morticer
Router
Spraygun
C.A.M.
Stapler

3.6 Joint Fasteners and Fixtures

Pupils are expected to understand the basic principles of joint design and, according to level, be able to select suitable joints following criteria determined by the projects being executed. The design and execution of any joint will be in the context of making an artefact (a practice joint which precedes the application will sometimes be desirable particularly for the inexperienced pupil). Adhesives and mechanical fasteners may be used in conjunction with various joints or to replace or simplify them. A knowledge of suitable hardware such as locks and hinges is also expected. The list which follows is not exhaustive and may be added to or mortified at the discretion of the teacher

Joint design and technique
Butt and mitre joints
Halving joints
Housed joints
Bridle joints
Mortise and Tenon joints
Dovetail joints
Dowelling
Screws and Nails)
Pins and Staples) includes associated tooling and hardware
"Knockdown" fittings)
Locks and Hinges)

3.7 Shaping and Forming

Not all students need undertake all of the elements listed and a degree of flexibility is encouraged. However, it is desirable that all pupils get hands-on lathe experience. The area of bending and laminating will depend on design, etc.
Embellishments and ornamentation will be developed and used as is appropriate to the design of the project. Pupils are not expected to experience all the processes but one or more is highly desirable, particularly where these encourage self expression and creativity.

3.7.1 Woodturning

The use of the lathe
Woodturning chisels
Templates/Design of outlines
Woodturning techniques
Selection of woods suitable for turning
Surface finishing on the lathe

3.7.2 Bending and Laminating

Reasons for lamination
Laminating techniques
Making and using jigs
Choice of materials
Choice of glues
Finishing bent and laminated elements

3.7.3 Embellishments/Ornamentation

Carving tools
Chip carving
Relief carving
Veneers and veneering
Inlayers (wood and other materials)
Marquetry (geometric and pictorial)
Fretwork
Mouldings
Wood sculpture

3.8 Experiments

While the scientific side of the course is seen as being fully integrated with the various topics, and experimental investigation may occur prior to or concurrently with the execution of the various projects, the following headlines are suggestions of likely experimental activity.

Moisture content of wood
Suitability of various glues
Effectiveness of fasteners
Suitability of stains, dyes and finishes, etc.

4. HEALTH AND SAFETY

All activity either inside or outside the classroom should have firmly established rules and guidelines regarding safe use of materials and equipment and this will need to be continually stressed and revised as appropriate to the activity.

Effects of inhalation of glues and solvents
Effects of solvents and sprays etc., on the environment
Safety with electrical equipment
Safe use of tools
Code of practice for safe use of power tools
Tidiness of the workplace
Storage of equipment, etc.
Protection of sight and hearing
Masks, goggles, muffs, gloves, etc.
Safety consideration in design and finish

5. ASSESSMENT

5.1 Assessment Objectives

Pupils should be able to:

(a) demonstrate an appreciation of the process of designing

(b) interpret design briefs and associated drawings and data

(c) Propose solutions to design problems in the context of perceived or imposed constraints

(d) Appraise proposed or executed solutions to problems and demonstrate the ability to modify these.

(e) Appraise and describe executed projects in the context of the original specification or brief

(f) Demonstrate graphical and other communication skills using various media (e.g. drawing board computer etc) as appropriate.

(g) Demonstrate a knowledge of appropriate drafting standards and conventions

(h) Display a knowledge of jointing techniques, fasteners, fixtures and adhesives.

(i) Demonstrate appropriate craft skills in the execution of tasks and projects and in finishing surfaces

(j) Use hand and powered tools appropriately

(k) Demonstrate the ability to shape and form wood and to add suitable embellishments and ornamentation.

(l) Select and quantify materials appropriate to a task or project

(m) Demonstrate a knowledge of wood and wood-based materials

(n) Describe the composition and properties of adhesives and finishing materials

(o) Demonstrate a knowledge of metals, plastics and fabrics.

(p) Plan the production of specified and non-specified solutions

(q) Satisfy safety standards in planning, experimenting and making.

(r) Appraise and describe the interrelationship between wood-technology and the environment and technology generally

(s) Describe the contribution of trees to environment, climate and the eco-system.

(t) Display a knowledge of the elements and the processes associated with the timber industry.

5.2 Levels and Differentiation

The course is offered at Ordinary and Higher Levels. Candidates will opt for higher or ordinary levels on selection of specified brief. Briefs will be set at two levels in year 3 and the written paper will have two levels.