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THE JUNIOR CERTIFICATE

TECHNOLOGY
SYLLABUS

Introduction

Technology is the achievement of human purposes through the disciplined use of materials, energy, and natural phenomena. Education in and through technology involves

- appropriate resources,
- suitable tasks, and
- the interplay between the two.

The resources involved are the knowledge and skills acquired by the student. A task is an undertaking in which the student seeks to apply those resources of knowledge and skills.

1.1 Aims

The aims of the course are:

- to contribute to the student's preparation for life through encouraging the constructive and creative use of such knowledge and transferable skills as might be applicable to solving practical problems;

- to contribute to the student's development of qualities of self-reliance, self-confidence, resourcefulness and initiative;

- to contribute to the student's preparation for life by stimulating the student's interest and confidence in working safely with equipment and materials;

- to develop in the student such skills of visualisation and of manipulation as are involved in designing and making artefacts;

- to develop in the student the abilities to make a critical evaluation of a piece of work and to take appropriate action;

- to develop the student's knowledge and understanding of communications conventions and of scientific and technological phenomena and terminology;

- to develop in the student an appreciation of how technology impacts on society and an understanding of how it might be used to the benefit or detriment of the social and physical environment;

- to develop in the student an appreciation that established technological solutions reflect the accumulation of the experience and wisdom of the ages.

1.2 Objectives:

Students who have completed a course in Technology should be able to:

- demonstrate a knowledge of technology through solving problems;
- show awareness of the possibilities represented by the development of materials, techniques and equipment;
- satisfy all safety requirements during the designing, planning and making of an artefact or system;
- use technical equipment in order to mark out, cut, shape, form, join and finish materials;
- represent, using recognised conventions, the visualisation of a completed piece of work;
- communicate in simple technical terms through the composition, reading and interpretation of basic working drawings;
- prepare a production plan;
- translate basic working drawings into practical reality by selecting and working materials, using tools and machines and applying relevant skills and knowledge;
- produce the work to a chosen design using, where appropriate, unprepared raw materials, part-prepared raw materials, and fully-prepared components or sub-assemblies;
- complete tasks to a standard of excellence;
- appraise critically the work for quality of design, function and finish and take any measures necessary;
- demonstrate an understanding of the properties of materials;
- demonstrate an understanding of the operating principles of simple components and mechanisms, and how they might be selected, applied, and tested for particular tasks;
- take proper care of equipment and materials;
- recognise the limitations of technology;
- discuss the environmental issues arising from the use of technology;
- demonstrate an understanding of the evolution of technology as a response to the needs of society

2. Course Structure

The central activity in the course is the TASK. The selection of the task will vary according to the stage of development of the student. Every task will require input in terms of knowledge and skills. The interplay between these appropriate resources and suitable tasks is the essence of the course. Knowledge and skills are not treated as independent courses or modules in themselves.

The structure of the course, indicating the relationships between its various elements, is illustrated in the accompanying diagram.

2.1 Knowledge and skills:

The knowledge and skills involved in technology might be related to areas already in the school's curriculum. The tasks undertaken could draw on such areas but further depth or breadth of treatment may be required. The identification of, and provision for, these resource requirements will be a matter for curriculum management.

Participation in a course in technology requires a sound knowledge basis. While it is likely that each student will have some appropriate knowledge, it is expected that a certain amount will need to be explicitly taught in order to ensure sufficient breadth and balance. In order to engage in technological activity, the student will require cognitive and psychomotor skills. Among the areas where skills will need to be developed are, design, making and communication.

2.2 Tasks:

The essence of technology is the process of finding a solution to a problem. The student will be confronted with tasks which involve the application of knowledge and skills. From the student's perspective, these tasks should be seen as allowing scope for creative response. In general they should allow for more than one solution.

The set of tasks to be undertaken will need to show both progression and balance.

Progression is the proper ordering of tasks so as to

- suit the developing abilities of students
- draw upon concepts developed in other areas
- involve a widening variety of materials and processes
- foster the ability to evaluate methods of construction
- involve a widening range of communications skills
- enable the student to address increasingly open-ended problems.

Balance entails

- drawing on as wide a range of resources as possible
- applying a range of design criteria which extends beyond, for example, expediency
- relevance to the individual student, to the community, and to developing technologies.

3. Content

3.1 Knowledge and Skills

The specific knowledge and skills to be taught will vary according to the tasks undertaken. Four categories of technology-related knowledge and skills - communications, craft and materials, energy and control, technology and society, must be experienced by each student.

3.1.1 Communications

It is intended that students acquire a set of communications skills which serves the general aims of the technology course. It is important that the communications component of the course be seen in its proper context and it is not envisaged as being a complete course or module on its own. The communications value of the visual image is three-fold: it is a means of representing something to one-self in the analysis or planning stage of an undertaking; it is a means of sharing one's thoughts with another; and it is a means of receiving information.

Sketching and Drawing
The abilities to create, to represent, and to modify an image are important elements of the thought processes involved in technology. The following elements are intended to contribute to the development of such abilities.

The choice of drawing instruments is left to the discretion of the teacher. It should be noted, however, that students will be expected to use a computer to produce some drawings.

Two dimensions (freehand):
reproduction of simple drawings; production of outline sketches; use of standard graphics symbols as appropriate to tasks undertaken.

Three dimensions (freehand or by other means):
planometric/oblique drawings; isometric drawings; elementary perspective. (Through this section, the use of shading and colour should be introduced as opportunities arise.)

Orthographic drawing:
use of instruments; scaling and measurement; planes of reference; production of working drawings.

Schematic drawings and procedural sketches:
production of simple schematic drawings and procedural sketches as appropriate to the range of tasks undertaken.

Computer Applications
It is necessary that the student be aware of the possibilities for the exploitation of the computer.

Introduction to computers:
- main input and output devices, elementary keyboard use, loading and saving programs/fires

Graphics:
- generation of graphic images and the production of drawings either by programming or by use of available software

Reports:

> **production of reports, including appropriate text and graphic images, through the use of suitable software.**

Information Sources
Communication includes the acquisition of information or data. In undertaking tasks, the student will often be expected to locate sources of information, extract the required elements, and apply them. For such purposes, a range of skills must be developed. These skills might be applied to information held by persons, stored on paper, or stored on magnetic media.

The information-gathering skills required for technology include:

> knowledge of a suitable set of information sources, including databases, related to the range of tasks which the student might undertake, use of indices or other keys to extract data from source works, interpretation of independently-prepared graphic data.

Additional Forms of Communication
In addition to the elements prescribed above, the student should experience some other means of communication. The following possibilities are listed as suggestions, but the decision should rest with the teacher and student.

Model-making:

> The making of models using easily worked materials (e.g. card, balsa wood, polystyrene, papier mache, kits etc.)

Presentation:

> As a supplement or an alternative to the production of reports on paper, students might use video- or audio-recording, use photography, or prepare a personal presentation using such aids as an overhead projector.

3.1.2 Craft and Materials

Particular attention should be paid to the development of foundation skills appropriate to the materials selected and the types of task undertaken. Students should have at their disposal a suitably wide range of materials and skills to realise the full potential represented by the subject.
It is not envisaged that students work with all the materials listed. They should work with a range of materials from the following categories:

> metals (steel, brass, copper, aluminium, etc)
> woods (hardwoods, softwoods, manufactured boards etc.)
> ceramics (glass, clay, enamels, etc.)
> fabrics: natural (wool, linen, leather, etc.), man-made (nylon, polyester, rayon, etc.)
> plastics (acrylic, polyester resin, glass fibre, plastic dip coating powders, etc.)
> composite materials (concrete, Plasticine, plaster, cardboard, paper, etc.)

Properties of Materials

> Students should acquire knowledge of the properties of materials through their use and through testing and through evaluation of completed pieces of work.

Measuring and Marking Out

> **Students should acquire the skills to transfer information from drawings, sketches, models, templates and patterns to materials.**
> **measuring which can include the use of rules, callipers, micrometers, etc.**
> **marking out with tools such as squares, gauges, scribers, dividers, chalks, etc.**

Cutting

> Students should acquire the skills to cut materials accurately and safely with tools such as saws, shears, knives, chisels, drills (including hand and power tools).

Shaping

> selection of appropriate tools in shaping materials i.e. by removing surplus material using tools such as planes, surforms, files, chisels, lathes, mallets, punches, glasscutters, shears, etc.

Forming

> changing the form of materials without loss of material. (Hot and cold methods may be applied); thermo forming of plastics and wood; moulding (P.V.C., low temperature metal casting, plaster casting, concrete, clay etc.); lamination (woods, glass fibre, etc.); potting wheel; hot and cold bending of metals; weaving (using frames and looms); macramé; felting; knitting; patchwork.

Joining and Assembling
Joining of materials can be by permanent or non-permanent methods. An assortment of assembly or joining methods is essential to facilitate easy fabrication of materials and components.

> These may include: wood joints, dowelling, nuts and bolts, screws, nails, rivets, solders, glues, adhesives, fastenings, clips, staples, sewing (hand and machine), etc.

Finishing of Materials

> processes employed to enhance the materials used in the completed task may include, abrasives, polishes, varnishes, lacquers, oils, paints, plastic dip coating, enamelling, dyeing and printing, preservatives, etching, appliqué and embroidery, etc.

3.1.3 Energy and Control

This section deals with sources of energy which, when changed and/or controlled, enable devices to perform tasks safely and efficiently.

Energy

> recognition of the following forms of energy - mechanical, chemical, electrical, heat, light, sound,
> devices that convert energy from one form to another described as simple input-output systems using block diagrams,
> units of energy and power,
> the need for the conservation of energy sources.

Structures
A structure is an assembly of members of selected materials arranged in a manner that maintains its general shape while under load.

> identification of the various types of forces acting on a structure (tension, compression, bending, shear, torsion)
> the role of triangulation in the rigidity of a structure.

Mechanisms
A mechanical device is made up of one or more mechanisms which change and transfer motion and force.

different types of motion (linear, rotary, oscillatory, reciprocating)
application of mechanisms such as levers, linkages, pulleys, belts, chains, gears, cams, screw threads, clutches etc.,
the function of bearings and lubrication.

Electric Circuits

electric current as a flow of charge,
correct use of the following terms: DC power source, voltage, current, resistance,
the relationship between voltage, current, resistance,
the units in which current, voltage, resistance are measured,
use of instruments to test continuity, to measure current, voltage, resistance,
simple circuits incorporating a range of simple devices e.g. bulbs, buzzers, switches.

Electronic Systems
Simple electronic systems are to be treated as in the following diagram,

input sensors to include switches. light, sound, heat. Etc.
process units to include decision making (digital logic), amplification, switching, time-delay;
output to include light. sound. heat. Motion,
assembly and use of simple systems

Pneumatics
Pneumatics is to be viewed as energy stored in compressed air converted into controlled motion by the use of valves, cylinders.

use of compressor, single acting (spring return cylinders), double acting cylinder, three port valve, five port valve, time delay device.
assembly and use of simple circuits to produce controlled motion.

Robotics
The extension of electronic and pneumatic systems to include memory in the process stage leading to controlled motion at the output.

use of the computer to provide control.

3.1.4 Technology and Society

Attention should be drawn to the relationship between technology and society wherever appropriate. Technology can be represented as one means by which society meets its needs and solves many of its practical problems. Attention should also be drawn to the limitations of technology and to some of its negative aspects. Students should acquire a basic understanding of some of the issues which society faces as a result of technological developments.

In addition to the general treatment suggested above, the student should undertake a particular study of five topics such as:

A brief history of technological developments since the Industda! Revolution.

The effects on the environment of technological development.

Technology and Agriculture.

Technology and Social/Cultural development.

Technology and Labour.

The technology gap between the first and third worlds.

Technology and Industry.

Technology in the home.

Food Technology.

An aspect of the history of design.

3.2 Design Procedure

This section of the course should not tie seen as serf-contained, but rather as an analysis of the approach to a task. Hence, there are clear links with the other sections of the course. Students need to develop a critical awareness of design problems and solutions. The procedure set out below is a design, make and test approach to problem-solving. The student's design activity may arise from either (a) observation or recognition of a need, want, desire or problem; or (b) from a brief which outlines a problem, need, or situation. The student should show evidence of investigation or analysis before presenting possible solutions to the problem. Solutions should be presented using appropriate communications techniques; a model or mock-up of the proposed solution might be appropriate. The design should be realised and a thorough evaluation of the product should take place in relation to the design brief and specification.

3.2.1 Identification of Problems

problem interpretation and clarification
preparation of a brief
production of a set of objective criteria as an ordered list of priorities
identification of constraints: technical (e.g. function, construction, ergonomics anthropometrics, safety); aesthetic (e.g. proportion, colour, shape, texture, structure.); economic (e.g cost, value for money, time); social (e.g. awareness of the impact of technology on society).

3.2.2 Research and Ordering of Information

investigation of the range of sources or stimuli for design - nature, man-made phenomena, previous design solutions
determining primary and secondary sources of information
acquisition of skills such as interviewing, field-studies, questionnaires, visual notation, brain-storming.

3.2.3 Conceptualisation and Modelling

translation of ideas from two-dimensional form to three-dimensional form where appropriate
model making, where appropriate, to determine scale, shape and form and the benefit of alternative solutions
modification and corrective action

3.2.4 Production

organised realisation of the design

3.2.5 Evaluation

evaluation of the solution in terms of the brief and specifications; reporting findings; modification and corrective action if necessary.

3.3 Tasks

A task is an undertaking which
involves an element of design/planning,
draws on resources of knowledge and skills, and
results in a completed piece of work.

It is a learning situation which provides students with enjoyable experiences in the practice of inventive thought through solving practical problems. The ability to undertake and complete a task is the essence of technological capability.

Tasks may be classified in a number of ways, viz.
A task may be <u>closed</u>, where there is only one possible outcome, which is fully predictable when the task is assigned, or it may be <u>open</u> where there are a number of possible outcomes.
A task may be <u>simple</u> involving a single area of knowledge and skills, or it may be requiring knowledge and skills from a number of areas.
A task may be <u>small-scale</u> or it may be <u>extensive</u>, occupying a student's attention over a number of weeks of class and study time.

In general, students may be expected to progress from tasks which are closed to those which are open; from tasks which are simple to those which are integrated; and from those which are small-scale to those which are extensive - while allowing a student to reach the highest level of excellence attainable. Tasks could involve individual/or group work.

Virtually all tasks will involve working with equipment/materials. Since the design-make-test process cannot be satisfactorily implemented as a paper exercise only, the tasks must be taken to completion.

In the selection of tasks a balance must be achieved between the different content areas of the syllabus. The choice of tasks may be teacher directed although students should be encouraged to suggest their own.

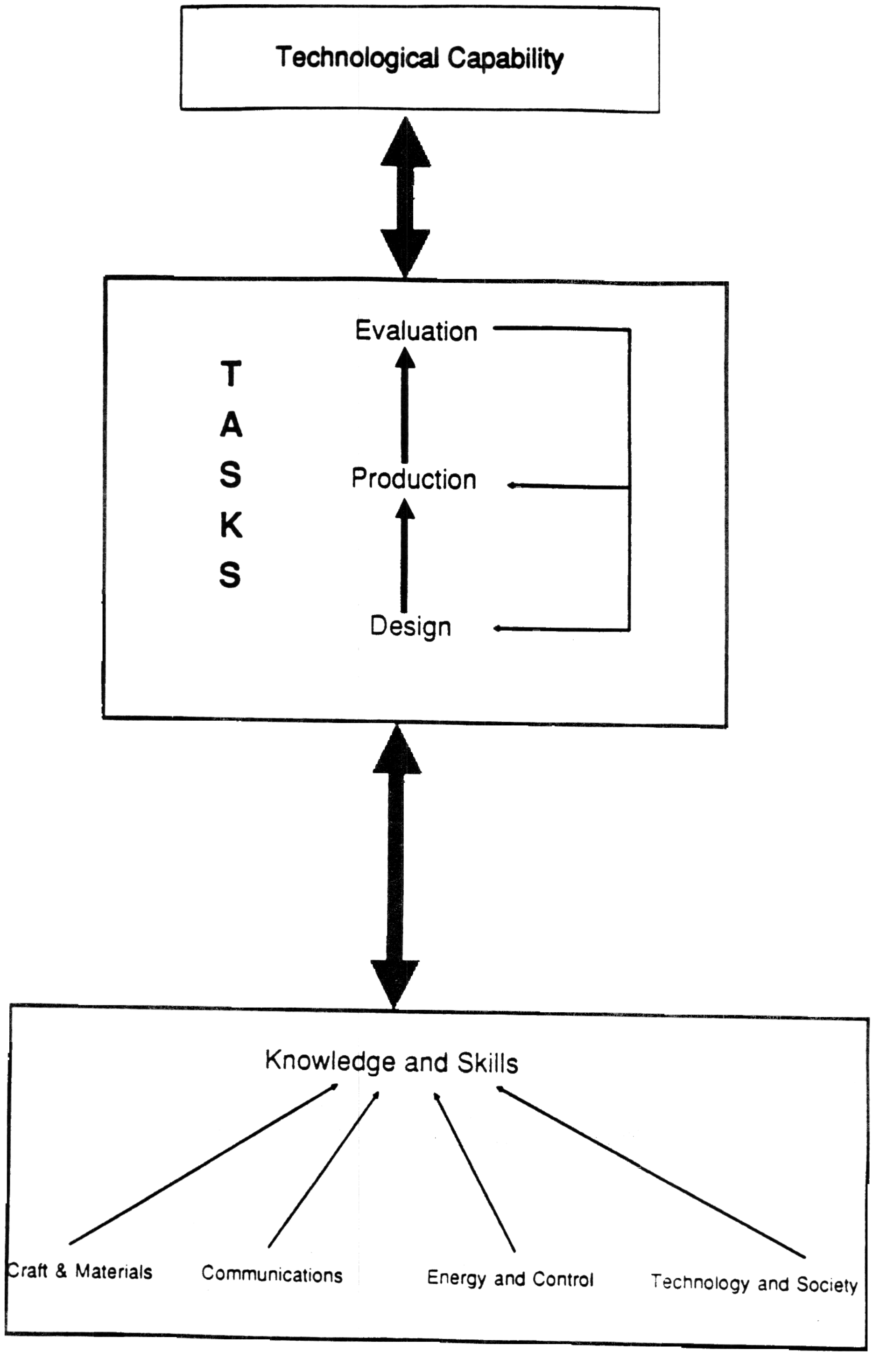
Closed, simple, small-scale tasks might include such exercises as cutting or forming a piece of material in a predetermined way, copying a drawing, or assembling a small number of components to replicate a simple assembly which is available for reference.

Open, simple, small-scale tasks might include assembling e small number of components to create a simple system of the student's choice, cutting or shaping a piece of material in a way which pleases the student, or producing an original drawing.

Closed, integrated, smell-scale tasks might include marking out material to accord with a drawing and cutting it accordingly, or constructing a circuit to accord with a schematic drawing.

Open, integrated, small-scale tasks might include designing a simple mechanical assembly for a particular purpose and building it from a kit of parts, or making a plan on paper for an ornamental piece and moulding that piece in some suitable material.

Open, integrated, extensive tasks have no necessary limits other than those imposed by resources and safety requirements. A student might be asked to design, make, and test a device for a particular purpose, or design, make, and test a mechanical or electronic system, or to plan, produce, and evaluate a video-recording dealing with a particular topic.


Technological Capability
TASKS
Evaluation
Production
Design
Knowledge and Skills
Craft & Materials
Communications
Energy and Control
Technology and Society