# Information Processing and Technology (IPT)

## Senior Syllabus 2010

Queensland Government

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# 1. Rationale

Information technology refers to the creation, manipulation, storage, retrieval and communication of information and to the range of technological devices and systems used to perform these functions.

Information Processing and Technology is a course of study that provides students with knowledge, skills, processes and understanding of information technology. It emphasises problem identification and solution rather than the use of specific applications, and is an intellectual discipline that involves a study of information systems, algorithms, software programming, human–computer interaction, and the social and ethical issues associated with the use of information technology.

This course should prove especially relevant to students by helping them to engage with the rapid rate of change associated with information technology and to appreciate its advantages and disadvantages. This course is designed to equip students with a repertoire of processes and concepts that may be adapted to accommodate such changes. The design and evaluation procedures are thus not restricted to specific programming languages, database environments, multimedia or presentation packages, but are designed to be applicable to a wide range of development tools. It is therefore important that an approach be employed that enables students to develop higher order processes of analysis, synthesis and evaluation, and that will best equip them to communicate their understanding of the conceptual base integral to information technology.

Information Processing and Technology touches many business and industry aspects of human life and finds itself drawing on and being applied to diverse fields of study. Students will be exposed to a variety of intellectual challenges involving distinctive approaches to problem solving, communication and a range of associated practical skills. As a result, the study of this subject will contribute, in a significant way, to the general education of students whether or not they intend to proceed to further studies or employment in the field of information technology.

With a strong focus on problem solving, Information Processing and Technology will attract students who enjoy, or who show ability for, a structured approach to problem solving. The course will allow them to design, develop and evaluate solutions using computers.

## 1.1 Indigenous perspectives

This syllabus recognises Aboriginal and Torres Strait Islander peoples, their traditions, histories and experiences prior to colonisation through to the present time. To strengthen students' appreciation and understanding of the first peoples of the land, relevant sections of the syllabus identify content and skills that can be drawn upon to encourage engagement with:

- Indigenous frameworks of knowledge and ways of learning
- Indigenous contexts in which Aboriginal and Torres Strait Islander peoples live
- Indigenous contributions to Australian society and culture.

The Information Processing and Technology syllabus encourages awareness of the requirements for the organisation, systemic coding and management of information, including Indigenous knowledges. It therefore urges users of the syllabus to engage with Information and Processing Technology contexts and contents to which Aboriginal and Torres Strait Islander peoples contribute.

# 2. General objectives

## Introduction

The general objectives for this subject are those that the school is required to teach and students have the opportunity to learn. The general objectives are grouped into four dimensions, i.e. the salient properties or characteristics of distinctive learning. The first three dimensions are the assessable general objectives. The fourth group of general objectives, Attitudes and values, is not directly assessed as it is achieved through teaching and learning approaches offered to students.

Progress in aspects of any dimension at times may be dependent on the characteristics and skills foregrounded and developed in another. The process of learning through each of the dimensions must be developed in increasing complexity and sophistication over a four-semester course.

Schools must assess how well students have achieved the general objectives. The standards are described in the same dimensions as the assessable general objectives.

The general objectives and dimensions for a course in this subject are:

- *knowledge and application*
- *analysis and synthesis*
- *evaluation and communication*
- *attitudes and values*

## 2.1 Knowledge and application

This dimension involves declarative knowledge and procedural application. It requires the explanation and application of fundamental information technology concepts and procedures to a broad range of information technology problems in simple or familiar situations.

It encompasses:

- knowledge of the terminology, applications and effects of ICTs, and of the syntax and rules of programming languages and query languages
- understanding of applicable concepts, design processes, diagrammatical representations, and social and ethical issues
- application of processes and algorithms for the solution of simple and familiar problems.

By the conclusion of the course, students should:

- define and explain information technology terminology, concepts, processes and principles
- apply set processes to solve simple or familiar information technology problems.

## 2.2 Analysis and synthesis

This dimension involves analysing problems or situations in order to determine a clear definition of what is involved, and the planning and development of a solution or resolution that satisfies the relevant constraints involved.

It encompasses:

- deconstruction of a setting to analyse a problem or situation to determine their salient features and their suitability for solution using information technology
- utilisation of appropriate design methods and principles
- synthesis of solutions to problems or situations that are unfamiliar, significant in scope or complex in nature.

By the conclusion of the course, students should:

- interpret and analyse problems and situations requiring information technology use
- design and develop solutions to unrehearsed or complex information technology problems.

## 2.3 Evaluation and communication

This dimension involves the ability to provide supporting evidence in making judgments of issues, cases, problems, products and processes, and the ability to communicate using a range of natural and formal languages to different audiences.

It encompasses:

- use of logic and reason in a range of evaluation approaches to make judgments and recommendations
- application of metrics and protocols to test solutions, and of prescribed criteria to draw conclusions and make recommendations
- evaluation of processes for identified products and solutions
- construction of documentation using the information literacy, software or information systems development cycles
- presentation of technical ideas, design concepts, solutions and evaluations.

By the conclusion of the course, students should:

- test processes and solutions, apply prescribed criteria, reasoning or evidence to draw conclusions and make recommendations
- construct documentation and present information to convey meaning using communication conventions.

## 2.4 Attitudes and values

Attitudes and values is the incorporation of information processing and technology into a view of the world, and a realisation of the impacts of information processing and technology on it. It includes envisioning possible, probable and preferred futures, and taking responsibility for actions and decisions while promoting ethical practices. A course in Information Processing and Technology promotes problem solving skills, teamwork, and communication through the development of products, investigation and the completion of assessment instruments.

By the conclusion of the course, students should:

- appreciate the complex interactions between information technology and individuals, and information technology and society
- recognise and value their potential to become productive participants in the development of information technology
- develop responsible attitudes towards the use of information technology
- appreciate the value of working independently and with others.

# 3. Course organisation

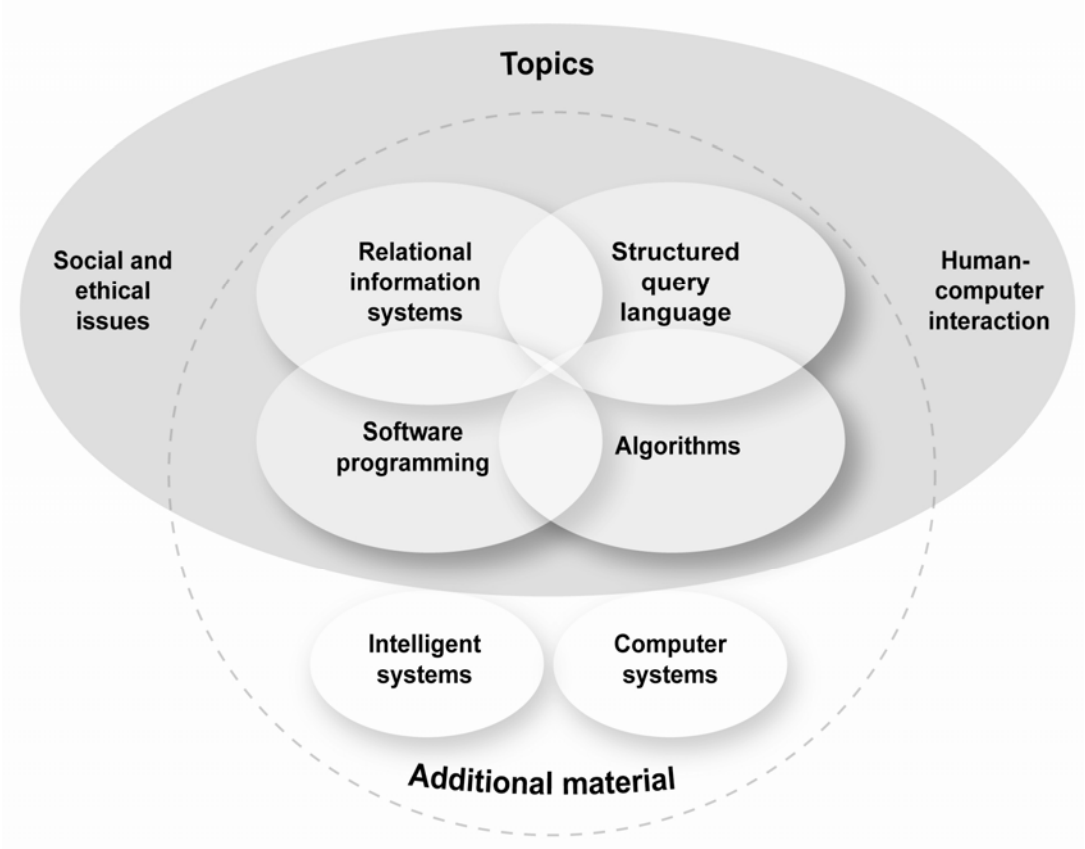
The minimum number of hours of timetabled school time, including assessment, for a course of study developed from this syllabus is 55 hours per semester. A course of study will usually be completed over four semesters (220 hours).

## 3.1 Course overview

A course in Information Processing and Technology consists of:

- the core from six topics
- additional material

The core uses material from each of the six topics. It occupies 165–180 hours of course time. Additional material can come from the following four topics: Relational information systems, Structured query language, Software programming and Algorithms. Intelligent systems and Computer systems are also additional material. Additional material occupies the remaining hours of the course time allocation and is selected by the school.




### *Additional material*

Additional material must reflect the intent of the syllabus as outlined in the general objectives and may expand the scope of a topic or explore the core in more detail. Additional material can be drawn from four of the six topics in Section 4.2. Additional material can also be found in Section 4.3.

If additional material is determined from the four topics it should not be treated as a separate entity in the teaching process.

The syllabus promotes a wide range of additional material that is neither prescriptive nor exhaustive. Schools should take into account the particular needs and interests of the individual students and the resources available within the school when making decisions about additional material.

## 3.2 Topics

Topics and a guide to the level of detail required in the delivery of each topic of study are detailed in Section 4.

It should be recognised that the topics are not discrete and that parts of one topic may be incorporated into the study of another. Social and ethical issues, and Human–computer interaction must be integrated within other topics.

Where appropriate, topics should be investigated through the design–develop–evaluate cycle. This approach is outlined in Section 5, Learning experiences.

Schools should plan a course of study offering an increasing level of challenge to students and provide opportunities for them to achieve the general objectives throughout the four-semester course. When designing a course of study schools should take into consideration the:

- Rationale (Section 1)
- General objectives (Section 2)
- Topics (Section 4)
- student needs and interests
- available resources.

## 3.3 Composite classes

This syllabus enables teachers to develop a course that caters for a variety of circumstances, such as combined Year 11 and 12 classes, combined campuses, or modes of delivery involving periods of student-managed study.

The flexibility of the syllabus can support teaching and learning for composite classes by enabling teachers to:

- structure learning experiences and assessment that allow students to access the key concepts and ideas suited to their needs in each year level
- provide opportunities for multilevel group work, peer teaching and independent work on appropriate occasions.

The following guidelines may prove helpful in designing a course of study for a composite class:

- The course of study could be written in a Year A/Year B format, if the school intends to teach the same topics to both cohorts.
- A topic that will allow Year 11 students ease of entry into the course should be placed at the beginning of each year.
- Learning experiences and assessment instruments need to cater for both year levels throughout the course. Even though tasks may be similar for both year levels, it is recommended that more extended and/or complex tasks be used with Year 12 students.

## 3.4 Bridging study

A bridging study could cater for students who enter the course later than the rest of the class. This may include students entering their first year of a composite class, or students entering significantly after the commencement of a course. Other contexts suited to bridging study are when students have had little exposure to the subject or no experience of the necessary prerequisite learning in Year 10.

The bridging study:

- might introduce key terms and concepts for independent study or supplement topics already covered in the course
- is not intended to be a substitute for teaching key terms and concepts or a topic; the intention is that the study will supplement any subsequent teaching
- is not expected to be included in a work program for approval.

Advice on designing a bridging study could be sought from the relevant QSA personnel.

## 3.5 Work program requirements

A work program is the school's plan of how the course will be delivered and assessed, based on the school's interpretation of the syllabus. It allows for the special characteristics of the individual school and its students.

The school's work program must meet all syllabus requirements and must demonstrate that there will be sufficient scope and depth of student learning to meet the general objectives and the exit standards.

The requirements for online work program approval can be accessed on the Queensland Studies Authority's website, <www.qsa.qld.edu.au> select Years 10–12 > Years 11–12 subjects. This information should be consulted before writing a work program. The requirements for work program approval may be updated periodically.

# 4. Topics

## 4.1 Overview

There are six topics:

- Algorithms
- Relational information systems
- Software programming
- Structured Query Language
- Social and ethical issues
- Human–computer interaction

A course of study comprises core from the six topics (making up between 165 and 180 hours), and additional material making up the remaining time.

Each topic has been structured into three sections (see below). Additional material is offered for four of the topics. Intelligent systems and Computer systems are also additional material and these are found in Section 4.3.

### *Core*

Under this subheading is outlined the subject material of the topic of study which should be covered. The core gives an overview of the intent of the topic of study through a brief introduction and a listing of the subject material.

### *Additional material*

Additional material may expand the scope of a topic of study or explore the core in more detail. Additional material can be drawn from the four core topics in Section 4.2 and Section 4.3.

### *Learning experiences*

This section provides learning experiences which may be effective in achieving the general objectives of the course. The listed learning experiences may require students to work individually, in small groups or as a class. This is not an exhaustive list and further detailed learning experiences can be found in Section 5.6.

## 4.2 Topics

### *4.2.1 Algorithms*

For this topic, a number of procedural or algorithmic design systems are available. No particular system is specified in this syllabus, but students should acquire skills in at least one formal representational system (e.g. flowcharts, structure design charts, pseudocode, Nassi-Schneidermann, etc.).

| Core | Additional material |
|---|---|
| **The following should be explored:**<br>• algorithm:<br>– results from mapping a specification to a process<br>– may operate on a number of sets of data<br>– is largely independent of the programming language in which it is eventually implemented<br>– involves a finite number of steps<br>– consists of processes operating on data structures<br>• metrics and protocols of testing (e.g. bench testing, exception testing)<br>• general principles of algorithm development such as top-down design and modularity<br>• basic elements of algorithm:<br>– assignment of a value to a variable<br>– procedure call (invocation of another algorithm)<br>– skip (specifying that nothing be done)<br>• standard algorithm control structures:<br>– sequence (steps are carried out in sequential order)<br>– selection (choice of one element from a number of elements)<br>– iteration (repetition of an element). | **The following could be explored:**<br>• recursion (definition of an element in terms of itself)<br>• other algorithm design methods (e.g. object orientated)<br>• encryption<br>• data compression<br>• search techniques. |

**Students should be able to:**

- use an algorithm design/description system or method
- define a problem clearly
- specify a problem solution
- design and describe an algorithm that solves a given problem
- design well-structured, modular algorithms.

## 4.2.2 Relational information systems

This topic introduces a formal model for describing the architecture of information systems, presents methods for developing these systems, and allows students to implement these to produce working information systems.

| Core | Additional material |
|---|---|
| **The following should be explored:**<br>• data, information, knowledge and wisdom, and the differences between the terms as they apply to information systems<br>• external, logical, conceptual and physical views of information systems<br>• classification systems for different types of information systems (e.g. flat, network, hierarchical, relational, object-oriented, distributed online)<br>• formal process of table normalisation<br>• fact-oriented design method such as object role modelling (ORM), entity relationship (ER) modelling, or unified modelling language (UML) including entities, relationships, constraints (e.g. uniqueness, necessity, cardinality, frequency, equality, exclusion, subset and subtype), derivation rules and assumptions<br>• steps of the information system development cycle for the production of an information system, i.e. identification, conceptualisation, formalisation, implementation, testing, evaluation, documentation and specification documentation<br>• relational perspectives of information systems, i.e. relational systems in contrast to and in comparison with other systems; relations (tables) including rows, columns, keys (primary, secondary composite and foreign), nulls and views; the creation of relational tables within a database management system<br>• physical and logical data independence<br>• system security and integrity<br>• the concept of data integrity and its maintenance<br>• metrics and protocols of testing, e.g. alpha- and beta- testing<br>• maintaining security and privacy in information systems<br>• design issues relating to information systems including data dependence, redundancy, performance, optimisation and total cost of ownership<br>• process-oriented analysis methods such as context diagrams or data flow diagrams (DFD) which include data source, data flow, process and data storage. | **The following could be explored:**<br>• comparison of chosen design/analysis methods with alternatives, e.g. ORM, ERM, DFD, UML<br>• reverse-engineering of existing information system to extract the conceptual design<br>• investigation of the design of non-relational information systems. |

**Students should be able to:**

- determine whether an information system would be suitable in a particular situation
- identify redundancy and performance issues in an information system
- explain the relationship between external, logical, conceptual and physical views
- work through all stages of the chosen fact-oriented design method
- derive table definitions
- apply the chosen process-oriented analysis method
- analyse an existing information system
- create, document and evaluate a working information system.

## 4.2.3 Software programming

This topic involves the study of the development of software. Students will gain some experience and skills in the design, development and evaluation of computer programs that solve practical problems or meet particular needs.

| Core | Additional material |
|---|---|
| **The following should be explored:**<br>• procedural design and implementation<br>• steps of the software development cycle for the production of a software solution, i.e. problem identification, solution specification, design implementation, testing, evaluation, and documentation<br>• use of a 3rd generation programming language (3GL)<br>• implementation of sequence, selection and iteration (both definite and indefinite) in a 3GL<br>• implementation of modularity in a 3GL (procedures and functions) and passing of values to and from modules<br>• metrics and protocols of testing, e.g. alpha- and beta- testing<br>• common data types and data structures including data types to represent real and integer numbers, single and multiple character strings, and data structures including variables, arrays and text files<br>• variable scope. | **The following could be explored:**<br>• use of static structures such as records, user-defined types, objects<br>• use of dynamic structures such as sets, binary files, lists, trees and pointers<br>• use of the control language in a multimedia-authoring program, providing enhanced interactivity over and above built-in drag-and-drop functionality<br>• creation of web-executable programs using public class libraries<br>• creation of network-aware applications that are able to interchange data from host to host<br>• use of game authoring program to code aspects of a computer game<br>• use of graphics language features for both hardware and software rendering of images<br>• use of other types of programming paradigms<br>• development of software using a non-procedural methodology<br>• development of printed manuals and online help systems. |

**Students should be able to:**

- convert an algorithm into a 3GL
- produce programming code from a formal representation of a solution
- make appropriate variable declarations
- de-bug their own or existing programming code
- step through a program monitoring the values stored in specific variables
- utilise data structures to represent values
- utilise at least one integrated development environment
- invoke modules from within the main body of a program, passing parameters as required
- utilise the software development cycle to produce a working program
- employ step-wise refinement in developing program code
- code sequence, selection, definite iteration, and both pre- and post-tested indefinite iteration.

## 4.2.4 Structured Query Language

This topic introduces a formal query language Structured Query Language (SQL), for the manipulation of data within a database.

| Core | Additional material |
|---|---|
| **The following should be explored:**<br>• terminology such as retrieval, insertion, deletion, update and modification<br>• data definition concepts, including:<br>– table and column names<br>– column data types<br>– defining tables<br>– populating a table with data<br>• data manipulation using SQL, including:<br>– analysing requests for information in order to recognise one or more types of query required<br>– retrieval from one or more columns in one table<br>– retrieval from one or more columns based on some selection criteria<br>– sorting data based on one or more columns<br>– use of logical, arithmetic and relational operators to build the relevant selection criteria<br>– predefined functions such as maximum, minimum, average and number of elements in a column<br>– inserting, updating and deleting of queries<br>– predefined functions on subsets of the table produced by grouping data<br>– retrieval from more than one table based upon the logical joins associated with the relational model<br>– retrieval of subqueries. | **The following could be explored:**<br>• data retrieval (querying) and presenting information in a system using a relational language, including:<br>– data retrieval where relational union, intersection, minus or division are required<br>– correlation of subqueries and any other relational operations easily formulated in a database language<br>– database queries using a combination of the above<br>• relational algebra concepts and set theory<br>• query by example (QBE)<br>• use of data definition language queries to create databases, tables and associated properties<br>• use of scripting languages to extract and display data<br>• creation of online database solutions<br>• updating of selected records. |

**Students should be able to:**

- investigate and interrogate online databases
- construct and populate tables in a relational database using appropriate data types for columns in tables
- formulate queries using SQL to manipulate or interrogate the data from a given database.

## 4.2.5 Social and ethical issues

This topic develops an appreciation and understanding of the impact that developments in information technology have on individuals and communities worldwide.

A true appreciation of the social and ethical issues will depend on knowledge gained from other sections of this course. This topic must be integrated within the other topics.

**Core**

**The following should be explored:**

- appropriate terminology for discussing social, ethical, legal and moral issues
- social and ethical issues as identified in the list below
- differences between morals, ethics and laws in our society and in other cultures, e.g. Indigenous, Asian/Pacific.

**This topic should be explored using a variety of the following suggested issues:**

**Security**

- issues associated with the physical and logical security of computer systems, e.g. data protection, backup systems, data integrity
- hacking
- software piracy/cracking – the responsibilities of software developers and retailers as well as users and purchasers
- copyright/intellectual property (IP), commercial licensing, open-source, copyleft and creative commons, freeware/shareware, public domain software, version control
- monopolies and the nature of competition in the software industry
- malicious code, e.g. viruses, trojans and worms
- phishing
- failure analysis.

**Privacy**

- freedom of information
- mailing lists, spam
- power of search facilities on massive databases
- unauthorised access
- identity theft
- the “big brother” concept, including monitoring of individuals, CCTV, tracking work habits, manipulating information for ulterior purposes, location tracking
- personal publishing, digital footprints, including implications of posting personal information online, lifelong personal profiles, manipulating the identity of others
- cyber bullying
- online censorship.

**Equity and accessibility**

- information technology for people with a disability
- role of voice recognition and speech synthesis
- application of standards in the manufacture, operation and management of computer systems
- the digital “haves” and “have nots”
- communication using visual images and hypertext and its effect on reading and writing
- access to broadband internet
- human resource ethics regarding outsourcing and off-shoring, skill retention and employment security.

**Other issues**

- green computing and both positive and negative environmental impacts
- storage and display of culturally sensitive information, e.g. pictures of indigenous people
- accountability, responsibility for damage to property and/or people caused by inadequate or faulty software and database content
- effect of computers and networks on employment, e.g. creation of new employment opportunities; automated processes and their impact on unemployment; redundancy in professional and clerical occupations
- professional practice, e.g. remote robotic surgery
- responsibilities and obligations in developing programs and systems, e.g. reliability of automated expert systems for diagnosis
- predictions about the future uses of information and communication technologies
- gaming and social networking addiction
- impact of mobile technologies on society
- ergonomics and health issues.

**Students should be able to:**

- analyse, synthesise and evaluate the ideas and arguments of others
- suggest methods of minimising problems expected in particular circumstances
- distinguish fact from opinion
- recognise rational and irrational arguments
- select and sequence material to defend a point of view
- express ideas logically in oral and written forms
- make informed judgments about the effects of the use of computers in our society.

## 4.2.6 Human–computer interaction

This topic develops an understanding of the interaction between humans and technology to inform better design and improve user interfaces. This topic must be integrated within the other topics.

**Core**

**The following should be explored:**

- role of affordances and metaphors in the design of interfaces
- different types of interfaces and fundamental terms used in the description of human–computer interaction
- that interfaces stand as layers (or "abstraction barriers") to assist in the interaction between people and computers
- approach to interfaces from the perspectives of different individuals, e.g. users, designers, programmers, hardware engineers
- value of good interface design in effective human and computer interaction
- fundamental importance of user-centred design for building new interfaces
- importance of sensitivity to other cultural contexts (e.g. Indigenous, American) for good interface design
- differences in human cognitive performance and the logical operation of computers, e.g.:
  - comparison of natural and formal languages
  - speed and accuracy of computation and decision making
  - dealing with uncertainty, ambiguity and errors
- existence of interfaces not only between a user and a computer system, but between programming elements (e.g. routine–subroutine communication), applications (e.g. protocols over a network) and hardware (e.g. physical and signal standards)
- user interfaces that:
  - provide barriers that hide distracting computational complexity
  - induce mental models (images) that help in visualising internal data operations and states
  - embody the external schema of information systems
- classification of various input–output devices and associated techniques for interaction
- types of interfaces for everyday devices and for computational systems
- principles of user-centred design:
  - design errors such as clutter, embellishment and interference
  - assessment of the fitness of an interface with user-centred criteria
  - usability
  - accessibility, i.e. accommodating for special needs including legal aspects and standards, verification of standards
  - use of style guide.

**The students should be able to:**

- categorise various physical and computational interfaces
- judge and explain the fitness of physical and computational interfaces from a user's viewpoint
- design prototype interfaces that conform to given guidelines and standards
- develop interfaces for information and computational systems that implement external schema features
- conduct usability tests for interfaces that are given or that they construct e.g.:
  - identifying clients and the tasks they perform
  - planning interface testing with test clients
  - implementing iterative and informed interface development
  - assessing the impact of user interfaces on behaviour
- explore emergent approaches and technologies
- employ user interface toolkits in programming
- parse commands in a command-driven interface
- use timing metrics and think-aloud protocols in usability testing.

## 4.3 Additional material

### *4.3.1 Intelligent systems*

This additional material introduces a formal model to describe the architecture of intelligent systems, presents methods for the development of these systems, and allows students to implement these to produce working intelligent systems.

**The following could be explored:**

- concepts of artificial intelligence
  - brief history of artificial intelligence
  - overview of elements of artificial intelligence, e.g. knowledge representation, machine learning
  - philosophical issues surrounding intelligent systems and attempts to model human behaviour and intelligence, such as the Turing test, Searle's Chinese Room, the mind-body question
- knowledge-based systems (in particular, rule-based) including:
  - general nature of knowledge-based systems and how they differ from information systems
  - some areas of application of knowledge-based systems and the major types of existing systems
  - general properties of rule-based systems
  - characteristics and components of rule-based systems
  - difference between "a fact" and "a rule"
  - rules aid in inference
  - knowledge-based design, e.g. decision trees, decision matrices
  - the importance of the feature of rule-based systems being able to justify their own reasoning and conclusions
  - some of the limitations and problems involved with knowledge based systems
- existence and application of specialised programming languages, e.g. Prolog, LISP
- simulation of human attributes and biological systems:
  - vision
  - speech
  - voice recognition
  - natural language processing
  - movement and gesture, e.g. robotics and avatars
  - pattern matching and learning
  - genetic algorithms
- neural networks
  - components, learning and structure
  - training and testing for a specific purpose
  - applications
- inference engines
  - applications
  - deductive databases
  - learning decision trees (inductive machine learning)
  - comparison with rule-based systems
- difference between forward and backward chaining techniques
- links between Prolog and the concepts of ORM
- knowledge-based systems:
  - interrogation of a rule-based system
  - creation of a decision tree and/or decision matrix using a familiar situation
  - obtaining of rules suitable for use in a knowledge-based system from a given decision

tree
- implementation of a decision tree and/or decision matrix using a knowledge-based system shell
- explanation of the functions of, and relationships between, the components of a knowledge-based system
- distinguishing between a fact and a rule
- tracing the logic of an inference engine of a knowledge-based system during a consultation.

## *4.3.2 Computer systems*

This additional material explores how computers and computer systems are organised, designed, and implemented. An introductory study of how processors and memory may be configured to form different computer architectures is also examined. It is essential that the emphasis be placed on the system architecture rather than on the component level.

**The following could be explored:**

- processors
- memory
- von Neumann architecture
- von Neumann bottleneck
- non–von Neumann architecture
- design issues related to the specification of a computer system to meet particular needs, e.g. functionality, ease of use, cost, number of users, performance, standards
- Boolean logic and logic gates
- systems administration and management
- systems security, e.g. firewalls
- local-area networks including network topology
- wide-area networks and distribution systems including the internet
- basic communication protocols
- peer-to-peer and client-server networks
- security requirements for a network
- systems integration/cross-platform communication
- management role of a systems administrator in a multi-user system.

# 5. Learning experiences

The design–develop–evaluate (DDE) cycle used to determine solutions is fundamental to how the subject is presented. For the solution of complex problems, the DDE cycle is expanded into the software development cycle, the information system development cycle, or the information literacy cycle.

When the learning experiences for this course are being planned, it is recommended that teachers seek to provide a balance and variety of activities within each topic and across the whole course.

In general, learning experiences should:

- provide opportunities for students to achieve the general objectives of the syllabus
- suit the particular needs, abilities, learning styles and interests of the students
- provide opportunities for students to think and work individually and with others in a cooperative way
- be interesting and challenging.

The course should be planned in such a way that students progress from simple to more complex experiences. Increasing demands should be made upon students to collect and analyse information, plan and organise activities, carry out procedures, solve problems, make decisions and judgments, use information technology and communicate the results appropriately and effectively.

Information Processing and Technology lends itself to a “hands on” approach with a significant emphasis on problem solving. A general approach to problem solving is the design–develop–evaluate cycle, which is a derivative of Polya’s general problem-solving cycle:

- define the problem
- plan a solution
- implement the solution
- look back.

The design–develop–evaluate cycle can be adapted to the software development cycle, the information system cycle and the information literacy cycle. Documentation of all phases is integral to the application of the design–develop–evaluate cycle. The correlations between the terms in each cycle are summarised in the following table.

| | | Polya's problem-solving cycle | Software development cycle | Information literacy cycle | Information system development cycle |
|---|---|---|---|---|---|
| Design | Documentation | define the problem | identify the problem | identify the topic | identify |
| | | plan a solution | specify a solution | determine information to find or collect | conceptualise |
| | | | select and apply appropriate design methods | identify potential sources | formalise |
| Develop | | implement the solution | implement the design | collect relevant information, organise material to present and prepare draft | implement |
| Evaluate | | look back | test for errors | reflect on, make judgments or draw conclusions about information presented | test |
| | | | evaluate the product and/or process | | evaluate |

## 5.1 Using information technology

Tasks involving the use of information technology might ask students to:

- undertake a critical analysis of different information systems
- carry out a critical appraisal of different web sites to look at their ease of use and functionality
- retrieve information from online databases and other sources
- explore different interface models, metaphors and devices
- use a search engine effectively
- compare and contrast the ways different approaches to IT problems have been solved, e.g. various operating systems or applications.

## 5.2 Solving problems

Students should gain experience in solving problems in a variety of domains (e.g. numerical calculation, text manipulation, sorting, simple data storage, graphics, sound). Such activities could include:

- performing critical analysis of a functioning information system in an industrial, commercial or educational setting
- observing, analysing and modifying existing solutions to problems
- developing partial or complete solutions to problems
- developing complete solutions to problems under varying amounts of guidance.

## 5.3 Extended writing

Students should be asked to analyse information from both traditional and online sources. Opportunities should be given for students to process and present information appropriately and effectively. Students should understand the issues associated with correct use of intellectual property.

Analysing data and information could include:

- using data from a wide variety of physical, human and electronic sources in both text-based and digital formats
- reflecting on the authority and veracity of collected information
- evaluating collected information and selecting the elements relevant for a given task
- processing information to add cognitive value
- using appropriate methods of presentation, referencing and citation.

Emphasis on the process rather than the final product can ensure learning outcomes are met in extended response tasks. It is also expected that there will be adequate supervision of student progress through tasks.

## 5.4 Presentation

Communication is an integral part of information technology. It is not only important to be able to solve a problem, but also to be able to communicate how the solution was achieved. The course should provide opportunities for students to develop techniques which encourage them to make informed judgments and teachers should encourage learning styles that involve social interaction and presentation using various media.

Activities for communicating the findings could involve:

- developing and publishing a planning document
- producing a specification document for an information system
- collecting, summarising and analysing information for a particular purpose
- structured discussions
- presenting seminars
- developing non-linear presentations such as hyperlinked documents or webpages
- responding to structured questions requiring a range of cognitive responses from comprehension to the more advanced responses of analysis and evaluation

- performing role-plays to provide a simulated context in which students are required to take the part of characters who may have opinions that differ from their own, for example hypothetical format, decision-making format.

## 5.5 Collaboration

Working as interdependent team members is especially important in information technology industries. As part of the learning environment, teachers should:

- encourage teamwork so that students gain experience in working collaboratively, planning enterprises and taking into consideration cultural and other issues
- provide opportunities for students to manage time and resources and learn how to manage this process. Project work is an ideal vehicle for such learning experiences.

Due care and attention will need to be given in assessment that involves teamwork to ensure that the developmental process, the final product, as well as each individual contribution are assessed. Objective and subjective measures of group participation, including self- and peer-assessment, may be used when apportioning individual credit. These methods must be transparent.

## 5.6 Suggested learning experiences

Detailed suggested learning experiences for the six topics, which teachers may consider when developing their teaching programs, are presented in the table below. The learning experiences are suggestions only and are not prescriptive. Schools are encouraged to develop alternative learning experiences, especially those which relate to the school's location, environment and resources.

| Topic | Suggested learning experiences |
|---|---|
| **Algorithms** | This topic explores the use of an algorithmic approach to problem solving and so students should be exposed to as wide a range of problems as possible. Strategies that may be explored include:<br>• use of algorithm and code libraries<br>• analysis of a problem and selection of the most appropriate algorithm for solution<br>• undertaking a comparative study of the performance of different algorithms<br>• solving a variety of problems<br>• interacting with a simple environment which implements algorithms<br>• role-playing algorithms to check correctness<br>• observing, analysing, modifying, testing, evaluating and/or documenting existing solutions<br>• developing partial solutions, possibly concentrating on only one of the three phases or completing all three phases for only part of a proposed system or program<br>• developing algorithmic solutions to simple problems given varying amounts of guidance. |
| **Relational information systems** | In this topic there should be an emphasis on project planning and group work. Strategies that may be explored include:<br>• developing and publishing a planning document, incorporating sections on general problem description, objectives, strategies for solving the |

| Topic | Suggested learning experiences |
|---|---|
| | problem, partitioning the tasks and developing timelines<br>• performing a critical analysis of a functioning information system in an industrial, commercial or educational setting<br>• producing a specification document for an information system<br>• producing working information systems<br>• analysing the design of an online information system<br>• producing a specification document for a database<br>• producing working databases. |
| **Software programming** | The teaching of this subtopic lends itself to a "hands on" approach and students should be exposed to a number of different computing environments. Strategies that may be explored include:<br>• undertaking a comparative study of the functionality of different software applications<br>• solving a variety of problems using 3GL<br>• observing, analysing, modifying, testing, evaluating and/or documenting existing solutions<br>• using a server-side scripting language<br>• enhancing the interactivity of a webpage using a client-side scripting language<br>• developing partial or complete solutions to problems<br>• producing a report that evaluates an existing application. |
| **Structured Query Language** | In this topic, there should be an emphasis on practical activity in using and investigating databases. Strategies that may be explored include:<br>• retrieving information from an existing database through ad hoc queries and the production of formal reports<br>• creating a database, setting field properties, inserting, modifying or deleting data<br>• identifying and using online database resources<br>• investigating online search engines<br>• investigating the underlying structure and functionality of emerging web-based applications. |
| **Social and ethical issues** | The Social and ethical issues topic provides the opportunity to develop techniques that encourage students to make informed judgments and to use a learning style that involves social interaction and oral presentation as well as the usual activities of reading and writing. The use of such methods may provoke student interest and increase motivation.<br>Many of the issues to be discussed in this topic are open to debate. It is important to provide a flexible approach in a variety of formats, focusing in particular on activities that acknowledge that judgments made about such issues are value-based.<br>To make valid judgments about social and ethical issues, students should be able to collect information from a variety of sources, analyse it and use it as a basis to form opinions. Opinions need to be critically evaluated, compared with other opinions and expressed in a variety of ways. The communication of ideas and information in a variety of genres is critical to an effective coverage of this topic.<br>Strategies that may be explored include:<br>• discussing, with the emphasis on expressing opinions and sharing information |

| Topic | Suggested learning experiences |
|---|---|
| | • completing worksheets, with structured questions requiring a range of cognitive responses, from comprehension to the more advanced responses of analysis and evaluation<br>• role-playing, to provide a simulated context in which students are required to take the part of characters who may have opinions that differ from their own, e.g. hypothetical format, decision-making format<br>• solving ethical or moral questions, to encourage students to develop ethical reasoning<br>• presenting situations or problems to help students discriminate between facts and opinions<br>• undertaking collaborative projects, to encourage students to work in teams inside and outside the classroom<br>• analysing and criticising predictions made about the future uses of computers and the effects on society of those developments.<br>Stimulus material may be obtained from sources such as the internet, videos, media reports, cartoons, electronic communications and external expertise. |
| **Human–computer interaction** | This topic is best introduced in the context of other topics. Strategies that may be explored include:<br>• experiencing many different types of input and output devices<br>• providing students with a working "back-end" application (with either primitive or no interface elements) to design and implement a user interface for it, e.g. a working database system that requires forms and reports or a simple game that requires real-time interaction<br>• conducting a technical evaluation of an interactive website using some generally accepted interface design criteria<br>• justifying design choices they have made in interfaces they have developed<br>• redesigning poor interfaces through the identification of deficiencies including:<br>– analysis: e.g. do we know who the users are, and what they need?<br>– design: e.g. does the interface give the users what they wanted in a useable fashion?<br>– implementation: e.g. was design embodied faithfully or was it sidetracked to satisfy programming constraints?<br>– technical: e.g. does the interface respond quickly, clearly and consistently?<br>• comparing software applications or hardware interfaces performing similar tasks. |

# 6. Assessment

Assessment is an integral part of the teaching and learning process. For Years 11 and 12 it is the purposeful, systematic and ongoing collection of information about student learning outlined in the senior syllabuses.

In Queensland, assessment is standards-based. The standards for each subject are described in dimensions, which identify the valued features of the subject about which evidence of student learning is collected and assessed. The standards describe the characteristics of student work.

The major purposes of assessment in senior Authority subjects are to:

- promote, assist and improve learning
- inform programs of teaching and learning
  - advise students about their own progress to help them achieve to the best of their ability
  - give information to parents and teachers about the progress and achievements of individual students to help them achieve to the best of their ability
- provide comparable levels of achievement in each Authority subject to be recorded in student learning accounts. The comparable levels of achievement may contribute to the award of a Queensland Certificate of Education
- serve as the base data for tertiary entrance purposes
- provide information about how well groups of students are achieving for school authorities and the State Education and Training Minister.

## 6.1 Principles of exit assessment

All the principles of exit assessment must be used when planning an assessment program and must be applied when making decisions about exit levels of achievement.

A standards-based assessment program for the four-semester course of study requires application of the following interdependent principles.

- Information is gathered through a process of continuous assessment.
- Balance of assessment is a balance over the course of study and not necessarily a balance over a semester or between semesters.
- Exit achievement levels are devised from student achievement in all areas identified in the syllabus as being mandatory.
- Assessment of a student's achievement is in the significant aspects of the course of study identified in the syllabus and the school's work program.
- Selective updating of a student's profile of achievement is undertaken over the course of study.
- Exit assessment is devised to provide the fullest and latest information on a student's achievement in the course of study.

While most students will exit a course of study after four semesters, some will exit after one, two or three semesters.

## Continuous assessment

Judgments about student achievement made at exit from a course of study must be based on an assessment program of continuous assessment.

Continuous assessment involves gathering information on student achievement using assessment instruments administered at suitable intervals over the developmental four-semester course of study.

In continuous assessment, all assessment instruments have a formative purpose. The major purpose of **formative assessment** is to improve teaching and student learning and achievement.

When students exit the course of study, teachers make a **summative** judgment about their levels of achievement in accordance with the standards matrix.

The process of continuous assessment provides the framework in which the other five principles of exit assessment operate: balance, mandatory aspects of the syllabus, significant aspects of the course, selective updating, and fullest and latest information.

## Balance

Judgments about student achievement made at exit from a course of study must be based on a balance of assessments over the course of study.

Balance of assessments is a balance over the course of study and not a balance within a semester or between semesters.

Balance of assessment means judgments about student achievements of all the assessable general objectives are made a *number of times* using a *variety of assessment techniques* and a *range of assessment conditions* over the developmental four-semester course.

See also Section 6.6 Requirements for verification folio.

## Mandatory aspects of the syllabus

Judgments about student achievement made at exit from a course of study must be based on mandatory aspects of the syllabus.

The mandatory aspects are:

- the general objectives of *knowledge and application*, *analysis and synthesis* and *evaluation and communication* and
- four topics studied and assessed in Year 12.

To ensure that the judgment of student achievement at exit from a four-semester course of study is based on the mandatory aspects, *the exit standards for the dimensions stated in the standards matrix (refer to Section 6.8.1) must be used*.

## Significant aspects of the course of study

Judgments about student achievement made at exit from a course of study must be based on significant aspects of the course of study.

Significant aspects are those areas described in the school's work program that have been selected from the choices permitted by the syllabus to meet local needs.

The significant aspects must be consistent with the general objectives of the syllabus and complement the developmental nature of learning in the course over four semesters.

### *Selective updating*

Judgments about student achievement made at exit from a course of study must be selectively updated throughout the course.

Selective updating is related to the developmental nature of the course of study and works in conjunction with the principle of fullest and latest information.

As subject matter is treated at increasing levels of complexity, assessment information gathered at earlier stages of the course may no longer be representative of student achievement. Therefore, the information should be selectively and continually updated (not averaged) to accurately represent student achievement.

Schools may apply the principle of selective updating to the whole subject group or to individual students.

#### Whole subject group

A school develops an assessment program so that, in accordance with the developmental nature of the course, later assessment information based on the same groups of objectives replaces earlier assessment information.

#### Individual students

A school determines the assessment folio for verification or exit (post-verification). The student's assessment folio must be representative of the student's achievements over the course of study. The assessment folio does not have to be the same for all students, however the folio must conform to the syllabus requirements and the school's approved work program.

Selective updating must not involve students reworking and resubmitting previously graded responses to assessment instruments.

### *Fullest and latest information*

Judgments about student achievement made at exit from a course of study must be based on the fullest and latest information available.

- "Fullest" refers to information about student achievement gathered across the range of general objectives.
- "Latest" refers to information about student achievement gathered from the most recent period in which achievement of the general objectives is assessed.

As the assessment program is developmental, fullest and latest information will most likely come from Year 12 for those students who complete four semesters of the course.

The fullest and latest assessment data on mandatory and significant aspects of the course of study is recorded on a student profile.

## 6.2 Planning an assessment program

To achieve the purposes of assessment listed at the beginning of this section, schools must consider the following when planning a standards-based assessment program:

- general objectives (see Section 2)
- learning experiences (see Section 5)
- principles of exit assessment (see Section 6.1)
- variety in assessment techniques over the four-semester course (see Section 6.5)

- conditions in which assessment instruments are undertaken (see Section 6.5)
- verification folio requirements, that is, the range and mix of assessment instruments necessary to reach valid judgments of student standards of achievement (see Section 6.6)
- post-verification assessment (see Section 6.6)
- exit standards (see Section 6.7).

In keeping with the principle of continuous assessment, students should have opportunities to become familiar with the assessment techniques that will be used to make summative judgments.

Further information can be found at <www.qsa.qld.edu.au> select Years 10–12 > Years 11–12 subjects.

## 6.3 Special provisions

Guidance about the nature and appropriateness of special provisions for particular students may be found in the Authority's *Policy on Special Provisions for School-based Assessments in Authority and Authority-registered subjects* (2009), available from <www.qsa.qld.edu.au> select Years 10–12 > Moderation and quality assurance.

This statement provides guidance on responsibilities, principles and strategies that schools may need to consider in their school settings.

To enable special provisions to be effective for students, it is important that schools plan and implement strategies in the early stages of an assessment program and not at the point of deciding levels of achievement. The special provisions might involve alternative teaching approaches, assessment plans and learning experiences.

## 6.4 Authentication of student work

It is essential that judgments of student achievement are made on accurate and genuine student assessment responses. Teachers should ensure that student work is their own, particularly where students have access to electronic resources or when they are preparing collaborative tasks.

The QSA information statement *Strategies for authenticating student work for learning and assessment* is available from <www.qsa.qld.edu.au> (search on "authenticating"). This statement provides information about various methods teachers can use to monitor that student work is their own. Particular methods outlined include:

- student planning production of drafts and final responses
- teachers seeing plans and drafts of student work
- maintaining documentation of the development of responses
- students acknowledging resources used.

Teachers must ensure students use consistent accepted conventions of in-text citation and referencing, where appropriate.

### *6.4.1 Advice on drafting (written, multimodal or spoken instruments)*

The purpose of viewing student drafts is to provide them with feedback so that they may improve their response. Drafting is a consultation process, not a marking process. Teachers should not award a notional result or level of achievement. Drafting feedback

should ask the student to reflect on strategies they might use to refine their work. The instrument-specific standards should be used to help students identify the areas they need to review. Schools should consider the aspect of increasing independence when constructing drafting policies.

### What is a draft?

A draft is a response that is nearly good enough to submit for assessment — it is likely to be the student's second or third attempt at the task. Prior to submitting a draft, students may be required to submit a written outline or to discuss their approach to the task with their teacher.

### What sort of feedback will be provided?

In providing feedback, teachers indicate aspects of the response that need to be improved or developed in order to meet the dimension/standard. Students are often advised: to consider other aspects of their response; to provide more factual detail; to provide stronger links to the physical activity; to give priority to the most important points by rearranging the sequence and structure of ideas. Teachers may indicate some textual errors and indicate that the draft requires more careful editing. They may not correct or edit all the textual errors in a draft. Teachers may provide some written feedback on drafts submitted by the due date for the draft; often teachers provide a summary of their feedback and advice to the whole class.

**Table 1: Suggested drafting strategy**

| Instruments | Year 11 | Year 12 |
|---|---|---|
| **Written** | • teacher consultation allowed<br>• outline submitted<br>• maximum of two drafts submitted | • teacher consultation allowed<br>• one draft or outline submitted |
| **Multimodal or spoken** | • teacher consultation allowed<br>• maximum of two drafts submitted<br>• verbal feedback provided | • teacher consultation allowed<br>• one draft or outline submitted<br>• verbal feedback provided |

## 6.5 Assessment techniques

The techniques and associated conditions of assessment most suited to the judgment of student achievement in this subject are described below. The general objectives and dimensions to which each technique is best suited are also indicated.

For each dimension, standards are described. These standards descriptors are used to determine the properties or characteristics to be assessed by individual assessment instruments. The properties or characteristics for each instrument determined by a school are termed criteria. Therefore, the criteria for an assessment instrument are drawn from the syllabus standards descriptors for relevant dimensions (see Section 6.8.1 Standards matrix).

Schools decide the instruments to be used for assessment. For each assessment instrument, schools develop a criteria sheet: a tool for making judgments about the quality of student responses to an assessment instrument. It lists the properties or characteristics used to assess student achievements. Students must be given a criteria sheet for each assessment instrument.

Where students undertake assessment in a group or team, instruments must be designed so that teachers can validly assess the work of individual students and not apply a judgment of the group product and processes to all individuals.

Assessment techniques in Information Processing and Technology include:

- supervised written assessment
- extended responses assessment
- product assessment

There should be variety and balance in the types of instruments used, thereby enabling students with different learning styles to demonstrate their performance within each dimension. Assessment instruments may assess more than one dimension.

Assessment of student achievement should not be seen as a separate entity, but as an integral part of the developmental learning process and should reflect the learning experiences of the students. An effective course of study includes a variety of learning experiences, and therefore a range of assessment techniques needs to be employed in gathering assessment data.

Assessment instruments should be designed to allow students to demonstrate their ability across all dimensions. It is not necessary for each assessment instrument to address every general objective, but all dimensions should be represented in assessment data that contribute to the award of exit levels of achievement. Each general objective need not have the same emphasis placed upon it in each topic. Refer to the statement on balance in Section 6.1

### 6.5.1 Supervised written

**Supervised written assessment**

**Purpose:**

This technique is used to assess student responses that are produced independently, under supervision and in a set timeframe. There is no question of student authorship in this technique.

**A brief description:**

An instrument in this technique includes written (by hand or on a computer) responses and is conducted under supervised conditions. Instruments may include single or multiple items.

**What dimensions will be assessed though this instrument?**

- *Knowledge and application*
- *Analysis and synthesis*
- *Evaluation and communication*.

A supervised written instrument could be constructed using one or more items. The items might be in response to stimulus materials, which may be seen or unseen, or questions which should be unseen prior to the administration of the assessment. When using seen questions, schools must ensure the purpose of this technique is maintained. These conditions must be explained on the assessment instrument. Unseen means that the students have not previously seen the material or question. Unseen materials or questions should not be copied from information or texts that students have previously been exposed to or have directly used in class. When stimulus materials are used they should be succinct enough to allow students sufficient time to engage with them. If the stimulus materials are lengthy, complex or large in number they may need to be shared with students prior to the administration of the assessment.

**Types of items that could be included in a supervised written assessment:**

- Extended written response — essays
  - require sustained analysis, synthesis and evaluation to fully answer a problem or question
  - generally follow analytical exposition format/genre
  - response to seen or unseen question or statement and seen or unseen supplied sources/stimuli
  - 400–800 words
  - extended written response better allows students to demonstrate the full range of standards and when used, should be the only item
- Short response — practical exercises and calculations
  - require construction, use, interpretation or analysis of primary or secondary data, statistics, graphs, tables or diagrams; and/or application of algorithms to demonstrate mathematical calculations and problem solving
  - may include paragraph responses
  - 50–250 words (applies to the prose, diagrams and workings not included in word count)
- Short response — prose
  - where further explanation than can be done in a sentence is required
  - ideas are maintained, developed, justified
  - students write in full sentences, constructing a piece of prose that may have one or several paragraphs
  - 50–250 words
- Multiple choice, single-word answers, true/false, definitions, diagrams or sentence answers
  - useful for diagnostic and formative purposes
  - often used for testing content knowledge
  - difficult to construct questions that will elicit meaningful higher order cognition responses

| Year 11 | Year 12 |
|---|---|
| • Recommended time: 1–1½ hours<br>• Perusal times may be required<br>• Schools must ensure that where computers are used the purpose of this instrument is maintained. Teachers should consider which general objectives are most appropriate.<br>• May be open book or notes allowed, these conditions must be clearly outlined on the assessment<br>• Short responses<br>– stimuli/questions unseen<br>– 50–250 words (applies to prose, diagrams and workings not included in the word count)<br>• Extended written response<br>– seen or unseen question<br>– 400–600 words. | • Recommended time: 1½–2 hours<br>• Perusal times may be required<br>• Schools must ensure that where computers are used the purpose of this instrument is maintained. Teachers should consider which general objectives are most appropriate.<br>• May be open book or notes allowed, these conditions must be clearly outlined on the assessment<br>• Short responses<br>– stimuli/questions unseen<br>– 50–250 words (applies to prose, diagrams and workings not included in the word count)<br>• Extended written response<br>– seen or unseen question<br>– 600–800 words. |

**What must teachers do when planning for a supervised assessment? What information must be provided to students about this technique?**

Teachers should:

- construct questions that are unambiguous
- format the assessment to allow for ease of reading and responding
- consider the language needs of the students
- ensure the questions allow the full range of standards to be demonstrated
- consider the instrument conditions in relation to the requirements of the question/stimulus
- determine appropriate use of stimulus materials and students notes
- provide students with learning experiences that support the types of items included in the assessment
- teach the appropriate language and communication skills and strategies
- inform the students and indicate what dimensions will be assessed.

## *6.5.2 Extended response*

### Extended response assessment

**Purpose:**

These techniques are used to assess the sustained application of higher order cognition of students to known and provided materials, stimuli and concepts.

**A brief description:**

Students are required to analyse, synthesise and evaluate data and information in the development of a response or a series of responses. It may involve proposing a solution to a problem, expressing and justifying a point of view, explaining and evaluating an issue or applying of concepts or theories to a circumstance. An extended response may be presented in a variety of modes. These assessments occur over a period of time and use in-class and often students' own time. Research is not the focus of this technique.

**What dimensions will be assessed through this instrument?**

- *Knowledge and application*
- *Analysis and synthesis*
- *Evaluation and communication*.

**Specific guidance to the techniques or items that should be used may include some conditions:**

- An extended response invites a range of perspectives through an open question that may have a range of possible answers.
- Stimulus materials for extended responses should come from a broad range of online and traditional text-based, and other resources.
- The student response to a case study will demonstrate all stages of the information literacy cycle: problem identification; solution specification; planning of structure of product; development of the product; checking for errors; checking for flow of communication and evaluation of the product and process.
- Extended response assessment requires sources to be acknowledged through in-text referencing, bibliography and/or reference list.

**Possible types of extended response assessment:**

- Analytical exposition/essay: students provide a response to a specific question or issue. The response may be supported by tables of data, diagrams and flowcharts. The response could be:
  - magazine article
  - newspaper
  - critique
  - review
  - persuasive essay
  - argumentative essay
- Folio: this is a purposeful collection of work in a specified area such as responses to a series of tasks relating to a single context. The folio can be used to document a variety of information, ideas and working processes. It should contain decisions made and reasons or justifications for these. Exercises may be completed over a short timeframe of one to two lessons or over an extended timeframe. Exercises may include:
  - querying of online relational databases
  - coding of algorithms
  - interrogating or implementing of expert systems
  - using operating systems
  - evaluating the usability of a user interface
  - conducting user tests of a prototype with clients
  - designing, developing and evaluating a product to meet determined specification.
- Online written response, e.g. blogs: students provide a reply to an inquiry, scenario or issue. In the response, there would be evidence of a conclusion, decision or recommendation supported by reasoned arguments.
- Response to a case study: students are required to conduct an in-depth investigation of an existing system, scenario or issue, to determine its appropriateness for a particular purpose and audience. The students must make a conclusion/decision/recommendation regarding the existing system, scenario or issue and support the conclusion/decision/recommendation with reasoned argument. In-text referencing, bibliography and/or reference list is required. A case study must contribute towards the assessment of Human–computer interaction, may provide opportunity to work in groups and can provide coverage of several topic areas. The student response should demonstrate all stages of the information literacy cycle.
- Extended responses may also be presented as spoken or multi-modal responses. Teachers must ensure that the full range of general objectives and standards is possible when using spoken or multi-modal techniques. Scripts or supporting documentation such as visual evidence where applicable, notes, palm cards, any other documentation, including the instrument-specific standards marked and annotated by the teacher, will be required to

substantiate decisions but the student spoken or multi-modal response is the focus for assessment decisions. Some techniques will require students to present to an audience (e.g. speech), while others may be presented through the use of technology. Spoken and multi-modal techniques include:

- interview
- speech
- PowerPoint presentations
- video evidence
- debate
- seminar
- lecture
- hypothetical.

| Year 11 | Year 12 |
|---|---|
| • Written instruments: 600–1000 words<br>• spoken responses: 3–4 minutes and supporting documentation.<br>• multi-modal responses: 3–5 minutes and supporting documentation. | • Written instruments: 800–1200 words<br>• spoken responses: 4–5 minutes and supporting documentation.<br>• multi-modal responses: 5–7 minutes and supporting documentation. |

**What must teachers do when planning for an extended response? What information must be provided to students about extended responses?**

The teacher should:

- provide a focus for the extended response.
- allow class time for students to be able to effectively undertake each component of the extended response assessment. However, independent student time will be required to complete the task.
- implement strategies to ensure authentication of student work. Some strategies are annotated notes in response to issues that emerged during the extended response, drafting, teacher observation sheets, referencing, and reference lists.
- consult, negotiate and provide feedback before and during the time the students are working on the extended response assessment to provide ethical guidance and to monitor student work. Feedback and assistance should be provided judiciously, gradually being reduced with the development of student experience and confidence.
- provide scaffolding. When an extended response assessment technique is undertaken for the first time, scaffolding should help students complete the assessment by modelling the process and skills required. However, the scaffolding provided should not specify or lead students through a series of steps dictating a solution. Scaffolding should be reduced from Year 11 to Year 12 to allow students to better demonstrate independence in the assessment instruments. When an extended response assessment technique is revisited (most likely in Year 12), the scaffolding should be reduced and could be a series of generic questions.
- provide students with learning experiences in the use of appropriate communication strategies, including the generic requirements for extended response instruments, e.g. research report structures, referencing conventions.
- indicate on the assessment what dimensions will be assessed and inform students about the instrument specific standards.

## 6.5.3 Product

### Product assessment

**Purpose:**

This technique assesses an authentic student response to the demands of the subject in the form of an application of a practical solution to solving a problem, e .g. a student's production of a software development package.

**A brief description:**

A product is based on the application of skills, theory and conceptual understandings. Products are the outcomes or culminating artefacts of a unit of work. Students are required to analyse, synthesise and evaluate data and information in the development of a product. This may involve solving a problem using information technology. Assessments occur over a period of time and use in-class and often students' own time.

**What dimensions will be assessed though this instrument?**

- *Knowledge and application*
- *Analysis and synthesis*
- *Evaluation and communication*

**Specific guidance to the techniques or items that should be used may include some conditions:**

Project: students are required to produce software development for a particular purpose or use problem-solving techniques involving technology. Projects can range in scale from major to minor. Accompanying written explanation is required. The written explanation may include problem definition, rationale, assumptions and evaluation of process and product.

**Possible types of product assessment:**

- major project
  - must be of at least six weeks duration
  - must contribute towards the assessment of Human–computer interaction
  - should provide opportunity to work in groups
  - can provide coverage of several topic areas
  - should demonstrate all stages of the software development cycle, the information system development cycle, or a combination of the two:

    Software development cycle: problem identification; solution specification; selection and application of appropriate design methods; implementation of the design; testing for errors; evaluation of the product and process

    Information system development cycle: identification; conceptualisation; formalisation; implementation; testing, evaluation.
- minor project:
  - must be of at least two weeks duration
  - need not include a contribution towards the assessment of Human–computer interaction
  - need not evidence all stages of the software development cycle or the information system development cycle
  - need not cover all three dimensions.

| Year 11 | Year 12 |
|---|---|
| • Product<br>• Written explanation 800–1000 words | • Product<br>• Written explanation 1000–1500 words |

**What must teachers do when planning for a product assessment? What information must be provided to students about product assessment?**

Teachers should:

- provide a focus for the product assessment.
- allow class time for students to be able to effectively undertake each component of the product assessment. However, independent student time will be required to complete the task.
- implement strategies to ensure authentication of student work. Some strategies are teacher observation sheets or annotated notes in response to issues that emerged during the product assessment or drafting.
- consult, negotiate and provide feedback before and during the time the students are working on the product assessment to provide ethical guidance and to monitor student work. Feedback and assistance should be provided judiciously, gradually being reduced with the development of student experience and confidence.
- provide scaffolding. When product assessment technique is undertaken for the first time, the scaffolding should help students complete the assessment by modelling the process and skills required. However, the scaffolding provided should not specify or lead the students through a series of steps dictating a solution. Scaffolding should be reduced from Year 11 to Year 12 to allow the students to better demonstrate independence in the product development process. When a product assessment technique is revisited (most likely in Year 12), the scaffolding should be reduced and could become a series of generic questions.
- provide students with learning experiences for developing appropriate product strategies
- indicate on the assessment task sheet what dimensions will be assessed and inform students about the instrument specific standards.

## 6.6 Requirements for verification folio

A verification folio is a collection of a student's responses to assessment instruments on which the level of achievement is based. For students who are to exit with four semesters of credit, each folio must contain the range and mix of assessment techniques for making summative judgments stated below.

Student verification folios for Information Processing and Technology must contain:

- a minimum of four and a maximum of six assessment instruments
- only assessment instruments from Year 12

Each student folio must contain:

- at least one instrument that demonstrates all steps of either the software development cycle or the information system development cycle or a combination of the two cycles.
- at least one instrument from each assessment technique

For information about preparing monitoring and verification submissions schools should refer to <www.qsa.qld.edu.au> select Years 10–12 > Moderation and quality assurance > Forms and procedures.

### 6.6.1 Post-verification assessment

Schools must use assessment information gathered after verification in making judgments about exit levels of achievement for those students who are completing the fourth semester of the course of study. For this syllabus students are to complete one assessment instrument. The assessment instrument and dimensions being assessed is at the discretion of the school, however it should reflect the stage of the course from which it comes.

### 6.6.2 Student profile

The purpose of the student profile is to record student achievement over the four-semester course of study. Key elements on the profile include:

- semester units/themes/topics
- assessment instruments in each semester
- standard achieved in each dimension for each instrument
- instruments used for summative judgments
- interim level of achievement at monitoring and verification.

Schools may use the sample profile template in the appendix or design their own.

## 6.7 Exit standards

The purpose of standards is to make judgments about student levels of achievement at exit from a course of study. The standards are described in the same dimensions as the assessable general objectives of the syllabus. The standards describe how well students have achieved the general objectives and are stated in the standards matrix.

The following dimensions must be used:

- Dimension 1: *Knowledge and application*
- Dimension 2: *Analysis and synthesis*
- Dimension 3: *Evaluation and communication*

Each dimension must be assessed in each semester, and each dimension is to make an equal contribution to the determination of exit levels of achievement.

## 6.8 Determining exit levels of achievement

When students exit the course of study, the school is required to award each student an exit level of achievement from one of the five levels:

- Very High Achievement (VHA)
- High Achievement (HA)
- Sound Achievement (SA)
- Limited Achievement (LA)
- Very Limited Achievement (VLA).

Exit levels of achievement are summative judgments made when students exit the course of study. For most students this will be after four semesters. For these students, judgments are based on exit folios providing evidence of achievement in relation to all general objectives of the syllabus and the standards.

All the principles of exit assessment must be applied when making decisions about exit levels of achievement.

### 6.8.1 Determining a standard

The standard awarded is an *on-balance judgment* about how the qualities of the student's work match the standards descriptors overall in each dimension. This means that it is not necessary for the student to have met every descriptor for a particular standard in each dimension.

When standards have been determined in each of the dimensions for this subject, the following table is used to award exit levels of achievement, where *A* represents the highest standard and *E* the lowest. The table indicates the *minimum combination of standards* across the dimensions for each level.

**Awarding exit levels of achievement**

| | |
|---|---|
| **VHA** | Standard A in any two dimensions and no less than a B in the remaining dimension |
| **HA** | Standard B in any two dimensions and no less than a C in the remaining dimension |
| **SA** | Standard C in any two dimensions and no less than a D in the remaining dimension |
| **LA** | At least Standard D in any two dimensions |
| **VLA** | Standard E in the three dimensions |

Some students will exit after one, two or three semesters. For these students, judgments are based on folios providing evidence of achievement in relation to the general objectives of the syllabus covered to that point in time. The particular standards descriptors related to those objectives are used to make the judgment.

Further information can be found at <www.qsa.qld.edu.au> select Years 10–12 > Moderation and quality assurance > Forms and procedures > scroll to Additional guidelines and procedures.

## *Standards matrix*

| Dimension | A | B | C | D | E |
|---|---|---|---|---|---|
| **Knowledge and application** | The student work has the following characteristics:<br>• detailed description and explanation of links between information technology concepts, terminology, processes, and principles<br>• detailed and effective application of set processes to solve simple and familiar problems. | The student work has the following characteristics:<br>• description and explanation of information technology concepts, terminology, processes, and principles<br>• effective application of set processes to solve simple and familiar problems. | The student work has the following characteristics:<br>• description of information technology concepts, terminology, processes, and principles<br>• application of set processes to solve simple or familiar problems. | The student work has the following characteristics:<br>• statements of information technology facts<br>• elements of set processes to partially solve simple or familiar problems. | The student work has the following characteristics:<br>• reproduction of isolated information technology facts<br>• elements of set processes used. |
| **Analysis and synthesis** | The student work has the following characteristics:<br>• detailed interpretation and analysis of problems and situations from multiple perspectives<br>• designed and developed effective solutions to unrehearsed or complex problems. | The student work has the following characteristics:<br>• interpretation and analysis of problems and situations<br>• designed and developed solutions for unrehearsed or complex problems. | The student work has the following characteristics:<br>• analysis of problems and situations<br>• designed and developed partial solutions for unrehearsed or complex problems. | The student work has the following characteristics:<br>• identification and classification of problems or situations<br>• designed or developed elements of solutions for unrehearsed or complex problems. | The student work has the following characteristics:<br>• restated problems or situations<br>• superficial elements of unrehearsed or complex problems. |

| Dimension | A | B | C | D | E |
|---|---|---|---|---|---|
| Evaluation and communication | The student work has the following characteristics:<br>• comprehensive testing of processes and solutions, application of self-determined and prescribed criteria, reasoning and evidence to draw conclusions and make supported recommendations.<br>• comprehensive construction of documentation and fluent presentation of information using suitable communication conventions to convey meaning appropriate to the context. | The student work has the following characteristics:<br>• reliable testing of processes and solutions, application of prescribed criteria, reasoning and evidence to draw conclusions and make supported recommendations<br>• effective construction of documentation and effective presentation of information using suitable communication conventions to convey meaning appropriate to the context. | The student work has the following characteristics:<br>• testing of process or solutions, application of prescribed criteria, reasoning or evidence to draw conclusions and make recommendations<br>• construction of documentation and presentation of information using communication conventions to convey meaning. | The student work has the following characteristics:<br>• elements of testing of processes or solutions to draw inferences<br>• presentation of information using elements of communication conventions. | The student work has the following characteristics:<br>• elements of testing<br>• presentation of information. |

# 7. Language education

It is the responsibility of all teachers to develop and monitor student abilities to use the forms of language appropriate to their own subject areas. Their responsibility entails developing the following skills:

- ability in the selection and sequencing of information required in the various forms (such as reports, essays, interviews and seminar presentations)
- the use of technical terms and their definitions
- the use of correct grammar, spelling, punctuation and layout.

Assessment in all subjects needs to take into consideration appropriate use of language.

Communication takes place in a variety of ways that may include speaking, listening, reading, writing, transfer of data; and representing designs, information flow, and algorithms graphically.

It is the responsibility of teachers of Information Processing and Technology to teach, not only the content, processes and skills of the course, but also to prepare students to be able to cope with the inherent language demands of the subject.

To do this, teachers should plan for the development of their students' language skills. This entails monitoring student abilities to understand what they read and hear and to communicate clearly by using appropriate and effective language.

Students should be encouraged to use language in a meaningful way within realistic contexts where possible. Opportunities should be provided for students to access, process and present information. This information should be presented using a range of genres and media to known or identified audiences.

To communicate effectively individually or as part of a team, students should be able to:

- read and understand technical reports, manuals, procedures, rules and regulations
- use appropriate genres
- use appropriate vocabulary
- develop and communicate ideas
- support conclusions with relevant evidence
- interpret oral, written, pictorial, graphical or tabular information
- provide spoken, written or multi-modal technical reports
- use appropriate digital technology.

# 8. Quantitative concepts and skills

Success in dealing with issues and situations in life and work depends on the development and integration of a range of abilities, such as being able to:

- comprehend basic concepts and terms underpinning the areas of number, space, probability and statistics, measurement and algebra
- extract, convert or translate information given in numerical or algebraic forms, diagrams, maps, graphs or tables
- calculate, apply algebraic procedures, implement algorithms
- use calculators and computers
- use skills or apply concepts from one problem or one subject domain to another.

Some subjects focus on mathematical concepts and processes to provide a basis for the development of quantitative skills. Nevertheless, students are to be encouraged to develop their understanding of mathematical strategies and approaches to tasks in all subjects. Students should be presented with experiences that stimulate their mathematical interest and hone relevant quantitative skills that contribute to operating successfully within each of their subject domains.

Depending on the approach taken, Information Processing and Technology may require that new mathematical concepts be introduced and new skills be developed. In all cases, however, it will be a matter for teachers, in the context of their own approach to the subject, to encourage the use of quantitative skills and understandings that were developed previously by their students. Within appropriate learning contexts and experiences in the subject, opportunities are to be provided for the revision, maintenance, and extension of such skills and understandings.

# 9. Educational equity

Equity means fair treatment of all. In developing work programs from this syllabus, schools should incorporate the following concepts of equity.

All young people in Queensland have a right to gain an education that meets their needs and prepares them for active participation in creating a socially just, equitable and democratic global society. Schools need to provide opportunities for all students to demonstrate what they know and can do. All students, therefore, should have equitable access to educational programs and human and physical resources. Teachers should ensure that particular needs of the following groups of students are met: female students; male students; Aboriginal students; Torres Strait Islander students; students from non–English-speaking backgrounds; students with disabilities; students with gifts and talents; geographically isolated students; and students from low socioeconomic backgrounds.

Subject matter chosen should include, whenever possible, the contributions and experiences of all groups of people. Learning contexts and community needs and aspirations should also be considered. In choosing appropriate learning experiences teachers can introduce and reinforce non-racist, non-sexist, culturally sensitive and unprejudiced attitudes and behaviour. Learning experiences should encourage the participation of students with disabilities and accommodate different learning styles.

Resource materials used should recognise and value the contributions of both females and males to society and include social experiences of both genders. Resource materials should also reflect cultural diversity within the community and draw from the experiences of the range of cultural groups in the community.

To allow students to demonstrate achievement, barriers to equal opportunity need to be identified, investigated and removed. This may involve being proactive in finding the best ways to meet the diverse range of learning and assessment needs of students. The variety of assessment techniques in the work program should allow students of *all* backgrounds to demonstrate their knowledge and skills related to the dimensions and standards stated in this syllabus. Syllabus dimensions and standards should be applied in the same way to all students.

Teachers should consider equity policies of individual schools and schooling authorities, and may find the following resources useful for devising an inclusive work program:

ACACA 1995, *Guidelines for Assessment Quality and Equity*, available from <www.acaca.org.au>.

ANTA 2004, *A guide to equity and the AQTF*, available from Australian Training Products Ltd <www.atpl.net.au>.

EQ 2005, *Inclusive education statement*; and 2005, *Education Policy and Procedures Register: Inclusive education*, available from <http://education.qld.gov.au/strategic/eppr>.

QCEC 2009, *Inclusive practices in Catholic schools in Queensland*, available from <www.qcec.qld.catholic.edu.au>.

QSA 2009, *Policy on Special Provisions for School-based Assessments in Authority and Authority-registered subjects;* and 2006, *QSA Equity Statement*, available from <www.qsa.qld.edu.au>.

QSCC 2001, *Equity considerations for the development of curriculum and test material,* available from <www.qsa.qld.edu.au>.

# 10. Resources

## *Text and reference books*

A wide variety of textbooks and resource materials that could be used as sources of information about Information Processing and Technology is available. Book suppliers provide information regarding current publications.


Allen, S 2002, *Data Modelling for Everyone*, Apress LP.

Summers, G 2009, *Developing Databases with Access*, 4th ed, Cengage Learning, Melbourne.

Elmasri, R & Navathe, S 2003, *Fundamentals of Database Systems*, Addison-Wesley.

Summers, G 2009, *Programming with Visual Basic,* 4th ed, Cengage Learning, Melbourne Australia.

Robertson, L. A 2000, *Simple Program Design*, Thomas Nelson, South Melbourne.

Glynn, N & Dixon, S 1997, *Designing databases*, McGraw-Hill, Sydney.

Habgood, J 2006,*The game maker's apprentice : game development for beginners*, Apress, NY.

Shelley, G, Thomas, B, Cashman, J & Herbert, C 2007, *Alice 2.0: introductory concepts and techniques,* Course Technology Inc., USA.

Schneider, D 2006, *An introduction to programming using Visual Basic 2005*, Pearson Prentice Hall, NJ.

Summers, G 2006, *Game programming with Visual Basic. NET*, Cengage Learning, South Melbourne.

Zelle, J 2004, *Python programming : an introduction to computer science*, Franklin, Beedle, Wilsonville, Oregon.

McCracken, D. &Wolfe, R 2004, *User-centered Website development : a human computer interaction approach,* Prentice Hall, Upper Saddle River, NJ.

Holzner, S 2005, *Spring into PHP 5*, Addison Wesley, Upper Saddle River, NJ.

Platt, D 2007, *Why software sucks-- and what you can do about it*, Addison-Wesley, Upper Saddle River, NJ.

Shupe, R & Rosser, Z 2008, *Learning actionscript 3.0 : a beginner's guide*, O'Reilly, Sebastopol, CA.

Weller, D & Hatton, H. Lobaì o, Alexandre, S *2004, Beginning .NET game programming in VB.NET*, Apress, California.

Tagliaferri, M 2003, *Learn VB.Net through game programming*, Apress, New York.

Spolsky, J 2001, User interface design for programmers, Apress, Berkeley, Ca.

## World Wide Web

Many interactive and static websites can be used to enhance a course in Information Processing and Technology and often include useful resources. Some particularly useful sites include:

- Artificial Intelligence Center: <www.ai.sri.com>
- Edinburgh Department of Artificial Intelligence Home Page: <www.dai.ed.ac.uk>
- EDIT publishing: <www.edit.net.au>
- GIDGITS: <www.gidgits.org>
- IT Resources, Summers, G.: <http://graemesummers.info>
- MIT Artificial Intelligence Laboratory Home Page: <www.ai.mit.edu>
- Navy Center for Applied Research in Artificial Intelligence, NRL: <www.aic.nrl.navy.mil>
- Queensland Society for Information Technology Educators (QSITE) website with resource collections for information processing and technology: <www.qsite.edu.au>
- Queensland Studies Authority (QSA) website: <www.qsa.qld.edu.au>
- Women in Technology (WIT), Queensland: <www.wit.org.au>
- User Interface Design for Programmers: <www.joelonsoftware.com>.

## Newspaper reports

Many newspapers carry regular pages, columns and features about Information Processing and Technology. Local newspapers can also be a source of useful data. The compilation of news files on particular topics can broaden the knowledge base of students and provide a valuable source of material for developing assessment instruments.

## Periodicals

Journals and periodicals provide current, relevant information. Journals and periodicals relevant to Information Processing and Technology may include the Journal of the Queensland Society for Information Technology in Education.

School librarians should be able to provide assistance with identifying and locating other useful periodicals.

## Electronic media and learning technology

A wide range of videos, DVDs and television recordings are available on a variety of topics related to Information Processing and Technology. A variety of computer software programs and CD-ROMs may be useful for a course in Information Processing and Technology, both as learning tools, to gain access to information presented in a variety of forms and to assist students in gaining ICT skills. Educational program distributors are able to supply updated resource lists.

## Software

Access (Microsoft)

Blaise SQL (Blaiseware)

Bugbrain <www.biologic.com.au>

Clixpert Expert System Shell for Windows (Graeme Summers) <www.graemesummers.info>

Delphi (Borland)

ES-Builder (McGoo Software) <www.mcgoo.com.au>

Gamemaker <www.gamemaker.nl>

InfoModelor (Microsoft)

Oracle (Oracle Corporation)

Visual Basic (Microsoft)

## Movies

AI Artificial Intelligence (Universal Studios)

Antitrust (MGM/UA Studios)

Bicentennial Man (Walt Disney Home Video)

The Matrix (Warner Studios)

Minority Report (Universal Studios)

The Net (Columbia/Tristar Studios)

Warriors of the Net (Ericsson Medialab)

Enemy of the State (Touchstone Pictures)

## Videos

The Computer Program, Part 8 “Artificial Intelligence”, BBC.

Expert Systems and their Applications, Continuing Education Support Unit, University of NSW.

First Person Shooter (50 minutes) 2002, VEA, Australia. Produced in Canada.

Hackers (60 minutes) 2001, VEA, Australia. Produced in the USA.

The Heart of the Game (52 minutes) 2001, VEA, Australia. Produced in France.

IT in Business (29 minutes) 2001, VEA, Australia.

Jobs at the Cutting Edge (25 minutes) 2000, VEA, Australia.

Keeping it Secret: Privacy and security in IT networks (17 minutes) 2001, VEA, Australia.

Lifting the Lid: How computers work (31 minutes) 2002, VEA, Australia.

Network Security (27 minutes) 2002, VEA, Australia.

Override.com.au: Young Australians in IT (26 minutes) 2000, VEA, Australia.

Robotic Revolution USA, National Geographic Society.

System Development Lifecycle. A case study of group wisdom (28 minutes) 2002, VEA, Australia.

## Organisations and community resources

A variety of government and community organisations provide personnel, advice, resources and information to assist in constructing and implementing a course in Information Processing and Technology.

# 11. Glossary

**Copyleft**: Copyleft is a play on the word copyright. It describes the practice of using copyright law to offer the right to distribute copies and modified versions of a work and requires that the same rights be preserved in modified versions of the work. Copyleft is a form of licensing and can be used to maintain copyright conditions for works such as computer software, documents, music and art.

**Communication conventions**: The rules that govern the way we write and speak, suitable to the purpose of the text and the audience it is intended for (e.g. formal or informal language). Includes mode (written, spoken, visual, multi-modal), genre (accepted patterns and conventions for presenting texts (e.g. the format for a written report, including referencing), vocabulary, spelling, punctuation, grammar, cohesion and sentence construction.

**Declarative knowledge**: The facts and information known in a particular field or in total, as compared to procedural knowledge which is concerned with knowing how to carry out a task.

**Procedural application**: Any activity that involves the use of information technology concepts and procedures in order to achieve a specific purpose, e.g. query development, debugging, interface design.

| Term | Syllabus context | Interpretation |
|---|---|---|
| **analysis** | analysis of Information Processing and Technology problems and situations | dissecting to ascertain and examine constituent parts and/or their relationships |
| **complex** | unrehearsed or complex problems | more than one part that may be interrelated, multifaceted |
| **comprehensive** | quality discriminator used for an A standard at exit | inclusive, broad, relevant, thorough |
| **criteria** | criteria is used to draw conclusions, this can be prescribed or self-determined | property, dimension or characteristic by which something is judged or appraised |
| **detailed** | quality discriminator used for an A standard at exit | meticulous and comprehensive |
| **effective** | quality discriminator used for an A standard at exit | meets the assigned purpose |
| **fluent** | quality discriminator used for an A standard at exit | flowing, convinced, smooth |
| **interpretation** | quality descriptor used for a B standard at exit | make sense of, examine |
| **problem** | analysing problems or situations in order to determine a clear definition of what is involved, and the planning and development of a solution or resolution that satisfies the relevant constraints involved | a question raised for consideration or solution |
| **reliable** | quality discriminator used for a B standard at exit | credible, probable, valid |
| **situation** | analysing situations or problems in order to determine a clear definition of what is involved, and the planning and development of a solution or resolution that satisfies the relevant constraints involved | the general state of things; the combination of circumstances at a given time |
| **unrehearsed** | unrehearsed or complex problems | not undertaken before |

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