Accreditation Period
2016–2019

Victorian Certificate of Education

COMPUTING

STUDY DESIGN

www.vcaa.vic.edu.au

VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

State Government Victoria

Authorised and published by the Victorian Curriculum and Assessment Authority
Level 1, 2 Lonsdale Street, Melbourne VIC 3000

Accredited by the Victorian Registration and Qualifications Authority
Level 4, 2 Lonsdale Street, Melbourne VIC 3000

ISBN: 978-1-922082-65-7

Contents

Assessment and reporting

Satisfactory completion

The award of satisfactory completion for a unit is based on the teacher's decision that the student has demonstrated achievement of the set of outcomes specified for the unit. Demonstration of achievement of outcomes and satisfactory completion of a unit are determined by evidence gained through the assessment of a range of learning activities and tasks.

Teachers must develop courses that provide appropriate opportunities for students to demonstrate satisfactory achievement of outcomes.

The decision about satisfactory completion of a unit is distinct from the assessment of levels of achievement. Schools will report a student's result for each unit to the VCAA as S (Satisfactory) or N (Not Satisfactory).

Levels of achievement

Units 1 and 2

Procedures for the assessment of levels of achievement in Units 1 and 2 are a matter for school decision. Assessment of levels of achievement for these units will not be reported to the VCAA. Schools may choose to report levels of achievement using grades, descriptive statements or other indicators.

Units 3 and 4

The VCAA specifies the assessment procedures for students undertaking scored assessment in Units 3 and 4. Designated assessment tasks are provided in the details for each unit in the VCE study designs.

The student's level of achievement in Units 3 and 4 will be determined by School-assessed Coursework (SACs) and/or School-assessed Tasks (SATs) as specified in the VCE study designs, and external assessment.

The VCAA will report the student's level of achievement on each assessment component as a grade from A+ to E or UG (ungraded). To receive a study score the student must achieve two or more graded assessments and receive S for both Units 3 and 4. The study score is reported on a scale of 0–50; it is a measure of how well the student performed in relation to all others who took the study. Teachers should refer to the current *VCE and VCAL Administrative Handbook* for details on graded assessment and calculation of the study score. Percentage contributions to the study score in VCE Computing are as follows:

- Unit 3 School-assessed Coursework: 10 per cent
- Unit 4 School-assessed Coursework: 10 per cent
- School-assessed Task: 30 per cent
- End-of-year examination: 50 per cent.

Details of the assessment program are described in the sections on Units 3 and 4 in this study design.

Authentication

Work related to the outcomes of each unit will be accepted only if the teacher can attest that, to the best of their knowledge, all unacknowledged work is the student's own. Teachers need to refer to the current *VCE and VCAL Administrative Handbook* for authentication procedures.

Key concepts

Four key concepts underpin VCE Computing: data and information, digital systems, approaches to problem solving, and interactions and impacts. These concepts are themes used as a way to understand and organise Computing content. They provide a conceptual framework for teaching and learning programs and establish a way of thinking about problems, opportunities and digital systems. They also assist students in recognising these concepts after they have encountered several examples in action.

The four key concepts are broadly defined as:

Approaches to problem solving focuses on ways of creating solutions and thinking about problems, opportunities and needs. A detailed approach to problem solving is explained in the stages and activities of the problem-solving methodology on pages 14 and 16. Overall approaches to problem solving involve computational, design and systems thinking (see glossary on pages 11–13).

Data and information focuses on the nature of data and how data and information can be acquired, structured, represented and interpreted to extract meaning. This process of preparing data and information appropriately is the precursor to creating solutions that meet intended needs.

Digital systems focuses on the functions and technical underpinnings of hardware and software components as well as networks (wireless, wired and mobile) and the internet, including protocols and styles of modern application architecture such as rich client, mobile and internet. This concept also addresses ways in which hardware and software are used to manage and control access to data and its transfer between digital systems. Digital systems form one of the components of an information system along with people, data and processes.

Interactions and impact focuses on the relationships within and between information systems and the effects of these in achieving economic and social goals. Relationships are considered from three perspectives: how people interact with other people when using digital systems for communication and collaboration; how people interact with, or respond to, different types of digital systems; and how information systems interact with other information systems. This concept also considers the impact of these relationships on meeting current and future needs of individuals, organisations and society, including the ownership and privacy of data and information, and personal safety.

Within an area of study, the key knowledge is organised under the headings of relevant concepts; however, not all concepts may be addressed in any one area of study.

Glossary

For the purposes of this study design and associated assessment the following definitions will apply.

Term	Definition
Application architecture	Application architecture is the process of identifying the components, and their interrelationships, of a structured (software) solution that meets all of the technical and operational requirements, while optimising common quality attributes such as performance, security and manageability. There are styles of application architecture such as client-server, peer-to-peer, rich client and service oriented.
Computational thinking	Computational thinking is a process of recognising aspects of computation in the world and being able to think logically, algorithmically, recursively and abstractly. It is about systematic problem solving in light of the capabilities of digital systems. It typically involves thinking abstractly, defining problems through decomposition, documenting steps and decisions through algorithms, transforming algorithms through the use of programming languages and software that supports automation, and evaluating the resulting digital solutions.
Data types	Data types are the particular forms that an item of data can take including numeric, character and Boolean, and are characterised by the kind of operations that can be performed on it. Depending on the software being used, these fundamental types can be divided into more specific types, for example integer and floating point are numeric types. More sophisticated types can be derived from them, for example a string of characters or a date type and their names may vary, such as text data type versus string data type.
Design brief	A design brief is a statement that contains an outline of a situation, context, problem, need or an opportunity, and constraints or conditions under which a solution must be developed. It is sometimes important to create a solution that not only meets the current needs but has the capacity to meet future or changing needs. It provides a basis from which students can apply some or all of the stages of the problem-solving methodology when creating digital solutions.
Design principles	Design principles are accepted characteristics that contribute to the functionality and appearance of solutions. In this study the principles related to functionality are useability, including robustness, flexibility and ease of use, and accessibility, including navigation and error tolerance. Design principles related to appearance are alignment, repetition, contrast, space and balance.
Design thinking	Design thinking is a way of thinking critically and creatively to generate innovative ideas, evaluate them and precisely define the preferred solution so it can be created using a digital system. It involves a strong understanding of the needs of users and of ways of creating solutions that are more efficient or effective than existing ones. When designing, students use both convergent and divergent thinking skills: divergent thinking supports creativity and the generation of a range of ideas, and convergent thinking supports the selection of a preferred solution and the preparation of accurate and logical plans and instructions to digitally create the solution.

Term	Definition
Efficiency	Efficiency is a measure of how much time, cost and effort is applied to achieve intended results. Measures of efficiency in a solution could include the speed of processing, its functionality and the cost of file manipulation. Measures of efficiency in a network include its productivity, processing time, operational costs and level of automation.
Effectiveness	Effectiveness is a measure of how well a solution, an information management strategy or a network work and whether each achieves its intended results. Measures of effectiveness in a solution include completeness, readability, attractiveness, clarity, accuracy, accessibility, timeliness, communication of message, relevance and useability. Measures of effectiveness of an information management strategy include integrity of data, security, ease of retrieval and currency of files. Measures of effective networks include reliability and maintainability.
Information architecture	Information architecture is the ways in which content (information and objects) is grouped, labelled and located in online solutions. This includes the structuring or grouping of sets of information and determining navigation pathways. Effective and efficient information architecture enables users to intuitively and confidently locate information they require. Key principles that govern information architecture include disclosure, classifications, navigation, growth, choices.
Information system	An information system is the combination of digital hardware and software components (digital systems), data, processes and people that interact to create, control and communicate ideas and digital solutions.
Legal requirements	There are legal requirements with which individuals and organisations are expected to comply, with respect to the ownership and privacy of information, and freedom of expression. For the purposes of this study the key provisions of the following acts are relevant: *Privacy Act 1988*, including *Privacy Amendment (Enhancing Privacy Protect) Act 2012*, *Privacy and Data Protection Act 2014*, *Health Records Act 2001*, *Copyright Act 1968*, *Charter of Human Rights and Responsibilities Act 2006* (VIC) (sections 13, 14 and 15), and the *Spam Act 2003* (Part 1.3, Simplified outline).
Normalisation	Normalisation is the process of ensuring that a database conforms to a set of normal forms. Its primary purpose is to remove redundancies that create threats to data integrity such as update anomalies. It also plays a role in making querying more efficient. The first three normal forms should be realised: First normal form (1NF): Where a table has no repeating groups, that is, no single row has a column containing more than one value or more than one column with the same kind of value, for example telephone1 and telephone2. Second normal form (2NF): Where a table is in 1NF and any column that is not part of the primary key is dependent on the whole primary key. Third normal form (3NF): Where a table is in 2NF and any column that is not part of the primary key is dependent only on the primary key and no other column. A table's primary key is the smallest set of columns needed to uniquely identify a row in the table.
Physical security controls	Physical security controls are the equipment and procedures used to assist in the protection of information systems and the files created, communicated and stored by individuals and organisations. Equipment controls include zoned security strategies, barrier techniques and biometrics. Physical procedures include backing up, shredding confidential documents and checking authorisation credentials. Also see Software security controls.

Term	Definition
Security threats	Security threats are the actions, devices and events that threaten the integrity and security of data and information stored within, and communicated between, information systems. The threats can be accidental, such as losing a portable storage device containing files; deliberate, such as malware, phishing; and events-based such as a power surge.
Software requirements specification	Software requirements specification is a comprehensive description of the intended purpose and environment for purpose-designed software solutions. It documents the key activities associated with the analysing stage of the problem-solving methodology. Software requirements specifications (SRS) fulfil the purposes of breaking down a problem into component parts, providing input to the design stage and serving as a reference point for further stages of the problem-solving methodology.
Software security controls	Software security controls are the software and procedures used to assist in the protection of information systems and the files created, communicated and stored by individuals and organisations. These include user names and passwords, access logs and audit trails, access restrictions, encryption, firewalls and system protection, and security protocols such as Transport Layer Security (TLS) and Secure Sockets Layer (SSL).
Solution (digital)	A digital solution is the method of creating required digital output through the application of digital systems and processes that transforms data and information. Depending on the chosen context, the output of a solution may take forms such as an information product like a website, instructions to control a game, an abstract piece of art or a soundscape. Solutions can be interactive or non-interactive, online (internet connected) or not, multimodal or not. An example of an interactive online solution is a website where users can input variable data. An example of a non-interactive, non-internet connected solution is an infographic stored on a hard drive. An example of a multimodal solution is a website that combines multiple types of data, for example text, sound and images to communicate an idea and information.
Systems thinking	Systems thinking is a way of thinking that takes a holistic approach to identifying and solving problems. It involves analysing the interactions and interrelationships between individual information system components (data, processes, people and digital systems), to identify how they influence the functioning of the entire system. Systems thinking also involves understanding the interdependence between information systems and how a change or output from one system can affect another, and how this affects larger systems such as the economy and society.
Types of data	Types of data are general categories of data including text, number, sound and image (still and moving).
User experience	User experience are those aspects that affect how an end-user interacts with digital systems such as visual, interface and navigation design, user needs, functional and content requirements, and ergonomics.
User flow diagrams	User flow diagrams are diagrammatic representations of the path a user travels through when using an online interactive solution to complete a task or transaction, such as making a reservation or purchasing a product. It is a diagram showing a user's journey to complete a task. User flow diagrams incorporate user interfaces and show the multiple entry points to interactive online solutions, for example, paid advertisements, social media and search engines may direct a user to a location in the solution other than the home page.

Units 1–4: Problem-solving methodology

Integral to the VCE Computing Study Design is a methodology for systematically creating solutions to problems, needs and opportunities. As applied in this study design the methodology comprises four stages: analysis, design, development and evaluation. For each of these stages there is a typical set of activities, as shown in Figure 1. Specific details of the scope of the problem-solving methodology are provided in the introduction to relevant areas of study. Note: when creating solutions, this methodology can be applied as a single stage-by-stage problem-solving process or to each iteration of an agile problem-solving process.

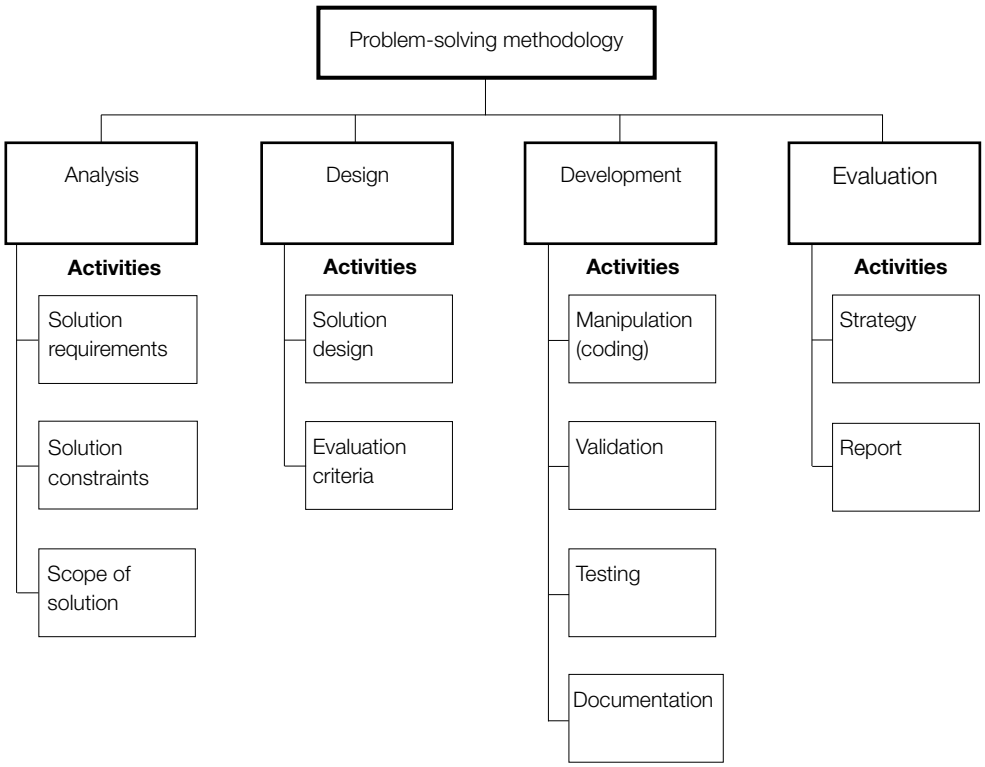

Figure 1: A problem-solving methodology for creating digital solutions

Analysis typically answers the 'what questions' – what is needed to solve a problem, given particular circumstances? It involves:

- Determining the solution requirements. What output is the solution to provide? What data is needed to produce the output? What functions must the solution provide? These requirements can be classified as being functional, that is, what the solution is required to do, and non-functional, which describes the attributes the solution should possess including useability, reliability, portability, robustness, maintainability. Tools to assist in determining the solution requirements include context diagrams, data flow diagrams and use cases.
- Identifying the constraints on the solution. What conditions need to be considered when designing a solution? Typical constraints include economic, such as cost and time; technical, such as speed of processing, capacity, availability of equipment, compatibility and security; social, such as level of expertise of users; legal, such as ownership and privacy of data requirements; and useability, such as usefulness and ease of use of solutions.
- Determining the scope of the solution. The scope states the boundaries or parameters of the solution. It identifies the area of interest or what aspects of the problem will and will not be addressed by the solution.

Design typically answers the 'how questions' – how will the solution requirements be achieved? It involves:

- Planning how the solution will function and its appearance. The solution design typically involves identifying what specific data is required and how the data will be named, structured, validated and manipulated. Typical design tools for this purpose include data dictionaries and data structure diagrams, input-process-output (IPO) charts, flowcharts, pseudocode, object descriptions. Solution design also involves, where appropriate, showing how the various components of a solution relate to one another, for example web pages, style sheets, scripts; queries, forms, reports; modules, procedures, methods, functions. Typical design tools used to show relationships include storyboards, site maps, entity-relationship diagrams, data flow diagrams, structure charts, hierarchy charts, and context diagrams.

  Planning the solution also involves determining its appearance, including, where appropriate, the user interface. This typically involves identifying the position and size of text, images and graphics, font types, colours and text enhancements. Design tools used for this purpose include layout diagrams, annotated diagrams/mock ups.
- Determining the evaluation criteria. What measures will be used to judge whether or not the solution meets the requirements? These criteria should arise from the solution requirements identified in the analysis stage.

Development typically asks the questions of how do we realise or transform solution instructions into a working solution through the use of digital systems. It involves:

- Electronically 'building' or creating the solution following initial designs. It may, however, warrant modifying initial designs in order to create a working solution.
- Validation to check for the reasonableness of data being input. Validation can be both manual and electronic. Proofreading is a manual technique and it occurs when a human scans the data for errors. Electronic validation occurs when the validation process is built into the solution. Its effectiveness is determined through the testing activity.
- Testing whether the solution does what it was intended to do. This activity typically involves:
  - establishing what tests will be conducted
  - determining what test data will be used
  - determining expected results
  - conducting the test
  - recording the actual results
  - correcting any identified errors.
- Writing internal and user documentation, including within the user interface, to support the functioning and use of the solution.

Evaluation typically answers the question: 'How well did the solution meet its stated requirements'? It involves:

- Determining a strategy for finding out the extent to which the solution meets the required needs of the user. Typically this occurs after the solution has been developed. Usually an evaluation strategy would include specifying a timeline, outlining what data will be collected and by what methods and techniques, and how the data relates to the criteria that were generated in the design stage.
- Reporting on the extent to which the solution meets the requirements of the user. This usually takes place after the solution has been used by the user/client and is based on the criteria generated in the design stage.

Unit 3: Informatics

In Informatics Units 3 and 4 students focus on data, information and information systems. In Unit 3 students consider data and how it is acquired, managed, manipulated and interpreted to meet a range of needs. In Area of Study 1 students investigate the way organisations acquire data using interactive online solutions, such as websites and applications (apps), and consider how users interact with these solutions when conducting online transactions. They examine how relational database management systems (RDBMS) store and manipulate data typically acquired this way. Students use software to create user flow diagrams that depict how users interact with online solutions, and acquire and apply knowledge and skills in the use of an RDBMS to create a solution.

Students develop an understanding of the power and risks of using complex data as a basis for decision making. In Area of Study 2 students complete the first part of a project. They frame a hypothesis and then select, acquire and organise data from multiple data sets to confirm or refute this hypothesis. This data is manipulated using tools such as spreadsheets or databases to help analyse and interpret it so that students can form a conclusion regarding their hypothesis. Students take an organised approach to problem solving by preparing project plans and monitoring the progress of the project. The second part of the project is completed in Unit 4.

Software tools

The following table indicates the software tools that students are required to both study and use in this unit.

Area of Study 1	A relational database management system (RDBMS) Drawing or graphics software

A list of minimum software capabilities or equivalents suitable for drawing and graphics software and a relational database management system will be published annually by the VCAA in the *VCAA Bulletin*.

The following table indicates the software tools that students are required to use, but not required to study, in this unit.

Area of Study 2	Appropriate tool for documenting project plans Software tools to capture, store, prepare and manipulate data

Area of Study 1

Organisations and data management

In this area of study students investigate why organisations acquire data online for transaction processing and how they structure their data-gathering processes to support these transactions. Students also develop and apply skills in using a relational database management system (RDBMS) to manipulate data typically sourced through interactive online solutions, such as websites and applications (apps). Students examine how value can be added to this data through the careful structuring of data and the application of functions, such as queries, searches and reports, that identify patterns and relationships between data sets.

Students investigate interactive online solutions to ascertain the types of data being acquired, how it is obtained and protected and how transactions are completed. They design a user flow diagram that traces different ways in which users interact with online solutions when initiating and completing transactions, acknowledging that there can be multiple entry points and multiple interactions. Students diagrammatically represent the user interface of the page on which the user commences an online transaction.

Students examine how organisations fulfil their legal requirements to protect the rights of those who provide data and why organisations want the data organised in particular ways. Students consider the fundamentals of an RDBMS; that is, fields and data types, data structures and the relationships between data sets. Students learn to describe data types and data structures, and apply functions, techniques, formats and conventions to store, validate and manipulate data, and to present suitable solutions.

When tracing user interactions and developing a solution, students respond to two teacher-provided design briefs: one relates to how users interact with an online solution when conducting a transaction; the other provides details of why an RDBMS solution is needed, and includes data. The contexts of the briefs can be the same or different.

In this area of study there is an emphasis on the design and development stages of the problem-solving methodology. Details of the methodology are located on pages 14–16. Students also apply design and systems thinking skills when problem solving.

Outcome 1

On completion of this unit the student should be able to design a solution, develop it using a relational database management system, and diagrammatically represent how users interact with an online solution when supplying data for a transaction.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of Study 1.

Key knowledge

Data and information

- techniques used by organisations to acquire data through their interactive online solutions and reasons for their choice
- techniques for efficient and effective data collection
- characteristics of data types

Digital systems

- physical and software security controls used by organisations to protect their data

Approaches to problem solving

- purposes and structure of an RDBMS, including comparison with flat file databases
- naming conventions to support efficient use and maintenance of an RDBMS
- a methodology for creating an RDBMS structure: identifying entities, defining tables and fields to represent entities; defining relationships by identifying primary key and foreign key fields; defining data types and field sizes; normalisation to third level
- design tools for describing data types and the value of entity relationship (ER) diagrams for representing the structure of an RDBMS
- design principles that influence the functionality and appearance of solutions
- design tools for representing solutions
- functions and techniques within an RDBMS to efficiently and effectively validate and manipulate data
- functions and techniques to retrieve required information through searching, sorting, filtering and querying data sets
- methods and techniques for testing that solutions perform as intended

Interactions and impact

- reasons why organisations acquire data using online facilities, including 24-hour customer access, improved efficiencies through direct data entry by customers, improvements in effectiveness, and access to global markets, marketing opportunities and ongoing services
- reasons why users supply data for online transactions, including convenience, variety of choice, reducing costs
- techniques used by organisations to protect the rights of individuals and organisations who supply data, including security protocols and stating privacy, shipping and returns policies
- user flow diagrams that depict different ways in which users interact with online solutions.

Key skills

- select and apply design tools and techniques for describing data types and representing the structure and functionality of solutions
- use RDBMS functions and techniques to construct a relational database to manipulate and validate data
- apply functions and techniques to construct queries that efficiently retrieve required information
- select and apply testing methods and techniques to confirm whether the solutions operate as intended
- use software tools to represent the user interface of the page on which online transactions begin, including data protection, where appropriate
- use software tools to represent the interactions between users and online solutions (user flow diagrams)
- annotate user flow diagrams to identify where and why data protection is used.

Area of Study 2

Data analytics: drawing conclusions

In this area of study students focus on data analytics, in particular selecting, referencing, organising, manipulating and interpreting relevant data to draw valid conclusions about a hypothesis. Students initially frame a hypothesis within a chosen field such as entertainment, sport, science/medicine, business and education, and undertake an analysis to determine the multiple data sets needed to support their claim, the scope of the hypothesis and any constraints. The hypothesis could reflect an existing or emerging trend such as confirming or predicting a changing pattern in food culture in a defined precinct due to demographic shifts. Students complete this as the first part of a project; the other part is undertaken in Unit 4, Outcome 1.

Students prepare their acquired data for manipulation through integrity checks and, where appropriate, codify data and information. Students manipulate this data to support interpretation and apply computational thinking skills to extract meaning from the data in order to express a conclusion to their hypothesis.

Details regarding the complexity of data sets, such as variety of types of data, number and variety of data sets and the state of the data (fully digitised or physical) will be published annually by the VCAA in the *VCAA Bulletin*.

Students devise a file management plan and prepare a project plan for the execution of the problem-solving methodology. This includes both parts of the project, from the framing of the hypothesis, the analysis and the conclusion (Unit 3, Outcome 2), through to the design, development and evaluation of the multimodal online solution showing the correctness (or otherwise) of the hypothesis (Unit 4, Outcome 1). Students determine the milestones of their project.

Outcome 2

On completion of this unit the student should be able to use a range of appropriate techniques and processes to acquire, prepare, manipulate and interpret complex data to confirm or refute a hypothesis, and formulate a project plan to manage progress.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of Study 2.

Key knowledge

Data and information

- primary and secondary data sources (digital and non digital) and methods of data acquisition, including observation, interview and querying of resources
- suitability of quantitative and qualitative data for manipulation including comparisons (quantitative) and policy formation (qualitative)
- data types and data structures relevant to selected software tools
- one of the following methods for referencing primary and secondary sources: Harvard, American Psychological Association (latest edition), Chicago, Institute of Electrical and Electronics Engineers (IEEE)
- criteria to check the integrity of data including timeliness, authenticity, relevance, accuracy
- techniques for coding qualitative data to support manipulation

Interactions and impact

- key legal requirements for storage and communication of data and information, including privacy, intellectual property and human rights requirements

Approaches to problem solving

- features of a reasonable hypothesis including a specific statement identifying a prediction and the variables
- solution specifications: requirements, including data to support the prediction of the hypothesis, constraints and scope
- project management concepts and processes, including milestones and dependencies (concepts), task identification, sequencing, time allocation, resources and documentation using Gantt charts (processes)
- file naming conventions to support efficient use of software tools
- software functions to organise, manipulate and store data
- techniques for identifying patterns and relationships between data

Digital systems

- roles, functions and characteristics of digital system components used to input, store, communicate and output data and information
- physical and software security controls suitable for protecting stored and communicated data.

Key skills

- frame a hypothesis that can be tested
- determine the specifications of the solution
- acquire complex data sets and use a standard referencing system to acknowledge intellectual property
- apply techniques that discriminate data on the basis of its integrity
- select and apply methods to secure stored and communicated data and information
- organise, manipulate and interpret selected data, identifying relationships and patterns to develop a conclusion
- devise and apply a file management plan
- prepare project plans using software
- select and use digital system components appropriate to project needs.

School-based assessment

Satisfactory completion

The award of satisfactory completion for a unit is based on whether the student has demonstrated the set of outcomes specified for the unit. Teachers should use a variety of learning activities and assessment tasks to provide a range of opportunities for students to demonstrate the key knowledge and key skills in the outcomes.

The areas of study and key knowledge and key skills listed for the outcomes should be used for course design and the development of learning activities and assessment tasks.

Assessment of levels of achievement

The student's level of achievement in Unit 3 will be determined by School-assessed Coursework and a School-assessed Task.

School-assessed Coursework

School-assessed Coursework tasks must be a part of the regular teaching and learning program and must not unduly add to the workload associated with that program. They must be completed mainly in class and within a limited timeframe.

Where teachers provide a range of options for the same School-assessed Coursework task, they should ensure that the options are of comparable scope and demand.

The types and range of forms of School-assessed Coursework for the outcomes are prescribed within the study design. The VCAA publishes *Advice for teachers* for this study, which includes advice on the design of assessment tasks and the assessment of student work for a level of achievement.

Teachers will provide to the VCAA a numerical score representing an assessment of the student's level of achievement. The score must be based on the teacher's assessment of the performance of each student on the tasks set out in the following table.

Contribution to final assessment

School-assessed Coursework for Unit 3 will contribute 10 per cent to the study score.

Outcomes	Marks allocated*	Assessment tasks
Unit 3 **Outcome 1** Design a solution, develop it using a relational database management system, and diagrammatically represent how users interact with an online solution when supplying data for a transaction.	**90** **10**	In response to a design brief that includes an analysis of a need or an opportunity and a data set: • the design and development of a relational database management system solution. **AND** In response to a design brief that includes a description of the online transaction requirements of an organisation and its data protection techniques: • an annotated, diagrammatic representation of a user's interactions with an online solution when conducting a transaction and the user interface for the page that initiates the transaction.
Total marks	**100**	

*School-assessed Coursework for Unit 3 contributes 10 per cent.

School-assessed Task

The student's level of achievement in Outcome 2 in Unit 3 and Outcome 1 in Unit 4 will be assessed through a School-assessed Task. Details of the School-assessed Task for Units 3 and 4 are provided on page 38 of this study design.

Contribution to final assessment

The School-assessed Task will contribute 30 per cent to the study score.

External assessment

The level of achievement for Units 3 and 4 is also assessed by an end-of-year examination, which will contribute 50 per cent.

Unit 4: Informatics

In this unit students focus on strategies and techniques for manipulating, managing and securing data and information to meet a range of needs. In Area of Study 1 students draw on the analysis and conclusion of their hypothesis determined in Unit 3, Outcome 2, and then design, develop and evaluate a multimodal, online solution that effectively communicates the conclusion and findings. The evaluation focuses on the effectiveness of the solution in communicating the conclusion and the reasonableness of the findings. Students use their project plan to monitor their progress and assess the effectiveness of their plan and adjustments in managing the project.

In Area of Study 2, students explore how different organisations manage the storage and disposal of data and information to minimise threats to the integrity and security of data and information and to optimise the handling of information.

Software tools

The following table indicates the software tool that students are required to both study and use in this unit.

Area of Study 1	Software tools to manipulate data for creating a multimodal online solution

A list of minimum software capabilities or equivalents suitable for creating multimodal online solutions will be published annually by the VCAA in the *VCAA Bulletin*.

The following table indicates the software tool that students are required to use, but not required to study, in this unit.

Area of Study 1	Appropriate tool for documenting project plans

Area of Study 1

Data analytics: presenting the findings

In this area of study students draw on the conclusion they formed to their hypothesis in Unit 3, Outcome 2, and design and develop a multimodal online solution that communicates and substantiates this conclusion. Students evaluate the effectiveness of the solution in communicating the conclusion.

Effective designs and clarity of messages are key features of solutions designed to communicate conclusions and findings arising from complex data sets. In this area of study students design a multimodal online solution with an educational purpose that is intended for a world-wide audience. When designing the solution, students generate two or three alternative design ideas and develop and apply criteria to select the design idea that will be fully detailed and transformed into a solution. Students use software tools and functions that support the types of data being manipulated to transform the design into a solution.

Students also use their set of criteria to evaluate the effectiveness of their solution in presenting the conclusion and findings. During these problem-solving methodology stages students use their project plan to monitor and record progress and assess the effectiveness of this strategy in managing the project.

Outcome 1

On completion of this unit the student should be able to design, develop and evaluate a multimodal online solution that confirms or refutes a hypothesis, and assess the effectiveness of the project plan in managing progress.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of Study 1.

Key knowledge

Approaches to problem solving

- characteristics of information for educating world-wide audiences, including gender and culture inclusiveness, commonality of language, age appropriateness
- techniques for generating design ideas
- criteria for evaluating alternative design ideas and the effectiveness of solutions
- characteristics of effective multimodal online solutions
- formats and conventions appropriate to multimodal online solutions
- design principles that influence the functionality and appearance of multimodal online solutions
- design tools for representing a solution's appearance and functionality, including relationships, where appropriate
- functions, techniques and procedures for efficiently and effectively manipulating data using software tools
- manual and electronic validation techniques
- functions, techniques and procedures for managing files
- techniques for testing that solutions do what is intended
- techniques for documenting the progress of projects, including annotations, logs and adjustments to tasks and timeframes
- strategies for evaluating the effectiveness of solutions and assessing project plans.

Key skills

- generate alternative design ideas
- select preferred design ideas, based on student-developed criteria
- select and apply design tools to represent the functionality and appearance of solutions
- select and apply software functions, methods, formats, conventions, techniques and design principles to develop multimodal online solutions that operate as intended
- monitor and adjust project plans where appropriate
- apply criteria to evaluate the effectiveness of multimodal online solutions in communicating conclusions to hypotheses
- assess the effectiveness of project plans in managing work practices.

Area of Study 2

Information management

This area of study focuses on information management and its importance to organisations. Students develop knowledge about the components of an information system and the role of these components in managing information. They investigate how different organisations store and dispose of their data and information. Students examine the threats to this data and information, whether accidental, deliberate or technical, and consider the potential consequences to organisations of ineffective information management strategies.

Students recommend information management strategies to protect the integrity and security of data and information, taking into account key legal requirements of organisations and any ethical dilemmas faced by organisations and individuals regarding security of information.

Outcome 2

On completion of this unit the student should be able to compare and contrast the effectiveness of information management strategies used by two organisations to manage the storage and disposal of data and information, and recommend improvements to their current practices.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of Study 2.

Key knowledge

Interactions and impact

- reasons why data and information are important to organisations, including meeting the goals and objectives of both organisations and information systems
- reasons why information management strategies are important to organisations, including maximising opportunities, minimising risks and fulfilling legal requirements
- key legislation that affects how organisations control the storage and disposal of their data and information: the *Privacy Act 1988*, the *Privacy and Data Protection Act 2014,* and the *Health Records Act 2001*
- ethical dilemmas arising from information management practices
- strategies for resolving legal and ethical tensions between stakeholders arising from information management practices
- reasons for preparing disaster recovery plans, and their scope, including evacuation, backing up, restoration and test plans
- possible consequences for organisations that fail to follow or violate security measures
- criteria for evaluating the effectiveness of information management strategies

Digital systems

- role of people, processes and digital systems in the management of data and information
- types and causes of accidental, deliberate and events-based threats to the integrity and security of data and information
- physical and software security controls for preventing unauthorised access to data and information and for minimising the loss of data accessed by authorised and unauthorised users
- the advantages and disadvantages of using networks and cloud computing for storing and disposing of data and information.

Key skills

- explain the current information management strategies used by organisations to monitor and control their data and information
- identify similarities and differences between the information management strategies of organisations
- propose and apply criteria to evaluate the effectiveness of information management strategies
- discuss possible consequences of ineffective information management strategies
- recommend information management strategies to improve current practices.

School-based assessment

Satisfactory completion

The award of satisfactory completion for a unit is based on whether the student has demonstrated the set of outcomes specified for the unit. Teachers should use a variety of learning activities and assessment tasks to provide a range of opportunities for students to demonstrate the key knowledge and key skills in the outcomes.

The areas of study and key knowledge and key skills listed for the outcomes should be used for course design and the development of learning activities and assessment tasks.

Assessment of levels of achievement

The student's level of achievement in Unit 4 will be determined by School-assessed Coursework and a School-assessed Task.

School-assessed Coursework

School-assessed Coursework tasks must be a part of the regular teaching and learning program and must not unduly add to the workload associated with that program. They must be completed mainly in class and within a limited timeframe.

Where teachers provide a range of options for the same School-assessed Coursework task, they should ensure that the options are of comparable scope and demand.

The types and range of forms of School-assessed Coursework for the outcomes are prescribed within the study design. The VCAA publishes *Advice for teachers* for this study, which includes advice on the design of assessment tasks and the assessment of student work for a level of achievement.

Teachers will provide to the VCAA a numerical score representing an assessment of the student's level of achievement. The score must be based on the teacher's assessment of the performance of each student on the tasks set out in the following table.

Contribution to final assessment

School-assessed Coursework for Unit 4 will contribute 10 per cent to the study score.

Outcomes	Marks allocated*	Assessment tasks
Unit 4 **Outcome 2** Compare and contrast the effectiveness of information management strategies used by two organisations to manage the storage and disposal of data and information, and recommend improvements to their current practices.	**100**	A written report **OR** An annotated visual report.
Total marks	**100**	

*School-assessed Coursework for Unit 4 contributes 10 per cent.

School-assessed Task

The student's level of achievement in Outcome 2 in Unit 3 and Outcome 1 in Unit 4 will be assessed through a School-assessed Task. Details of the School-assessed Task for Units 3 and 4 are provided in the following table.

Contribution to final assessment

The School-assessed Task will contribute 30 per cent to the study score.

Outcomes	Assessment tasks
Unit 3 **Outcome 2** Use a range of appropriate techniques and processes to acquire, prepare, manipulate and interpret complex data to confirm or refute a hypothesis, and formulate a project plan to manage progress.	A short report that sets out a statement of a student-generated hypothesis, the conclusion that has been drawn and an outline of the findings supporting the conclusion **AND** A collection of data sets, and information derived from them, that allows a conclusion to be drawn about the hypothesis and evidence of: • the specifications for creating the information • acknowledgment of intellectual property • the validation and manipulation processes and techniques used • the methods used to secure stored and communicated data and information **AND** A project plan (Gantt charts) indicating times, resources and tasks.
Unit 4 **Outcome 1** Design, develop and evaluate a multimodal online solution that confirms or refutes a hypothesis, and assess the effectiveness of the project plan in managing progress.	A folio of two or three alternative design ideas and the detailed design specifications of the preferred design **AND** A multimodal online solution that communicates the confirmation or refutation of a hypothesis as detailed in Unit 3 **AND** • an evaluation of the effectiveness of the solution • an assessment of the effectiveness of the project plan (Gantt chart) in monitoring project progress in one of the following: • a written report • an annotated visual plan.

*School-assessed Task for Units 3 and 4 contributes 30 per cent.

External assessment

The level of achievement for Units 3 and 4 is also assessed by an end-of-year examination.

Contribution to final assessment

The examination will contribute 50 per cent.

End-of-year examination

Description

The examination will be set by a panel appointed by the VCAA. All the key knowledge and key skills that underpin the outcomes in Units 3 and 4 are examinable.

Conditions

The examination will be completed under the following conditions:

- Duration: two hours.
- Date: end-of-year, on a date to be published annually by the VCAA.
- VCAA examination rules will apply. Details of these rules are published annually in the *VCE and VCAL Administrative Handbook*.
- The examination will be marked by assessors appointed by the VCAA.

Further advice

The VCAA publishes specifications for all VCE examinations on the VCAA website. Examination specifications include details about the sections of the examination, their weighting, the question format/s and any other essential information. The specifications are published in the first year of implementation of the revised Units 3 and 4 sequence together with any sample material.