

**Updated – version 1.1**

Amendments to study design history

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| Version | Status | Release Date | Comments |
| 1.1 | Current | August 2023 | Unit 1, Area of Study 1, Outcome 1 key knowledge: updated bullet point 1; key skills: updated bullet point 1 and 2 (page 21).Unit 1, Area of Study 2, Outcome 2 key knowledge: updated bullet point 1 and 2; key skills: updated bullet point 2 and 8 (page 22).Unit 3, Area of Study 2, Outcome 2 key knowledge: updated bullet point 1 and inserted new bullet point 2 (page 30); key skills: updated bullet point 1 and 8 (page 31).Unit 3, Area of Study 3, Outcome 3 key knowledge: updated bullet point 1 (page 31). |
| 1.0 | Superseded | January 2023 | Original study design. |

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Contents

[Important information 5](#_Toc117080838)

[Introduction 6](#_Toc117080841)

[Scope of study 6](#_Toc117080842)

[Rationale 6](#_Toc117080843)

[Aims 7](#_Toc117080844)

[Structure 7](#_Toc117080845)

[Entry 7](#_Toc117080846)

[Duration 7](#_Toc117080847)

[Changes to the study design 8](#_Toc117080848)

[Safety and wellbeing 8](#_Toc117080849)

[Monitoring for quality 8](#_Toc117080850)

[Employability skills 8](#_Toc117080851)

[Legislative compliance 8](#_Toc117080852)

[Child Safe Standards 8](#_Toc117080853)

[Assessment and reporting 9](#_Toc117080854)

[Satisfactory completion 9](#_Toc117080855)

[Levels of achievement 9](#_Toc117080856)

[Authentication 10](#_Toc117080859)

[Cross-study specifications 11](#_Toc117080860)

[Unit 1: Design practices 20](#_Toc117080871)

[Area of Study 1 20](#_Toc117080872)

[Area of Study 2 21](#_Toc117080874)

[Assessment 23](#_Toc117080876)

[Unit 2: Positive impacts for end users 24](#_Toc117080877)

[Area of Study 1 24](#_Toc117080878)

[Area of Study 2 25](#_Toc117080880)

[Area of Study 3 26](#_Toc117080882)

[Assessment 27](#_Toc117080884)

[Unit 3: Ethical product design and development 28](#_Toc117080885)

[Area of Study 1 28](#_Toc117080886)

[Area of Study 2 30](#_Toc117080888)

[Area of Study 3 31](#_Toc117080890)

[School-based assessment 32](#_Toc117080892)

[External assessment 33](#_Toc117080896)

[Unit 4: Production and evaluation of ethical designs 34](#_Toc117080897)

[Area of Study 1 34](#_Toc117080898)

[Area of Study 2 35](#_Toc117080900)

[School-based assessment 36](#_Toc117080902)

[External assessment 38](#_Toc117080906)

Important information

Accreditation period

Units 1–4: 1 January 2024 – 31 December 2028

Implementation of this study commences in 2024.

Other sources of information

The [*VCAA Bulletin*](https://www.vcaa.vic.edu.au/news-and-events/bulletins-and-updates/bulletin/Pages/index.aspx) is the only official source of changes to regulations and accredited studies. The Bulletin also regularly includes advice on VCE studies. It is the responsibility of each VCE teacher to refer to each issue of the Bulletin. The Bulletin is available as an e-newsletter via [free subscription](https://www.vcaa.vic.edu.au/Footer/Pages/Subscribe.aspx) on the VCAA website.

To assist teachers in developing courses, the VCAA publishes online [Support materials](https://www.vcaa.vic.edu.au/curriculum/vce/vce-study-designs/productdesign-and-technology/Pages/Index.aspx) (incorporating the content previously supplied in the *Advice for teachers*).

The current [*VCE Administrative Handbook*](https://www.vcaa.vic.edu.au/administration/vce-vcal-handbook/Pages/index.aspx) contains essential information on assessment processes and other procedures.

VCE providers

Throughout this study design the term ‘school’ is intended to include both schools and other VCE providers.

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Introduction

Scope of study

Product design is a solution-focused approach that engages with the diverse needs and opportunities of individuals, society and the environment in which we live. Product designers aim to improve welfare, which includes quality of life, by designing innovative and ethical solutions. Product design is enhanced through knowledge of social, technological, economic, historical, ethical, legal, environmental and cultural factors. These factors influence the form, function and aesthetics of products.

Central to VCE Product Design and Technologies is a design process that encourages divergent and convergent thinking while engaging with a problem. The design brief identifies a real need or opportunity and provides scope for designing, making and evaluating. Investigation and research inform and aid the development of designed solutions that take the form of physical, three-dimensional products.

In VCE Product Design and Technologies students are designer-makers who design solutions that are innovative and ethical. As designer-makers, they learn about the design industry, teamwork and the collaborative nature of teams, entrepreneurial activities, innovative technologies and enterprise. The development of designed solutions requires speculative, critical and creative thinking, problem-solving, numeracy, literacy, and technacy. Students participate in problem-based design approaches that trial, test, evaluate, critique and iterate product solutions. Students prototype and test using a variety of materials, tools and processes. Throughout the process of designing and testing, students learn that innovative and ethical solutions come from constructive failure and intentional evaluation.

Knowledge and use of technological resources are integral to product design. Designers safely and sustainably transform materials into products using a range of materials, tools and processes. In this study, students gain an understanding of both traditional and new and emerging materials, tools and processes. They study and experience a variety of design specialisations and use a range of materials, tools and processes as they demonstrate technacy.

Rationale

VCE Product Design and Technologies offers students a range of relevant practical and applied experiences that can support future career pathways in design fields. These include industrial design, textiles, jewellery, fashion, interior spaces and exhibitions, engineering, building and construction, furniture, and transport. Future pathways also include careers in specialised areas of arts and design at professional, industrial and vocational levels.

VCE Product Design and Technologies offers students a unique focus on creativity through the development and production of innovative and ethical products. Through the study of VCE Product Design and Technologies students become solution-focused and equipped to deal with both the interdisciplinary (interrelationship of multiple disciplines) and transdisciplinary (when disciplines interconnect to form new ideas) natures of design. This is achieved through collaboration (shared work) and teamwork (working on own tasks with a common goal to others), use of computer-aided manufacturing, work practice in designing and making, and development of speculative, critical and creative thinking skills. Students work with a variety of materials, tools and processes to develop their technacy and they employ innovative and ethical practices as they practise design. All of this contributes to the real-life industry relevance of this course.

Aims

This study enables students to:

* understand sustainability and other ethical responsibilities that a designer addresses to embed social, environmental, economic and worldview considerations when designing and creating for identified needs and opportunities with the end users
* use design thinking strategies − critical, creative and speculative − in the process of product development
* employ a design process to generate and communicate multiple creative ideas, concepts and product design options, using a range of visual techniques and prototypes to develop viable solutions to needs and opportunities
* explore, test and use a wide range of materials, as well as explore the characteristics and properties that inform their use in a variety of contexts
* practise methods of sourcing, processing, producing and assembling materials, and acknowledge their environmental, social, economic and psychological implications
* develop, document and follow safe methods of working with technologies, across a range of materials, tools and processes
* apply project management techniques to ensure production is delivered according to budget and timelines
* analyse, evaluate and critique the appropriateness of designed products.

Structure

The study is made up of four units.

* Unit 1: Design practices
* Unit 2: Positive impacts for end users
* Unit 3: Ethical product design and development
* Unit 4: Ethical production and evaluation

Each unit deals with specific content contained in areas of study and is designed to enable students to achieve a set of outcomes for that unit. Each outcome is described in terms of key knowledge and key skills.

Entry

There are no prerequisites for entry to Units 1, 2 and 3. Students must undertake Unit 3 and Unit 4 as a sequence. Units 1–4 are designed to the equivalent standard of the final two years of secondary education. All VCE studies are benchmarked against comparable national and international curriculum.

Duration

Each unit involves at least 50 hours of scheduled classroom instruction.

Changes to the study design

During its period of accreditation minor changes to the study will be announced in the [*VCAA Bulletin*](https://www.vcaa.vic.edu.au/news-and-events/bulletins-and-updates/bulletin/Pages/index.aspx). The Bulletin is the only source of changes to regulations and accredited studies. It is the responsibility of each VCE teacher to monitor changes or advice about VCE studies published in the Bulletin.

Monitoring for quality

As part of ongoing monitoring and quality assurance, the VCAA will periodically undertake an audit of VCE Product Design and Technologies to ensure the study is being taught and assessed as accredited. The details of the audit procedures and requirements are published annually in the [*VCE Administrative Handbook*](https://www.vcaa.vic.edu.au/administration/vce-vcal-handbook/Pages/index.aspx). Schools will be notified if they are required to submit material to be audited.

Safety and wellbeing

It is the responsibility of the school to ensure that duty of care is exercised in relation to the health and safety of all students undertaking the study. This study may involve the handling of potentially hazardous substances and the use of potentially hazardous equipment. Teachers should refer to the [Hazards substances](https://www.education.vic.gov.au/hrweb/safetyhw/Pages/chemicalmgt.aspx) information within the OHS Management System on the Department of Education’s Chemical Management page and also [Use of machinery in technology teaching](https://www.education.vic.gov.au/hrweb/safetyhw/Pages/technology.aspx). For additional information about risk assessment, refer to the [WorkSafe website](https://www.worksafe.vic.gov.au/). Teachers with students working in the areas of wood and metal materials must be competent in the use of machinery associated with use of these materials, for example through completion of the 21820VIC Course in Safe Use of Machinery for Technology Teaching (Woodwork and Metalwork). Details about types of appropriate equipment for use in this study are included in the [Support materials](https://www.vcaa.vic.edu.au/curriculum/vce/vce-study-designs/productdesign-and-technology/Pages/Index.aspx).

Employability skills

This study offers a number of opportunities for students to develop employability skills. The [Support materials](https://www.vcaa.vic.edu.au/curriculum/vce/vce-study-designs/productdesign-and-technology/Pages/Index.aspx) provide specific examples of how students can develop employability skills during learning activities and assessment tasks.

Legislative compliance

When collecting and using information, the provisions of privacy and copyright legislation, such as the Victorian *Privacy and Data Protection Act 2014* and *Health Records Act 2001*, and the federal *Privacy Act 1988* and *Copyright Act 1968*, must be met.

Child Safe Standards

Schools and education and training providers are required to comply with the Child Safe Standards made under the Victorian *Child Wellbeing and Safety Act 2005*. Registered schools are required to comply with *Ministerial Order No. 1359 Implementing the Child Safe Standards – Managing the Risk of Child Abuse in Schools and School Boarding Premises*. For further information, consult the websites of the [Victorian Registration and Qualifications Authority](https://www.vrqa.vic.gov.au/childsafe/Pages/Home.aspx), the [Commission for Children and Young People](https://ccyp.vic.gov.au/) and the [Department of Education and Training](https://www2.education.vic.gov.au/pal/child-safe-standards/policy).

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 VCE study designs.

The student’s level of achievement in Units 3 and 4 will be determined by School-assessed Coursework (SAC), and a School-assessed Task (SAT) as specified in the VCE study design, 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 in the study and receive an 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 completed the study. Teachers should refer to the current [*VCE Administrative Handbook*](https://www.vcaa.vic.edu.au/administration/vce-vcal-handbook/Pages/index.aspx) for details on graded assessment and calculation of the study score.

Percentage contributions to the study score in VCE Product Design and Technologies are as follows:

* Units 3 and 4 School-assessed Coursework: 20 per cent
* Units 3 and 4 School-assessed Task: 50 per cent
* End-of-year examination: 30 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 Administrative Handbook*](https://www.vcaa.vic.edu.au/administration/vce-vcal-handbook/Pages/index.aspx) for authentication rules and strategies.

Cross-study specifications

Cross-study specifications provide details of the concepts which underpin Units 1 to 4 of the study design. These concepts provide students with the methodology to achieve designed solutions. They should inform students’ work, and should be applied throughout the study.

Aboriginal and Torres Strait Islander knowledge, history and culture

Aboriginal and Torres Strait Islander peoples are the first Australians, and the oldest, continuous living culture in human history. They have diverse cultures, social and kinship structures and unique, complex knowledge systems. VCE Design and Technologies provides opportunities for students to develop understandings of the significant contributions of Aboriginal and Torres Strait Islander peoples’ connection to Country, place and culture through the acknowledgement of tradition and culture, and how product design can be a demonstration of culture.

Aboriginal and Torres Strait Islander peoples have historically transformed materials from their local environments using skill and innovation. They demonstrated a high level of knowledge and skills to use materials, tools and processes to design and make products for specific purposes, such as using natural fibres in various ways, for example weaving baskets to gather and carry food, to make fish and eel traps,
to make clothing and to make thermoplastic resin – a sticky, black substance strong enough to bind rock to wood and used to create tools such as spears, woomeras and axes. Aboriginal and Torres Strait Islander weaving practices are intrinsically connected to the local environment because of the use of local materials. Careful use of local materials is linked to sustainability; care was taken to not remove all plants so they could grow back for future use, and they were discarded in a way that allowed materials to return to earth through composting.

Aboriginal people also designed and made a range of highly sophisticated tools for different uses. They fashioned stone and natural glass into chisels, saws, knives, axes and spearheads, and these were used for hunting and gathering food and for making baskets, nets and ochre. They designed and made boomerangs to hunt; boomerangs are designed with an angled shape and asymmetrical curves that makes use of asymmetrical lift, one of the most complicated principles of aerodynamics. Aboriginal people also used natural materials to design and make clothing, children’s toys such as rattles, dolls, spinning tops, and musical instruments such as the didgeridoo, a type of wind instrument. Today, Aboriginal and Torres Strait Islander people continue to use a range of traditional and new and emerging materials, tools and processes to design and make a range of products.

This understanding of Aboriginal design and product development helps support cultural learning, encouraging students to make connections between their own world and the worlds of others, encourage collaboration, develop empathy with others, and provide students with the insight to understand themselves as part of a diverse and global community.

Teachers are encouraged to include Aboriginal and Torres Strait Islander knowledge and perspectives in the design and delivery of teaching and learning programs related to VCE Product Design and Technologies. Many local Aboriginal and Torres Strait Islander communities have protocols that they have developed in relation to education. The preferred education model of the Victorian Koorie community enables teachers to focus inclusively on supporting students to consider Victorian Koorie education matters, and systematically support students to learn about local, regional, state and national Indigenous perspectives. VCE studies involve a focused extension of this model and include a broader application of national and international perspectives.

Protocols for Koorie education in Victorian schools, and other resources relating to the inclusion of Aboriginal and Torres Strait Islander knowledge and perspectives may be accessed at [VAEAI](https://aus01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.vaeai.org.au%2Fresources%2F&data=05%7C01%7CPatrick.Wilkes%40education.vic.gov.au%7C97ff3bd92bf4408ffe7208dbcf9cc519%7Cd96cb3371a8744cfb69b3cec334a4c1f%7C0%7C0%7C638332044457805833%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=xUkdGaltGHK8vQAdUq9iOueX5pRsl%2FJhr8OLF1KHpbo%3D&reserved=0).

Design brief

In VCE Product Design and Technologies, a design brief is formulated to facilitate the design response to a real personal, local or global design need or opportunity. A design brief is developed to clarify this need or opportunity so that a viable solution may be developed to address the need or opportunity of the end user(s). It is a summary of the analysis of research into the nature of a need or opportunity and should not solve the problem at this stage. The design brief should provide enough detail for the student to be able to explore a range of possible ideas.

Elements of a design brief include identification of the need or opportunity, the formulation of the profile of end user(s), identification of the intended function and the project scope. The project scope includes identification of constraints and considerations with reference to the factors that influence product design. The project scope is used to develop evaluation criteria. Criteria are used to inform, evaluate, critique and justify the chosen product concept; to evaluate the processes required to design and make the product; and to evaluate the finished product, including how it addresses the need or opportunity for the end user(s).

Design process

A design process is a framework that supports students to employ design thinking. In VCE Product Design and Technologies, the Double Diamond design approach is used to support students to apply design thinking when creating an intentionally designed product. The Double Diamond design approach is an extension of a process known to students in the Victorian Curriulum F–10 Design and Technologies curriculum. It recognises when students are creating their own design brief and intent, and it also acknowledges the necessity for a non-linear process that best facilitates creative and critical thinkers. Students investigate and define a need or oppportunity and generate and design ideas to address the identified need or opportunity. Each ‘diamond’ is overlaid with both divergent (creative) and convergent (critical) thinking activities. The Double Diamond design approach also supports speculative thinking where students synthesise information and consider the future. This encourages thorough exploration of real needs and opportunities prior to developing a design brief, and identification of the subsequent considerations and constraints.

The use of creative and critical thinking strategies that are both divergent and convergent, along with speculative thinking, enable students to deeply understand design needs and opportunities before planning and developing ideas to produce solutions that best address the design brief. Speculative thinking is an ideation process for provoking deeper debate about possible designed solutions, which will prove invaluable for students as they move towards future careers in areas of design.

The diagram below outlines the Double Diamond design approach, and the activities within the two ‘diamonds’ of this approach.



Double Diamond design adapted from [Design Council (UK)](https://aus01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.designcouncil.org.uk%2Four-work%2Fskills-learning%2Fthe-double-diamond%2F&data=05%7C01%7CJulie.Coleman%40education.vic.gov.au%7C4486fff7c9b2420396f208db3417b058%7Cd96cb3371a8744cfb69b3cec334a4c1f%7C0%7C0%7C638161048935648667%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=e7gXdIxXVqKi0b5EDRUQZQtMjhU7XkE%2FsNNDaww6c%2BQ%3D&reserved=0)

Each ‘diamond’ in this design process includes various activities that serve particular purposes, as depicted in the table below. The activities within each diamond are not sequential; students do not have to complete each activity in order; students should approach the order of each ‘diamond’ task as suited to their project needs. The process of designing should be adapted and customised to suit each project. Depending on the unit and its context, some activities in each ‘diamond’ may require greater emphasis or be taught in conjunction with others, and some activities may be skipped.

The Double Diamond design approach encourages thinking, planning and refinement when investigating and defining; generating and designing; planning and managing; producing and implementing and evaluating. This supports students to generate and refine three-dimensional prototypes, and test elements of the proposed production until a final proof of concept is achieved and before the actual production occurs.

|  |  |
| --- | --- |
| First diamond | Second diamond |
| **Activities** | **Activities**  |
| **Investigating and defining**End user needs and opportunitiesSynthesis of data | **Generating and designing**Graphical and physical product conceptsPrototyping, testing, trialling, experimenting, iterations |
| **Producing and implementing**Products |
| **Evaluating**Existing products | **Evaluating**Graphical and physical product conceptsProcesses to make physical product concepts and productFinished product |
| **Planning and managing**Organisation of research | **Planning and managing**Organisation of designingOrganisation of production through development of scheduled production plan: timeline that includes production steps, estimated times and quality measures; materials and costings list, tools and processes; and risk assessments and safety control measures |

Design thinking: critical, creative and speculative thinking

Design thinking is an approach used throughout a design process that enables divergent and convergent strategies to occur. This extends students’ understanding and application of Critical and Creative Thinking from Victorian Curriculum F−10.

In VCE Product Design and Technologies, critical thinking is where evaluation, reasoning and comparison occur. It is where ideas are processed and refined, and this aligns with convergent aspects of a design process.

In VCE Product Design and Technologies, creative thinking is where ideation occurs. It stimulates the broadening of ideas and concepts that are imaginative and unique, and this aligns with divergent thinking aspects of a design process.

In VCE Product Design and Technologies, speculative thinking is where students synthesise information and consider the appropriateness and usefulness of a range of ideas or suggestions, with a focus on the future. Students hypothesise, propose and recommend ideas and suggestions based on research requiring critical and creative thinking. Speculative thinking may focus on ethical consequences of designing and making, including environmental, social, and economic and worldview considerations.

Students are required to apply design thinking throughout this study, and this includes the act of working creatively, critically and speculatively to conduct thorough research, tests and trials, and to make informed decisions from evaluation.

Developing and conceptualising products

Students develop product concepts that are based on a real need or opportunity which is identified in the design brief. A product concept is a product idea that is not yet in production; product concepts are shaped by the design process and their intent is shaped by a design brief.

When students generate and design, they propose their ideas through the development of both graphical and physical product concepts. Graphical product concepts are represented through visualisations, design options and working drawings. Students use appropriate drawing systems for the graphical representations of their selected design specialisations. Drawing systems could include flats, fashion illustrations, multiview, layout, assembly, oblique, perspective, isometric and orthographic. (Refer to the [Support materials](https://www.vcaa.vic.edu.au/curriculum/vce/vce-study-designs/productdesign-and-technology/Pages/Index.aspx) for further advice about drawing systems.)

Prototyping helps to refine product concepts prior to implementation and production by experimenting and testing in a ‘physical’ capacity, whether undertaken actually or virtually. Product concepts are graphical in nature prior to prototyping. Prototypes demonstrate the physicality of the product concepts. A prototype can be used to ratify parts of a product concept in low fidelity or alternative materials prior to using more expensive resources. Prototypes can also be computer-generated using computer-aided design (CAD) or other virtual modelling tools. A calico toile or a 3D model of a hinge are examples of prototypes.

The chosen product concept becomes a final proof of concept, such as a working model(s) and/or scaled sample(s), and this signals the readiness of the design to move into implementation and production. The flowchart below depicts the process of developing a final proof of concept in VCE Product Design and Technologies.

Design specialisations

In VCE Product Design and Technologies, students design and make three-dimensional products using a range of materials, tools and processes. The available resources will vary between school settings; however, where possible they should emulate current design industry practices.

A breadth of experiences should be offered across a variety of materials, tools and processes, allowing students to encounter the diverse nature of design. Isolated experiences with singular materials are not encouraged and should be minimised. Through their practical work, students should become skilled in the inter- and trans-disciplinary nature of design, and come to understand that design specialisations require broad skills, and may combine traditional materials, tools and processes with new and emerging materials, tools and processes. For example, wearable accessories could employ fabric and plastic and be manufactured using traditional textile production processes as well as 3D-printed plastic clips and resin cast components. In this example, students are working across multiple materials and learning a broad range of processes to demonstrate technacy, and also learning how multiple technologies can be successfully integrated.

The table below depicts possible design specialisations that students may explore along with examples of materials, tools and processes.

| Design specialisations and examples | Examples of materials, tools and processes |
| --- | --- |
| **Engineering*** Steel fabrication for indoor, outdoor and recreational use
* Metal products
* Assistive products

**Furniture*** Indoor and outdoor, home and workplace furniture
* Storage solutions and combination furniture

**Health, medicine and agriculture*** Personal/medical aids
* Assistive devices
* Products to improve agricultural production and labour

**Industrial design** * Biophilic design
* Casings for consumer electronic products, home entertainment, personal grooming products, appliances
* Wearable technology

**Furnishings*** Physical homewares for bedroom, bathroom, laundry and kitchenware
* Lighting (low voltage)

**Jewellery*** Goldsmithing and silversmithing
* Resin
* Lapidary
* Enamelling
* Wax and slip casting (using traditional lost methods and/or 3D-printed methods)
* Jewellery for functional multi-purposes including aesthetic adornment

**Music products, accessories and instruments*** Musical instruments
* Stands, cases, brackets and fixtures/fittings

**Sports, travel and recreation** * Sporting equipment
* Toys and games

**Textiles − apparel and non-apparel*** Garments
* Wearable accessories
* Soft furnishings
* Sports accessories
* Toys and recreation
 | Students should have a breadth of experiences across a broad range of:* materials
* tools
* processes.

They should be encouraged to experiment in making or reusing materials and integrating traditional techniques with available technologies and experimental processes to innovate and test while developing their products. **Materials** * Timber: hardwoods, softwoods, repurposed and reclaimed, manufactured or composite boards that comply with safety requirements and sustainably sourced materials
* Fabrics: commercially bought and reused, repurposed, synthetics and natural; knitted, woven, non-woven; fibres like roving or yarns, felt, leather
* Plastics: extruded, bioplastic, thermosetting, polymer, resin or those sourced through repurpose or disassembly
* Bio-materials: vegetable skins or plant products, alternative materials such as symbiotic culture of bacteria and yeast (SCOBY) leather or mycelium
* Metals: Ferrous metals, non-ferrous metals, alloys, coated metals, or metals sourced sustainably through repurpose or disassembly
* Dyes and finishes: natural and plant-based, acrylic/oil-based paints, coatings and clear finishes

**Tools*** Machinery and equipment such as 3D printer, laser cutter, vinyl cutter, sewing machine, scroll-saw, battery and pedestal drill, joints/joining techniques tools to cut and shape such as a chisel, rasp, file, and tools to finish such as overlocker or sander, computer numerical control (CNC), computer-aided manufacture (CAM) and digital or traditional fabric printing

The above list illustrates the broad range of tools available but is not an exhaustive list. Teachers should refer to the [Support materials](https://www.vcaa.vic.edu.au/curriculum/vce/vce-study-designs/productdesign-and-technology/Pages/Index.aspx) for further advice.**Processes: prototyping methods and production processes*** Testing making samples, e.g. joinery and seams
* Prototyping using cardboard, foam, scrap box materials, e.g. toiles and partial models
* Developing a final proof of concept that looks like a working model(s) or scaled sample(s)
* Modelling using computer-aided design (CAD)
* Automated manufacturing, e.g. computer numerical control (CNC) milling and similar production techniques
* Production processes, e.g. low volume such as hand-sewing and high volume such as rapid 3D prototyping and laser technology
 |

In Units 1 and 2, the focus is on building upon students’ existing knowledge of drawing systems. They produce prototypes in low-fidelity materials and/or virtually. This allows time for students to test and experiment with manufacturing processes in available material(s) before making products.

In Units 3 and 4, students elect to work in a design specialisation and use a range of appropriate and available materials, tools and processes. They should use materials that allow for finished products to be of a refined and finished quality.

Working technologically and technacy

When students are working technologically, they demonstrate technacy; that is, they demonstrate the holistic understanding of technologies in relation to the creation, design and implementation of projects. Technacy encompasses technological problem-solving, experimentation and communication.

Working technologically refers to the synthesising and designing of ideas. When using a design process, students synthesise, integrating the parts in order to understand the whole and create newly designed products. They seek to account for context variables and focus on the ethical effects of designing products. Students test and/or simulate to evaluate whether a designed solution will work according to purpose and criteria. They are directly accountable for the design aspect of their work, which progresses from developing product concepts, selecting the chosen product concept, developing a final proof of concept, to the making of their designed solutions.

Practical work, using materials, tools and processes effectively and safely is a component of working technologically. The integration of practical work is integral to VCE Product Design and Technologies. Practical programs are contingent on school settings, resources and capabilities. They take into consideration student interests and preferences and can be undertaken as collaborative or individual activities.

Factors that influence product design

The following factors that influence product design are referred to throughout Units 1 to 4. They are used as a framework to propose product concepts, evaluate existing products, and as a springboard to developing evaluation criteria. These factors are broad in nature to cater for the variety of products that students may explore, design and make.

| Factors that influence product design  | Scope of factor as it relates to product design |
| --- | --- |
| Need or opportunity | Identification of the purpose for, or of, a product. Considerations include the context and purpose for designing and how a product will be used.Needs and opportunities are identified from research and development, feedback from end user(s), new ideas and knowledge, and new and emerging technologies (including materials).In VCE Product Design and Technologies, the needs or opportunties that are explored must be real. |
| Function | The purpose of a product that makes it fit-for-use for its intent. |
| End users | The human and/or non-human ‘consumers’ of the product for whom or what the product is intended.Considerations of the end users incorporates welfare that includes quality of life; quality of life encompasses culture and religion, emotional and sensory appeal, universal design, demographics, social and physical needs and trends, safety, accessibility, comfort, ergonomics and anthropometric data.  |
| Aesthetics  | Relates to the product’s form, appearance and feel.  Considerations include design elements and design principles. Design elements include point, line, shape, texture, colour (tone, transparency, translucency and opacity).Design principles of balance, contrast, repetition, movement/rhythm, pattern, proportion, asymmetry/symmetry, negative/positive space and surface qualities are used to combine and arrange the design elements.Aesthetics may relate to ethical considerations in design; aesthetics can influence quality of life. |
| Market needs and opportunities  | Designing innovatively and working entrepreneurially require a creative approach to develop new or improved designed solutions to unsolved problems or new needs or opportunities.  |
| Product lifecycle  | The resource inputs that span a product’s manufacture; this includes sourcing of materials, useful life and the impact of disposal/reuse.  |
| Technologies: materials, tools and processes | Technologies include those materials, tools and processes that are traditional as well as ones that are new and emerging. Students should know and experience a variety of materials, tools and processes through making and designing products, as well as through researching designs and the work of designers. Materials are selected for use based on their appropriate properties (their performance and behaviour, both chemically and physically under certain conditions) and desirable characteristics (such as visible features). Examples of materials, tools and processes appropriate to this study are listed on pages 15–17.  |
| Ethical considerations in design | Ethics in design is concerned with enabling both individual values (such as more time with family and friends) and public values (such as a fair and just society). This can be realised through products that reflect and enable an end user’s values, or by working towards social goals such as belonging, access, usability and equity for the disadvantaged. Inclusive design processes can enact respect and concern for humans and non-humans. Ethical considerations encompass sustainability. Sustainability and other ethical considerations are concerned with human and non-human welfare and aim at positive impacts and minimisation of harm in regard to what is made and how it is made, for both present and future generations.Ethics can also involve legal responsibilities. The legal aspects of product design include intellectual property (IP), which refers to creations of the mind through intellectual or creative activities. Intellectual property includes copyright, patents, trademarks and registered designs.Australian and International (ISO) standards, regulations and legislation (including OHS) are other legal responsibilities. Products must be produced safely and be safe for the end users |

Sustainability

Sustainability involves actions to manage environmental, social and economic resources in such a way as to benefit present generations while not disadvantaging future generations, and generally maintaining or improving the health of these resources. Throughout this study sustainability is presented as a complex, holistic concept comprising three dimensions: environmental, economic and social.

* The environmental dimension is about ensuring that the resources of the planet are available for future generations and includes the selection of resources used for manufacturing and production as well as resources required for use after production. It relates to addressing the needs of a product’s lifecycle without depleting resources and/or having a lasting impact on the environment.
* The economic dimension is about using resources efficiently so that economic growth continues over time. It includes the contribution of product design industries to the Australian and global economies, the creation of employment opportunities, and the costs of a product across each stage of its lifecycle. Considerations include the comparison of costs of different materials and production settings (low volume and high volume [mass-produced]) and the value that resources have today as well as their possible value in the future.
* The social dimension is about ensuring that current and future generations have access to social resources such as human rights, education, political empowerment and connection to community. Social sustainability extends to stewardship that is considerate of the broad community and future generations.

Health, safety and ethical research considerations

Risk and safety assessment, and the principles of occupational health and safety, are integral to practices and systems in VCE Product Design and Technologies. They must underpin all practical work and theoretical responses.

As part of this study, teachers and students may need to conduct research that involves human subjects. Teachers and schools have a legal and moral responsibility to ensure that students follow ethical principles at all times when undertaking such research. For advice, teachers should refer to the Australian Code for the Responsible Conduct of Research (2007, updated 2018), issued by the [National Health and Medical Research Council (NHMRC)](https://www.nhmrc.gov.au/), Australian Research Council and Universities Australia.

Unit 1: Design practices

This unit focuses on the work of designers across relevant specialisations in product design. Students explore how designers collaborate and work in teams; they consider the processes that designers use to conduct research and the techniques they employ to generate ideas and design products. In doing this, they practise using their critical, creative and speculative thinking strategies. When creating their own designs, students use appropriate drawing systems – both manual and digital – to develop graphical product concepts. They also experiment with materials, tools and processes to prototype and propose physical product concepts.

In this unit, students analyse and evaluate existing products and current technological innovations in product design. They achieve this through understanding the importance of a design brief, learning about factors that influence design, and using the Double Diamond design approach as a framework.

In their practical work, students explore and test materials, tools and processes available to them in order to work technologically, and they practise safe skill development when creating an innovative product. This is achieved through the development of graphical product concepts and the use of prototypes to explore and propose physical product concepts.

Area of Study 1

Developing and conceptualising designs

In this area of study, students focus on the Double Diamond design approach. They investigate and define needs and/or opportunities. They generate and design when proposing graphical product concepts using visualisations, design options and working drawings. This gives them the opportunity to demonstrate design thinking that incorporates critical, creative and speculative thinking.

Specifically, they learn to use appropriate drawing systems for their design specialisations and refine their product concepts to convey their ideas graphically, using manual and digital technologies.

Students work in various design specialisations and have opportunities to work individually, in teams, and collaboratively in their classroom environment. Teamwork encourages communication between students and mirrors professional design practice where designers, when developing designed solutions, have identified roles within transdisciplinary and interdisciplinary teams. Teamwork combines individual efforts of all team members to achieve a goal. Additionally, collaboration occurs when students are working together on classroom activities and completing work collectively. Examples of collaboration include group discussions, brainstorming ideas, analysing problems and reaching consensus about processes. Digital technologies can facilitate teamwork and collaboration when students are developing designed solutions.

Outcome 1

On completion of this unit the student should be able to apply design thinking strategies to research, critique and communicate a response to a need or opportunity, and work collaboratively and in teams to develop and propose graphical product concepts that address a design brief.

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

Key knowledge

* activities and their purposes within the Double Diamond design approach to investigate and define, generate and design graphical product concepts, evaluate and plan and manage
* relationships between the Double Diamond design approach and design thinking strategies
* approaches, roles and responsibilities of working collaboratively and as a team
* methods to support collaboration and teamwork, including use of digital technologies
* elements of a design brief: need or opportunity, profile of end user(s), function, project scope (constraints and considerations )
* importance of design thinking when responding to a design brief
* factors that influence product design
* purpose of, and methods to develop, evaluation criteria
* qualitative and quantitative research methods using primary and secondary sources
* methods to conduct ethical research and to appropriately acknowledge sources and intellectual property of others
* types of drawings to represent graphical product concepts: visualisations, design options and working drawings.

Key skills

* explain activities and their purposes within the Double Diamond design approach
* describe and apply design thinking strategies to refine graphical product concepts
* construct, justify and use research methods to gather data to investigate and define needs and/or opportunities
* explain and demonstrate approaches, roles and responsibilities to support working collaboratively and as part of teams, including the use of digital technologies
* formulate a design brief that addresses a real need or opportunity, with reference to factors that influence product design
* develop and use criteria to:
	+ inform and evaluate graphical and physical product concepts
	+ evaluate processes to design and make the product
	+ evaluate the finished product
* use manual and digital technologies to represent graphical product concepts.

Area of Study 2

Generating, designing and producing

In this area of study, students focus on the second diamond in the Double Diamond design approach to develop, trial and test physical product concepts, and make a designed product. Based on the graphical product concepts proposed in Outcome 1, students create prototypes to experiment with the physicality of their product concepts. Trials and tests are conducted to inform, evaluate and critique physical product concepts and to justify the selection of the chosen product concept and its production processes. Students develop a final proof of concept and implement a scheduled production plan to make the product efficiently and effectively. They explore available materials, tools and processes, and develop skills in using them to develop technacy through generating, designing, producing and implementing. Students use various materials, tools and processes to demonstrate how products can be a synthesis of various design specialisations and technologies. They have further opportunities to work individually, collaboratively and in teams to share work, knowledge and skills. Students evaluate their designed product and their contributions to collaborations and teamwork to complete the project.

Outcome 2

On completion of this unit the student should be able to work collaboratively and in teams to trial and test, evaluate and use materials, tools and processes to determine their chosen product concept and produce a product through implementing a scheduled production plan, as well as reflect on and make suggestions for future improvements when working collaboratively and as a team.

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

Key knowledge

* activities and their purposes within the second diamond of the Double Diamond design approach to generate and design physical product concepts, produce and implement, evaluate and plan and manage
* relationships between the second diamond of the Double Diamond design approach and design thinking strategies to refine physical product concepts and product
* materials, tools and processes used in specific design specialisations and the purpose of experimenting and practising with these technologies
* risk management for safe, accurate and efficient use of materials, tools and processes
* strategies to experiment with the physicality of product concepts through prototyping, including use of digital technologies
* methods to test and communicate physical product concepts, such as data from tests and trials, videos and photos
* relationships between product concepts and final proof of concept, and methods to develop a final proof of concept from a product concept
* methods to evaluate the finished product against the criteria described in the design brief
* traditional and/or new and emerging materials, tools and processes to produce a product
* methods to plan to produce a product, including developing a scheduled production plan
* strategies to reflect on collaborative and teamwork activities when designing.

Key skills

* explain activities and their purposes within the second diamond of the Double Diamond design approach
* conduct and evaluate tests and trials using design thinking techniques to propose, critique and justify the chosen product concept
* explain and use a range of materials, tools and processes to experiment with physical product concepts
* experiment with, and document the use of, a range of materials, tools and processes to produce a finished product
* collect and use data to inform and record refinements to develop a final proof of concept and apply a design process
* use criteria to evaluate the production process and determine how well a product addresses the design brief
* reflect on collaboration and teamwork and make suggestions for future improvements when working collaboratively and as a team
* work technologically, collaboratively and as part of a team to manage the activities within the second diamond of the Double Diamond design approach to implement a scheduled production plan to make a finished product safely
* manage risks to use materials, tools and processes safely.

Assessment

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 that provide a range of opportunities for students to demonstrate the key knowledge and key skills in the outcomes.

The areas of study, including the 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 must be a part of the regular teaching and learning program and should be completed mainly in class and within a limited timeframe.

All assessments at Units 1 and 2 are school-based. Procedures for assessment of levels of achievement in Units 1 and 2 are a matter for school decision.

For this unit students are required to demonstrate two outcomes. As a set, these outcomes encompass the areas of study in the unit.

Suitable tasks for assessment in this unit are:

* a multimodal record of evidence of research, development and conceptualisation of products as well as a reflection on collaboration, teamwork and ways to improve in the future
* practical work: a demonstration of graphical and physical product concepts including prototyping and making final proof of concept along with a finished product.

Where teachers allow students to choose between tasks, they must ensure that the tasks they set are of comparable scope and demand.

Unit 2: Positive impacts for end users

Designers should look outward, both locally and globally, to research the diverse needs of end users. They should explore how inclusive product design solutions can support belonging, access, usability and equity. In this unit, students specifically examine social and/or physical influences on design. They formulate a profile of an end user(s), research and explore the specific needs or opportunities of the end user(s) and make an inclusive product that has a positive impact on belonging, access, usability and/or equity.

Students also explore cultural influences on design. They develop an awareness of how Aboriginal and Torres Strait Islander peoples design and produce products, how sustainable design practices care for Country, and how traditions and culture are acknowledged in contemporary designs. Students also have opportunities to make connections to personal or other cultural heritages.

Area of Study 1

Opportunities for positive impacts for end users

In this area of study, student engage with a variety of human and/or non-human end user scenarios and research current products that cater for the specific needs of end users. They explore opportunities to work collaboratively with end users to create positive impacts and minimise harm by supporting increased belonging, access, usability and/or equity through inclusive product design.

In this unit, students research designs across a range of design specialisations, and critique products to make judgments about their success (or failure) using the factors that influence product design. Products selected for research should address inclusion through belonging, access, usability and/or equity considerations. Students also analyse and evaluate future market opportunities or needs for products.

Outcome 1

On completion of this outcome the student should be able to investigate and critique products using the factors that influence design, to make judgments about the success or failure of the products to support positive impacts for end users.

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

Key knowledge

* role and work of designers from a range of industries and specialisations whose products address needs and/or opportunities that support positive impacts for end users
* market needs and opportunities for products that support positive impacts for end users
* methods used by designers whose products address needs and/or opportunities that support positive impacts for end users
* use of the Double Diamond design approach to apply design thinking to critique products that have positive impacts for end users
* methods to communicate research using a variety of multimodal forms, such as written reports, audio files, video files, mood boards, diagrams, charts and/or drawings
* factors that influence designing for positive impacts for end users
* criteria used to evaluate processes to develop inclusive products that support positive impacts for end users as well as evaluate the inclusive products.

Key skills

* investigate practices of designers and critique their products research and discuss market needs and/or opportunities for products that support positive impacts for end users
* use manual and digital techniques to collect, collate, interpret and communicate findings of research
* use factors that influence product design to develop evaluation criteria to make judgments about a product’s ability to support positive impacts for end users
* work technologically to manage the Double Diamond design approach to consider positive impacts of products for end users.

Area of Study 2

Designing for positive impacts for end users

In this area of study, students respond to a need or opportunity to develop a profile of an end user(s), and they design and make an inclusive product that improves belonging, access, usability and/or equity for the end user(s). Students explore needs and/or opportunities of end users, which may involve adjustments and/or variations for specific needs or opportunities, to create positive impacts and minimise harm by supporting inclusion through increased belonging, access, usability and/or equity.

Specifically, students use design thinking strategies − creative, critical and speculative − to examine ways to make a positive impact and minimise harm when generating and designing graphical and physical product concepts, including prototypes, and a final proof of concept that addresses the need or opportunity of the end user.

Outcome 2

On completion of this unit the student should be able to design and make an inclusive product that responds to a need or opportunity of an end user(s) that addresses positive impacts in relation to belonging, access, usability and/or equity.

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

Key knowledge

* quantitative and qualitative methods to gather primary and secondary research, such as focus groups, interviews and product reviews to formulate a profile of an end user(s) and describe their needs or opportunities related to positive impacts
* ethical research methods when gathering, representing and using data
* design thinking strategies to examine positive impacts for end users
* methods to plan, record and implement the Double Diamond design approach using a scheduled production plan
* materials, tools and processes used in a variety of design specialisations to make inclusive product designs
* methods to generate and record graphical and physical product concepts, including prototyping, and to develop a final proof of concept for an inclusive product to support positive impacts
* methods to develop criteria to evaluate product concepts, final product of concept and finished product.

Key skills

* conduct and use research, including data from tests and trials, as well as design thinking strategies to:
	+ formulate a profile of an end user(s) and describe their need or opportunity
	+ generate, refine, evaluate and critique product concepts
	+ justify a chosen product concept and develop a final proof of concept
* use criteria to evaluate processes used to develop product concepts and final proof of concept and make a finished product
* plan and record implementation of design process: development of product concepts, final proof of concept and making of product
* use materials, tools and processes to safely make a product that supports positive impacts for end users in relation to belonging, access, usability and /or equity
* work technologically to implement, manage and document the Double Diamond design approach: development of product concepts and final proof of concept and making of product.

Area of Study 3

Cultural influences on design

In this area of study, students look at how culture influences products, and how a designer should engage with culture as they develop a profile of an end user(s) when designing products to address their needs and/or opportunities. Specifically, students look through a cultural lens to extend their thinking about the needs and opportunities of end users, going beyond physical requirements.

Students investigate a diverse range of end users, designers and other people, and explore varied perspectives to develop insights into how culture influences and affects product design. Students specifically focus on Aboriginal and Torres Strait Islander peoples and explore how they demonstrate their culture through design in both traditional and contemporary ways. Students are also encouraged to make connections to their own cultural heritage through the understanding of other cultures. Students research locally and globally to develop a worldview of cultural influences in order to gain an understanding about themselves as both designer and consumer within a diverse global community.

Outcome 3

On completion of this unit the student should be able to research and discuss how designers and end users are influenced by culture.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of Study 3.

Key knowledge

* cultural influences on product design including those of Aboriginal and Torres Strait Islander peoples
* factors that influence cultural needs and opportunities of end users
* quantitative and qualitative research methods to collect and record information about culture of designers and end users, including ethical considerations.

Key skills

* examine a variety of products through a cultural lens
* use ethical research methods to extrapolate information from a variety of sources to connect and make meaning between a designer’s culture and the products that they design
* investigate cultural factors in relation to end user needs and/or opportunities
* discuss examples of cultural influences in the design of products from the perspectives of both designers and end users.

Assessment

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 that provide a range of opportunities for students to demonstrate the key knowledge and key skills in the outcomes.

The areas of study, including the 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 must be a part of the regular teaching and learning program and should be completed mainly in class and within a limited timeframe.

All assessments at Units 1 and 2 are school-based. Procedures for assessment of levels of achievement in Units 1 and 2 are a matter for school decision.

For this unit students are required to demonstrate three outcomes. As a set these outcomes encompass the areas of study in the unit.

Suitable tasks for assessment in this unit are:

* multimodal record of evidence of research, development and conceptualisation of products addressing a need or opportunity related to positive impacts for the end user(s)
* practical work: demonstration of graphical and physical product concepts including prototyping and making final proof of concept along with the finished product addressing a need or opportunity related to positive impacts for the end user(s)
* case study analysis or research inquiry of a designer and end user(s) that explores the influence of culture in product design.

Where teachers allow students to choose between tasks, they must ensure that the tasks they set are of comparable scope and demand.

Unit 3: Ethical product design and development

In this unit students research a real personal, local or global need or opportunity with explicit links to ethical considerations. They conduct research to generate product concepts and a final proof of concept for a product solution that addresses the need(s) or opportunities of the end user(s).

Product designers respond to current and future social, economic, environmental or other ethical considerations. This unit focuses on the analysis of available materials in relation to sustainable practices, tensions between manufacturing and production, modern industrial and commercial practices, and the lifecycles of products from sustainability or worldview perspectives.

Students plan to develop an ethical product through a problem-based design approach, starting with a need or opportunity and using a design process and testing to problem-solve. The design brief, product concepts and the final proof of concept are developed through the Double Diamond design approach, using design thinking. Students undertake the role of a designer to generate, analyse and critique product concepts, with the chosen product concept becoming the final proof of concept. Throughout a design process, the product concepts and the final proof of concept are evaluated using relevant factors that influence product design, and shaped using design thinking. Students learn about ethical research methods when investigating and defining their design need and/or opportunity and generating and designing their product concepts.

In Area of Study 1, students examine a range of factors that influence the design, development and production of products within industrial settings. Students research and investigate designs across a range of specialisations that include historical iconic designs that have stood the test of time; designs with inbuilt obsolescence; products that are fast to the market; products that are designed to last its lifetime; products that have a second life through disassembly and reuse and/or designs in and with nature. They consider influences on product design when addressing ethical considerations for end users.

In Area of Study 2, students use design thinking to formulate a design brief that addresses a need or opportunity related to ethical product design, and conduct research to explore current market needs and/or opportunities. Students generate, evaluate and critique graphical product concepts (visualisations, design options and working drawings) related to ethical product design.

In Area of Study 3, students explore the physicality of product concepts through developing prototypes to select and justify the chosen product concept and a final proof of concept. Students develop a scheduled production plan to manage the resources in a design process and implement this scheduled production plan to make their product safely.

Area of Study 1

Influences on design, development and production of products

Students explore examples of product design and innovation and evaluate their impact on sustainability and other ethical considerations. They also examine how companies react to market needs and/or opportunities and technological advancements. In particular, they focus on how new and emerging technologies and innovation influence the design, development and production of products.

Students investigate the use of computer modelling, computer-aided design (CAD) and computer-aided manufacture (CAM), and new and emerging technologies including tools and/or materials used in industry. In the context of industrial manufacturing, they develop an understanding of a range of issues relating to innovation, research and development, and how designing ethically positively impacts and creates market needs and/or opportunities.

Outcome 1

On completion of this unit the student should be able to critique examples of ethical product design and innovation within industrial settings.

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

Key knowledge

* methods of manufacturing in low-volume and high-volume production settings
* technologies used in different scales of manufacturing: one-off, low-volume, high-volume, continuous production
* relationship between lean manufacturing and flexible and responsive manufacturing
* sustainability frameworks and strategies
	+ 6Rs: Rethink, Refuse, Reduce, Reuse, Recycle, Repair
	+ circular economy
	+ cradle-to-cradle approach
	+ Design for Disassembly (DfD)
	+ Extended Producer Responsibility (EPR)
	+ lifecycle analysis/assessment (LCA)
	+ triple bottom line
* benefits and issues for the producer and consumer, and associated environmental, economic and worldview issues with planned obsolescence (style, technical and functional)
* technologies and their impacts on processes used in production: artificial intelligence (AI), automation, computer-aided design (CAD), computer-aided manufacture (CAM), computer numerical control (CNC), laser technology; rapid 3D prototyping, and robotics
* experimental materials and processes and their sustainability and worldview impacts: bio-products including mycelium; innovative polymers used for 3D printing; composite metals; repurposed plastics
* alternative materials and their sustainability and worldview impacts: vegan leather instead of animal hide, and bamboo instead of hardwoods.

Key skills

* describe methods of manufacturing processes in different production settings
* compare technologies used in different scales of manufacturing regarding their viability in different contexts and influence on productivity
* discuss sustainability frameworks that influence design, manufacturing and marketing in industry and critique examples of product design in relation to these frameworks
* analyse the impact of planned obsolescence on sustainability and other ethical considerations
* compare and critique impacts of the use of technologies in production processes and experimental and alternative materials for both consumers and producers.

Area of Study 2

Investigating opportunities for ethical design and production

In this area of study, students apply design thinking to investigate, research, test and experiment when formulating a design brief and defining a need or opportunity that relates to the ethical design of a product. They conduct research to analyse current market needs and/or opportunities. Students examine how a design brief describes an identified need or opportunity, and how the project scope and its constraints and considerations shape product concepts.

Students work in the first diamond of the Double Diamond design approach to identify a purpose for their product by conducting research, evaluating existing products, and investigating and defining the needs or opportunities of an end user(s). In doing so, they acknowledge and navigate IP and other legal responsibilities. Students collect and present data, demonstrating ethical research practices, including privacy. Students work in the second diamond of the Double Diamond design approach to propose graphical product concepts to address the design brief. They draw visualisations and gather feedback to refine design options and working drawings to generate and design graphical product concepts. They record the process in their multimodal record of evidence.

Outcome 2

On completion of this unit the student should be able to investigate a need or opportunity that relates to ethics and formulate a design brief, conduct research to analyse current market needs or opportunities and propose, evaluate and critique graphical product concepts.

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

Key knowledge

* activities and their purposes within the Double Diamond design approach to investigate and define, generate and design graphical product concepts, evaluate and plan and manage and the relationships between critical, creative and speculative thinking
* design thinking to generate, refine and critique graphical product concepts
* methods used by designers to formulate a design brief, including investigating and conducting research, and recording, collating and forming information about an identified need or opportunity of an end user(s)
* elements of a design brief: need or opportunity, profile of end user(s), function, project scope (constraints and considerations)
* relationships between the need or opportunity, designer and end user(s)
* purpose of, and methods to develop, evaluation criteria
* relationships between the design brief, evaluation criteria, research and product design development
* processes to develop and communicate graphical product concepts
* characteristics of drawing systems for visualisations, design options and working drawings: level of detail and types of annotations relevant to the design specialisation
* factors that influence ethical design of a product
* ethical considerations when gathering qualitative and quantitative research, and methods to investigate current market needs or opportunities that include using digital technologies
* methods to conduct ethical research and to appropriately acknowledge sources and intellectual property of others
* methods to examine and test ethical products.

Key skills

* explain activities and their purposes within the first diamond of the Double Diamond design approach
* formulate a design brief that relates to an ethical consideration
* explain the scope of a design project, including considerations and constraints, and identify aspects that require research and testing
* use factors that influence product design to examine, analyse and critique existing ethical products
* propose and explain methods of ethical research to explore current market needs or opportunities for ethical products
* use ethical research methods to gather, present and interpret research
* explain relationships between design brief, evaluation criteria, research and product design development activities
* develop and use criteria to:
	+ inform and evaluate product concepts
	+ evaluate processes to design and make the product
	+ evaluate the finished product
* demonstrate a range of appropriate drawing systems, using manual and digital technologies
* work technologically to use research and design thinking techniques to generate, evaluate and critique graphical product concepts related to ethical design.

Area of Study 3

Developing a final proof of concept for ethical production

In this area of study, students engage with the second diamond of the Double Diamond design approach to generate and design physical product concepts based on the graphical product concepts developed in Outcome 2 . Students also apply design thinking to test materials, tools and processes to develop and refine physical product concepts through prototyping that will inform the chosen product concept. The chosen product concept becomes the final proof of concept, which in turn, becomes the product that the students make. Students develop a scheduled production plan for making their product and evaluating it; then they make judgments and recommendations about ethical considerations regarding use of materials, tools and processes, and they consider resources such as time and costs.

Outcome 3

On completion of this unit the student should be able to evaluate product concepts related to ethical design, synthesise and apply feedback to justify a final proof of concept, and plan to make the product safely.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of Study 3.

Key knowledge

* activities and their purposes within the second diamond of the Double Diamond design approach to generate and design physical product concepts, produce and implement, evaluate and plan and manage the relationships between critical, creative and speculative thinking
* design thinking to generate, refine and critique the physicality of product concepts
* ethical research methods to gather quantitative and qualitative data including end user feedback
* social, environmental,economic and worldview considerations related to selecting materials, tools and processes
* role and components of scheduled production plans: timeline that includes production steps, estimated times and quality measures; materials and costings list, tools and processes; and risk assessments and safety control measures
* methods used to record progress in scheduled production plans and reasons for modifications to the design, planning and timing
* methods to research characteristics and properties of materials, including experimentation techniques and trial processes
* purpose of prototypes and a final proof of concept
* risk assessment associated with selecting and using materials, including chemicals and other substances, tools and processes.

Key skills

* explain the activities and their purposes within the second diamond of the Double Diamond design approach
* work technologically to research, test and use experimentation techniques and/or trial processes to design and evaluate physical product concepts and develop prototypes to select and justify chosen product concept, and develop final proof of concept
* use design thinking techniques to evaluate selection of materials, tools and processes in relation to ethical considerations, and discuss impacts on individuals, society, the economy and the environment
* justify selection involving different degrees of difficulty associated with the manufacture of a product in terms of materials, tools and processes used to make the product safely
* synthesise research and feedback from end user(s) in order to justify a final proof of concept
* develop a scheduled production plan, including assessing risks in production and recording implementation of safety control measures.

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-assessment 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 [Support materials](https://www.vcaa.vic.edu.au/curriculum/vce/vce-study-designs/productdesign-and-technology/Pages/Index.aspx) for this study, which include 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 in 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 |
| **Outcome 1**Critique examples of ethical product design and innovation within industrial settings. | **50** | Any one or a combination of:* case study analysis
* oral presentation using multimedia: face-to-face or recorded as a video or podcast
* research inquiry.
 |
| **Total marks** | **50** |  |

School-assessed Task

Assessment of VCE Product Design and Technologies includes a School-assessed Task. For this assessment teachers will provide to the VCAA a score representing an assessment of the student’s level of performance in achieving Outcomes 2 and 3 in Unit 3 and Outcome 1 in Unit 4 according to criteria published by the VCAA. Details of the School-assessed Task for Units 3 and 4 are provided on [page 37](#SAT) of this study design.

Contribution to final assessment

The School-assessed Task contributes 50 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 (see [page 38](#Exam)), which will contribute 30 per cent to the study score.

Unit 4: Production and evaluation of ethical designs

In this unit students continue to work as designers throughout the production process. They observe safe work practices in their chosen design specialisations by refining their production skills using a range of materials, tools and processes.

Students collect, analyse, interpret and present data, use ethical research methods and engage with end user(s) to gain feedback and apply their research and findings to the production of their designed solution. Students also focus on how speculative design thinking can encourage research, product development and entrepreneurial activity through the investigation and analysis of examples of current, emerging and future technologies and market trends.

In Area of Study 1, students continue to make the product designed in Unit 3, using materials, tools and processes safely and responsibly. Throughout the production process, they monitor and record their progress during implementation of their scheduled production plan and justify decisions and modifications, if and when necessary.

In Area of Study 2, students evaluate their product and a range of existing products using criteria, data and feedback. They speculate on how designers can be future-focused, innovative and entrepreneurial by suggesting and justifying possible product enhancements and/or improvements based on this evaluation.

Area of Study 1

Managing production for ethical designs

In this area of study, students focus on working technologically to implement the scheduled production plan and make a product that relates to ethics in order to address the needs or opportunities of an end user(s) as described in Unit 3. Students continue to use materials, tools and processes safely and manage the risks involved. They record and monitor their implementation of the scheduled production plan and document decisions and modifications made throughout this process.

Outcome 1

On completion of this unit the student should be able to implement a scheduled production plan, using a range of materials, tools and processes and managing time and other resources effectively and efficiently to safely make the product designed in Unit 3.

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

Key knowledge

* risk management associated with selecting and using materials, including chemicals and other substances, tools and processes
* techniques for goal-setting when implementing a scheduled production plan, and methods used to record and report progress that include monitoring efficiency and effectiveness of production activities, and management of time and other resources and the overall project
* methods for documenting decisions and modifications made when following the scheduled production plan.

Key skills

* apply risk management throughout production
* use materials, tools and processes safely, demonstrating different degrees of difficulty
* devise and use methods to manage time and other resources effectively and efficiently to make a quality product
* record and report progress, and justify decisions and modifications when implementing a scheduled production plan.

Area of Study 2

Evaluation and speculative design

In this area of study, students have the opportunity to gather feedback from end users and use criteria to evaluate their product and a range of other existing products. Students follow ethical research practices and use digital technologies that facilitate efficiencies in the collection of data. Students interpret and use these results and other feedback to suggest and justify possible product enhancements and/or improvements.

In addition, students explore speculative design thinking and examine how designers can be future-focused, innovative and entrepreneurial in the adaptation and renewal of products, by using research and development to integrate new and emerging technologies and address market trends.

Outcome 2

On completion of this unit the student should be able to synthesise data to evaluate a range of products, including making judgments about the success of each product, and discuss product designs in regard to entrepreneurial activity, innovation and sustainability and/or other ethical considerations.

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

Key knowledge

* the role of research and development (R&D) and its importance to entrepreneurial activity and innovation
* speculative design thinking and innovation and their importance to entrepreneurial activity and the success or failure of products
* product developments that integrate new and emerging technologies
* environmental, economic, social and worldview issues associated with new and emerging technologies
* relationships between market research and the product development process
* qualitative and quantitative methods of evaluating a range of products, including their own product, that are evidence-based, including criteria and end user feedback
* methods to interpret and present data
* key factors that determine the success of a product.

Key skills

* discuss the importance of research and development
* describe the product development process in industry through the analysis of products that integrate new and emerging technologies
* use speculative design thinking to discuss and analyse strategies that encourage innovation and entrepreneurial activities
* discuss sustainability and other ethical considerations for products that use new and emerging technologies
* construct qualitative and quantitative research to collect data on a range of products, applying ethical considerations and using digital technologies where appropriate
* collate, interpret and synthesise data to evaluate the success of a range of products
* use data to justify enhancements and/or improvements to a range of products.

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 [Support materials](https://www.vcaa.vic.edu.au/curriculum/vce/vce-study-designs/productdesign-and-technology/Pages/Index.aspx) for this study, which include 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 in 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.

|  |  |  |
| --- | --- | --- |
| **Outcome** | **Marks allocated** | **Assessment tasks** |
| **Outcome 2**Synthesise data to evaluate a range of products, including making judgments about the success of each product, and discuss product designs in regard to entrepreneurial activity, innovation, sustainability and/or other ethical considerations. | **50** | Any one or a combination of:* data analysis
* oral presentation using multimedia: face-to-face or recorded as a video or podcast
* product analysis
* research inquiry.
 |
| **Total marks** | **50** |  |

School-assessed Task

Assessment of VCE Product Design and Technologies includes a School-assessed Task. For this assessment teachers will provide to the VCAA a score representing an assessment of the student’s level of performance in achieving Outcomes 2 and 3 in Unit 3 and Outcome 1 in Unit 4 according to criteria published by the VCAA.

Contribution to final assessment

The School-assessed Task contributes 50 per cent to the study score.

|  |  |
| --- | --- |
| **Outcomes** | **Assessment tasks** |
| **Unit 3Outcome 2**Investigate a need or opportunity that relates to ethics and formulate a design brief, conduct research to analyse current market needs or opportunities and propose, evaluate and critique graphical product concepts.**Outcome 3**Evaluate product concepts related to ethical design, synthesise and apply feedback to justify a final proof of concept, and plan to make the product safely. | * multimodal record of evidence that records:
* formulation of a design brief and gathering evidence of research that explores market needs or opportunities
* generation, design and evaluation of product concepts
* justification of final proof of concept
* scheduled production plan, including progress during the production process and decisions and modifications made to the scheduled production plan.

AND* practical work that demonstrates**:**
* use of technologies to develop physical product concepts including prototypes and finished product
* management of time and other resources.
 |
| **Unit 4Outcome 1**Implement a scheduled production plan, using a range of materials, tools and processes and managing time and other resources effectively and efficiently to safely make the product designed in Unit 3. |  |

External assessment

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

End-of-year examination

Contribution to final assessment

The examination will contribute 30 per cent to the study score.

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: 1 hour and 30 minutes.
* 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 Administrative Handbook*](https://www.vcaa.vic.edu.au/administration/vce-vcal-handbook/Pages/index.aspx).
* 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 Unit 3 and 4 sequence together with any sample material.