



# Technologies: Design and Technologies

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Teaching, learning and assessment exemplar

**Year 10**

**Food specialisations: Proof is in the pudding**



## **Acknowledgement of Country**

Kaya. The School Curriculum and Standards Authority (the Authority) acknowledges that our offices are on Whadjuk Noongar boodjar and that we deliver our services on the country of many traditional custodians and language groups throughout Western Australia. The Authority acknowledges the traditional custodians throughout Western Australia and their continuing connection to land, waters and community. We offer our respect to Elders past and present.

## **Background**

This teaching, learning and assessment exemplar (the exemplar) has been developed by the School Curriculum and Standards Authority (the Authority) as part of the *School Education Act Employees (Teachers and Administrators) General Agreement 2017* (Clause 61.1–61.3).

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## **Disclaimer**

Any resources such as texts, websites and so on that may be referred to in this document are provided as examples of resources that teachers can use to support their learning programs. Their inclusion does not imply that they are mandatory or that they are the only resources relevant to the course. Teachers must exercise their professional judgement as to the appropriateness of any they may wish to use.

This resource utilises electronic web-based resources, such as videos and image galleries. Teachers should be present while an electronic resource is in use and close links immediately after a resource, such as a video has played to prevent default ‘auto play’ of additional videos. Where resources are referred for home study, they should be uploaded through Connect, or an equivalent system, that filters advertising content.

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## The Western Australian Curriculum

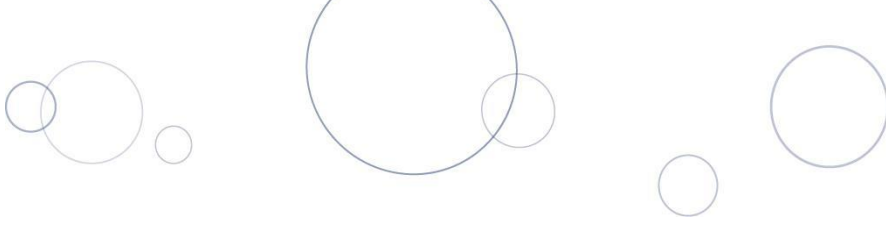
The *Western Australian Curriculum and Assessment Outline* (the *Outline* – <https://k10outline.scsa.wa.edu.au/>) sets out the mandated curriculum, guiding principles for teaching, learning and assessment, and support for teachers in their assessment and reporting of student achievement. The *Outline* recognises that all students in Australian schools, or international schools implementing the Western Australian Curriculum, are entitled to be given access to the eight learning areas described in the *Alice Springs (Mparntwe) Education Declaration*, December 2019.

### The Technologies curriculum

The mandated curriculum is presented in the year level syllabus documents.

The Technologies curriculum delivers a sequential and age-appropriate progression of learning with the following key elements:

- a year level description that provides an overview of the context for teaching and learning in the year
- a series of content descriptions, populated through strands and sub-strands, that sets out the knowledge, understanding and skills that teachers are expected to teach and students are expected to learn
- an achievement standard that describes an expected level that the majority of students are achieving by the end of a given year of schooling. An achievement standard describes the quality of learning (e.g. the depth of conceptual understanding and the sophistication of skills) that would indicate the student is well placed to commence the learning required in the next year.



## **This exemplar**

This Technologies exemplar articulates the content in the *Outline* and approaches to teaching, learning and assessment reflective of the Principles of Teaching, Learning and Assessment. This exemplar demonstrates a sequence of teaching and learning, including suggested assessment points, for 12 lessons.

## **Catering for diversity**

This exemplar provides a suggested approach for the delivery of the curriculum and reflects the rationale, aims and content structure of the learning area. When planning the learning experiences, consideration has been given to ensuring that they are inclusive and can be used in, or adapted for, individual circumstances. It is the classroom teacher who is best placed to consider and respond to (accommodate) the diversity of their students. Reflecting on the learning experiences offered in this exemplar will enable teachers to make appropriate adjustments (where applicable) to better cater for students' gender, personal interests, achievement levels, socio-economic, cultural and language backgrounds, experiences and local area contexts.



### **Using this exemplar**

This teaching, learning and assessment exemplar provides suggestions to support the delivery of the mandated curriculum content. The exemplar provides:

- a teaching and learning sequence
- the mandated curriculum content to be taught at each point of the teaching and learning sequence, suggested resources, sample assessment tasks and marking keys
- the number of lessons to deliver the teaching and learning experiences
- learning intentions and support notes that may provide focus questions and additional information and/or examples to assist with the interpretation of curriculum content
- support notes to assist teachers to unpack the content and support teaching and learning experiences
- teaching and learning experiences that outline the structure of the lesson. These explicitly state each activity that the lesson will progress through and the key focus area for that activity.

### **Links to electronic resources**

This sequence of lessons may utilise electronic web-based resources, such as videos and image galleries. Teachers should be present while an electronic resource is in use and close links immediately after a resource, such as a video, has played to prevent default 'auto play' of additional videos. Where resources are referred for home study, they should be uploaded through Connect, or an equivalent system, that filters advertising content.



## Best practice

### Teaching and learning

The teaching and learning opportunities offered in this exemplar are not exhaustive. Thus, teachers are encouraged to make professional decisions about which learning experiences, and the sequence in which they are delivered, are best suited to their classroom context, taking into account the availability of resources and student ability.

This sample may prove a useful starting point for amplifying creativity in the classroom, while presenting the embedded expectations of the Western Australian Curriculum: Technologies. Teachers may find opportunities to incorporate the General Capabilities and the Cross-curriculum Priorities into the teaching and learning program.

**Ways of teaching** – teachers can locate additional information on the Ways of teaching from the School Curriculum and Standards Authority (the Authority) website  
<https://k10outline.scsa.wa.edu.au/home/wa-curriculum/learning-areas/technologies/design-and-technologies/p-10-design-and-technologies-teaching/design-and-technologies-ways-of-teaching>.

### Assessing

Assessment, both formative and summative, is an integral part of teaching and learning. Assessment should arise naturally out of the learning experiences provided to students. In addition, assessment should provide regular opportunities for teachers to reflect on student achievement and progress. As part of the support it provides for teachers, this exemplar includes suggested assessment points. It is the teacher's role to consider the contexts of their classroom and students, the range of assessments required, and the sampling of content descriptions selected to allow their students the opportunity to demonstrate achievement in relation to the year level achievement standard. Teachers are best placed to make decisions about whether the suggested assessment/s are used as formative or summative assessment and/or for moderation purposes.

**Ways of assessing** – a range of assessment strategies that can enable teachers to understand where students are in their learning is available on the Authority website  
<https://k10outline.scsa.wa.edu.au/home/wa-curriculum/learning-areas/technologies/design-and-technologies/p-10-design-and-technologies-assessing/design-and-technologies-ways-of-assessing>.

### Reflecting

Reflective practice involves a cyclic process during which teachers continually review the effects of their teaching and make appropriate adjustments to their planning. The cycle involves planning, teaching, observing, reflecting and replanning.

This exemplar supports reflective practice and provides flexibility for teachers in their planning. The exemplar shows how content can be combined and revisited throughout the year. Teachers will choose to expand or contract the amount of time spent on developing the required understandings and skills according to their reflective processes and professional judgements about their students' evolving learning needs.



## **Proof is in the pudding**

This exemplar can be used to further develop students' understanding and skills in Food specialisations. Throughout the teaching and learning sequence, teachers will explicitly teach the design thinking skills students require to complete the formative and summative assessments at the end of the learning sequence.

If the suggested learning experiences and relevant syllabus content for this unit have been studied, students will be well positioned to address the requirements of the assessment task to the best of their ability.

This exemplar presents a teaching and learning sequence that will enable students to understand the impact of the emerging technology of 3D food printing, apply design thinking skills and the concepts of properties of food.

Note: it is not necessary to have access to 3D printers, only suitable extrusion equipment, such as large syringes, cookie dough presses with a fine nozzle or piping bags with a fine nozzle. It is this type of equipment that transforms the standard 3D printer to a 3D food printer.



## Year level description

In the middle adolescence phase of schooling, teaching and learning programs encourage students to develop an open and questioning view of themselves as active participants in their society and the world.

Design and Technologies builds on the earlier work students have experienced in investigating patterns, processes and phenomena, and explore forms of representation and use of a range of technologies. They understand that particular ways of managing, working and thinking have developed over time for particular reasons and may still be subject to critical review, revision and change. Learning experiences will enhance working collaboratively and enable students to draw on increasingly diverse and complex sources of information to facilitate comparing, contrasting, synthesising, questioning and critiquing information to achieve desired solutions.

In Year 10, students have opportunities to learn about technologies in society and ways people consider social, ethical, sustainable and security factors to adapt and improve design and production systems in at least one of the following Design and Technologies contexts: Engineering principles and systems, Food and fibre production, Food specialisations, and Materials and technologies specialisations. Students develop an understanding of ways products, services and environments are designed and developed. They consider specialised occupations and economic factors to identify market opportunities, innovate, create and develop entrepreneurial behaviours.

Students apply design thinking skills and use divergent techniques to generate design ideas for user experiences and a range of solutions. They manage and accommodate social, ethical, sustainable and consumer and/or producer considerations in the development of entrepreneurial and marketing strategies for specialised products, systems and environments. Students evaluate enterprise opportunities and impact of existing and new solutions. They competently identify and manage processes for effective project management with consideration of time, production processes, social, ethical, economic and sustainable factors, and legal responsibilities for optimum quality and performance to achieve designed solutions.



## Achievement standard

By the end of the year:

Students consider ways social, ethical, sustainable and security factors affect designed solutions, complexity of design, and production processes. In Engineering principles and systems, students identify the process of combining materials with force, motion and energy to design solutions. In Food and fibre production, students consider the role of technological innovations in ways food and fibre products are grown, processed and marketed in the design of sustainable products and systems. In Food specialisations, students select processing techniques for the preservation of food products, considering nutrition principles, consumer and/or producer values and ways properties influence design, preparation and development of specialised food products. In Materials and technologies specialisations, students consider the functional properties of materials and the application of specialised technologies and systems in the design and development of designed solutions.

In the Design and Technologies contexts, students ideate a problem and define the needs of the client/stakeholder to develop a design brief and determine the basis for a designed solution. They determine required resources and availability to develop designed solutions, considering associated constraints. Students consider specialised occupations and economic factors to identify market opportunities, innovate, create and develop entrepreneurial behaviours to design and develop products, services and environments for clients/stakeholders. Students provide relevant analysis to evaluate design processes and solutions against student-developed criteria. They manage projects, using suitable technologies, with an agile and collaborative approach. Students use project management processes/skills, consider time, production, social, ethical, economic and sustainable factors, and legal responsibilities.





## Lessons 1–12

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Proof is in the pudding



## Lesson 1: Food technology and processing techniques

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The Western Australian Curriculum content addressed in this lesson is below.

### Contexts

#### Food specialisations

- Processing techniques and the preservation of food products, considering application of nutrition principles; ways sensory and physical properties of food influence the design, preparation and development of specialised food products
- Social, ethical, sustainable, consumer and producer considerations in the design and development of entrepreneurial and marketing strategies for a specialised food enterprise, including management of risks, security measures and regulatory responsibilities for optimum quality and performance to achieve designed solutions

#### Technologies and society

- People consider social, ethical, sustainable and security factors to improve design and production systems using specialised technologies to achieve designed solutions
- Products, services and environments are designed and developed with consideration of specialised occupations, economic and environmental factors to identify market opportunities, innovate, create and develop entrepreneurial behaviours

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### Learning intentions

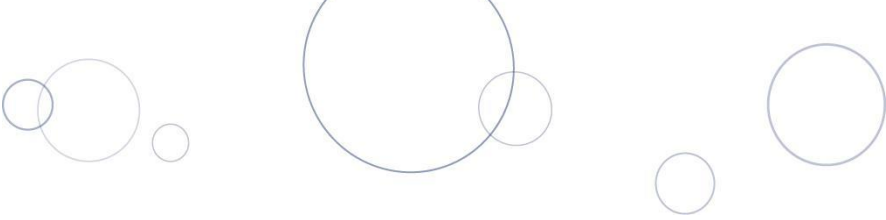
- Investigate a range of processing techniques that can be used in food production.
- Consider the impact the food trend ‘molecular gastronomy’ may have on food product design.
- Examine the impact of 3D printing as an emerging food technology on food product design.

### Preparation for teacher

Organise access to the links and resources in Appendix A.

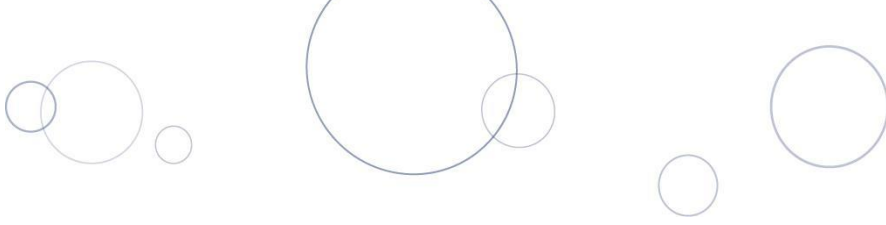
### Teacher

- Outline the learning intentions.
- Explain to students that over the course of this learning sequence they will be investigating a range of food processing and preservation techniques, which will then be considered when designing and producing food products.
- Conduct a class discussion of the processing techniques used in food production.
- Option to watch the following video as an introduction:
  - Mr Ruel Tuition – Food Processing Technology (Overview) [https://youtu.be/JhFy\\_zi2Njg](https://youtu.be/JhFy_zi2Njg)
- Facilitate discussion of processing techniques, covering topics such as a range of processing techniques, the benefits of food processing, the impact on nutrition, the impact on physical and sensory properties and the development of specialised food products.

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- Introduce ‘molecular gastronomy’ – this has been a major trend in restaurants since the early 2000s. It applies scientific principles, such as physical and functional properties, and new technologies to food preparation which results in highly creative and innovative food presentation and products. Highlight how molecular gastronomy has impacted food products in the fast-food industry, such as bursting bubbles of flavour in soft drinks.
  - The following YouTube links may be helpful when explaining the molecular gastronomy concept.
    - Vsauce2 – What is molecular gastronomy?  
<https://www.youtube.com/watch?v=vbvQIKzSmkQ>
    - MOLECULE-R – Channel Page  
<https://www.youtube.com/channel/UCp4s0S6M-RTABo9vdCjt-5g>
  - Explain to students that printing food using 3D printers is an emerging technology. As the technology develops and becomes more affordable, new food products and trends will emerge.
  - Provide students with the list of questions below and read through them with the class.
  - You may wish to show the students the following clip:
    - FT Rethink – Dinner is printed: Is 3D technology the future of food?  
<https://www.youtube.com/watch?v=B0Ty6wgM8KE>
  - Ask students to consider the questions listed below and record answers in a digital or hard copy format or on the class board. This may be completed collaboratively or individually.
    - What is 3D-printed food?
    - How does it work?
    - What food materials can be used?
    - What properties are required for food materials to be 3D printed?
    - What designs can be printed?
    - What are some of the benefits of 3D-printed food?
    - What are some of the disadvantages of 3D-printed food?
  - As a class, identify and discuss the answers to the questions. Highlight that food materials must have suitable physical properties to pass through the printer. Explain to students that they will investigate food materials suitable for 3D printing in future lessons.
  - The following optional resources may provide further topics for discussion and deeper learning on the impact of 3D printing on social, ethical, economic and sustainability issues throughout the unit.
    - FRANCE 24 English – 3D-printed fake meat: The healthier, greener future of food?  
<https://www.youtube.com/watch?v=fLpeeUYtW94>
    - Redefine Meat – Home page  
<https://www.redefinemeat.com>
    - Dezeen – 3D-printing with living organisms ‘could transform the food industry’  
<https://www.youtube.com/watch?v=sHsxDvt9mb8>

### Students

- Participate in a class discussion on processing techniques used in food production.
- Watch suggested clips provided by the teacher.
- Respond to the questions and discuss as a class and/or in pairs. Record answers digitally, written on paper or on the class board as instructed by the teacher.
- Optional: Watch and discuss the clips and investigate websites provided to develop understanding about the impact of 3D printing. Consider the potential impact on social, ethical, economic and sustainability factors.



### **Lesson conclusion**

- Reiterate the learning intentions.

### **Opportunities for formative assessment**

- Ask students to write their answer to the following question on a piece of paper and submit it as an exit ticket (submit to teacher before exiting classroom):
  - 'How might 3D printed food impact the way we eat in the future?'
- Complete a *Plus Minus Interesting* chart (PMI) on two processing techniques that can be used in food production.



## Lesson 2: Sensory and physical properties of food

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The Western Australian Curriculum content addressed in this lesson is below.

### Contexts

#### Food specialisations

- Processing techniques and the preservation of food products, considering application of nutrition principles; ways sensory and physical properties of food influence the design, preparation and development of specialised food products
- Social, ethical, sustainable, consumer and producer considerations in the design and development of entrepreneurial and marketing strategies for a specialised food enterprise, including management of risks, security measures and regulatory responsibilities for optimum quality and performance to achieve designed solutions

#### Technologies and society

- Products, services and environments are designed and developed with consideration of specialised occupations, economic and environmental factors to identify market opportunities, innovate, create and develop entrepreneurial behaviours

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### Learning intentions

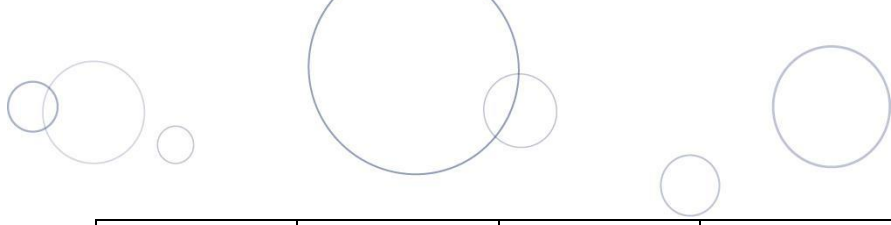
- Investigate the sensory and physical properties of food.
- Understand the desirable sensory and physical properties of food for 3D printing.

### Preparation for teacher

- Review exit tickets from previous lesson.

### Teacher

- Outline the learning intention.
- Review answers from the exit ticket question in the previous lesson. How will 3D-printed food impact the way we eat in the future? Discuss responses noted on exit tickets.
- Introduce the topic of sensory and physical properties of food.
- Explain that the sensory properties of food are the attributes that influence how we perceive and experience food through our senses. This includes the appearance, aroma, flavour, texture and sound.
- Explain that the physical properties of food refer to the observable characteristics that can be measured or observed without changing its chemical composition. This may include colour, size, shape, viscosity and elasticity.
- Facilitate a class brainstorm, discussing each property of food and descriptive words that can be used when describing each sensory and physical property.
- Ask students to complete a sensory evaluation taste test on a range of food items. The teacher chooses a range of food items to be sampled. Students complete the table below while sampling the food items.



Food item	Appearance	Aroma	Flavour	Texture	Sound

- Optional: The following YouTube clips may provide inspiration for discussion on food materials and designs.
  - DW Food – 3D Printed vegan steak that tastes like real meat  
<https://www.youtube.com/watch?v=238yRdb0niw>
  - CNN Business – 3-D food printer makes dessert  
<https://www.youtube.com/watch?v=XQni3wb0tyMGE>
- Explain how 3D printing works: A heated material is extruded onto a surface. Alternatively, dry powder is used and then solidified. Almost any shape or form can be printed. 3D forms are built up gradually, layer by layer.
- Describe the physical properties of the food materials required to pass through a 3D printer.

### Students

- Review the answers on the exit ticket from the previous lesson. How do you think 3D-printed food will impact the way we eat in the future? Discuss answers noted on exit tickets.
- Listen to the topic introduction on physical and sensory properties of food.
- Participate in a class brainstorm, discussing each property of food and the descriptive words that can be used when describing each sensory and physical property.
- Complete a sensory evaluation taste test on a range of food items. Complete the table.
- Discuss the findings as a class, considering how these might change when sampling similar food produced by a 3D printer.
- Describe the physical properties of the food materials required to pass through a 3D printer.

### Lesson conclusion

- Reiterate the learning intentions.
- Students share their responses to the following questions:
  - Describe the properties of one of the foods that you sampled.
  - Explain whether you were surprised by any of the results on your table.



## Lesson 3: Food preservation

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The Western Australian Curriculum content addressed in this lesson is below.

### Contexts

#### Food specialisations

- Processing techniques and the preservation of food products, considering application of nutrition principles; ways sensory and physical properties of food influence the design, preparation and development of specialised food products
- Social, ethical, sustainable, consumer and producer considerations in the design and development of entrepreneurial and marketing strategies for a specialised food enterprise, including management of risks, security measures and regulatory responsibilities for optimum quality and performance to achieve designed solutions

#### Design thinking skills

##### Investigating and defining

- Investigate a range of technologies, resources and/or components to develop ideas and solutions, with consideration of social and ethical factors, legal responsibilities and competing constraints

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#### Learning intentions

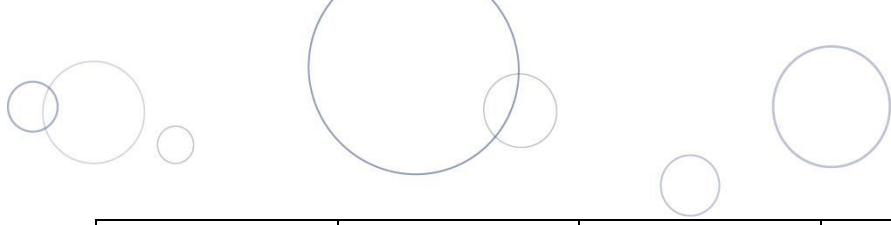
- Investigate food preservation techniques.
- Understand how food preservation techniques impact sensory and physical properties of food.

#### Preparation for teacher

- Prepare any relevant texts, websites or video clips.
- Organise electronic or printed copies of the table below for students to complete.

#### Teacher

- Outline the learning intentions.
- Introduce the topic of food preservation. Explain that these techniques are used to extend the shelf life of food and prevent spoilage, allowing it to be stored and consumed later. These techniques are essential for reducing food waste, maintaining nutritional value and ensuring food safety.
- Ask students to brainstorm any additional benefits to using food preservation techniques.
- Ask students to work in groups to complete the table below. There is also an option to do a jigsaw activity and allocate a technique for each group to investigate and then share their results with the rest of the class. Students research a range of preservation techniques, such as dehydrating, freezing, candying, curing, fermenting, pickling.
- Optional: have a range of preserved food products for students to sample. For example, students could compare the sensory properties of a dehydrated strawberry, strawberry jam, a frozen strawberry and a fresh strawberry.



Preservation technique	Explanation	Impact on sensory properties	Impact on nutrition	Suitable foods

### Students

- Listen to the lesson introduction.
- Brainstorm the benefits of using food preservation techniques.
- Work in groups or individually complete the food preservation table.
- Sample a range of preserved food products while comparing the sensory properties.

### Lesson conclusion

- Reiterate the learning intentions.
- Ask students to do a *Think-Pair-Share* activity, selecting a food preservation technique and discussing one impact on sensory properties and one impact on nutrition.
- Ask if any students would like to share their answer with the class.
- Present the exit ticket question: Explain how you could use a food preservation technique in a dessert product.



## Lesson 4: Batters and doughs

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The Western Australian Curriculum content addressed in this lesson is below.

### Design thinking skills

#### Investigating and defining

- Investigate a range of technologies, resources and/or components to develop ideas and solutions, with consideration of social and ethical factors, legal responsibilities and competing constraints

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### Learning intentions

- Investigate the suitability of pancake batter and biscuit dough for 3D printing.
- Investigate how altering the viscosity of batters impacts the sensory properties of the product.
- Understand the impact of altering the temperature and the cooking time of dough on the product.

### Preparation for teacher

- Locate and prepare a pancake batter recipe and a biscuit dough recipe.
- Order and prepare the required ingredients for both recipes.
- Organise suitable extrusion equipment, such as large syringes or piping bags with a fine nozzle.

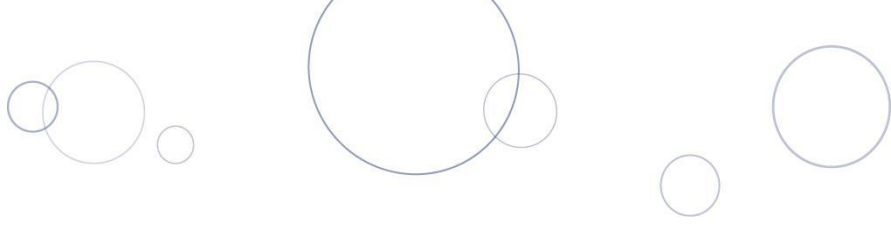
### Teacher

- Outline the learning intentions. Remind students of safety and hygiene considerations.
- Explain to students that pancake batter and biscuit dough are recipes that are suitable for 3D printing.
- Discuss the process of 3D printing both of these recipes and how to use the extrusion equipment.
- The following clip may be used to provide an opportunity to discuss what needs to be considered when 3D printing biscuit dough, such as viscosity and changes during baking:

IDG.tv – *3D printing in cookie dough*

<https://www.youtube.com/watch?v=JPg3U9R9tQ4>

- Distribute the pancake batter and biscuits dough recipes. Depending on time constraints, half the class can produce one recipe each and then compare, or students can make both recipes if there is sufficient time available.
- For the pancake batter recipe:
  - Explain that the viscosity of the food material may be altered using varying quantities of liquid. However, a thicker batter will take longer to cook. Lower the temperature to allow the batter to cook thoroughly, without burning on the outside.
  - Optional: Discuss the process of starches breaking down when browning if time and student interest allows.
  - Remind students that some foods are structurally unstable until cooked properly, such as batter. The batter must be set before attempting to turn over to cook the other side.
  - Ask students, 'How will you know when the batter is set?' (answer: check for bubbles on the surface of the pancake).

- 
- Guide and assist students to prepare and adjust batter recipes, place into large syringes or piping bags and pipe 3D forms onto a heated non-stick or buttered frying pan.
  - Instruct students to observe the changes to stability and colour as the pancake batter cooks.
  - For the biscuit dough recipe:
    - Instruct students to preheat the ovens to an appropriate heat and prepare baking sheets with a suitable non-stick material, such as a silicone mat or baking paper.
    - Highlight the exclusion and inclusion of raising agents. Explain that raising agents will alter the size and shape of the food product when the raising agent is activated. Explain the difference between baking soda and baking powder. Baking soda, or bicarbonate of soda, requires an acid to activate and make the batter rise. Baking powder has an acid included, such as tartaric acid, and only requires water to activate.
    - Remind students that the viscosity of the food material may be altered using ingredients, such as flour.
    - Explain to students that the colour of the food product will change due to the impact of heat on the starches in the flour. This can be altered by changing the cooking time and temperature. Cooking above 160° C will cause quicker browning.
  - Ask students to respond to the following on completion of the recipes.
    - Describe how the size and shape of the products changed during the cooking process.
    - Explain why the changes occurred.
    - Decide which recipe was the most suitable for 3D printing and the reasons why.

### Students

- Preheat the ovens to an appropriate temperature and prepare baking sheets with a suitable non-stick material, such as a silicone mat or baking paper.
- View the *3D printing in biscuit dough* video as a class.
- For the pancakes batter recipe: prepare and adjust the batter, examining the viscosity. Experiment with the viscosity of the batter using more or less liquid. Make changes as necessary to achieve the correct viscosity. Place into large syringes or piping bags and pipe pancake batter onto a heated non-stick or buttered frying pan.
- For the biscuit dough recipe: prepare and adjust the biscuit dough, examining the viscosity. Experiment with the viscosity of the batter using more or less flour. Make changes as necessary to achieve the correct viscosity. Place biscuits on a baking sheet and bake in the oven as per the recipe instructions.
- Observe changes to the stability and colour as the product cooks.
- Clean up the kitchen area on completion of tasks.
- Consider the suitability of pancake batter and biscuit dough for 3D printing.

### Lesson conclusion

- Reiterate the learning intentions.
- Briefly discuss how students changed the viscosity of the batter and biscuit dough.
- Ask students to provide their opinion on the suitability of pancake batter and biscuit dough as a printable ingredient using thumbs up, sideways and down or a similar strategy to justify their opinion.



## Lesson 5: Chocolate and meringue

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The Western Australian Curriculum content addressed in this lesson is below.

### Design thinking skills

#### Investigating and defining

- Investigate a range of technologies, resources and/or components to develop ideas and solutions, with consideration of social and ethical factors, legal responsibilities and competing constraints
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### Learning intentions

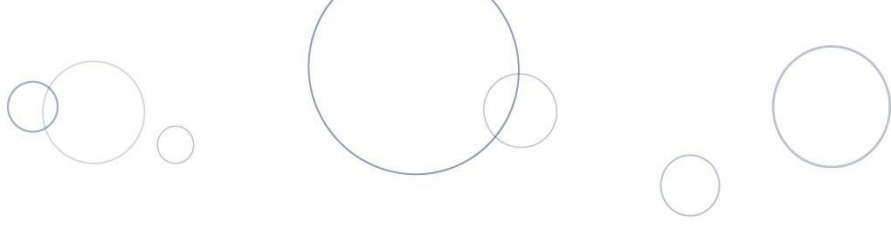
- Investigate the suitability of chocolate and meringue for 3D printing.
- Investigate temperature, viscosity and structural qualities of food materials.
- Observe changes to volume and structural qualities of meringue caused by vigorous whisking.

### Preparation for teacher

- Locate and prepare a meringue recipe and a chocolate recipe.
- Order and prepare the required ingredients for both recipes.
- Organise suitable extrusion equipment, such as large syringes or piping bags with a fine nozzle.

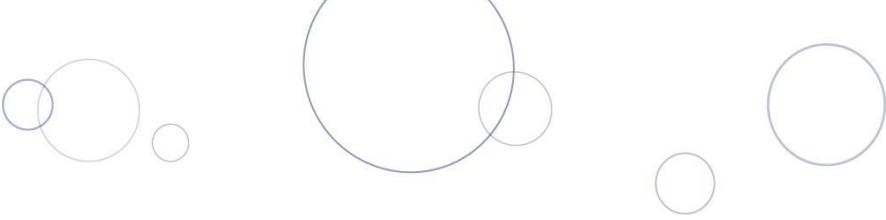
### Teacher

- Outline the learning intentions.
- Review student exit tickets from the previous lesson. Discuss answers as a class.
- Explain to students that they will be investigating food materials suitable for 3D printing and the properties required to pass through a 3D printer. The food to be printed also requires a structural quality that allows it to retain a 3D form. Highlight that it is not necessary to have a 3D printer for this investigation, only suitable extrusion equipment, such as large syringes or piping bags with a fine nozzle. It is this type of equipment that transforms a standard 3D printer to a 3D food printer.
- Explain to students that chocolate and meringue are recipes that are suitable for 3D printing.
- The following optional clips may be used to introduce the practical topic and provide an opportunity to discuss what needs to be considered when 3D printing.
  - Localish – 3D printer that prints chocolate?! | Bite Size  
[https://www.youtube.com/watch?v=uYLJRQBU\\_dl](https://www.youtube.com/watch?v=uYLJRQBU_dl)
  - byFlow – 3D printing with meringue  
<https://www.youtube.com/watch?v=NaIWHxZAS6c>
- Distribute both recipes to students. Depending on time constraints, half the class can produce each recipe and then compare, or students can make both recipes if there is sufficient time available. Remind students of safety and food-handling protocols in the kitchen.

- 
- Melting chocolate:
    - Explain that chocolate was one of the first foods to be 3D printed.
    - Reiterate the definition of viscosity. Demonstrate melting chocolate and changing viscosity due to temperature. Explain the importance of temperature and viscosity when using chocolate for printing. When the temperature is too high, the viscosity is too low. The chocolate flows too quickly and will not set, meaning it will not have suitable structural qualities. When the temperature is too low, the viscosity is too high, and the chocolate will not pass through the printing nozzle.
    - Briefly explain when chocolate meets water, it seizes and the texture changes. This reaction cannot be reversed. It will not easily pass through the printing nozzle if this occurs.
    - Guide and assist students to melt milk, white and/or dark chocolate either over a pot of boiling water (bain-marie) or in the microwave.
    - Demonstrate how to place the melted chocolate into large syringes or piping bags and pipe 3D forms onto a non-stick sheet.
  - Creating and baking meringue:
    - Explain that meringue must be cooked to retain its shape.
    - Instruct students to turn the ovens on to a low heat and prepare the baking sheets with a suitable non-stick material, such as a silicone mat or baking paper.
    - Explain that whisking incorporates air into the egg white and/or aquafaba to create a foam and increases the viscosity. However, the structural qualities of the foam are not stable. Cooking will set the foam in its 3D form. Using a low cooking temperature will prevent the meringue from browning. Stress the importance of ensuring that there is no egg yolk present in the egg white mixture.
    - Optional: discuss the process of sugars browning if time and student interest allows.
    - Explain how the viscosity may be altered by whisking and/or adding ingredients, such as sugar, cream of tartar or corn starch. If the sugar is not whisked sufficiently, it will result in a gritty texture.
    - Encourage students to experiment with the viscosity of their meringues using whisking, and/or ingredients. Guide and assist students to prepare the meringue recipe, place it into large syringes or piping bags and pipe 3D forms onto a non-stick sheet.
    - Instruct students to observe changes to the volume and structural qualities caused by whisking.

### Students

- Chocolate:
  - Melt milk, white and/or dark chocolate either over a pot of boiling water or in the microwave. Use only clean, dry glass or stainless steel bowls and metal spoons to stir.
  - Place chocolate into large syringes or piping bags and pipe 3D shapes onto a non-stick sheet.
  - Consider how the changing viscosity impacts the ability of the chocolate to pass through the nozzle and hold a form, as the chocolate cools in the syringe or piping bag.

- 
- Meringue:
    - Prepare the meringue recipe. Use only clean, dry glass or stainless steel bowls and metal spoons to stir. Ensure there is no egg yolk present in the egg white mixture. Place into large syringes or piping bags and pipe meringue onto non-stick sheets on baking trays. Bake meringues at a low temperature.
    - Consider how the viscosity can be changed to pass through the nozzle and hold a form. Experiment with the viscosity of the meringue mixture using whisking and/or ingredients. Make changes as necessary to achieve the correct viscosity.
    - Observe changes to the volume and structural qualities when whisking.

### **Lesson conclusion**

- Reiterate the learning intentions.
- Briefly discuss as a class how students changed the viscosity of the meringue.
- Ask students to provide their opinion on the suitability of meringue as a printable ingredient using thumbs up, sideways and down, or a similar strategy, justifying their responses.
- Discuss how changing the viscosity of chocolate impacts the ability to pass through the nozzle and hold a form as the chocolate cools in the syringe or piping bag.
- Discuss what causes chocolate to seize.
- Ask students which chocolate was the easiest to melt to the required viscosity.
- Ask students to provide their opinion on the suitability of chocolate as a printable ingredient using thumbs up, sideways and down, or a similar strategy, justifying their responses.



## Lesson 6: Purée and icing

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The Western Australian Curriculum content addressed in this lesson is below.

### Contexts

#### Food specialisations

- Processing techniques and the preservation of food products, considering application of nutrition principles; ways sensory and physical properties of food influence the design, preparation and development of specialised food products

#### Technologies and society

- People consider social, ethical, sustainable and security factors to improve design and production systems using specialised technologies to achieve designed solutions

#### Design thinking skills

##### Investigating and defining

- Investigate a range of technologies, resources and/or components to develop ideas and solutions, with consideration of social and ethical factors, legal responsibilities and competing constraints

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### Learning intentions

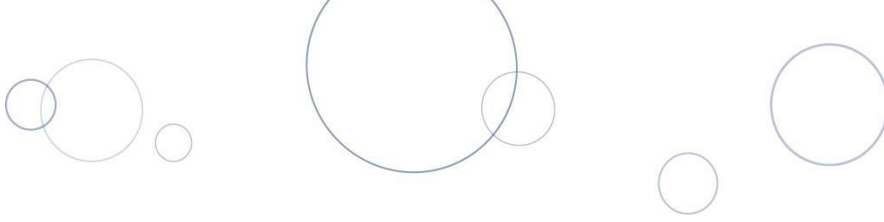
- Consider ways to improve the nutritional value of a 3D-printed food product.
- Consider how icings, frostings and fruit purées may be used creatively to decorate 3D-printed food products.
- Investigate altering textural and structural qualities of icings, frostings and fruit purées for 3D printing.

### Preparation for teacher

- Organise access to the optional links in the teaching and learning experiences.
- Locate and prepare basic icing, frosting and fruit purée recipes.
- Source suitable extrusion equipment, such as large syringes or piping bags with a fine nozzle.
- Source food colouring.

### Teacher

- Outline the learning intentions.
- The following link may be used to introduce the practical topic and provide an opportunity to discuss what needs to be considered when 3D printing.
  - Best Crowdfunding Campaigns – Cakewalk 3D – a handy food extruder for your own 3D printer  
<https://www.youtube.com/watch?v=I3VLEh3kuY8>
- Distribute the icing, frosting and fruit purée recipes.
- Decide whether students will be divided into groups and allocated a recipe to produce, or if students will produce all three recipes. Review and decide, based on time constraints.



- Fruit purées:
  - Explain the benefits of including fruit and vegetables in the design of food products, as they improve the nutritional value of the product. These food materials are higher in nutrients, such as vitamins and minerals. Fruits also provide dietary fibre for gut health and phytochemicals, which may reduce the risk of heart disease.
    - Optional: Further discussion on the nutritional and health benefits of fruit and vegetables may occur if time and student interest allows.
  - Explain that cooking and puréeing foods alters the textures of these ingredients but lowers the viscosity and structural qualities of the food. Adding starch can improve this for the 3D printing processes. The addition of sugar and salt may help to preserve these foods, especially when there is an excess of produce due to over-supply or seasonality. However, it is also important to consider the impact of consuming too much sugar and salt. Discuss the impact that processing has on the nutritional properties of foods.
    - Optional: Further explanation of the spoilage and preservation of fruit may be provided if time and student interest allows.
  - Demonstrate how to mix a little water into a tablespoon of arrowroot, cornflour, rice flour or tapioca starch, and then gradually stir into a cup of water in a small saucepan to evenly distribute the starch without lumps. Heat gently, stirring constantly, to demonstrate the process in action.
  - Encourage students to experiment with the viscosity and structural qualities of their purées using different, more or fewer ingredients. Guide and assist students to prepare and adjust the purée recipes, place into large syringes or piping bags and pipe 3D forms onto a plate or baking paper and tray.
    - Note: the purée may need to be cooled in a refrigerator before piping. This can be done while students conduct a preliminary clean-up of equipment and workspaces.
- Icing and frosting:
  - Coloured icings and frostings can provide visual, textural and flavoured interest to a design.
  - Remind students that it is important to moderate how much sugar is consumed. Icing is not suggested as a part of a daily diet.
  - Explain that icing made from icing sugar and water will become very hard once it dries out. This may be difficult for some people to bite, such as the elderly or young children. Adding butter to the icing sugar provides volume and stability and retains a softer texture.
  - Encourage students to experiment with the textural and structural qualities of icings and frostings using different, more or fewer ingredients. Guide and assist students to prepare and adjust the recipes. Place the icing into large syringes or piping bags and pipe 3D forms onto a plate or baking paper and tray.
  - Encourage students to consider creative processes with the food materials, such as piping multicoloured images.



## Students

- Fruit purées:
  - Prepare and adjust the purée recipes, examining the viscosity. Experiment with the viscosity and structural qualities of the purée using different, more or less mixing or ingredients. Make changes as necessary to achieve the correct viscosity. Place the mixture into large syringes or piping bags and pipe onto a plate or baking paper/tray.
    - Note: the purée may need to be cooled in a refrigerator before piping. This can be done while conducting a preliminary clean-up of equipment and workspaces.
  - Consider the suitability of purées for using up excess produce and 3D printing.
- Icing and frosting:
  - Prepare and adjust the icing and frosting recipes, examining the textural and structural qualities. Experiment with the viscosity of their recipes using different, more or less mixing of ingredients. Make changes as necessary to achieve a suitable texture and structure. Place into large syringes or piping bags and pipe 3D forms onto a plate or baking paper and tray.
  - Be creative with the food materials, such as piping multicoloured images.
  - Consider how icings and frostings may be used creatively to decorate 3D-printed food products.

## Lesson conclusion

- Reiterate the learning intentions.
- Students share their responses with a partner.
  - Explain the effectiveness of icing, frosting and purée as an ingredient used for 3D printing.
  - Would you consider using any of these elements in a dessert product?



## Lesson 7: Proof is in the pudding (investigating and defining)

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The Western Australian Curriculum content addressed in this lesson is below.

### Contexts

#### Food specialisations

- Processing techniques and the preservation of food products, considering application of nutrition principles; ways sensory and physical properties of food influence the design, preparation and development of specialised food products

#### Technologies and society

- People consider social, ethical, sustainable and security factors to improve design and production systems using specialised technologies to achieve designed solutions
- Products, services and environments are designed and developed with consideration of specialised occupations, economic and environmental factors to identify market opportunities, innovate, create and develop entrepreneurial behaviours

### Design thinking skills

#### Investigating and defining

- Ideate a problem and define the needs of the client/stakeholder through anecdotal evidence and/or data gathering techniques
- Develop a design brief for a solution or to innovate an existing product, service or environment
- Investigate a range of technologies, resources and/or components to develop ideas and solutions, with consideration of social and ethical factors, legal responsibilities and competing constraints

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### Learning intentions

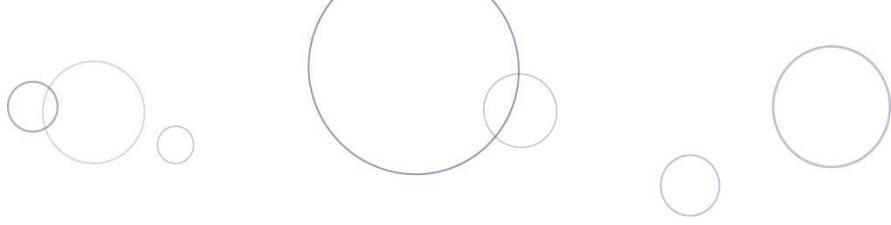
- Describe the properties and considerations required when designing a food product for a client/market group.
- Understand the task requirements for the *Proof is in the pudding* task.
- Complete the investigating and defining section of the task.

### Preparation for teacher

- Organise access to the optional links in the teaching and learning experiences.
- Prepare task booklets for the *Proof is in the pudding* task.

### Teacher

- Outline the learning intentions.
- The following clip may be used to introduce the topic:
  - Insider Food – This chef uses a 3D printer to create incredible cakes  
<https://www.youtube.com/watch?v=ILX-cVy-wq8>
- Provide students with the *Proof is in the pudding* task (Appendix B).

- 
- Explain to students the task requirements (Appendix B). Students are required to use processes and skills developed in the previous lessons when completing this task.
  - One 3D-printed element needs to be included in the dessert. Revisit the following considerations when selecting food materials for 3D printing:
    - viscosity
    - temperature
    - texture
    - structural qualities
    - impact of raising agents to shape of design
    - impact of cooking to colour and shape of design.
  - Ask students to answer/respond to the following questions before commencing the task:
    - Who is your client/market group?
    - Who is purchasing the product?
    - Who is eating the product?
    - What design features should you consider when designing a food product for these clients?
      - Aesthetics – what could or should the product look like?
      - Nutrition
      - Portion sizes
      - Sensory properties
      - Cost.
  - Guide students in developing criteria to evaluate the design processes and solution in this task, using the curriculum content. Students select two criteria to evaluate the dessert product.
  - Students record the following:
    - Explain the purpose of the task.
    - Identify your chosen client/market group and describe the design features that need to be considered.
    - Describe considerations and constraints when selecting food materials for 3D printing.
    - Describe the physical and sensory properties that need to be considered when designing a food product.
    - Identify two methods of food preservation and describe how each method could be incorporated into the dessert product.
  - Provide equipment and materials for recording written answers and sketching, such as pencils and paper, if required. Provide ongoing support or guidance as the students complete the investigating and defining section of the task.

### **Students**

- Students complete the investigating and defining section of the *Proof is in the pudding* task (Appendix B). Record answers either electronically or on paper.
- Students develop criteria to evaluate the design processes and solution in this task. Students select two criteria to evaluate the dessert product.

### **Lesson conclusion**

- Reiterate the learning intentions.
- Inform students that in the next lesson they will complete the designing section of the task.



## Lesson 8: Proof is in the pudding (designing)

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The Western Australian Curriculum content addressed in this lesson is below.

### Contexts

#### Food specialisations

- Processing techniques and the preservation of food products, considering application of nutrition principles; ways sensory and physical properties of food influence the design, preparation and development of specialised food products

#### Technologies and society

- People consider social, ethical, sustainable and security factors to improve design and production systems using specialised technologies to achieve designed solutions
- Products, services and environments are designed and developed with consideration of specialised occupations, economic and environmental factors to identify market opportunities, innovate, create and develop entrepreneurial behaviours

#### Design thinking skills

##### Designing

- Design alternative solutions considering available technologies, functionality, accessibility, usability and aesthetics, using appropriate technical terms

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#### Learning intentions

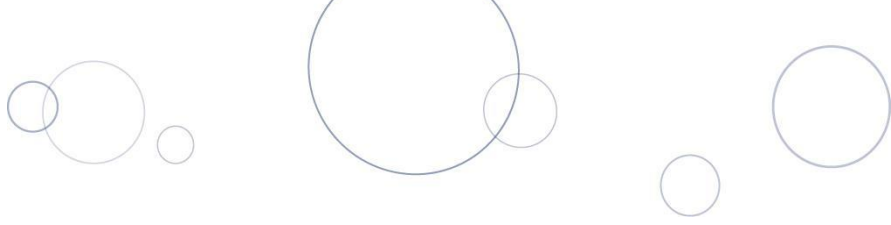
- Continue investigating the development of 3D-printed food products.
- Design a dessert suitable for a specific client/market group.
- Produce a detailed design of the dessert product.

#### Preparation for teacher

- Organise access to optional websites listed in the teaching and learning experiences.
- Provide students with an electronic or printed copy of *Proof is in the pudding* task instructions.
- Prepare equipment and materials, such as pencils and paper, for recording written answers and sketching, if required.

#### Teacher

- Outline the learning intentions.
- Show students the following websites. Students may wish to explore the blog independently or in pairs if sufficient devices are available.
  - Anrich3D – About (Founder’s Motivation)  
<https://anrich3d.wixsite.com/anrich3d/about>
  - Beets – 3D Jelly printing  
<https://www.youtube.com/watch?v=OSUKC6VLFFA>
- Discuss the aesthetic features of the products and the impact of colour and form when cooked.

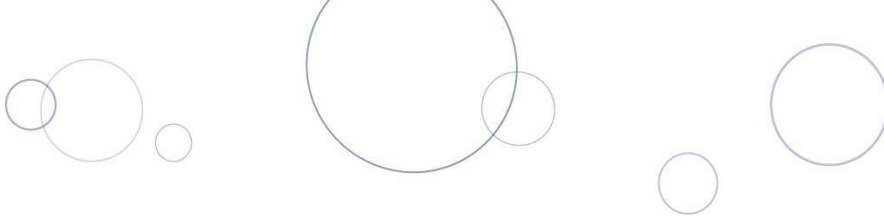
- 
- Ask the students:
    - What problem is Anrich3D trying to solve using 3D printers?
    - Who do you think their clients (or market) might be?
    - What food materials were used?
    - Which food materials and designs were the most successful?
    - Why do you think these were successful?
    - What changes do you think could be made to these designs?
  - Ask students to complete the following instructions for the task:
    - Design two suitable desserts considering the task criteria, including functionality, accessibility, usability and aesthetics.
    - For each design, explain how it meets the criteria and the needs of the client/market group.
    - Select a design to produce. Justify the design selection against the needs of the client/stakeholder and the task criteria.
  - Provide equipment and materials, such as pencils and paper, for recording written and drawn answers, if required. Provide ongoing support or guidance as students complete the designing questions in the *Proof is in the pudding* task.

### **Students**

- Examine the Anrich3D website and blog. Consider the aesthetic features of the products and the impact to colour and form when cooked. As a class, discuss thoughts and opinions.
- Students complete the designing section of the *Proof is in the pudding* task (Appendix B). Record answers electronically or on paper.

### **Lesson conclusion**

- Reiterate the learning intentions. Inform students during the next lesson they will complete the project management section of the task.



## Lesson 9: Proof is in the pudding (project management)

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The Western Australian Curriculum content addressed in this lesson is below.

### Contexts

#### Food specialisations

- Processing techniques and the preservation of food products, considering application of nutrition principles; ways sensory and physical properties of food influence the design, preparation and development of specialised food products

#### Technologies and society

- People consider social, ethical, sustainable and security factors to improve design and production systems using specialised technologies to achieve designed solutions
- Products, services and environments are designed and developed with consideration of specialised occupations, economic and environmental factors to identify market opportunities, innovate, create and develop entrepreneurial behaviours

#### Design thinking skills

##### Project management

- Manage projects, using suitable technologies, with an agile and collaborative approach. Use project management processes to consider time, production processes, social, ethical, economic and sustainable factors, and legal responsibilities

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#### Learning intentions

- Consider the social, ethical, economic and sustainable factors that impact the dessert design.
- Produce a detailed time plan to be used during the dessert production process.

#### Preparation for teacher

- Read the *Proof is in the pudding* task instructions (Appendix B).
- Prepare the equipment and materials for recording written answers and sketching, such as pencils and paper, if required.
- Have printed or electronic copies of the food order and time plan templates for all students.



### Teacher

- Outline the learning intentions.
- Review with students the investigating and defining and designing sections of the *Proof is in the pudding* task (Appendix B). Request students to complete these sections before they commence the project management section.
- Students complete the following questions from the task:
  - Create a detailed time plan outlining the steps required to produce the dessert over two lessons.
  - Explain how social, ethical, economic and sustainable factors were considered during the production of the dessert.
- Guide students to complete a food order sheet, and to order the ingredients and equipment required to produce their dessert.

### Students

- Review the investigating and defining and designing sections of the *Proof is in the pudding* task. Students to complete these sections before commencing the project management section.
- Complete the designing section of the *Proof is in the pudding* task. Record answers either electronically or on paper.

### Lesson conclusion

- Reiterate the learning intentions.
- Inform students they will be producing their dessert over the next two lessons.



## Lesson 10: Prepare and produce dessert (Part 1)

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The Western Australian Curriculum content addressed in this lesson is below.

### Design thinking skills

#### Project management

- Manage projects, using suitable technologies, with an agile and collaborative approach. Use project management processes to consider time, production processes, social, ethical, economic and sustainable factors, and legal responsibilities

#### Producing and implementing

- Select, justify, implement and test a range of technologies, techniques, and processes, to produce designed solutions and/or prototypes

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### Learning intentions

- Produce dessert product for the chosen client/market group (one 3D-printed element must be included).
- Follow the time plan and use project management processes.

### Preparation for teacher

- Provide the *Proof is in the pudding* task instructions (Appendix B).
- Provide the required food materials and equipment.
- Organise suitable extrusion equipment, such as large syringes or piping bags with a fine nozzle.

### Teacher

- Outline the learning intentions.
- Explain this is Part 1 of 2 lessons.
- Support students as they individually produce their planned desserts.
- Distribute the food order and time plan sheets to students.
- Instruct students on the packaging and storage of partially completed dessert product.
- Optional: use a 3D printer if available.

### Students

- Follow the time plans and project management processes to commence producing the dessert product.
- Package and store any elements of the dessert product produced for next lesson.

### Lesson conclusion

- Reiterate the learning intentions.
- Explain to students that in the next lesson they will be completing the dessert and presenting it to the teacher.



## Lesson 11: Prepare and produce dessert (Part 2)

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The Western Australian Curriculum content addressed in this lesson is below.

### Contexts

#### Food specialisations

- Processing techniques and the preservation of food products, considering application of nutrition principles; ways sensory and physical properties of food influence the design, preparation and development of specialised food products

#### Technologies and society

- People consider social, ethical, sustainable and security factors to improve design and production systems using specialised technologies to achieve designed solutions
- Products, services and environments are designed and developed with consideration of specialised occupations, economic and environmental factors to identify market opportunities, innovate, create and develop entrepreneurial behaviours

#### Design thinking skills

#### Producing and implementing

- Select, justify, implement and test a range of technologies, techniques, and processes, to produce designed solutions and/or prototypes

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### Learning intentions

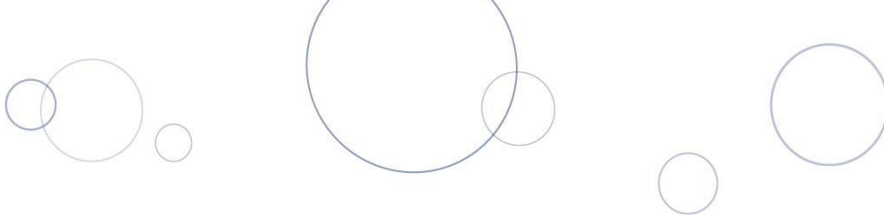
- Produce a dessert product for the chosen client/market group (one 3D-printed element must be included).
- Follow the time plan and use project management processes.
- Present the dessert, taking into consideration the sensory properties of food.

### Preparation for teacher

- Provide the *Proof is in the pudding* task instructions (Appendix B).
- Provide the required food materials and equipment.
- Organise suitable extrusion equipment, such as large syringes or piping bags with a fine nozzle.
- Optional: use a 3D printer if available.

### Teacher

- Outline the learning intentions.
- Remind students this is the final lesson to produce and present their product.
- Distribute the food order and time plan sheets to students.
- Guide students while they continue producing their dessert product.
- Instruct all students to photograph their finished dessert product.
- Advise students that once they have cleaned up their area, they may sample and review their dessert product.



### **Students**

- Follow the time plans and project management processes to continue producing their dessert product. This is the final lesson to complete the dessert production.
- Present their completed dessert product and photograph it.
- Once their work area is clean, students can sample and review their dessert product.

### **Lesson conclusion**

- Reiterate the learning intentions.
- As a class, review the production process. In pairs, students discuss with a partner one thing that went well during dessert production and one area for improvement.
- Explain to students that in the next lesson they will be completing the *Dessert evaluation* task (Appendix C).



## Lesson 12: Evaluation of dessert product

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The Western Australian Curriculum content addressed in this lesson is below.

### Contexts

#### Food specialisations

- Processing techniques and the preservation of food products, considering application of nutrition principles; ways sensory and physical properties of food influence the design, preparation and development of specialised food products

#### Design thinking skills

##### Evaluating

- Evaluate design processes and solutions against student-developed criteria
- 

#### Learning intentions

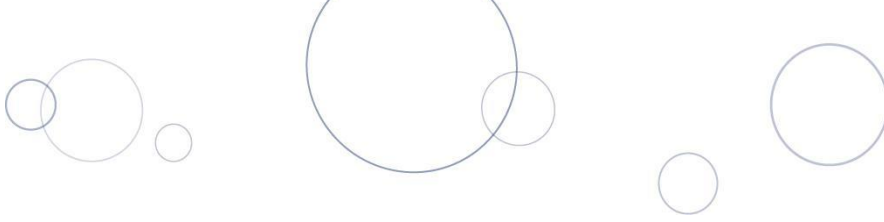
- Review the production processes from the previous lessons and evaluate the design processes and solution against student-developed criteria.

#### Preparation for teacher

- Provide printed or electronic copies of the *Dessert evaluation* (Appendix C) instructions.

#### Teacher

- Outline the learning intentions.
- Conduct a class discussion reviewing the production processes from the previous two lessons.
- Ask students to take photos of their completed dessert to aid in evaluation.
- Advise students they only have this lesson to complete their dessert evaluation.
- Students complete the following questions from the task.
  - State the two student-developed criteria from prior lessons. Justify whether your dessert meets the identified criteria. (4 marks)
  - Describe how the dessert product considers desirable sensory and physical properties of food. (2 marks)
  - Explain how the dessert product meets the needs of the chosen client/market group. What changes could you make to better suit the needs of the client/market group? (5 marks)
  - Identify the 3D-printed element included in the dessert and describe how this enhances the product. (3 marks)
  - Explain how sustainability was considered during the production of the dessert product. (3 marks)
  - Describe how project management skills were demonstrated during this task. (2 marks)
- Collect student responses for marking.



### **Students**

- Students review the production processes from the previous two lessons.
- Students complete *Dessert evaluation* task (Appendix C). Record answers electronically or on paper.
- Students to provide photo of their completed dessert.

### **Lesson conclusion**

- Reiterate the learning intentions.
- Collect completed evaluations and photos of the desserts from all students.





# Appendix A

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## Resources

## Appendix A: Resources

Lesson	Resource	Link/information
1	YouTube link Food Processing Technology (Overview)	<ul style="list-style-type: none"> <li>Mr Ruel Tuition – Food Processing Technology (Overview) <a href="https://youtu.be/JhFy_zi2Njg">https://youtu.be/JhFy_zi2Njg</a></li> </ul>
	YouTube link What is molecular gastronomy?	<ul style="list-style-type: none"> <li>Vsauce2 – What is molecular gastronomy? <a href="https://www.youtube.com/watch?v=vbvQIKzSmkQ">https://www.youtube.com/watch?v=vbvQIKzSmkQ</a></li> </ul>
	YouTube Channel MOLECULE-R	<ul style="list-style-type: none"> <li>MOLECULE-R – Home page <a href="https://www.youtube.com/channel/UCp4s0S6M-RTABo9vdCjt-5g">https://www.youtube.com/channel/UCp4s0S6M-RTABo9vdCjt-5g</a></li> </ul>
	YouTube link 3d-printing, future of food	<ul style="list-style-type: none"> <li>FT Rethink – Dinner is printed: is 3D technology the future of food?   Rethink <a href="https://www.youtube.com/watch?v=B0Ty6wgM8KE">https://www.youtube.com/watch?v=B0Ty6wgM8KE</a></li> </ul>
	YouTube link 3-D food printer makes dessert	<ul style="list-style-type: none"> <li>CNN Business – 3-D food printer makes dessert <a href="https://www.youtube.com/watch?v=XQni3wb0tyMGE">https://www.youtube.com/watch?v=XQni3wb0tyMGE</a></li> </ul>
	YouTube link 3D-printed fake meat	<ul style="list-style-type: none"> <li>France 24 English – 3D-printed fake meat: The healthier, greener future of food? <a href="https://www.youtube.com/watch?v=fLpeeUYtW94">https://www.youtube.com/watch?v=fLpeeUYtW94</a></li> </ul>
	Website Redefine Meat products	<ul style="list-style-type: none"> <li>Redefine Meat Ltd – Products <a href="https://www.redefinemeat.com/products/">https://www.redefinemeat.com/products/</a></li> </ul>
YouTube link 3D-printing with living organisms	<ul style="list-style-type: none"> <li>Dezeen – 3D-printing with living organisms “could transform the food industry” <a href="https://www.youtube.com/watch?v=sHsxDvt9mb8">https://www.youtube.com/watch?v=sHsxDvt9mb8</a></li> </ul>	
2	YouTube link 3D Printed Vegan Steak That Tastes Like Real Meat	<ul style="list-style-type: none"> <li>DW Food – 3D Printed Vegan Steak That Tastes Like Real Meat <a href="https://www.youtube.com/watch?v=238yRdb0niw">https://www.youtube.com/watch?v=238yRdb0niw</a></li> </ul>
	YouTube link 3-D food printer makes dessert	<ul style="list-style-type: none"> <li>CNN Business – 3-D food printer makes dessert <a href="https://www.youtube.com/watch?v=XQni3wb0tyMGE">https://www.youtube.com/watch?v=XQni3wb0tyMGE</a></li> </ul>
4	YouTube link 3D printing in cookie dough	<ul style="list-style-type: none"> <li>IDG.tv – 3D printing in cookie dough <a href="https://www.youtube.com/watch?v=JPg3U9R9tQ4">https://www.youtube.com/watch?v=JPg3U9R9tQ4</a></li> </ul>

Lesson	Resource	Link/information
5	YouTube link 3D printer that prints chocolate?!	<ul style="list-style-type: none"> <li>Localish – 3D printer that prints chocolate?!   Bite Size <a href="https://www.youtube.com/watch?v=uYLJRQBU_dI">https://www.youtube.com/watch?v=uYLJRQBU_dI</a></li> </ul>
	YouTube link 3D-printing with meringue video	<ul style="list-style-type: none"> <li>byFlow – 3D-printing with meringue <a href="https://www.youtube.com/watch?v=NalWHxZAS6c">https://www.youtube.com/watch?v=NalWHxZAS6c</a></li> </ul>
6	YouTube link Cakewalk 3D	<ul style="list-style-type: none"> <li>Best Crowdfunding Campaigns – Cakewalk 3D - a handy extruder for your own 3D printer <a href="https://www.youtube.com/watch?v=l3VLEh3kuY8">https://www.youtube.com/watch?v=l3VLEh3kuY8</a></li> </ul>
7	YouTube link This chef uses a 3D printer to create incredible cakes	<ul style="list-style-type: none"> <li>Insider Food – This chef uses a 3D printer to create incredible cakes <a href="https://www.youtube.com/watch?v=ILX-cVy-wq8">https://www.youtube.com/watch?v=ILX-cVy-wq8</a></li> </ul>
8	Website Anrich3D About	<ul style="list-style-type: none"> <li>Anrich3D – About <a href="https://anrich3d.wixsite.com/anrich3d/about">https://anrich3d.wixsite.com/anrich3d/about</a></li> </ul>
	YouTube link 3D Jelly printing	<ul style="list-style-type: none"> <li>Beets – 3D Jelly printing <a href="https://www.youtube.com/watch?v=OSUKC6VLFFA">https://www.youtube.com/watch?v=OSUKC6VLFFA</a></li> </ul>





## **Appendix B**

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Formative assessment task

Proof is in the pudding



## Task details

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<b>Title</b>	Proof is in the pudding
<b>Description</b>	Students will investigate and design a dessert product to demonstrate understanding of physical and sensory properties of food, processing techniques, preservation and presentation of food by creating a sophisticated design solution.
<b>Type of assessment</b>	Formative
<b>Purpose of assessment</b>	To assess students' application of design thinking skills when critiquing and creating solutions to meet the needs of the client/stakeholder
<b>Ways of assessing</b>	Observation, practical evidence, written work
<b>Evidence to be collected</b>	Options for students to individually present the tasks as a written response, video presentation, infographic or website/blog
<b>Suggested time</b>	Two one-hour lessons in class
<b>Differentiation</b>	Teachers should differentiate their teaching and assessment to meet the specific needs of their students, based on their level of readiness to learn and their need to be challenged. Where appropriate, teachers may either scaffold or extend the scope of the assessment task.

## Content descriptions

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### Food specialisations

- Processing techniques and the preservation of food products, considering application of nutrition principles; ways sensory and physical properties of food influence the design, preparation and development of specialised food products

### Design thinking skills

#### Project management

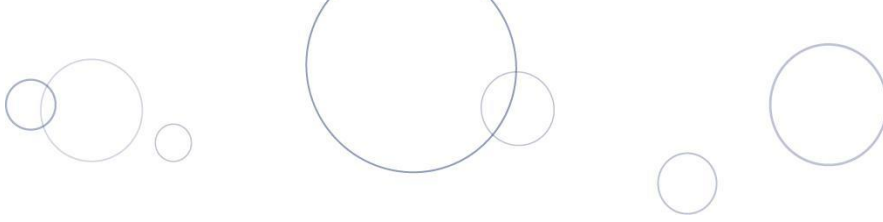
- Manage projects, using suitable technologies, with an agile and collaborative approach. Use project management processes to consider time, production processes, social, ethical, economic and sustainable factors, and legal responsibilities

#### Investigating and defining

- Ideate a problem and define the needs of the client/stakeholder through anecdotal evidence and/or data gathering techniques
- Develop a design brief for a solution or to innovate an existing product, service or environment
- Investigate a range of technologies, resources and/or components to develop ideas and solutions, with consideration of social and ethical factors, legal responsibilities and competing constraints

#### Designing

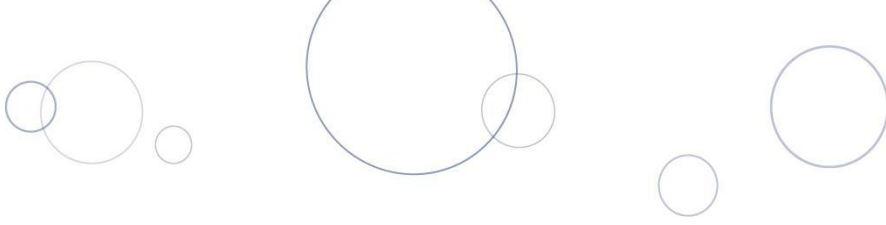
- Design alternative solutions considering available technologies, functionality, accessibility, usability and aesthetics, using appropriate technical terms



## **Prior learning**

Students have completed the previous lessons where they were provided with opportunities to learn the following syllabus content:

- physical and sensory properties of food
- identifying client/stakeholder needs
- food processing and preservation techniques
- application of nutrition
- preparation of specialised food products, such as 3D-printed food.



**Instructions to students**

**(Total 34 marks)**

As a food product designer, you have been tasked with the challenge of developing an innovative dessert product for a specific client/market group.

The dessert product should include one element that has been 3D printed and one preserved element, and should consider the sensory and physical properties of food.

You should use processes and skills developed in the previous lessons when completing this task.

You have two one-hour lessons in class.

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**Investigating and defining**

1. Explain the purpose of the task. (3 marks)

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2. Identify your chosen client/market group and describe the design features that need to be considered for this client. (3 marks)

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3. Describe considerations and constraints when selecting food materials for 3D printing. (2 marks)

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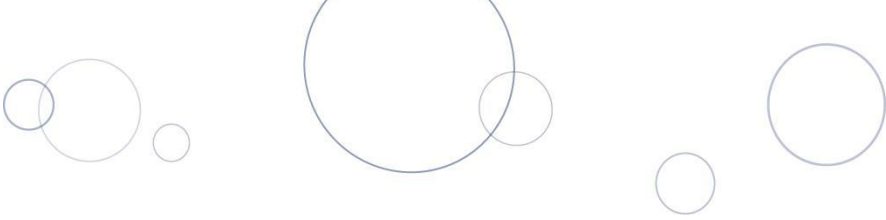
4. Describe the physical and sensory properties that need to be considered when designing a food product. (4 marks)

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5. Identify two methods of food preservation and describe how each method could be incorporated into the dessert product. (4 marks)

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**Designing**

- 1. Design two suitable desserts considering the task criteria, including functionality, accessibility, usability and aesthetics. (4 marks)
- 2. For each design, explain how it considers the criteria and the needs of the client/market group. (6 marks)
- 3. Select a design to produce. Justify the design selection against the needs of the client/stakeholder and the task criteria. (2 marks)

**Project management**

- 1. Create a detailed time plan that outlines the steps required to produce the dessert over two lessons. (3 marks)
- 2. Explain how social, ethical, economic and sustainable factors were considered during the production of the dessert. (3 marks)

## Marking key

Description	Marks
<b>Investigating and defining</b>	
<b>1. Explain the purpose of the task.</b>	
Explains the purpose of the task	3
Describes the purpose of the task	2
Outlines the purpose of the task	1
<b>Subtotal</b>	<b>/3</b>
<b>2. Identify your chosen client/market group and describe the design features that need to be considered for this client.</b>	
Identifies chosen client/market group	1
<b>Subtotal</b>	<b>/1</b>
Describes the design features that need to be considered for this client	2
Outlines the design features that need to be considered for this client	1
<b>Subtotal</b>	<b>/2</b>
<b>3. Describe considerations and constraints when selecting food materials for 3D printing.</b>	
Describes considerations and constraints when selecting food materials for 3D printing	2
Outlines considerations and constraints when selecting food materials for 3D printing	1
<b>Subtotal</b>	<b>/2</b>
<b>4. Describe the physical and sensory properties that need to be considered when designing a food product.</b>	
Describes the physical properties that need to be considered when designing a food product	2
Outlines the physical properties that need to be considered when designing a food product	1
<b>Subtotal</b>	<b>/2</b>
Describes the sensory properties that need to be considered when designing a food product	2
Outlines the sensory properties that need to be considered when designing a food product	1
<b>Subtotal</b>	<b>/2</b>

Description	Marks
<b>5. Identify two methods of food preservation and describe how each method can be incorporated into the dessert product.</b>	
Describes how a method of food preservation can be incorporated into the dessert product	2
Outlines how a method of food preservation can be incorporated into the dessert product	1
<b>Subtotal</b>	<b>/2</b>
Describes how a method of food preservation can be incorporated into the dessert product	2
Outlines how a method of food preservation can be incorporated into the dessert product	1
<b>Subtotal</b>	<b>/2</b>
<b>Investigating and defining total</b>	<b>/16</b>
<b>Designing</b>	
<b>1. Design two suitable desserts considering the task criteria, including functionality, accessibility, usability and aesthetics.</b>	
<b>Design 1</b>	
Considers task criteria in design, including functionality, accessibility, usability and aesthetics	2
Considers some task criteria in design	1
<b>Subtotal</b>	<b>/2</b>
<b>Design 2</b>	
Considers task criteria in design, including functionality, accessibility, usability and aesthetics	2
Considers some task criteria in design	1
<b>Subtotal</b>	<b>/2</b>
<b>2. For each design, explain how it considers the criteria and the needs of the client/market group.</b>	
<b>Design 1</b>	
Explains how the design considers the criteria and the needs of the client/market group	3
Describes how the design considers the criteria and the needs of the client/market group	2
Outlines how the design considers the criteria and the needs of the client/market group	1
<b>Subtotal</b>	<b>/3</b>

Description	Marks
<b>Design 2</b>	
Explains how the design considers the criteria and the needs of the client/market group	3
Describes how the design considers the criteria and the needs of the client/market group	2
Outlines how the design considers the criteria and the needs of the client/market group	1
<b>Subtotal</b>	<b>/3</b>
<b>3. Select a design to produce. Justify the design selection against the needs of the client/stakeholder and the task criteria.</b>	
Justifies how the design selection meets the needs of the client/stakeholder and the task criteria	2
Partially justifies how the design selection meets the needs of the client/stakeholder and the task criteria	1
<b>Subtotal</b>	<b>/2</b>
<b>Designing total</b>	<b>/12</b>
<b>Project management</b>	
<b>1. Create a detailed time plan that outlines the steps required to produce the dessert over two lessons.</b>	
Develops a detailed time plan that outlines all the steps required to produce the dessert	3
Develops a time plan that outlines most of the steps required to produce the dessert	2
Develops a time plan that outlines some of the steps required to produce the dessert	1
<b>Subtotal</b>	<b>/3</b>
<b>2. Explain how social, ethical, economic and sustainable factors were considered during the production of the dessert.</b>	
Explains how social, ethical, economic and sustainable factors were considered during the production of the dessert	3
Describes how social, ethical, economic and sustainable factors were considered during the production of the dessert	2
Outlines how social, ethical, economic and sustainable factors were considered during the production of the dessert	1
<b>Subtotal</b>	<b>/3</b>
<b>Project management total</b>	<b>/6</b>
<b>Total</b>	<b>/34</b>



## Appendix C

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Summative assessment task

Dessert evaluation



## Task details

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<b>Title</b>	Dessert evaluation
<b>Description</b>	After producing the dessert product designed in the <i>Proof is in the pudding</i> task, students will evaluate the design process and end product. The design process will be evaluated against student-developed criteria.
<b>Type of assessment</b>	Summative
<b>Purpose of assessment</b>	To assess students' evaluation skills
<b>Ways of assessing</b>	Evaluation, written work
<b>Evidence to be collected</b>	Written responses, sketches, observations and photos
<b>Suggested time</b>	One-hour lesson, in class
<b>Differentiation</b>	Teachers should differentiate their teaching and assessment to meet the specific needs of their students, based on their level of readiness to learn and their need to be challenged. Where appropriate, teachers may either scaffold or extend the scope of the assessment task.

## Content descriptions

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### Food specialisations

- Processing techniques and the preservation of food products, considering application of nutrition principles; ways sensory and physical properties of food influence the design, preparation and development of specialised food products

### Design thinking skills

#### Evaluating

- Evaluate design processes and solutions against student-developed criteria

## Task preparation

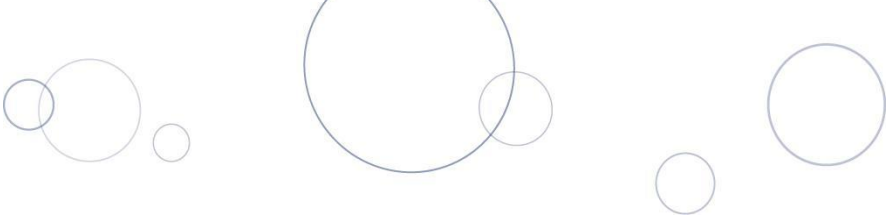
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### Prior learning

Students have completed the previous set of lessons and formative assessment.

Students have been provided with opportunities to learn the following syllabus content:

- physical and sensory properties of food
- identifying client/stakeholder needs
- food processing and preservation techniques
- application of nutrition
- preparation of specialised food products, such as 3D-printed food.



**Instructions for students**

Evaluate the design processes and solution against student-developed criteria.

You may refer to photos of your dessert to assist you when responding to some of the questions.

Answer the following questions individually. You have one hour in class under test conditions.

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**Evaluation** **(Total 19 marks)**

- 1. State the two student-developed criteria from prior lessons. Justify whether your dessert meets the identified criteria. (4 marks)

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- 2. Describe how the dessert product considers desirable sensory and physical properties of food. (2 marks)

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- 3. Explain how the dessert product meets the needs of the chosen client/market group. What changes could you make to better suit the needs of the client/market group? (5 marks)

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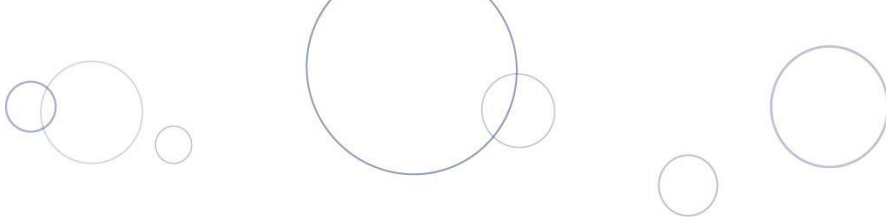
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4. Identify the 3D-printed element included in the dessert and describe how this enhances the product. (3 marks)

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5. Explain how sustainability was considered during the production of the dessert product. (3 marks)

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6. Describe how project management skills were demonstrated during this task. (2 marks)

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## Marking key

Description	Marks
<b>1. List the two student-developed criteria from prior lessons. Justify whether your dessert meets the identified criteria.</b>	
Lists two suitable student-developed criteria	2
Lists one suitable student-developed criteria	1
<b>Subtotal</b>	<b>/2</b>
Justifies clearly whether the dessert meets the identified criteria	2
Partially justifies whether the dessert meets the identified criteria	1
<b>Subtotal</b>	<b>/2</b>
<b>2. Describe how the dessert product considers desirable sensory and physical properties of food.</b>	
Describes how the dessert product considers desirable sensory and physical properties of food	2
Outlines how the dessert product considers desirable sensory and physical properties of food	1
<b>Subtotal</b>	<b>/2</b>
<b>3. Explain how the dessert product meets the needs of the chosen client/market group. What changes could you make to better suit the needs of the client/market group?</b>	
Explains how the dessert product meets the needs of the chosen client/market group	3
Describes how the dessert product meets the needs of the chosen client/market group	2
Outlines how the dessert product meets the needs of the chosen client/market group	1
<b>Subtotal</b>	<b>/3</b>
Identifies two changes that can be made to better suit the needs of the client/market group	2
Identifies one change that can be made to better suit the needs of the client/market group	1
<b>Subtotal</b>	<b>/2</b>
<b>4. Identify the 3D-printed element included in the dessert and describe how this enhances the product.</b>	
Identifies the 3D-printed element included in the dessert	1
<b>Subtotal</b>	<b>/1</b>
Describes how the 3D-element enhances the product	2
Outlines how the 3D-element enhances the product	1
<b>Subtotal</b>	<b>/2</b>

Description	Marks
<b>5. Explain how sustainability was considered during the production of the dessert product.</b>	
Explains how sustainability was considered during the production of the dessert product	3
Describes how sustainability was considered during the production of the dessert product	2
Outlines how sustainability was considered during the production of the dessert product	1
<b>Subtotal</b>	<b>/3</b>
<b>6. Describe how project management skills were demonstrated during this task.</b>	
Describes how project management skills were demonstrated during this task	2
Outlines how project management skills were demonstrated during this task	1
<b>Subtotal</b>	<b>/2</b>
<b>Total</b>	<b>/19</b>



