

Nutrition & Food Science

Teaching & Learning Guide



Ministry of Education
SINGAPORE

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INTRODUCTION

The design of the Nutrition and Food Science (NFS) syllabus takes into account the changing social and economic landscape in Singapore, new lifestyles and technological advancements that lead to the introduction of new ideas and food products. With lifestyle changes, self-management through knowledge of basic nutrition and attitude towards physical activities have direct impact on one's health. Technological advancements in food science address national concerns with food security. Therefore, knowledge and skills in NFS are important as they prepare our students to thrive in a future driven by globalisation and technological advances.

The NFS curriculum is aligned with the Desired Outcomes of Education (DOE) and remains relevant in today's context. It aims to nurture concerned citizens who take an active role in bettering the lives of those around them through their knowledge in nutrition and health, food literacy and food science. With increased life expectancy, good health through selection and consumption of nutritious food is crucial. Through sound meal-planning or food selection for themselves and their family members, students act as advocates to those around them to combat Singapore's increasing prevalence of diet-related health problems (such as obesity, coronary heart diseases and hypertension)¹.

Food security is of concern for Singapore as the nation imports more than 90% of its food²². Food literacy and food science are key to the development and acquisition of appropriate food commodities that will provide sustainable, safe and healthier food products for the nation. Through application of food science knowledge in experimentation with recipes to improve the sensory and nutritional qualities of food products, students are able to become active contributors by developing innovative food products that are nutritious, sustainable and yet affordable (e.g., plant-based protein food such as tofu nuggets).

Food literacy will allow students to be confident individuals who are able to make discerning judgement and think critically in a society where there is an increase in demand for convenience food due to busy lifestyles. For example, selecting convenience foods that are healthier such as canned tuna in water with a reduced sodium content as compared to canned curry tuna that is high in fats and salt. Students will also take responsibility for their own learning through assignment of self-directed authentic tasks, for example, to conduct their own investigation on the ways to reduce the amount of food waste generated in the school canteen to promote food sustainability.

¹ https://www.moh.gov.sg/content/moh_web/home/statistics/Health_Facts_Singapore.html

² <https://www.todayonline.com/singapore/big-read-far-peoples-minds-food-security-looming-issue>

Value of Nutrition and Food Science Curriculum

The study of NFS is important as it builds a strong foundation in understanding the link between nutrition and good health, whereby students will be cognisant of making informed food choices. Students will also be able to apply food science principles in the area of food preparation and cooking in creating healthier food products. At the same time, food sustainability issues in Singapore will be introduced in the syllabus to create awareness of the nation's concern on food security.

Develops Food Literacy and Promotes Health. NFS aims to equip students with essential knowledge and skills on food literacy, developing them to be discerning individuals in selecting food commodities that are suitable for preparing healthier yet palatable dishes. With these knowledge and skills, they will be able to plan balanced meals for themselves and their families which may reduce the risk of potential diet-related health problems.

Promotes Consumer Education. In a fast-paced society with a variety of easily available food choices, it is important for Singaporeans to be discerning in their food choices and be aware of food safety issues that plague consumers globally. Hence, this curriculum aims to prepare students to be discerning consumers who can make informed decisions in an increasingly sophisticated consumer landscape (e.g., to select food from reliable sources).

Develops Capability in Food Sustainability. Food science plays an important role in Science, Technology, Engineering and Math (STEM) field dealing with issues such as food sustainability and food security. These are key areas of concern that Singapore faces while we seek to stay resilient in terms of making sure that there is a sustainable supply of food in Singapore. Through the NFS curriculum, students will gain knowledge on food security in Singapore, choose food from sustainable sources and do their part in reducing food wastage.

Promotes Food Innovation through Food Science. Early introduction to food science education in the NFS curriculum could interest students to explore the possibilities of joining the growing food industry³. The Food Manufacturing Transformation Map aims to have an average productivity growth of 4.5% and to create 2000 jobs by 2020, with Singapore as a leading food and nutrition hub in Asia by 2025⁴. With food science and technology gaining importance in the manufacturing sector, food companies in Singapore are investing in research and development to develop innovative food products to capture new markets in a sustainable manner.

³ In the food manufacturing sector in 2013, there were 844 food-related establishments, and these accounted for 0.7% of Singapore's Gross Domestic Contribution with a value-add of \$2,828 million. Source: Economic Development Board & SPRING Singapore (2013)

⁴ <https://www.enterprisesg.gov.sg/industries/type/food-manufacturing/industry-profile>

Nutrition and Food Science in the 21st Century

The NFS curriculum offers opportunities for students to develop 21st Century Competencies (21CC) as illustrated by the following examples:

- a) ***Civic, Global and Cross-cultural Literacy.*** Students will learn how to plan meals that meet the needs of different groups of people around them, for instance, understanding dietary restrictions of different cultures, religions or managing meals for people with allergies.
- b) ***Communication, Collaboration and Information Skills.*** Students will have opportunities to work in groups and collaborate in assignments that hone these skills. For example, advocating sustainability when making food choices through designing a brochure where students will hone their communication, collaboration and information gathering skills through the process.
- c) ***Critical, Adaptive and Inventive Thinking.*** Students will have the opportunities for experiential learning in the form of the sensory evaluation process during practical lessons. These practical lessons develop students to reflect and think critically about the strengths and weaknesses of the dishes they have prepared, so as to identify areas for improvements. For example, when the spaghetti in a pasta dish is too chewy for the elderly, the student may brainstorm solutions to improve the outcome of the dish to suit the elderly.

Framework and Big Ideas in NFS curriculum

The design of the NFS syllabus is guided by the NFS Education Framework. This framework is conceptualised around three student outcomes: **Health Ambassador**, **Discerning Consumer** and **Food Innovator**, which stem from the value-proposition of the subject.

The middle ring shows the three main attitudes: **Appreciate**, **Advocate** and **Apply**, which the curriculum should be anchored upon. The main strands of the subject, Nutrition & Health, Food Literacy & Consumer Literacy and Food Science were included in the framework to guide the overarching content.



Figure 1: NFS Education Framework

The table below provides an elaboration of the student outcomes:

Table 1. Elaboration of NFS Student Outcomes

Health Ambassador	Advocate nutrition and health for self, family and the community.
Discerning Consumer	Appreciate how a variety of food is used in food management and take into consideration the issue of food security, which includes food safety and sustainable food consumption.
Food Innovator	Apply scientific principles during food preparation and cooking.

The focus of each strand is elaborated below:

- a) **Nutrition and Health.** Topics provide the foundation for students to understand the importance of good nutrition and its relationship to various diet-related health problems. This helps them select and prepare nutritious food for consumption to support proper growth and good health.
- b) **Food Literacy.** Topics provide fundamental concepts for developing a discerning person capable of planning a balanced meal and making responsible decisions in sustainable food selection for self and others. The introduction to 'Sustainable Food Consumption' is a first step to educate students on how they can play an active role in practising sustainability during meal planning and food preparation. *(NB: Consumer Literacy only applies to lower secondary Food & Consumer Education)*
- c) **Food Science.** Students can use their knowledge in culinary food science covered in this strand to innovate food products that are nutritious, appealing and sustainable. It equips students with knowledge to apply food science concepts learnt in food preparation and cooking, such as understanding the functions of sugar (tenderising agent in baked products) to determine the minimum amount of sugar to make a tender savoury cupcake that contains lesser sugar and yet appealing to a diabetic adult.

As NFS students understand the concepts learnt in the curriculum, they will have the opportunities to apply scientific principles during food preparation and cooking. They also learn to appreciate the importance of using a variety of food commodities in food management and the issues of food security, including food safety and sustainable food consumption. In this way, they will also be able to advocate nutrition and health for self, family and the community, thereby achieving the student outcomes of a health ambassador, a discerning consumer and a food innovator.

The big ideas of the subject can be found in Table 2 as follows:

Table 2. NFS Big Ideas

Nutrition & Health

- Right amounts of nutrients are essential for proper growth and development.
- Excessive or deficiency in nutrient intake can lead to diet-related health problems.

Food Literacy & Consumer Literacy

- A balanced diet is achieved through proper meal planning.
- Appropriate food choices contribute to sustainable food consumption.
- Good money management habits help to build savings and meet needs and wants.⁵
- A discerning consumer makes informed decisions for self, family and the community.

Food Science

- Food will deteriorate in quality if not handled or stored properly.
- Sensory qualities of food are altered during preparation and cooking.
- Application of food science principles can culminate in unlimited combination of food possibilities that can meet human nutritional needs.

⁵ Only applicable to lower secondary Food & Consumer Education

Effective Teaching and Learning

The key features of any curriculum include **Content**, **Pedagogy** and **Assessment**.

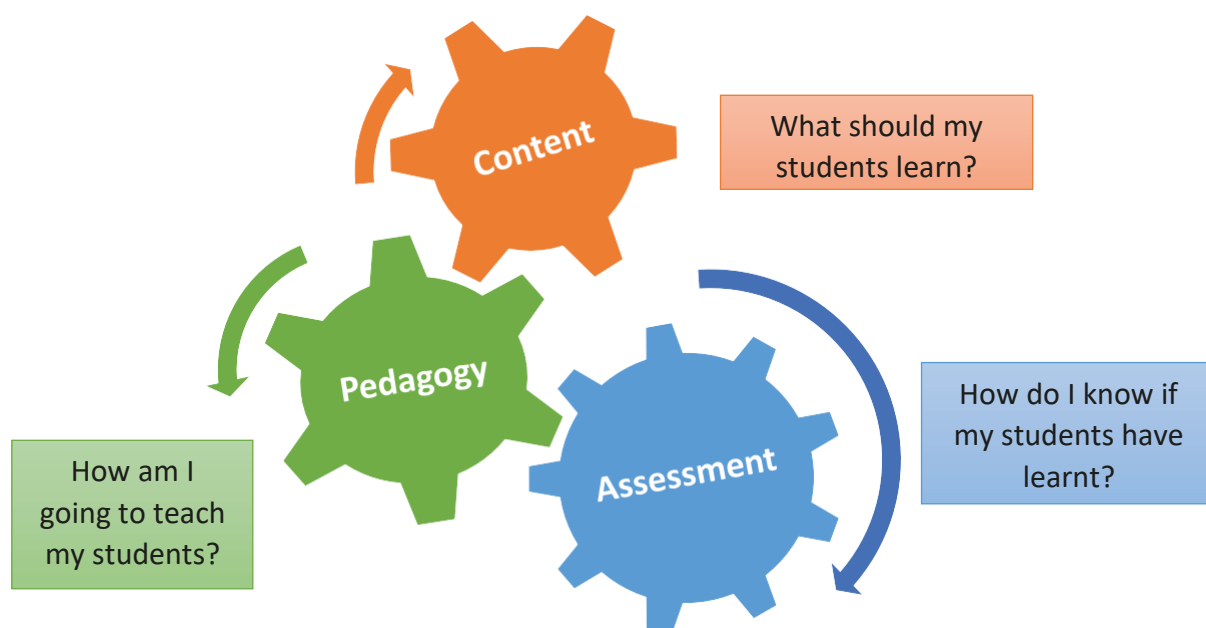


Figure 2: Key Features of Curriculum

Figure 2 shows the fundamental questions that every teacher should ask for teaching and learning to take place in the classroom. Teachers could use appropriate strategies to stretch students' thinking and learning. This Teaching and Learning Guide (TLG) provides key pointers for engaging students in effective learning. There are three main sections in the guide:

CONTENT | PLANNING THE CURRICULUM

This section looks at the aims of the syllabus, guidelines for planning schemes of work, and management of curriculum time.

PEDAGOGY | DELIVERING THE CURRICULUM

This section provides information on some teaching approaches and strategies that are central in ensuring effective learning and teaching to take place. Lesson examples that promote student-centred learning are provided for reference.

ASSESSMENT | ASSESSING THE LEARNING

This section discusses the principles, modes and format of assessment, both formative and summative.

1. CONTENT | PLANNING THE CURRICULUM

1.1 Planning an Effective NFS Curriculum

Syllabus Aims

The NFS syllabus provide students with a broad understanding of concepts in nutrition and health, food literacy and principles of food science. Students will be exposed to authentic real-world contexts through hands-on practical and coursework. Through these learning experiences, the syllabus aims to develop students to:

- lead a healthier lifestyle proactively through proper diet and nutrition;
- advocate sustainable food consumption by planning and making appropriate food choices; and
- apply principles of culinary science creatively in food preparation and cooking.

Overview of Content Structure

The NFS syllabus content comprises three strands, Nutrition and Health, Food Literacy and Food Science. An overview of the organisation of the syllabus content is presented in [Table 3](#).

Table 3. Content Structure NFS Syllabus (O and N(A) Levels)

Strands	Topics	Description
Nutrition and Health	Nutrients	This strand is about the importance of macronutrients, micronutrients, water and dietary fibre in the diet and their relationship to health. As such, students can become advocates <u>for proper nutrition and health</u> .
	Diet and Health	
Food Literacy	Food Management	This strand focuses on the factors to consider when planning meals for various groups of people. It also covers content knowledge on sustainable food consumption. This strand develops students to be discerning consumers <u>who make appropriate food choices</u> .
	Smart Consumer	
Food Science	The Science in Food Preparation	This strand covers topics such as the reasons for cooking food, and the science behind food preparation and cooking. Having basic knowledge in food science can foster students to be inquisitive in innovating food products.
	Reactions in Food During Preparation and Cooking	
	Sensory Evaluation of Food	

Managing Curriculum Time

The NFS syllabus spans across a two-year period with a total of 46 and 43 curriculum weeks⁶ for O and N(A) levels respectively. It is recommended that schools allocate a minimum of five periods (about 35-40 minutes per period) of NFS lessons per week. To make learning meaningful, the lesson content could consist of three consecutive periods of practical and two periods of theory per week. In addition, content could also be taught through the coursework task in Secondary Three.

Table 4. Curriculum Time

Level	No. of weeks	Duration
Secondary 3 & 4 - O level	46	a minimum of 5 periods (175 – 200 minutes)
Secondary 3 & 4 - N(A) level	43	

Planning the Scheme of Work (SOW)

Content is the *knowledge, skills and attitudes* that lead to the achievement of the goals.

The following are some factors to consider when determining content:

Table 5. Factor to Consider when Determining Content

Scope	Breadth and depth of coverage
Sequence	Logical ordering of content within and across levels
Students' readiness	Matching of content with students' readiness and prior knowledge
Coherence	Holding the content together in a meaningful way (e.g., through the use of big ideas and essential questions using the Understanding by Design (UbD) approach)
Balance	Distribution of content across the levels in terms of amount and quality

A scheme of work (SOW) breaks down the yearly plan for execution of syllabus into weekly operational plans. When planning the SOW, the teacher should be familiar with the syllabus content, learning outcomes, teaching strategies, available resources and key educational initiatives.

Coursework process skills should be integrated into the SOW as the skills need to be built up. Short activities could be weaved into theory and practical lessons to give students opportunities to acquire different coursework process skills and encourage self-directed learning.

⁶ This is after deducting time needed for school events, examinations and WAs, but includes time for white space.

A regular review of the SOW (e.g., on a half-yearly or yearly basis) should be conducted to ensure that the instructional programme is effective in meeting students' needs.

A proposed Teaching and Learning Plan (T&L Plan) to aid teachers in planning the SOW for the implementation of the syllabus can be found in Annex A. The proposed T&L plan was designed with students' learning needs in mind. It comprises learning activities, culinary food science practical sessions and coursework skills that should be taught within the stipulated curriculum weeks. The learning activities allow students to construct knowledge actively and encourage the development of thinking skills and disposition. Most food commodities, food science reactions, methods of cooking and culinary skills are also included in the proposed plan.

Teachers may adapt or modify these proposed lessons in their SOW to cater to the profile of their students, keeping in mind that NFS lessons should have the following characteristics:

- engage students and motivate them to learn beyond classroom activities
- state clearly the learning outcomes for the topic
- teach the essential NFS concepts and skills
- infuse thinking skills, 21st century competencies and National Education messages
- consider the desired outcomes of education
- use suitable ICT tools to enable learning whenever possible/necessary
- use a variety of resources, e.g., videos, picture cards, food models, to deliver learning
- use of Assessment for Learning (AfL) to check students' understanding and provide opportunities to address students' learning gaps

1.2 Designing NFS lessons

Understanding by Design

There are a number of approaches to designing a meaningful curriculum that brings about effective learning. Understanding by Design (UbD) is a curriculum design approach developed by Grant Wiggins and Jay McTighe. Teachers can use this approach to help them clarify the learning outcomes, develop meaningful assessments, and plan effective learning activities for student understanding.

The UbD approach is made up of a three-stage process called “backward design” where the learning outcomes are established, and assessment modes developed, before the classroom activities are planned. These stages do not have to be completed in a linear manner but the outcomes, assessment modes, and learning experiences should be linked.

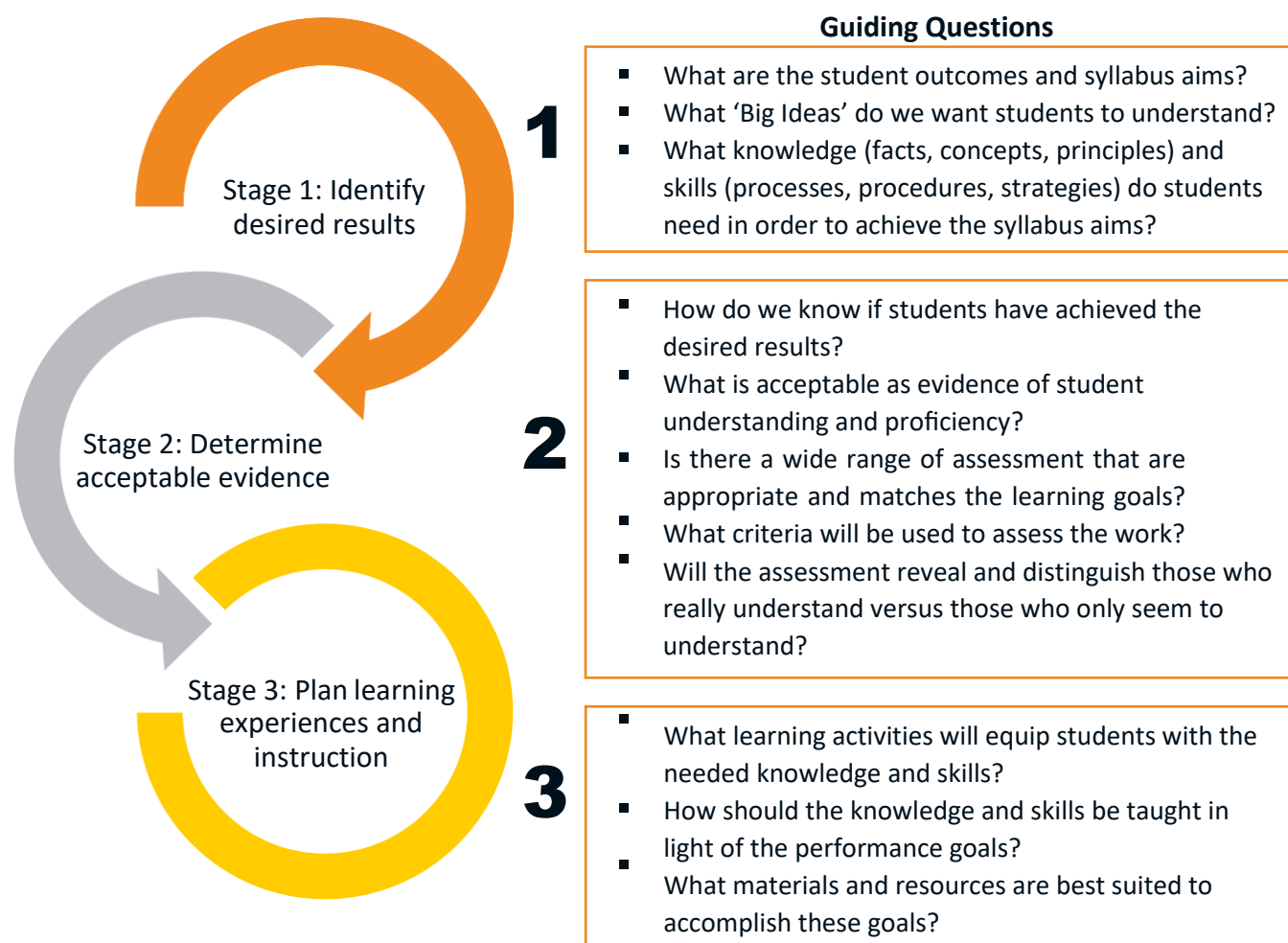


Figure 3: Understanding by Design Model

The UbD model⁷ is useful to keep teachers focused on the learning outcomes when planning lessons that emphasise student creativity, engagement and trigger students' critical thinking. This backward planning process helps avoid the common problems of treating the textbook as the curriculum rather than as a resource, and activity-oriented teaching in which no clear priorities and purposes are set.

Teachers are coaches of understanding, not mere distributors of content knowledge, skill, or activity. They focus on ensuring that learning happens, not just teaching (and assuming that what was taught was learnt); they always aim and check for successful meaning making and transfer of knowledge by the learner. The idea is to teach towards deep understanding rather than a shallow overview of the content. For instance, when covering the topic on fats, instead of just focusing on the definition and types of fats, students should also understand the role of fats and its effect on health and be able to make dietary modifications to suit individual needs.

⁷ Adapted from:

https://www.ascd.org/ASCD/pdf/siteASCD/publications/UbD_WhitePaper0312.pdf
<https://cft.vanderbilt.edu/cft/guides-sub-pages/understanding-by-design/>

2. PEDAGOGY | DELIVERING THE CURRICULUM

2.1 The Singapore Curriculum Philosophy

The Singapore Curriculum Philosophy (SCP) guides teachers to think about the teaching and learning of the curriculum, while placing our students' interest at heart.

The beliefs of SCP are:

- 1) We believe in holistic education.
- 2) We believe that every child wants to learn and can learn. We focus on students' learning needs when designing learning experiences.
- 3) We believe that learning flourishes:
 - in caring and safe environments,
 - when students construct knowledge actively,
 - through the development of thinking skills and dispositions, and
 - when assessment is used to address students' learning gaps.

NFS teachers should use these beliefs when designing and implementing lesson ideas to enhance the learning experiences of students. This can help students find more meaning and make connections in the knowledge and skills gained through the curriculum.

Pedagogical Considerations

Learner-centred approaches that involve students in doing and evaluating their work support the applied learning nature in the NFS syllabus. Inquiry-Based Learning (IBL), Collaborative Learning (CoL), and Experiential Learning (ExL) are examples of strategies that are learner-centred. These strategies allow students to think deeply and foster learning, thus helping students construct and retain knowledge better.

Adapting IBL in the teaching and learning of NFS requires students to evaluate their findings from food science experiments to determine appropriate types and quantity of ingredients, optimum temperature or preparation time to produce the best outcome for the food products.

CoL in a NFS classroom encourages students to work together to make connections of the knowledge acquired across the different topics to solve a real-life problem. An example is the task of planning meals for an elderly who is lactose intolerant; in order to prevent osteoporosis, students will need to plan meals that are rich in calcium and yet lactose-free. Students can form expert groups, conduct research, collaborate and share survey findings to suggest appropriate dishes to meet the nutritional needs of the elderly.

In ExL, students can collaborate with one another and have active conversation during practical lessons to discuss ways to modify recipes to make dishes healthier; improve quality of the dishes; and promote sustainability.

Students will be motivated when they are engaged in their learning through meaningful authentic tasks as such tasks will allow students to construct their own knowledge and develop thinking skills. These take place when students generate explanation, elaborate and/or reflect on the outcomes of their work with their teachers as facilitators.

Teaching Processes

The Singapore Teaching Practice (STP)⁸ is a model that shows explicitly how effective teaching and learning can be achieved in our Singapore classrooms. One of the components of the STP, the Pedagogical Practices, comprises four Teaching Processes that outline what teachers ought to reflect on and put into practice before, during and after their interactions with students in all learning contexts.

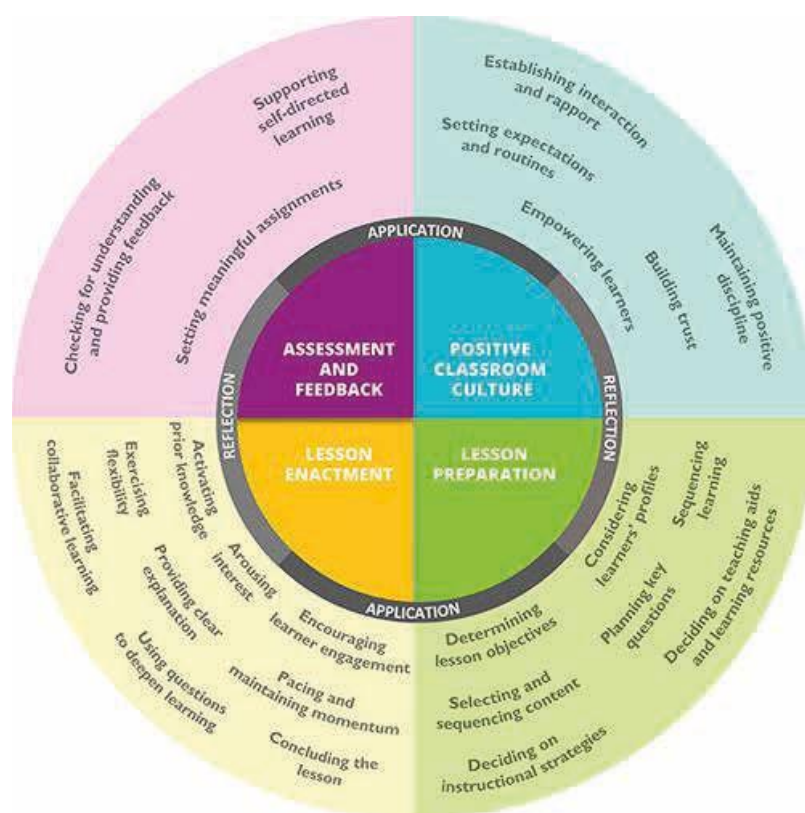


Figure 4: Pedagogical Practices

As we value every student as an individual with diverse learning needs, experiences, beliefs, knowledge and skills, there is a need to customise and adapt the enactment of the Teaching Areas and Teaching Actions. Each Teaching Area includes a set of important considerations or Teaching Actions that help enact it.

⁸ For more information on STP, refer to the STP website (<https://opal.moe.edu.sg/STP>).

Table 6 presents the four Teaching Processes which are further expanded into 24 Teaching Areas:

Table 6. Teaching Areas

Assessment and Feedback	Positive Classroom Culture
<ul style="list-style-type: none"> • Checking for understanding and providing feedback • Supporting self-directed learning • Setting meaningful assignments 	<ul style="list-style-type: none"> • Establishing interaction and rapport • Maintaining positive discipline • Setting expectations and routines • Building trust • Empowering learners
Lesson Enactment	Lesson Preparation
<ul style="list-style-type: none"> • Activating prior knowledge • Arousing interest • Encouraging learner engagement • Exercising flexibility • Providing clear explanation • Pacing and maintaining momentum • Facilitating collaborative learning • Using questions to deepen learning • Concluding the lesson 	<ul style="list-style-type: none"> • Determining lesson objectives • Considering learners' profiles • Selecting and sequencing content • Planning key questions • Sequencing learning • Deciding on instructional strategies • Deciding on teaching aids and learning resources

As we value every student as an individual with diverse learning needs, experiences, beliefs, knowledge and skills, there is a need to customise and adapt the enactment of the Teaching Areas and Teaching Actions. Each Teaching Area includes a set of important considerations or Teaching Actions that help enact it.

Table 7 provides some examples of Teaching Areas of the STP and specific examples that could be used in the NFS classrooms.

Table 7. Examples of NFS lessons using STP Teaching Areas and Actions

Teaching Area	Teaching Action	Lesson Example
Activating prior knowledge / Facilitating collaborative learning	<p>Teaching Action 1: Think-Pair-Share</p> <p>Students consider a question on their own before discussing with their peers. This way, they learn from one another to deepen their understanding and application of their learning when given such opportunities.</p>	<p>Teacher: Sugar adds sweetness to cakes; gives pleasant aroma to cakes; improve the tenderness of cakes. So, does it mean that the quality of cakes would improve if I add more sugar? Think about your response and share it with your table partner.</p> <p>As students are sharing, the teacher can walk around to listen to their discussion and get two to three pairs to share their discussion.</p> <p>The teacher then get students to conduct an investigation on how sugar affects the quality of cakes.</p>
Arousing interest	<p>Teaching Action 1: Using Stories and Images</p> <p>The use of stories and images can help students make connection to theory and real-life context. This could trigger students to explore the content and deepen their understanding of the topic(s).</p> <p>Real-life examples and real-world problems could be presented to students to allow them to discuss, identify problems and provide possible solutions.</p>	<p>A case study on hygiene lapses by food operators can be shared with students. Teachers can open the discussion to the class or get students to work together to answer questions related to food safety and discuss the importance of keeping food safe (ethical issue).</p> <p>To further engage students, teachers could get students to:</p> <ul style="list-style-type: none"> - share with the class ways in which food safety can be practiced using a jingle - create a video advertisement on how to reduce risks of food safety <p>**Articles from the following sources could be considered:</p> <ul style="list-style-type: none"> • The Straits Times • Ministry of Health • National Environment Agency • Singapore Food Agency

Teaching Area	Teaching Action	Lesson Example
Encouraging learner engagement	<p>Teaching Action 2: Engage, Explore, Apply</p> <p>When students are involved in authentic tasks and are able to connect what they have learnt, they will be more motivated to complete the tasks.</p>	<p>Task: Your manager has tasked you to look into the sponge cake recipe and improve on it as the sales team at Bakes Bakery received feedback from customers that the sponge cakes were not fluffy.</p> <p>Engage:</p> <ul style="list-style-type: none"> - Teacher to provide the “troubled” sponge cake recipe to the students - Students to discuss the possible reasons for a non-fluffy sponge cake (key ingredients and procedures) <p>Explore:</p> <ul style="list-style-type: none"> - Teacher to group students into smaller groups to carry out research on the possible solutions - Students to modify the recipe based on their research <p>Apply:</p> <ul style="list-style-type: none"> - Students to carry out the practical, evaluate and explain the sensory outcomes of the products
Facilitating collaborative learning	<p>Teaching Action2: Jigsaw</p> <p>Working together to complete a shared goal maximises students’ learning. In the process of accomplishing the given goal, students search for solutions together and make sense of the information as a group. Such learning experiences allow them to deepen their understanding of the concept learnt.</p>	<p>Task: Plan and prepare three interesting dishes for an active teenager who is a vegan.</p> <p><u>Instruction:</u></p> <ol style="list-style-type: none"> 1. Form home groups of four and name each student “A”, “B”, “C”, and “D” 2. Form expert groups, e.g., all “A” students to research on “vegan” (“B” students on “active teenagers”, “C” students on “meal planning” and “D” students on “interesting dishes”) 3. Experts then share what they have learnt and discussed in their expert group to their home group members 4. Completion of task by home group by planning and preparing interesting dishes for an active vegan teenager

2.2 Framework for 21st Century Competencies and Student Outcomes

The NFS syllabus is designed to prepare students for the 21st Century. The development of 21st Century Competencies (21CC) is inherent in the content, learning process and assessment tasks of the syllabus. NFS provides an important platform in preparing students to live in a world marked by changing lifestyles, globalisation and consumer patterns. The Framework for 21CC and Student Outcomes is shown in Figure 5 below.

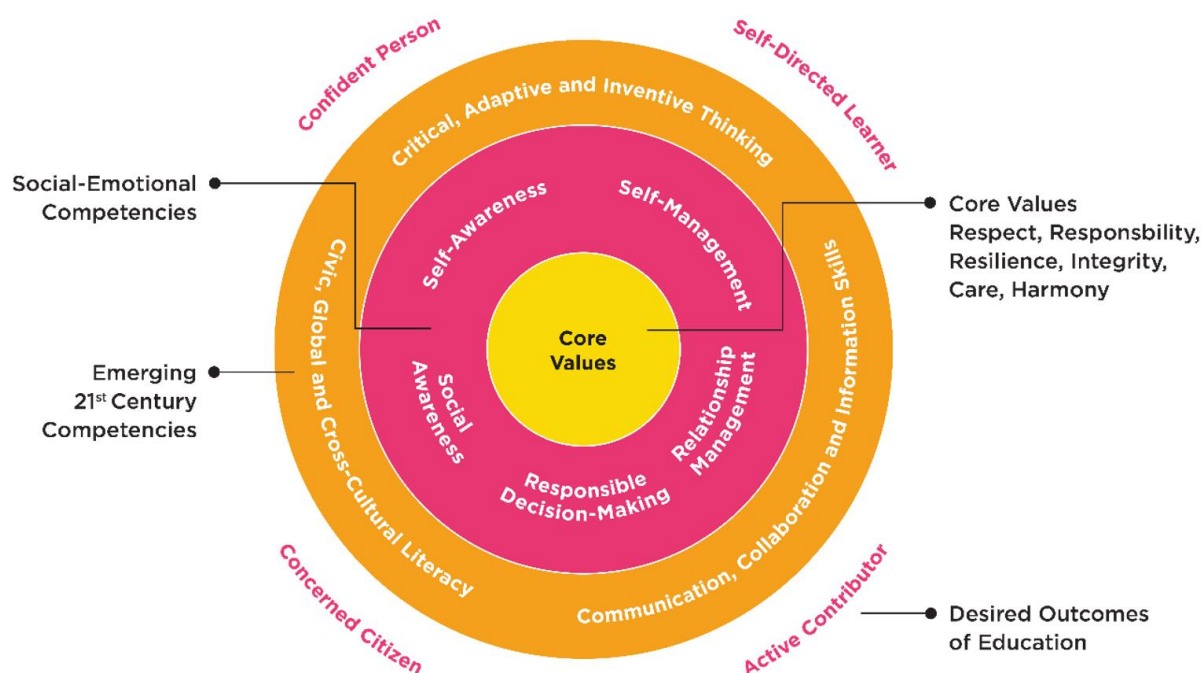


Figure 5: Framework for 21st Century Competencies and Student Outcomes

Table 8 shows how the NFS syllabus correspond to the corresponding 21CC developmental milestone for upper secondary⁹.

⁹ Information taken from MOE's Framework for 21st Century Competencies and Student Outcomes
<https://intranet.moe.gov.sg/21CCO/Pages/21st-Century-Competencies.aspx>

Table 8. Knowledge, Skills and Attitudes in NFS and the Corresponding Developmental Milestone

Knowledge, Skills and Attitudes in NFS	Corresponding 21CC Developmental Milestone
Civic, Global and Cross-cultural Literacy	
<ul style="list-style-type: none"> Consider social factors when planning meals for different ethnic and/or religious groups. 	<p>1.4</p> <p>The student can convey and critically evaluate knowledge to co-construct new understandings and complex ideas persuasively and with impact, while considering the specific purpose and context of communication.</p>
<ul style="list-style-type: none"> Work well and show respect with other socio-cultural groups during lessons and collaborative learning. 	<p>6.4</p> <p>The student can contribute to information and perspectives shared in constructive and ethical ways, and manage their online reputation and relationships responsibly.</p>
Critical, Adaptive and Inventive Thinking	
<ul style="list-style-type: none"> Understand the relationship between nutrition/diet and health and makes connections and ideas to solve issues Makes decisions, with supporting justifications, to incorporate food sustainability 	<p>1.4</p> <p>The student can use evidence and adopt different viewpoints to explain their reasoning and decisions, having considered the implications of the relationship among different viewpoints.</p> <p>5.4</p> <p>The student can generate ideas that are unique or modified substantially from existing ones and explore different pathways that lead to solutions.</p>
<ul style="list-style-type: none"> Understand the scientific principles underlying food preparation, processing and safety Explore, adapt and modify ideas and/or recipes to meet the task requirement Manages complexities and ambiguities by adjusting one's perspective and strategies Assesses different contexts and situations in order to make connections and draw new insights 	<p>2.4</p> <p>The student can plan, organise and evaluate their thinking strategies to monitor their learning. They suspend judgement, reassess conclusions and consider alternatives to refine their thoughts, attitudes, behaviour and actions.</p> <p>4.4.</p> <p>The student can draw on different perspectives and strategies to adjust their approach when required, adapting learnt knowledge and skills in new and unexpected contexts to solve complex and unexpected problems.</p> <p>3.4</p> <p>The student can draw on the similarities and differences between different contexts or situations to extract new insights to inform their perspective or approach.</p>

Communication, Collaboration and Information Skills	
<ul style="list-style-type: none"> Effectively communicates information and co-constructs meaning 	<p>1.4</p> <p>The student can convey and critically evaluate knowledge to co-construct new understandings and complex ideas persuasively and with impact, while considering the specific purpose and context of communication.</p>
<ul style="list-style-type: none"> Employs effective strategies to locate digital and non-digital information and resources, and exercises discernment by evaluating the accuracy, credibility, and relevance of information 	<p>5.4</p> <p>The student can refine search results, organise information systematically and manage information sensitively, and evaluate the accuracy, credibility and relevance of information.</p>

2.3 Useful Teaching Strategies

To enhance active learning, two teaching strategies are introduced. They are Differentiated Instruction and Socratic Questioning. Lesson examples based on some of these strategies are also provided.

Differentiated Instruction (DI)

DI is an approach to planning and delivering a lesson for the entire class while meeting the needs of every individual. As students come from diverse backgrounds and possess varied skills, strengths, and learning styles, teachers cannot possibly reach every learner by using only one method of instruction. By using DI, teachers can identify the best way to teach each student.

Figures 6 and 7 outline the various aspects of DI.

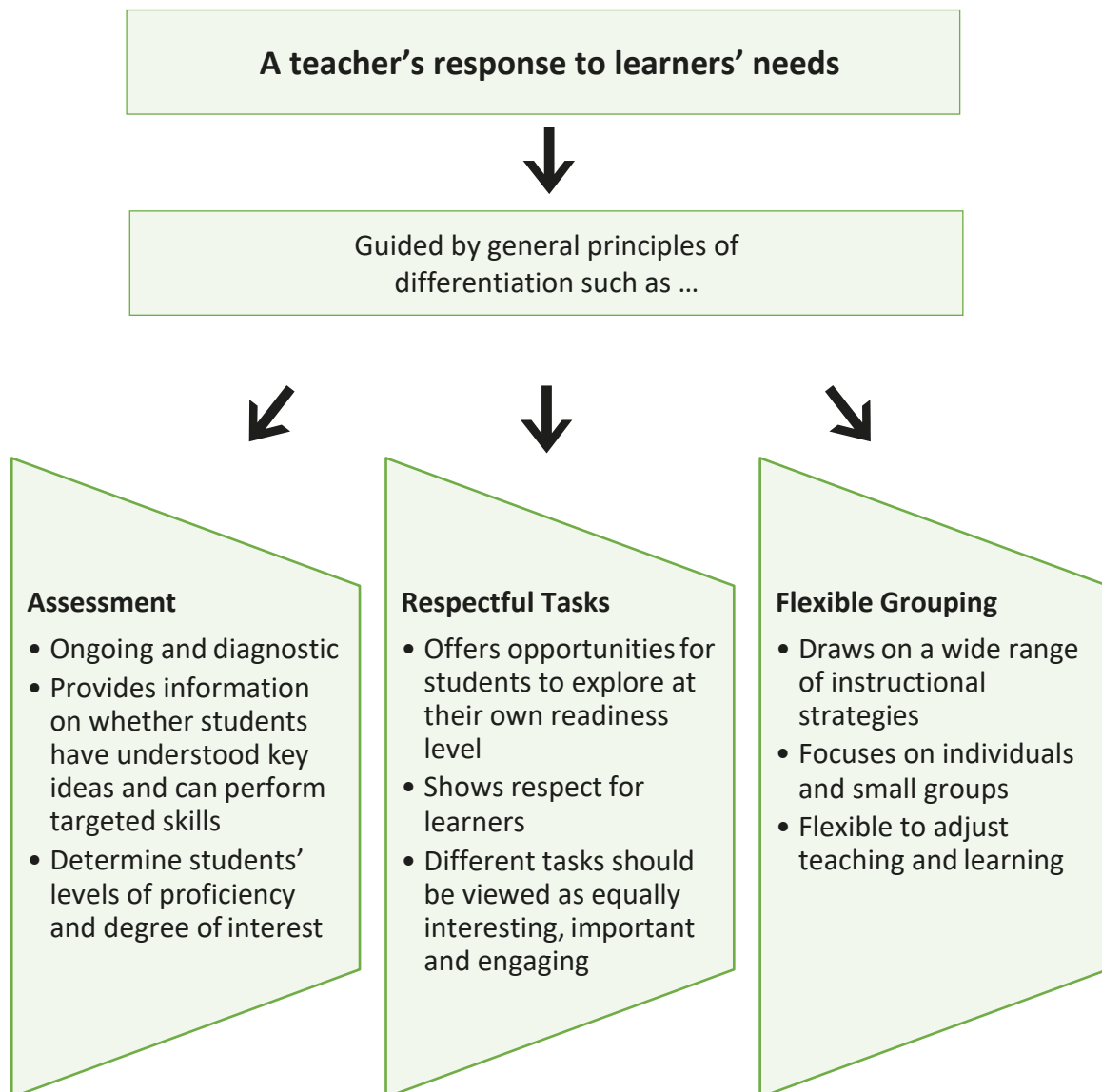


Figure 6: Differentiated Instruction

Teachers can differentiate instruction through content, process, product and environment according to students' interest, readiness and learning profile.

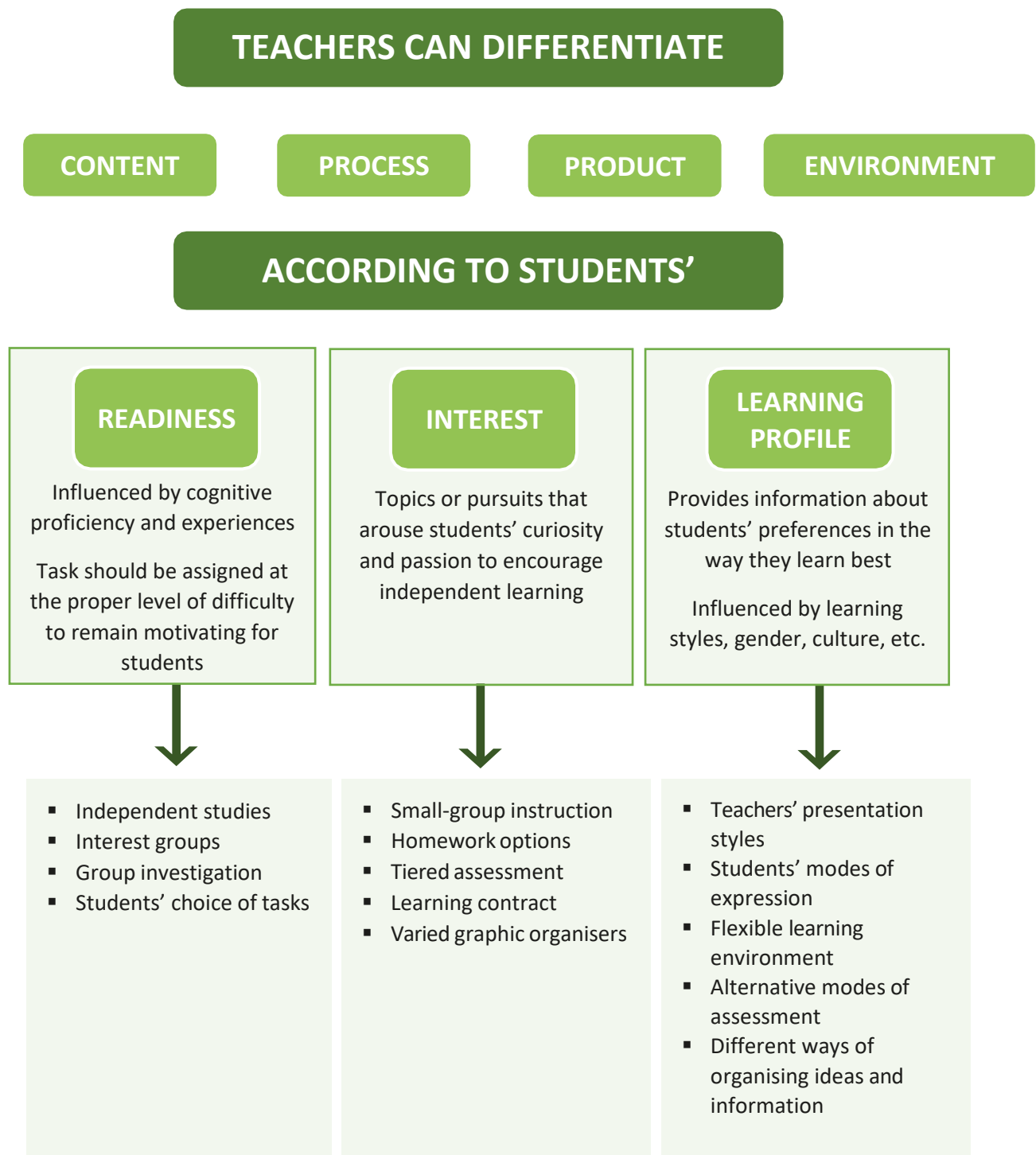
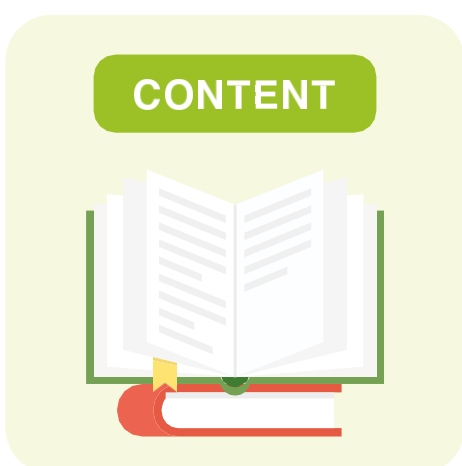


Figure 7: Ways to Differentiate Instruction (Tomlinson & Imbeau, 2010)

Students tend to learn better if tasks:

- are a close match for their skills and understanding of a topic (readiness);
- ignite curiosity or passion in them (interest); and
- encourage them to work in a preferred manner (learning profile).

Ideas and materials that build on students' interest and choice should be incorporated in the curriculum to engage students in learning.



Differentiation in Content

Content can be described as the knowledge, skills and attitudes we want students to learn. It refers to our standards and written curriculum, or simply what we teach or what we want students to learn.

Differentiating content requires students to be pre-tested so that the teacher can identify students who do not require instruction. Students who demonstrate understanding of the concept can skip the instruction step and proceed to apply the concepts to the task of solving a problem.

The revised Bloom's Taxonomy provides a comprehensive set of classifications for learner cognitive processes. Each level builds on the foundation that precedes it. It helps teachers to determine the level of learning that could be included in an instructional unit and the differentiation of content to cater to students' abilities.

Table 9. Content Differentiation using the revised Bloom's Taxonomy

Level	Definition	Questions
Remembering	Recall Regurgitation of facts	Tell, List, State, Define
Understanding	Repeat in own words	Give an example, Explain
Applying	Apply to a new situation	Build, Demonstrate, Make, Develop
Analysing	Study parts	Compare, Analyse, Categorise, Contrast
Evaluating	Give opinion backed by facts	Evaluate, Judge, Critique, Discuss
Creating	Form new concept from learned material	Design, Create, Construct, Develop

Table 10. Examples of Content Differentiation using the revised Bloom’s Taxonomy

Examples of Questions (on nutrients) Using the Revised Bloom’s Taxonomy
<p>Remembering</p> <ul style="list-style-type: none"> • List the chemical elements that make up a protein molecule. • List three good sources of high biological value proteins. • State three functions of iron in the body.
<p>Understanding</p> <ul style="list-style-type: none"> • Explain the differences between fat-soluble vitamins and water-soluble vitamins. • Explain the term ‘complementary proteins’ with examples. • Explain the need to reduce intake of saturated fats.
<p>Applying</p> <ul style="list-style-type: none"> • Demonstrate how calcium can be incorporated in a vegetarian diet. • Illustrate, with examples, the use of fats and oils in food preparation. • Demonstrate ways to include vitamin A in a teenager’s diet.
<p>Analysing</p> <ul style="list-style-type: none"> • Compare and contrast the nutritional value of polished rice and unpolished rice. • Analyse the fat content of different baked products using a recipe analyser. • Compare the vitamins content between an apple pie and a chicken pie using a food composition table.
<p>Evaluating</p> <ul style="list-style-type: none"> • Critique this statement “obesity increases the risk of diet-related problems”. • “Complex carbohydrate is recommended over simple carbohydrate for diabetics.” Discuss. • Discuss this statement “all fats are bad for our health”.
<p>Creating</p> <ul style="list-style-type: none"> • Create a healthy snack that is rich in calcium for a teenager. • Design a pamphlet to create the awareness of osteoporosis. • Develop an experiment to investigate the effect of heat on carbohydrates.

Differentiation in Process

Differentiating the processes means varying learning activities or strategies to provide appropriate methods for students to explore the concepts. It is important to give students alternate paths to manipulate the ideas embedded within the concept.

To differentiate processes, it is important to consider students' academic strengths, learning preferences and emotional states. This will help to determine how students make sense of or master content differently, so that teachers can decide on the appropriate instructional strategy to adopt. One way to differentiate the process of learning to help students make sense of the content is to

scaffold students' learning with different levels of support, challenge and complexity based on their academic strengths and emotional states, such as their readiness and confidence level. Organising students according to their learning preferences to maximise active participation and learning in the lesson, either individually, in pairs or in groups, is another strategy. By designing learning tasks that require students to collaborate with one another, teachers can tap on students' strengths, and by supporting them to understand information and ideas and to apply skills, teachers differentiate the learning process based on learners' profiles.

The figure below provides a visual representation of the five dimensions of a learner's profile that teachers must understand and address to enhance the effectiveness of teaching and learning.

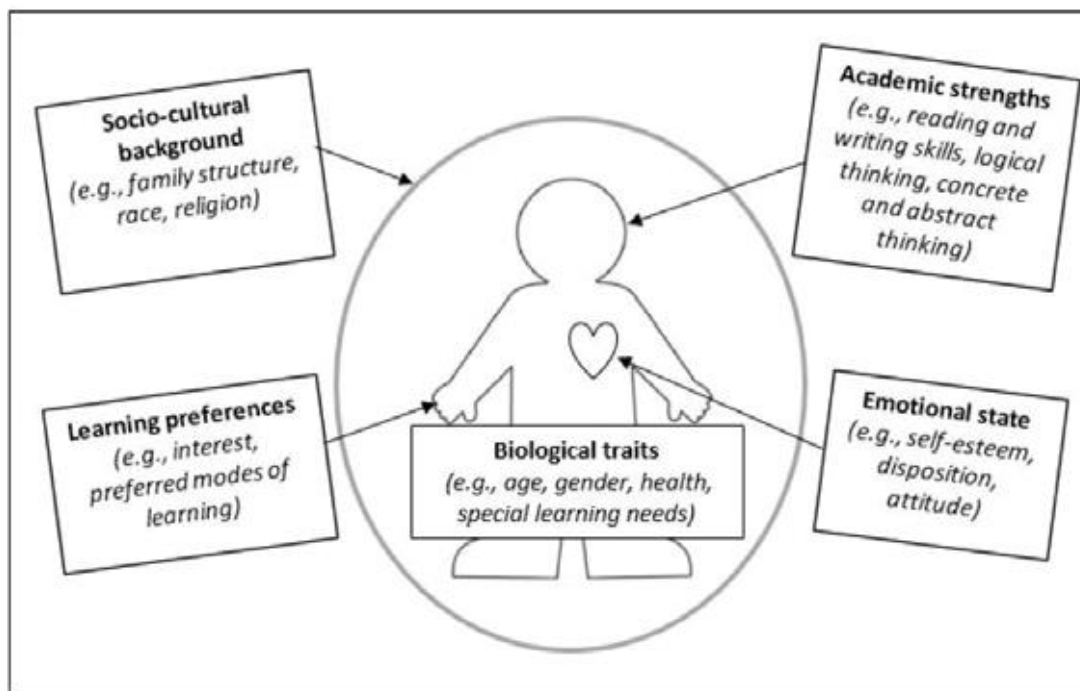


Figure 8: Five Dimensions of a Learner's Profile
(Adapted from Powell & Kusuma-Powell, 2011)



PRODUCT



Differentiation in Product

Product refers to assessments or demonstrations of what students have learned after an extended period of learning.

Students demonstrate the knowledge, skills, attitudes and values (KSAV) that they acquired at the end of a unit or over a period of time through meaningful assignments that require them to rehearse, apply and extend their learning. To differentiate the product, teachers will need to consider all five dimensions of their learners' profiles so as to provide students with variety,

choice and challenge when demonstrating their learning. One way to do so is to provide students with different choices to represent their learning. For example, instead of writing an essay, students can be given the choice to express their learning by creating a skit, producing a graphic organiser or presenting an oral report. Another way could be to consider providing students with varied working arrangements to complete the assignment; for instance, they may work either individually or as a group for different assignments. Table 11 shows some relevant examples for consideration.

Differentiation in Environment

The positive climate of a classroom and its configuration impact students' learning tremendously. When teachers understand all the five dimensions of learners' profiles, they can design learning environment that would enable students to feel affirmed, as well as to develop a sense of affiliation and purpose that contribute to their learning.

For example, teachers can establish classroom routines that allow the academically stronger students to help their peers when they are busy with other students and unavailable to offer help immediately. If some students prefer to work alone in a quiet space while others learn better through peer discussion, the teacher can also manage the learning space by providing areas in the classroom for students to work quietly without distractions, as well as provide collaborative spaces that facilitate discussions.

ENVIRONMENT

Me

The Group



Table 11. Product Differentiation

Type of Intelligence	Suggested Ideas of Project Design
Written	<ul style="list-style-type: none">▪ Read a nutritional or health-related book and write a report▪ Interview a health professional and report findings▪ Compose a poem related to nutritional needs of young children▪ Keep a daily journal of food intake and physical activities for a week▪ Compare and contrast various nutritional information (e.g., low-fat UHT milk versus low-fat pasteurised milk)
Oral	<ul style="list-style-type: none">▪ Compose a song related to food and kitchen safety▪ Make up a diet-related rap song▪ Perform a play, dance, or skit depicting various elements of nutrition-related topics (e.g., obesity, and coronary heart diseases)▪ Create a video related to nutritional needs of young children
Visual	<ul style="list-style-type: none">▪ Draw a picture or create a poster about food wastage for displaying in the canteen▪ Create a deck of slides showing good nutritional ideas▪ Create new garnishing ideas using food to encourage healthy eating▪ Create a nutritional brochure to be given to members of the community▪ Collect data to show the relationship of a health problem (e.g., water intake and constipation) through a comic strip▪ Develop a board game to encourage sustainable food consumption

Socratic Questioning (SQ)

Questioning is an action of asking questions. Effective questioning is essential to good teaching and learning and is particularly useful in teaching the NFS coursework as it helps to ensure that key issues are discussed. Good questioning helps to develop the way students think and learn.

Socratic questioning technique is named after Socrates (470-399 B.C.), a Greek philosopher. The technique is based on the practice of a disciplined and rigorously thoughtful dialogue. The teacher elicits an engaged dialogue with the student during the discussion which enables the student to examine ideas in depth and breadth and construct meaning from them.

Benefits of Socratic Questioning

Socratic questioning helps students to think critically by focusing on the process of thinking surrounding a central issue. Carefully structured questioning also helps examine students'

own thinking processes. Thoughtful, disciplined questioning in the classroom supports student-centred learning, develops problem-solving skills and helps students construct and retain knowledge.

Teachers can use the Socratic questioning technique to facilitate the development of NFS coursework, especially for the management and processing of information. Through questioning, students are enabled to interpret, analyse and communicate ideas. This method serves to promote active, student-centred learning, while the teacher maintains the role of a facilitator.

Types of Socratic Questioning

There are six types of Socratic Questions according to R.W. Paul, (2006), Examples of how these can be used during the NFS coursework process are illustrated in [Table 12](#).

Table 12. Types and Examples of Socratic Questions

No	Type of Socratic Question	Examples of Socratic Questions in Coursework Facilitation
1	Assumption Probing Questions <i>Questions that allow students to examine their assumptions underlying an issue</i>	<ul style="list-style-type: none"> • How did you arrive at these assumptions? • How would you support your assumptions? • What would happen if you boil/fry/bake a potato? • Can you explain the effect of different cooking methods on meat?
2	Reasons and Evidence Probing Questions <i>Questions that seek to examine the reason and evidence supporting an issue</i>	<ul style="list-style-type: none"> • Why do you think this information is true/useful and necessary for your task? • How can I be sure of what you are saying? • Why did you say that different cooking methods have different effects on food? • Can you provide an example to illustrate your point? • Are these reasons relevant to the task? • How do you know that meat is overcooked/undercooked?

3	<p><i>Implications and Consequences</i> Probing Questions <i>Questions that seek to examine the perspective taken on an issue</i></p>	<ul style="list-style-type: none"> • What are the consequences of that assumption? • How does this affect the overall quality of the food? • How does this contribute to an interesting and healthy dish/meal? • Are you implying that other methods of cooking are not as good as frying? • How does this decision relate to the research information earlier? • Why is this information important and what does it help to prove? • What do you predict will happen next?
4	<p><i>Clarifying Questions</i> <i>Questions that seek to clarify the issue at hand by removing ambiguity and vagueness</i></p>	<ul style="list-style-type: none"> • Can you explain that further? • Why do you think frying produces the best result? • How does this relate to our task? • What do you mean by the term ‘unique’? • What do we already know about this?
5	<p><i>Viewpoints and Perspectives Questions</i> <i>Questions that seek to examine the perspectives taken on an issue</i></p>	<ul style="list-style-type: none"> • What other ways can you look at this? • Why do you choose these dishes? • What are the differences and similarities between the two samples? • Why is this way better than the other? • What are the strengths and weaknesses of your product/execution process? • How could you look at this from another viewpoint? • How do you think these dishes illustrate the effects of different methods of cooking?
6	<p><i>Questions about the Question</i> <i>Questions that seek to examine the very question/issue itself</i></p>	<ul style="list-style-type: none"> • What is the question asking us to do? • Is the question clear? Why? • Why do you think I asked this question? • Why is this question important? • To answer this question, what questions do you have to answer first? • Looking back at the task question, what do you think it is asking for? • Does this question ask us to evaluate/investigate something? • How have you linked the information/decision to the task question?

Using Socratic Questioning in the Classroom¹⁰

Role of the Teacher

- Respects students' viewpoints, probes their understanding and shows genuine interest in their thinking
- Poses questions that are meaningful to aid students in learning
- Creates and sustains an intellectually stimulating classroom environment

Tips for the Teacher

- Wait Time: Maintain silence and wait at least 5 to 10 seconds for students to respond
- Phrase the questions clearly and specifically
- Keep the discussion focused
- Do not pose questions that are vague, ambiguous, or beyond the level of students
- Do not pose yes/no questions, as they do little to promote thinking or encourage discussion
- Follow up on students' responses and invite elaboration

Role of the Student

Before an exercise in thoughtful questioning, it is advisable that the teacher tells students that they are expected to do the following:

- Participate when called upon
- Answer questions as clearly and succinctly as possible

Conditions for Effective Socratic Questioning to Take Place

- **A Safe Environment**

A safe environment is crucial as it lessens students' anxiety and fear of making mistakes. It would enable students to be confident to respond to questions and to form their own questions to explore and learn new things. Teachers would need to develop the confidence in their students to ask questions and clarify understanding in the classroom.

- **Wait Time**

Every student is a unique individual and the time taken to process the thoughts would differ. Understanding students' profile would help teachers decide on the wait time needed to seek answers for their questions. Giving sufficient time also means that students' answers are well considered.

¹⁰ <http://serc.carleton.edu/introgeo/socratic/index.html>

Responding to partial/wrong responses

Teachers could prompt and probe students to be more accurate and specific in answering. Teachers could understand what students are thinking by asking them to rationalise their responses.

Teachers could also acknowledge the parts of the answer that are correct. If students still do not answer correctly, teachers should continue to prompt students.

e-Pedagogy

Teachers can leverage digital technologies to accelerate and deepen learning of NFS by making learning more active and personalised. e-Pedagogy is the practice of teaching with technology for active learning that creates a **participatory, connected, and reflective classroom** to nurture the future-ready learner.

Designing lessons with technology is intentional and principle-based, informed by what learning sciences tells us about how people learn. [Figure 9](#) explains how the principles of learning sciences guide the way teachers design for **active learning with technology**.

Principles from Learning Sciences	Tapping on Prior Knowledge Students have preconceptions about how the world works. These must be engaged and harnessed for conceptual change.		
	Building Schema Students must be supported to understand ideas in the context of a conceptual framework and re-organise knowledge according to their own structures for retrieval and application.		
	Thinking about Thinking Students need support to take control of their learning by defining learning goals, monitoring their own progress in achieving them and thinking about their own thinking and actions.		
Active Learning Processes	Activate Learning How will students' focus and interest be oriented towards the learning objectives?	Promote Thinking and Discussion How will students think about ideas and concepts? What skills and processes will students perform? How will students build on their current understanding?	Facilitate Demonstration of Learning How will students demonstrate their understanding and new learning?
	Monitor and Provide Feedback How can students' learning be advanced?		

Figure 9: How learning principles inform the lesson design processes

Teachers should continue to be cognisant of the NFS curricula intent when designing and developing lessons using technology. The four elements of e-Pedagogy (see Figure 5) serve as a good guide for:

a) Constructive Alignment

Ensures that students are constructing meaning for themselves through relevant learning activities, and the learning outcomes, learning activities and assessment tasks are coherent.

b) Learning Experience

Consider how the learning activities are pulled together meaningfully to achieve the intended learning outcomes.

c) Active Learning Processes and Interactions

Learning sciences principles tell us that learning interactions are at the heart of the active learning processes, where the focus is on how students learn with teachers, peers, community and resources.

d) Key Applications of Technology

Consider the affordances of technology that can be harnesses to enhance the learning processes.



Figure 10: Elements of e-Pedagogy in EdTech PS

EdTech Pedagogical Scaffold

e-Pedagogy is the practice of teaching with technology for active learning that creates a participatory, connected, and reflective classroom to nurture the future-ready learner.

The EdTech Pedagogical Scaffold (PS) supersedes SLS PS 2.0 as the tool to guide teachers in applying e-Pedagogy. It translates e-Pedagogy into five key actions that guide teachers in designing and facilitating active learning with technology.

The following resources are provided for teachers' use:

- The online *Guide to e-Pedagogy* <https://go.gov.sg/enedagogyguide> (iCON login is required) provides details and examples for teachers who wish to learn more about the EdTech PS and is designed for navigation based on teachers' interest and readiness levels.
- The *Quick Guide to EdTech PS* <https://go.gov.sg/edtechps> helps teachers to understand and start applying the EdTech PS for lesson design.

Example of e-Pedagogy NFS Lesson

Figure 11 captures the relationship between the sequences of e-Pedagogy (e.g., acquisition) and STP teaching moves (e.g., activate learning) in a NFS lesson.

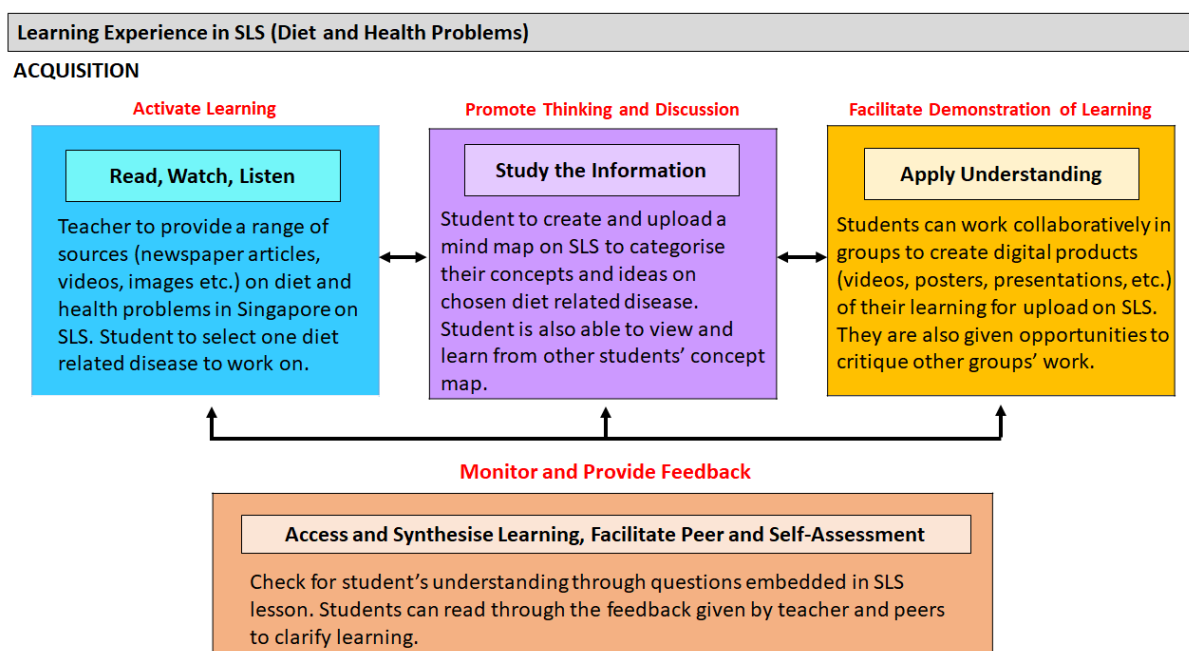


Figure 11: Elements of e-Pedagogy in a NFS lesson

Blended Learning

Why Blended Learning

Blended Learning in MOE's context transforms our students' educational experience by seamlessly blending different modes of learning. The key intents are to nurture (i) self-directed and independent learners; and (ii) passionate and intrinsically motivated learners.

An aspect of Blended Learning is the integration of home-based learning (HBL) as a regular feature of the schooling experience. HBL can be a valuable complement to in-person schooling. Regular HBL can equip students with stronger abilities, dispositions and habits for independent and lifelong learning, in line with MOE's Learn for Life movement.

Blended Learning presents an opportunity to re-think and innovate on curriculum, pedagogies and assessment for a more effective and student-centric educational experience. It gives students more ownership and agency over how they learn, at a pace they are comfortable with. It also offers scope for teachers to tap the advantages of both in-person learning and distance learning to plan lessons best suited to each mode of learning opportunity.

What is Blended Learning

Blended Learning provides students with a broad range of learning experiences (see [Figure 12](#)).



Figure 12: Examples of Blended Learning experiences

Table 13. Elaboration of possible Blended Learning experiences

Possible Blended Learning Experiences	What this means
Structured/Unstructured learning	A combination of structured time for students to learn within a given time frame and unstructured time for students to learn at their own pace and exercise self-management.

Possible Blended Learning Experiences	What this means
Synchronous/Asynchronous learning	A combination of in-person schooling, live online lessons and online/offline learning where students learn remotely and at their own pace.
Within-curriculum/Out-of-curriculum learning	Opportunities for students to learn from and beyond the formal curriculum.
Distance/In-person learning	Opportunities for students to learn during face-to-face lessons with teachers and peers in school, complemented by out-of-school learning activities.
ICT-mediated/Non-ICT-mediated learning	Opportunities for students to learn through a combination of ICT-mediated and non-ICT-mediated learning experiences.

What are the Design Considerations for Blended Learning Experiences

For effective Blended Learning experiences, traditional in-class learning should be thoughtfully integrated with other learning approaches such as technology-based approaches. Teachers should be intentional and selective with the aspects of the curriculum to be delivered in school or at home, and leverage technology where it is meaningful and helpful for learning.

Some useful questions to consider when planning for Blended Learning include:

- *What do I want to teach and what are the learning outcomes?*
- *What is the prior knowledge or experience my students have?*
- *Is it safe to carry out the activity at home?*
- *Does everyone have access to the resources required for home-based learning?*
- *What is the best way to organise the learning experiences?*
- *How do I capitalise on the benefits of in-person and home-based learning? How can I plan the activities for classroom learning and home-based learning such that they complement or supplement each other? Which content is more optimally taught in-person, and which, remotely?*
- *Have I integrated Universal Design for Learning principles into my face to face and online lessons, activities and assessments to ensure that all students can access content and participate in the learning opportunities?*
- *How do I assess my students' learning?*
- *How can I provide my students with feedback on the lesson?*
- *How do I help my students organise their knowledge to form a rich set of connections across the Blended Learning experiences?*

Important point to note:

Do not support preparation of food and the conduct of food science experiments at home unless they are conducted under adult supervision. Safety is of utmost importance as these activities may involve open flame, high temperature, sharp objects and food safety.

Link to NFS OPAL2.0 wiki page on Blended Learning

(<https://www.opal2.moe.edu.sg/csl/content/perma?id=162904>)

Ensuring a Positive Classroom Culture for Blended Learning

As teachers consider how best to design meaningful learning experiences for Blended Learning, there is also a need to create a caring and safe environment for students, both in the physical and virtual spaces. Teachers can bear in mind the following considerations for a positive classroom culture in the Singapore Teaching Practice:

- Foster positive teacher-student and peer relationships through building a culture of care, trust and mutual respect.
- Use preventive and intervention strategies for effective behaviour management and discipline.
- Encourage and reinforce good behaviour by establishing and applying expectations and routines.
- Develop a sense of curiosity and inquiry for lifelong learning.
- Encourage students to take responsibility for their own learning, be involved in decision-making, regard mistakes as learning opportunities and express their views confidently.

For more information, teachers may refer to [The Singapore Blended Learning Guide for Educators](#) on OPAL2.0.

3. ASSESSMENT | ASSESSING THE LEARNING

Assessment is an important feature of the teaching and learning process. It is integral to the learning process and helps students become self-directed learners as it creates awareness of their progress. It helps teachers to determine whether learning has taken place by providing information on students' progress. Assessment also gives teachers feedback on the effectiveness of their own teaching. However, there is a need to match the type of assessment to the specific purpose for which it is intended.

3.1 The Assessment Process

The figure below outlines considerations for the assessment process:

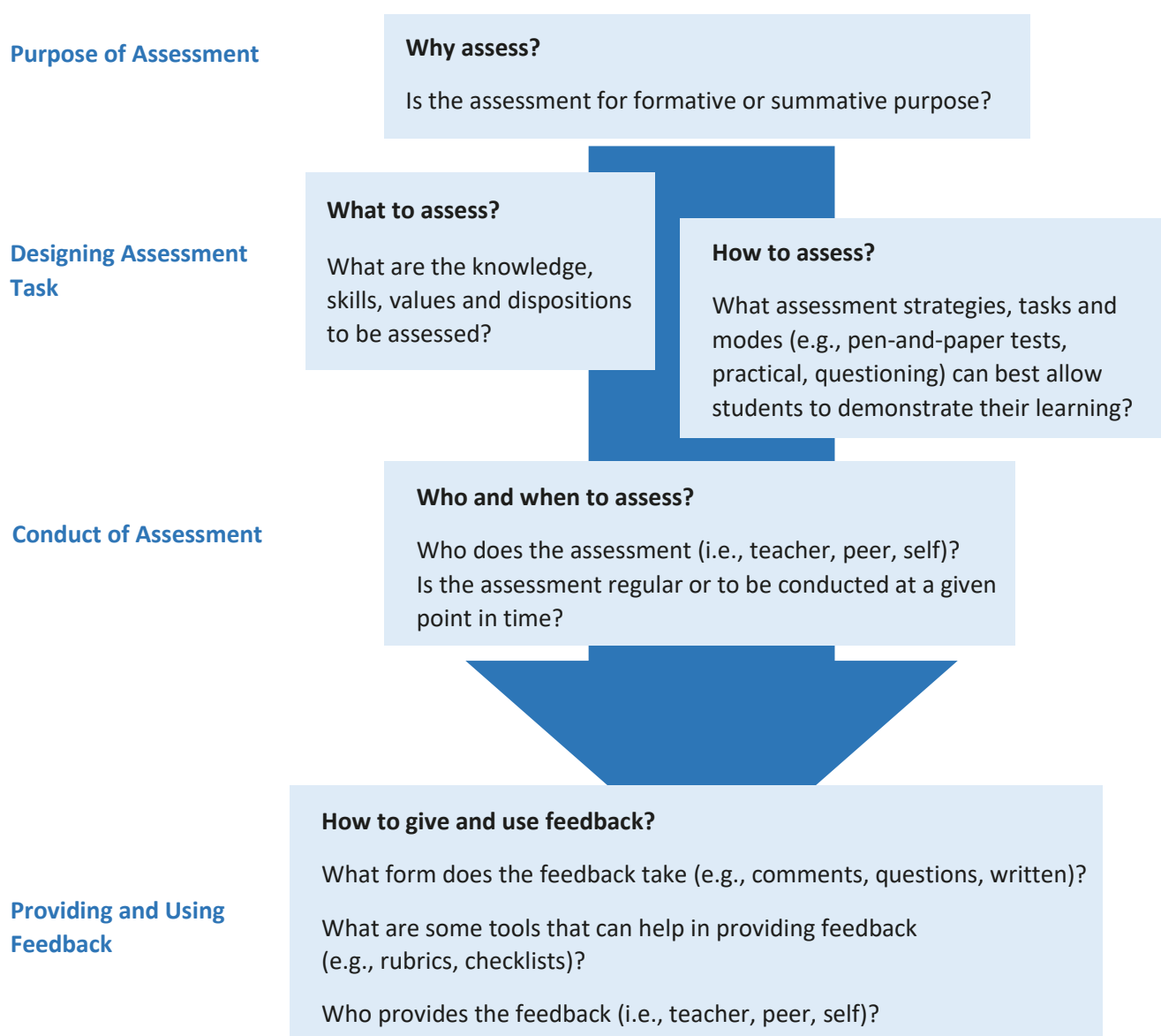


Figure 13: The Assessment Process

3.2 Principles of Assessment

To design, conduct and evaluate appropriate assessment, teachers could use the following principles of assessment:

Fair

- Tasks set should consider the different capabilities of students and the learning outcomes that are achievable by majority of them.
- Tasks should also be sensitive to ethnicity, gender, religion, socio-economic status and linguistic ability.

Valid and Reliable

- Validity refers to the extent to which the assessment achieves what it sets to measure.
- Reliability refers to whether the results would be the same if the same assessment was given for a second time.

Demonstrative of learning outcomes

- When assessment is focused on the learning outcomes, students are aware of what is being assessed and the criteria by which the learning outcomes are judged.

Transparent

- Making assessment criteria available to students will ensure that they are aware of how and what is being evaluated.

Balance

- There should be a balance between formative and summative assessment. A balance of both assessments would ensure a more holistic evaluation of students' learning.

Figure 14: Principles of Assessment

3.3 Types of Assessment

It is necessary that assessment is closely aligned with curricular objectives, content and pedagogy. In the assessment of the NFS curriculum, both formative and summative assessment could be used during school-based assessment to check for students' understanding and provide opportunities for them to apply the knowledge and skills they had learnt.

Formative Assessment (FA)

Formative Assessment (FA) is carried out during the instructional process to provide feedback to adjust ongoing teaching and learning in order to improve students' achievement of intended instructional outcomes. It may involve informal methods such as observation and oral questioning, or the formative use of more formal measures such as quizzes or performance assessment.

Assessment for Learning (AfL) is an assessment that supports teaching and learning with the specific use of learner-centred approaches and strategies. Teachers may identify gaps in students' learning and provide quality feedback for students on how to improve their work. AfL is used to redirect learning in ways that help learners master learning goals and is primarily used for ensuring that the intended learning outcomes are achieved by students.

Teachers could refer to the Teaching Areas and use the Teaching Actions in the STP to carry out AfL during classroom and practical lessons. Examples of Teaching Areas and Teaching Actions are found in Table 14.

Table 14. Examples of Teaching Area and Teaching Action in NFS Classroom

Teaching Area	Teaching Action	Example
Using questions to deepen learning	Teaching Action 1: Initiate-Respond-Follow up or Feedback (IRF) Chains	<p>Topic: Dietary Fibre and Water</p> <p>Teacher: Can I have a show of hands how many of you had experienced constipation? (I)</p> <p>Student: Hands-up (R)</p> <p>Teacher: Can anyone of you share on what you experienced when suffering from constipation? (F)</p> <p>Student: Dry stools; Difficulty going to the toilet (R)</p> <p>Teacher: Yes that's right! These are some symptoms of constipation. Why do you think you would get dry stools? (F and I)</p> <p>Student: Maybe I didn't eat enough fruit and vegetables! (R)</p> <p>Teacher: Yes, that could be possible! Dietary fibre in fruit and vegetables helps to bulk up our stools and make them easier to pass out. Other than dietary fibre, what else do you need to keep your stools soft? (F and I)</p> <p>Student: WATER! (R)</p> <p>Teacher: That's right! Dietary fibre and water can help prevent constipation! Can you name me the sources of water? (F and I)</p> <p>Student: Plain water; fruit juice; bubble tea; soup; fruits (R)</p> <p>Teacher: Yes, you're right! These are the sources of water. However, can you tell me which one of those are not recommended to be consumed regularly and why? (F and I)</p> <p>Student: Bubble tea as it is very sweet and contains a lot of sugar. (R)</p> <p>Teacher: Yes, it is also because tea is diuretic and may cause you to lose more water. The best source of water is still plain water. (Feedback)</p>

Teaching Area	Teaching Action	Example
Checking for understanding and providing feedback	Teaching Action 1: Comment Only Feedback	<ol style="list-style-type: none"> 1. Get students into groups to plan meals for different groups of people, each group presents the planned meal to the class and teacher could provide feedback on the suitability of the planned meal. 2. Get the class to suggest ways in which they could educate the school to reduce food waste and teacher could assess the suggestions and provide feedback on the feasibility.
	Teaching Action 4: Share My Learning	<ol style="list-style-type: none"> 1. Students to take individual notes on the advantages and disadvantages of various methods of cooking during practical lessons. 2. Get students into groups of three to share what they have written on their notes as teacher walk around to facilitate the session. 3. Teacher then get two to three students to share their consolidated learning with the class.

Progressive Learning of Coursework Skills

Schools are encouraged to do a series of practical sessions and coursework assignments in Secondary Three to prepare students for the national coursework assessment in Secondary Four and/or Five. These assignments could include the various coursework skills required for coursework assessment such as research, planning of food science experiment, interpretation of food science practical outcomes and overall evaluation of practical outcomes.

While the assignments need not build on one another, the development of these process skills requires teachers to carefully plan and design assessment tasks that build on one another such that the attainment of such skills can be achieved. This would give students opportunities to apply their learning of various topics and make connections across the different topics.

Teachers and students could use the coursework assessment rubric to ascertain students' level of competency. Teachers could also help students understand the assessment rubrics so that students can continue to progress to the next level of attainment. This would also aid teachers in familiarising with the coursework assessment rubrics and give students an insight on the coursework expectations.

Summative Assessment (SA)

The purpose of summative assessment (SA) is to provide information on students' mastery of content, knowledge and skills, and assigning grades or certifying students' proficiency. In Secondary Three, there should be no more than one weighted assessment (WA) per term, in addition to end-of-year examination (EYE). The WA could include tasks such as written test, online assignment, case study, brochure or oral presentation. There will not be mid-year examination (MYE) in Secondary Three.

Table 15 shows different possible assessment weighting distribution in Secondary Three.

Table 15. Examples of Possible Assessment Weighting for NFS

Secondary Three						
	Term 1	Term 2		Term 3	Term 4	
Assessment Type	WA	WA	MYE	WA	WA	EYE
Example 1	10%	15%	-	15%	10%	50%
Example 2	10%	15%	-	15%	-	60%
Example 3		15%	-	15%	-	70%

In NFS, WAs and/or examinations could be aimed to assess students' understanding and application of the concepts learnt rather than on recall of knowledge. Other than written form of assessment, schools could also consider alternative modes of assessment such as practical skills and coursework process skills.

3.4 Assessment Objective for Nutrition and Food Science

The assessment objectives are classified into three main areas:

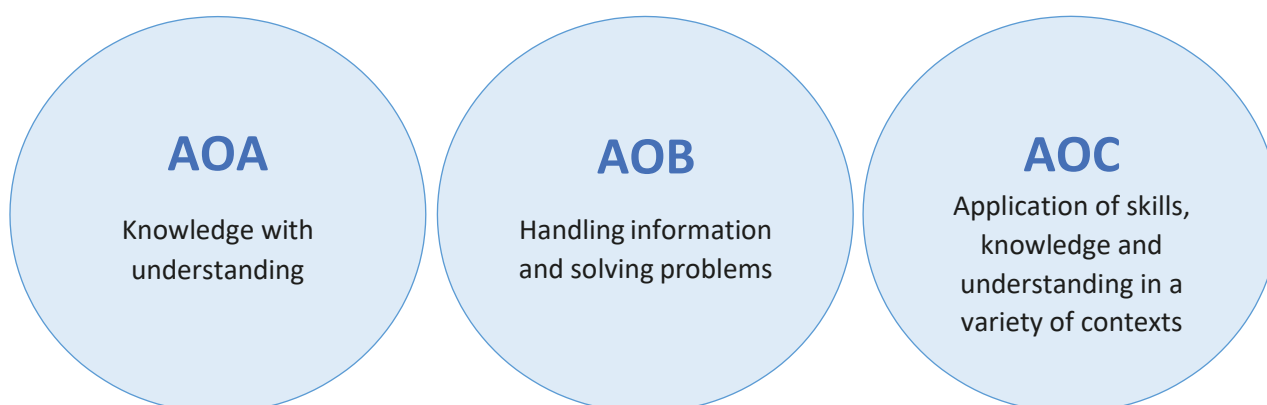


Figure 15: Assessment Objectives

Table 16. Assessment Objectives and Their Descriptors

<p>AOA: (O and N(A) Levels)</p>	<p>Knowledge with understanding Candidates should be able to demonstrate knowledge and understanding of facts, concepts, and terminology in relation to:</p> <ul style="list-style-type: none"> (i) nutrition and health (ii) food literacy (iii) food science
<p>AOB: (O and N(A) Levels)</p>	<p>Handling information and solving problems Candidates should be able to:</p> <ul style="list-style-type: none"> (i) locate, select, interpret information (ii) analyse information (iii) present reasoned explanations (iv) solve problems
<p>AOC:</p>	<p>Application of skills, knowledge and understanding in a variety of contexts Candidates should be able to extend the learnt knowledge towards planning a food investigation, preparing, cooking and presenting dishes in a variety of contexts involving the following processes:</p> <p>O Level:</p> <ul style="list-style-type: none"> ▪ gather information on the roles/functions of the ingredients ▪ gather information on meal planning guidelines for a target group of people ▪ justify the appropriateness of the selected dishes with reference from the prior research ▪ present recipes of the final three dishes with justifications ▪ analyse and use the research findings to plan a food investigation ▪ observe and record sensory evaluations ▪ present clear photographic evidence ▪ observe and measure results accurately ▪ record results using graphs, tables, charts, sensory analysis, labelled diagrams ▪ analyse results linked to research findings and food science principles ▪ demonstrate good organisational and time management skills in planning for investigation and/or task ▪ apply food preparation techniques and use different cooking methods in preparing dishes/meals for different situations ▪ demonstrate proficient use of equipment and good management of resources in food preparation ▪ demonstrate ability to evaluate the sensory outcome of the dishes

	N(A) Level: <ul style="list-style-type: none"> gather information on the effects of the ingredients in a food product gather information on meal planning guidelines for a target group of people justify the appropriateness of the selected dishes with reference from prior research present recipes of the final three dishes with justifications use the research findings and the given aim to plan an exploratory study observe and record sensory observations present clear photographic evidence present observations to link to the target group demonstrate good organisational and time management skills in planning for exploratory study/task apply food preparation techniques and use different cooking methods in preparing dishes/meals for different situations demonstrate proficient use of equipment and good management of resources in food preparation demonstrate ability to evaluate the sensory outcome of the dishes
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The assessment weighting for GCE O and N(A) Level syllabus are stated in the following table.

Table 17. Examination Weighting and Format for O and N(A) Levels

Paper	Assessment Objectives			Total
	AOA	AOB	AOC	
1 (Written Examination)	~25%	~15%	N.A	40%
2 (Coursework)	~10%	~10%	~40%	60%
Overall	35%	25%	40%	100%

Paper 1 Written Paper

The format of both the O and N(A) level written papers are similar. The differences lie in the depth and demand of questions. The table below outlines the format for both syllabuses.

Table 18. Written Paper Format for NFS Syllabus (O and N(A) Level)

	O Level	N(A) Level
Section A	Multiple choice questions (MCQ) (15 marks)	Multiple choice questions (MCQ) (16 marks)
Section B	Short answer type questions and Data-response questions (55 marks)	Short answer type questions and Data-response questions (40 marks)
Section C	2 Open-ended questions (15 x 2 marks)	2 Open-ended questions (12 x 2 marks)
Weighting	40%	40%
Total Marks	100 marks	80 marks
Duration	2 hours	1½ hours

All questions are compulsory in the Paper 1 Written Paper.

Section A consists of Multiple-Choice Questions (MCQs) that test students' ability to recall and apply content knowledge. Multiple Choice Questions (MCQs) require students to select one choice for each question from a list of answers.

Section B consists of short answer type and data-response questions that assess students' ability to handle information and solve problems.

Section C consists of open-ended questions that test students' ability to communicate and present understanding on their mastery of learning. Students are expected to provide sufficient points to support their knowledge and understanding of the content.

Setting Paper 1 Written Paper

In NFS, written class tests and/or examinations could aim to assess students' understanding and application of the concepts learnt rather than on recall of knowledge. [Table 19](#) shows item types with varying difficulty levels recommended for NFS written class tests and/or examinations.

Table 19. Item Types Recommended for NFS

Item Type	Question
Multiple choice question	<ol style="list-style-type: none"> Which of the following is a true statement about saturated fats? <ol style="list-style-type: none"> Saturated fats are fatty acids that contain double bonds Saturated fats are mostly found in plant fats Saturated fats are made up of one fatty acid and three glycerols Saturated fats are healthier than unsaturated fats Which of the following cause pastry to shrink during baking? <ol style="list-style-type: none"> Oven temperature is too high Excessive rolling of the dough Insufficient time for the dough to rest Uneven distribution of fat in the dough mixture <ol style="list-style-type: none"> 1 and 4 1 and 2 2 and 3 3 and 4
Short-answer question	<ol style="list-style-type: none"> Define the term 'malnutrition'. List two functions of iron. Name the health problem caused by a deficiency in iron. Provide four reasons for cooking food. <ol style="list-style-type: none"> Egg is a versatile ingredient. <ol style="list-style-type: none"> Identify the roles of egg in the following: <ol style="list-style-type: none"> Creamed cake Quiche (a) State the chemical reaction that takes place when a raw egg is cooked. (b) Describe the changes that occurred in raw eggs when it undergoes the chemical reaction named in part (a). Suggest ways in which one can apply sustainable food consumption guidelines in food preparation and cooking.

Item Type	Question																																								
Data-response question	<p>1. The following ingredients can be used to make a cake.</p> <p style="text-align: center;">100g plain flour 75g fat 75g sugar 1 egg</p> <ol style="list-style-type: none"> Name the method of cake making. Suggest two types of fats that can be used. Suggest and explain two ways in which the recipe can be modified for an obese teenager. Explain the function(s) of flour in cake making. <p>2. An ingredient list from a canned tuna is presented below.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p>Ingredients: Tuna fish, sunflower oil, vegetable broth, salt</p> </div> <ol style="list-style-type: none"> Identify the ingredient which is present in the largest amount. Name the food additive found in the canned tuna and state its function. Explain how this canned tuna can be combined with fresh ingredients to create a balanced diet. <p>3. The nutritional information from the labels of two ice creams is shown.</p> <div style="display: flex; justify-content: space-around; margin: 10px 0;"> <table border="1" style="border-collapse: collapse; text-align: center;"> <thead> <tr> <th colspan="2">Ice Cream A</th> </tr> <tr> <th colspan="2">Nutrition Facts</th> </tr> </thead> <tbody> <tr> <td>Serving size: 1 container</td><td>Qty per serving</td> </tr> <tr> <td>Total calories</td><td>170 kcal</td> </tr> <tr> <td>Total Fat</td><td>2.5 g</td> </tr> <tr> <td>Saturated Fat</td><td>2 g</td> </tr> <tr> <td>Cholesterol</td><td>10 mg</td> </tr> <tr> <td>Sodium</td><td>85 mg</td> </tr> <tr> <td>Carbohydrate</td><td>33 g</td> </tr> <tr> <td>Sugars</td><td>26 g</td> </tr> </tbody> </table> <table border="1" style="border-collapse: collapse; text-align: center;"> <thead> <tr> <th colspan="2">Ice Cream B</th> </tr> <tr> <th colspan="2">Nutrition Facts</th> </tr> </thead> <tbody> <tr> <td>Serving size: 1 container</td><td>Qty per serving</td> </tr> <tr> <td>Total calories</td><td>140 kcal</td> </tr> <tr> <td>Total Fat</td><td>2.0 g</td> </tr> <tr> <td>Saturated Fat</td><td>1.5 g</td> </tr> <tr> <td>Cholesterol</td><td>10 mg</td> </tr> <tr> <td>Sodium</td><td>75 mg</td> </tr> <tr> <td>Carbohydrate</td><td>25 g</td> </tr> <tr> <td>Sugars</td><td>21 g</td> </tr> </tbody> </table> </div> <ol style="list-style-type: none"> Which ice cream is more suitable for people who are obese? Give a reason for your answer in (a). 	Ice Cream A		Nutrition Facts		Serving size: 1 container	Qty per serving	Total calories	170 kcal	Total Fat	2.5 g	Saturated Fat	2 g	Cholesterol	10 mg	Sodium	85 mg	Carbohydrate	33 g	Sugars	26 g	Ice Cream B		Nutrition Facts		Serving size: 1 container	Qty per serving	Total calories	140 kcal	Total Fat	2.0 g	Saturated Fat	1.5 g	Cholesterol	10 mg	Sodium	75 mg	Carbohydrate	25 g	Sugars	21 g
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Sodium	75 mg																																								
Carbohydrate	25 g																																								
Sugars	21 g																																								
Open-ended question	<ol style="list-style-type: none"> Discuss the nutritional factors to consider when planning meals for: <ol style="list-style-type: none"> Children Elderly Vegans Carbohydrates undergo various reactions when heated. Discuss the reactions that take place in the following cooking processes: <ol style="list-style-type: none"> Boiling rice Heating sugar Toasting bread 																																								

When setting open-ended questions in Section C, the following points should be considered:

- identify the topic and learning outcomes
- craft the question and mark scheme concurrently
- a clear mark scheme should include both acceptable and unacceptable responses

Table 20. Examples of ‘Instruction Verbs’ for setting Open-ended Questions.

Instruction Verbs	Definition
Analyse	Separate into parts and discuss, examine or interpret each part
Account for	Explain the circumstances under which something occurred
Assess	Consider all the facts and decide what is likely to happen
Compare	Examine two or more things by identifying the similarities and differences between them
Describe	Give a detailed account
Differentiate	Show the difference(s) between two things
Discuss	Examine the argument for and against
Elaborate	Provide details and examples to make something clearer
Explain	Give reasons about something
Evaluate	Give an opinion on the significance, value or quality of something based on a careful study of the good and bad features. Include evidence to support the opinion
Illustrate	Give concrete examples to explain. Explain clearly by using comparisons or examples
Justify	Explain why it is reasonable, suitable and necessary

Assessing Open-ended Questions

Example: Explain how the choice of cooking method can affect the nutritional value of food.

The answer may include the following:

Any of the following points on choices of cooking methods and how they affect nutritional value of food:

- Cooking methods which avoid the addition of extra fat - e.g., grilling, stewing, boiling, dry frying. Dry frying uses the marbling fat in poultry/meat/nuts
- Cooking methods that require additional oil (e.g., deep frying) will increase the energy value in food. Deep fried food usually have batter coating which would result in higher calories.
- Choice of cooking methods:
 - Choose cooking methods to suit food, e.g., baked potato is healthier than fried ones
 - Deep-frying food would increase the fat content in the food
 - Grilling or steaming are healthier options than frying
 - Grilling meat can reduce the fat content by extracting the fat out from the meat
- Possible effects of cooking on nutritional value of food – water-soluble vitamins could be destroyed by cooking, dissolved in boiling water; fat-soluble vitamins could be lost to the cooking oil used
- Vitamins B and C are easily lost during application of heat
- Vitamins B and C level are reduced during prolonged cooking
- Vitamins B and C levels are reduced when food products are cooked in water
- Vitamin A is dissolved in cooking oil
- Minerals leach into the cooking liquid
- Dietary fibre-rich food is softened when moist heat is used

Some cooking methods retain more nutrients than others:

- Meat can be cooked in a casserole or stew to ensure all nutrients are retained
- Microwave cooking is a quick method of cooking and less nutrients are lost
- Steaming vegetables retains higher nutritional value than boiling vegetables in water

Paper 2 Coursework

The GCE O and N(A) Levels coursework task will be issued to schools at the beginning of the examination year. Teachers could get students to start on the coursework only when the necessary teaching is completed (e.g., in Feb or Mar). This will equip students with a certain level of knowledge to better cope with the coursework expectations and reduce the disparity in their understanding.

The coursework will be completed under supervision and submitted for assessment. The coursework will be marked by the school coursework assessor and moderated by the Singapore Examinations and Assessment Board (SEAB). The table below shows the coursework format for NFS syllabus (GCE O and N(A) Levels).

Table 21. Coursework Format for NFS Syllabus (GCE O and N(A) Levels)

Criteria (Marks)	O Level		N(A) Level	
	Research	10m	Research	6m
	Decision Making	8m	Decision Making	6m
	Investigation - plan - conduct - apply	22m	Exploratory Study - plan and conduct - discussion	12m
	Planning	8m	Planning	6m
	Execution	24m	Execution	24m
	Evaluation	8m	Evaluation	6m
	60%		60%	
Weighting	60%		60%	
Total Marks	80		60	
Duration	28 hours		25 hours	
Page Range	20 – 25 pages		15 – 20 pages	

The duration includes time for students to research, plan and execute an investigation/exploratory study; analyse data; plan; execute; evaluate final products and subsequently write a report, all carried out in a controlled environment, as well as facilitation by coursework supervisors. The coursework duration should be spread out from January to July for discussion, facilitation and execution of students' work.

Target dates for providing guidance and facilitation as well as expected dates for the completion of the various stages of the task could be highlighted to the students. Progressive marking should be done to ensure that students are proceeding without difficulty to meet the deadlines.

Refer to Singapore-Cambridge GCE O and N(A) Examination Syllabus Guide from SEAB for more information on assessment criteria of coursework.

Developing and Setting Coursework Tasks for Practice in Secondary Three

The starting point to the writing of a coursework task is to refer to what is in the syllabus content. Other than referring to AOC to design the coursework task for students offering the NFS syllabus (O and N(A) Levels), teachers could consider the following key points:

- Ensure relevance to NFS syllabus
- Use problem solving approach
- Set clear expectations
- Be purposeful and realistic
- Start with a statement, hypothesis or question
- Make it accessible to the full range of students
- Ensure the task is interesting

Coursework Task Expectations for O and N(A) Levels

Table 22. Coursework Task Expectations for O and N(A) Levels

Area Of Assessment	Description	
Research	<ul style="list-style-type: none"> ▪ Presents detailed and relevant research that is linked to the task ▪ Presents well-organised research gathered from a wide range of sources ▪ Includes relevant examples of dishes/ways to modify dishes to meet the requirements of the coursework task 	
	O level <ul style="list-style-type: none"> ▪ Presents relevant background information for Investigation <ul style="list-style-type: none"> ○ Food science principles related to key ingredients ○ Sensory qualities of food product related to task question 	N(A) level <ul style="list-style-type: none"> ▪ Presents relevant background information for Exploratory Study <ul style="list-style-type: none"> ○ Sensory qualities of food product related to task question
Decision Making	<ul style="list-style-type: none"> ▪ Selects three final dishes that are all appropriate ▪ Provides detailed justification based on a wide range of factors presented in the previous research 	

Investigation (for O level)	Plan	<ul style="list-style-type: none"> ▪ Presents an investigation plan with an end product in mind, it should include: <ul style="list-style-type: none"> - an investigation aim that is clear and comprehensive - detailed and logical investigation process and data collection methods 	
	Conduct	<ul style="list-style-type: none"> ▪ Carries out investigation proficiently and methodically 	
	Apply	<ul style="list-style-type: none"> ▪ Records a range of observations based on attributes identified in the aim of the investigation ▪ To include photographic evidence of investigation outcome ▪ Shows thorough interpretation of results with good application of relevant food science content 	
Exploratory Study (for NA level)	Plan and Conduct	<ul style="list-style-type: none"> ▪ Presents a comprehensive exploratory study plan with sufficient details of the steps in carrying out the exploratory study (including sensory evaluation) ▪ Carries out exploratory study proficiently and methodically 	
	Discussion	<ul style="list-style-type: none"> ▪ Records detailed sensory observations (including photographic evidence) that are relevant and accurate ▪ Makes strong link of the recorded sensory qualities to the target group 	
Planning		<ul style="list-style-type: none"> ▪ Includes all recipes with a thorough list of ingredients, materials, equipment and methods 	
		O level <ul style="list-style-type: none"> ▪ Time plan that is well-sequenced ▪ At least 2 progressive washing (including a final wash-up) ▪ Dovetailing ▪ In/out ▪ Shows efficient use of time and resources 	N(A) level <ul style="list-style-type: none"> ▪ Time plan that is well-sequenced ▪ At least 2 progressive washing (including a final wash-up) ▪ Dovetailing ▪ In/out ▪ Shows efficient use of time
Execution	Organisation and Management	<ul style="list-style-type: none"> ▪ Works independently with a high level of organisation and initiative ▪ Shows effective and economical use of time and resources 	
	Manipulation	<ul style="list-style-type: none"> ▪ Carries out the execution processes independently without any assistance ▪ Demonstrates a high level of proficiency food preparation and cooking skills and the use of equipment ▪ Demonstrate a wide range of food preparation skills (refer to Table 22) 	

	Product and Presentation	<ul style="list-style-type: none">▪ Presents food products that are very attractive and well-cooked for the target group▪ Presents clear photographic evidence (including cross section, if necessary) of final dishes	
Evaluation	<ul style="list-style-type: none">▪ Provides detailed sensory evaluation of all dishes, using appropriate sensory terms▪ Provides detailed review (strengths, weaknesses and suggestions for improvement) of the execution process		
	O level <ul style="list-style-type: none">▪ Review organisation and management▪ Review manipulation process▪ Review product and presentation	N(A) level <ul style="list-style-type: none">▪ Review manipulation process▪ Review product and presentation	

Assessing Execution in Coursework

Although the emphasis of coursework is on process skills, the execution component is equally important. Basic culinary skills are part and parcel of NFS. Students should therefore continue to be taught the finer points of food preparation and serving. Effective use of time and resources is a notable skill of organisation and management. Students should learn to allocate appropriate amounts of time for the work to be done. They need to show efficiency and confidence as well as being economical and resourceful in the use of materials and equipment. A student who scores high band in the Execution component of the coursework should have met the expectations of the food preparation skills found in the [Table 23](#).

Food Preparation Skills

Candidates are to select recipes that would allow them to demonstrate the food preparation skill sets listed below. The skill set mentioned in the Coursework Assessment Task (CAT) would be considered as 1 skill set.

Table 23. Food Preparation Skills Expectations

Skill Set 1			
Choose any <u>2</u>	Knife Skills (at least 2) May include: <ul style="list-style-type: none"> • slice, dice, julienne, chop, mince, carve (garnish), grate into appropriate sizes 	Prepare, Combine or Shape May include: <ul style="list-style-type: none"> • roll, wrap, skewer, coat, layer ingredients 	Setting or Finishing May include: <ul style="list-style-type: none"> • custard, jelly, pudding: using appropriate quantities of ingredients to achieve required texture setting • preparing and piping of frosting, fruit glaze
Skill Set 2			
Choose <u>1</u> only	Biscuits and Cakes To demonstrate: <ul style="list-style-type: none"> • proper techniques to achieve biscuits/cakes with desired sensory qualities 	Pastry To demonstrate: <ul style="list-style-type: none"> • proper techniques to achieve pastries with desired sensory qualities 	Dough (Yeast and Pasta) To demonstrate: <ul style="list-style-type: none"> • proper techniques to achieve yeast and pasta dough with desired sensory qualities
Skill Set 3			
Choose <u>1</u> only	Batters May include: <ul style="list-style-type: none"> • thick batter: thick consistency: able to coat/bind food • thin batter: pouring consistency 	Sauces May include: <ul style="list-style-type: none"> • starch-based (e.g., roux/blended sauce): free from lumps • reduction sauce (e.g. compote) • emulsified sauce (e.g. mayonnaise): stabilised emulsion, free from splitting • curry paste/<i>rempah</i>/<i>sambal</i> sauce 	

Internal Standardisation of Coursework

The purpose of internal standardisation is to establish a clear and common understanding of the requirements of the standards among all school assessors before marking begins, and not during marking.

Procedures for Internal Standardisation of Coursework

Step 1. Develop a comprehensive task structure with the unit/department and bring along the previous year's Centre Feedback Form on moderation. It is important for centres to calibrate their marking based on the feedback provided.

Step 2. For centres with one assessor, begin internal standardisation by going through previous year's coursework benchmarks and the assessment criteria. Select 3 pieces of the current year's high, medium and low benchmark scripts and start assessing based on task structure and calibrate using Centre Feedback Form on moderation.

For centres with more than one assessor, each assessor is to select 3 pieces of coursework (high, medium and low benchmarks) for their class. All assessors discuss and establish a common understanding of the standards with reference to the assessment criteria and previous year's Centre Feedback Form on moderation.

For example:

Table 24. Coursework Sample Selection for Internal Standardisation

	HIGHEST SCORE	MARK RANGE OF COURSEWORK		
		Top 30%	Middle 40%	Bottom 30%
Assessor A	75	48 - 75	13 - 47	0 - 12
Assessor B	60	38 - 60	9 - 37	0 - 8
Assessor C	65	41 - 65	10 - 40	0 - 9

The coursework chosen from each class should be similar to each other in the mark range. The difference in marks should be within +/- 3 marks.

Step 3. In the case where one assessor is not consistent with the agreed standard, remarking must be done prior to submission for external moderation.

Step 4. When a common standard has been achieved for the school, the whole cohort will be marked in a single order of merit, from the highest mark to the lowest mark. The school assessor(s) will upload the candidates' coursework report, marks and comments via the e-exam system.

Step 5. After the school assessor(s) and internal moderator(s) agree on the mark, the endorsement officer will review and submit marks to SEAB via the e-exam system.

Providing Feedback on Students' Work

Teachers should give constructive feedback that focuses on what students have done well in addition to areas for improvement. The following questions may help teachers focus their feedback on students' work to enable them to identify the next steps to improve:

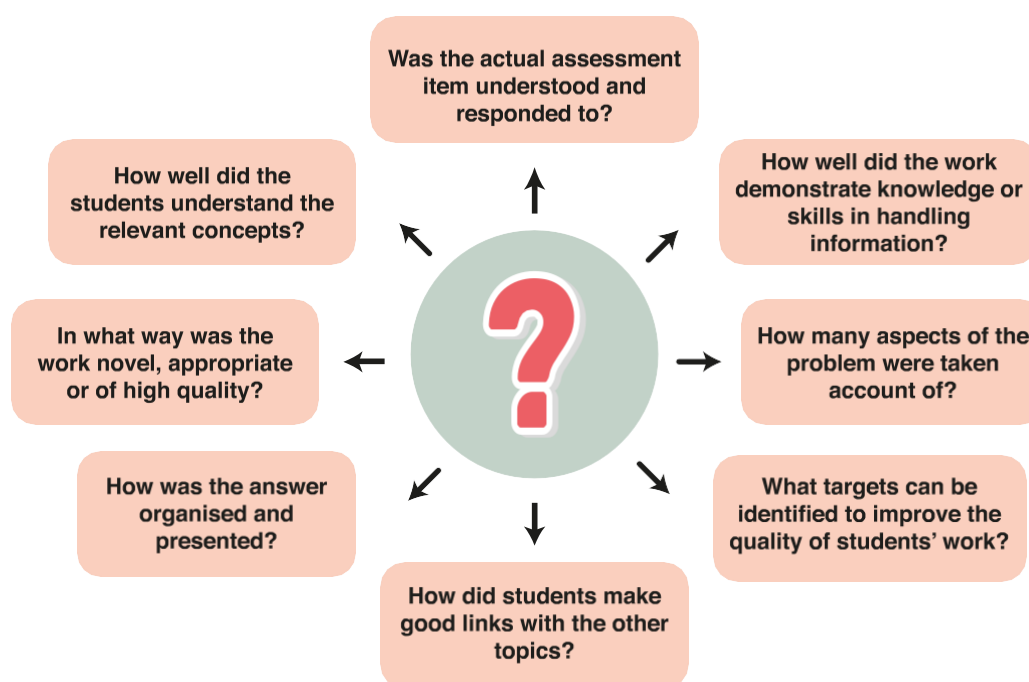


Figure 16: Questions to Ask when Providing Feedback

4.1 One Portal All Learners (OPAL) 2.0

OPAL 2.0 is an updated online platform that provides teachers with updates on NFS. Teachers are able to share resources with each other to promote a collaborative culture. The NFS website on OPAL 2.0 will facilitate teachers' access of information such as the Teaching and Learning Guide (TLG), materials from NFS seminars and sharing days, and course materials. Teachers will be able to access OPAL 2.0 easily on their mobile devices.

4.2 Student Learning Space (SLS)

The SLS portal is an online learning platform that enhances the learning experience of students. Students are able to access the learning packages (resources) through this portal both at home and in school to either learn at their own pace or collaboratively. With the SLS, students take greater ownership of their own learning. Teachers are able to create online lesson packages using the platform to complement classroom teaching and learning.

4.3 Printed Material

The following is a range of books and other reading resources available to support the syllabus and are by no means exhaustive. It is suggested that schools select the latest editions and update the existing list when they become available.

Table 25. Suggested Reading Resources

Book Title	Author	Publisher
Food Styling	Delores Custer	John Wiley & Sons, Inc., Hoboken, New Jersey
Cooking Ingredients: A Practical Guide to Choosing and using World Foods	Christine Ingram	Anness Publishing Ltd
Waste Free Kitchen handbook	Dana Gunders	Library of Congress Cataloging-in-Publication
Knife Skills: How to Carve/Chop/Slice/Fillet	Marcus Wareing, Shaun Hill, Charlie Trotter, Lyn Hall	Dorling Kindersley Limited
The Science of Food: An exploration of what we eat and how we cook	Marty Jopson	Michael O'Mara Books Limited
Culinary Reactions: The Everyday Chemistry of Cooking	Simon Quellen Field	Chicago Review Press – Incorporated
How Food Works	-	Dorling Kindersley Limited
The Science of Cooking	Dr. Stuart Farrimond	Dorling Kindersley Limited
The Food Lab	J. Kenji Lopez - ALT	W.W. Norton & Company Limited

ANNEX A: Proposed Teaching and Learning Plan

Year / Term / Week	Strands and Topic	Learning Outcomes	Learning Activity	21 st CC	Proposed Culinary Food Science	Scientific Reactions	Skills	MOC	Commodities	Coursework Process Skills	Recipe Variation
Sec 3 Term 1											
S3 T1W1	Introduction										
S3 T1W2&3	NUTRITION & HEALTH A. Nutrients, Water and Dietary Fibre	Carbohydrates (a) State the chemical elements which make up a carbohydrate molecule (b) (O level only) State the digestion products of carbohydrates (i.e., glucose, fructose and galactose) (c) List the food sources of carbohydrates (d) Explain the functions of carbohydrates in the body (e) Define: (i) simple carbohydrates as monosaccharides and disaccharides and give food examples (ii) complex carbohydrates as polysaccharides (i.e., starch, cellulose and pectin) and give food examples	<u>Teaching Area: Encouraging Learner Engagement</u> <u>Teaching Action 2: Explore, Engage, Apply</u> Students to compare a variety of carbohydrate-rich food and compare nutritive values (using food labels). They then present their recommendation(s) on the types of food suitable for regular consumption.	CCI, CIT	Students to prepare and cook: Chicken / beef (with marinade) / seafood / <i>tofu</i> kebabs with sweet potato balls and vegetables. Food Science Activity: find out the amount of sucrose found in drinks sold in the canteen using a Brix Refractometer.	Denaturation (marinade) Coagulation (protein food) Gelatinisation (sweet potato balls)	Shaping (sweet potato balls)	Boil (sweet potato balls) Grill (kebabs)	Poultry / meat / seafood / <i>tofu</i> Sweet potato / other vegetables		
S3 T1W4&5	NUTRITION & HEALTH A. Nutrients, Water and Dietary Fibre	Fats (a) State the chemical elements which make up a fat molecule (b) (O level only) State the digestion products of fats (i.e., fatty acids and glycerol) (c) List the food sources of fats (d) Explain the functions of fats in the body (e) Define: (i) saturated fats and give food examples (ii) monounsaturated fats and give food examples (iii) polyunsaturated fats and give food examples (iv) trans fats and give food examples	<u>Teaching Area: Facilitating Collaborative Learning</u> <u>Teaching Action 3: Reciprocal Teaching</u> Teacher to bring an article on the alleged benefits of a particular type of oil, e.g., olive oil, to class and get students to discuss the pros and cons of the oil. After which, allow students to work in pairs using different types of fats and oils and co-teach their partners through predicting whether the oil is healthier, questioning the health concerns, clarifying the nutrient composition and summarising the type of oil.	CCI, CIT	Students to prepare and cook: Creamed cakes using various fats, with sensory evaluation. Food Science Activity: find out the tenderness of the cakes using penetrometer.	Gelatinisation and Dextrinisation (wheat flour) Caramelisation (sugar) Maillard browning (cake crust) Shortening (fats)	Creaming	Bake (cake)	Fats and oils Wheat (using different wheat flours)		Sweet & savoury ingredients, e.g., <i>gula melaka</i> and spicy dried shrimp (local flavours for cultural context)

Year / Term / Week	Strands and Topic	Learning Outcomes	Learning Activity	21 st CC	Proposed Culinary Food Science	Scientific Reactions	Skills	MOC	Commodities	Coursework Process Skills	Recipe Variation
Sec 3 Term 1											
S3 T1W6&7	NUTRITION & HEALTH A. Nutrients, Water and Dietary Fibre	Proteins (a) State the chemical elements which make up a protein molecule (b) (O level only) State the digestion products of proteins (i.e., amino acids) (c) List the food sources of proteins (d) Explain the functions of proteins in the body (e) Define: (i) essential amino acids and give examples (ii) non-essential amino acids and give examples (iii) high biological value proteins and give food examples (iv) low biological value proteins and give food examples (v) complementary proteins and give food examples	<u>Teaching Area:</u> <u>Activating Prior Knowledge</u> <u>Teaching Action 1:</u> <u>Think-Pair-Share</u> Students work in pairs to mix and match manipulatives on different protein sources to the different types of protein and share their answers with the class.	CCI, CGC	Students to prepare and cook: Scotch eggs with recipe modification to make it suitable for a person with a given medical condition from the list.	Coagulation (egg) Maillard browning (outer layer of scotch egg) Smoke point (frying of scotch egg)	Shaping (of outer layer of scotch egg)	Boil / Sous Vide (egg) Shallow fry / deep fry / air fry (scotch egg)	Egg Meat		Different types of eggs, e.g., quail egg, century egg
S3 T1W8	Coursework										
S3 T1W9&10											
Sec 3 Term 2											
S3 T2W1&2	NUTRITION & HEALTH A. Nutrients, Water and Dietary Fibre	Vitamins (a) Classify vitamins into fat-soluble vitamins (A, D, E and K) and water-soluble vitamins (B ₁ , B ₂ , B ₃ , B ₁₂ and C) (b) List the food sources of the following vitamins: A, B ₁ , B ₂ , B ₃ , B ₁₂ , C, D, E and K (c) Explain (O level) / State (N(A) level) the functions of vitamins A, B ₁ , B ₂ , B ₃ , B ₁₂ , C, D, E and K in the body Minerals (a) List the food sources of the following minerals: calcium, phosphorous, iron, sodium chloride and potassium (b) Explain (O level) / State (N(A) level) the functions of calcium, phosphorus, iron, sodium chloride and potassium in the body Water (a) Explain the factors that affect water intake: state of health, diet, level of activity and environment (b) List the food sources of water in the diet (c) Explain (O level) / State (N(A) level) the functions of water in the body Dietary Fibre (a) List the food sources of dietary fibre (b) Explain (O level) / State (N(A) level) the functions of dietary fibre in the body	<u>Teaching Area:</u> Arousing Interest <u>Teaching Action 1:</u> <u>Using Stories and Images</u> Trigger students with pictures and stories of various diet-related health problems related to vitamins, minerals, water and dietary fibre and get them to form linkages between the nutrients and the health problems. <u>Teaching Area:</u> <u>Facilitating Collaborative Learning</u> <u>Teaching Action 2:</u> <u>Jigsaw</u> Students to work in expert groups and conduct research on the nutrients (vitamins, minerals, water and dietary fibre). They then summarise, collate using a Web 2.0 tool (e.g., Padlet) and present summary to classmates.	CCI, CIT	Students to prepare and cook: wholemeal bread / Shortcrust pastry (spinach quiche) with varied fillings (sweet, e.g., fruit or custard sauce and savoury, e.g., egg and cheese), with sensory evaluation.	Shortening (fats) Gelatinisation (blended sauce) Enzymatic browning (sweet filling of fruit) Coagulation (savory filling of egg and cheese)	Rubbing-in (shortcrust pastry) Blended sauce (custard filling)	Bake (pastry) Boil (sauce)	Wheat (shortcrust pastry) / sauce Fruit / meat / cheese / egg (filling)	Research	Choice of food sources to provide necessary vitamins and minerals in the pastry (include ingredients higher in dietary fibre / healthier)

Year / Term / Week	Strands and Topic	Learning Outcomes	Learning Activity	21 st CC	Proposed Culinary Food Science	Scientific Reactions	Skills	MOC	Commodities	Coursework Process Skills	Recipe Variation
Sec 3 Term 2											
S3 T2W3	FOOD SCIENCE C. Sensory Evaluation of Food	Sensory Evaluation (a) State the reasons for conducting sensory evaluation of food products from recipes and food investigations (b) Evaluate the sensory properties (texture, flavour, appearance, aroma) of food products	<u>Teaching Area: Arousing Interest</u> <u>Teaching Action 2: Discrepant Event</u> Teacher to bring two brands of milk (premium vs house brand) to class, allow students to identify the brand and state their preference. Students then do sensory evaluation of different brands of milk (labelled with random numbers) and state their preference after tasting. Some students might be surprised with their preference after the reveal.	CCI	Students to prepare and cook: <i>Wanton</i> skin using different flours and MOC, with sensory evaluation.	Gelatinisation (dough) Denaturation (meat)	Dough (<i>wanton</i> skin) Wrapping	Boil / steam / fry / airfry (<i>wantons</i>)	Wheat (flour) Meat/poultry Vegetables	Sensory evaluation of products	Dough made with various colours, e.g., spinach (green), beetroot (purple)
S3 T2W4	NUTRITION & HEALTH B. Diet and Health Problems	Diet and Health Problems (a) Define the term malnutrition (shortage / excess intake of particular nutrients) (b) Explain the common health problems associated with an excessive or insufficient intake of nutrients, water and dietary fibre in Singapore: (i) obesity (ii) hypertension (iii) type 2 diabetes (iv) coronary heart disease (v) dehydration (vi) heat stroke (vii) constipation (viii) osteoporosis (ix) anaemia	<u>Teaching Area: Using Questions to Deepen Learning</u> <u>Teaching Action 4: Generating Questions</u> Students to analyse a task (allow students to ask questions throughout the process using the revised Bloom's Taxonomy). They then research on the prevalence of diet-related diseases in Singapore using information on Health Promotion Board and HealthHub websites and modify recipes to suit the person with a diet-related health problem.	CIT, CGC	Students to prepare and cook Shepherd's pie with varied fillings.	Gelatinisation (potato) Maillard browning (browning of the crust) Denaturation (meat)	Piping (of potato topping)	Stir fry (fillings) Boil and grill (potato)	Potato Meat / egg / vegetables	Research	Use of different root vegetables as topping
S3 T2W5&6	Coursework										

Year / Term / Week	Strands and Topic	Learning Outcomes	Learning Activity	21 st CC	Proposed Culinary Food Science	Scientific Reactions	Skills	MOC	Commodities	Coursework Process Skills	Recipe Variation
Sec 3 Term 2											
S3 T2W7&8	FOOD LITERACY A. Food Management	Diet & Meal Planning (a) Explain the term balanced diet (b) Explain the concept of energy balance (c) Explain the factors to consider when planning meals: (i) nutritional needs: school children, teenagers, adults and elderly (ii) physiological: age, gender, metabolic rate, level of physical activity, health status (iii) psychological: individual preferences (including vegetarians: lacto vegetarian, ovo vegetarian, lacto-ovo vegetarian and vegan) (iv) social: occasions, ethnic customs and traditions, religions, parental/peer / media influence, vegetarianism (v) economic: value for money, demand and supply (in relation to cost, quality, quantity and nutritional value)	<u>Teaching Area: Using Questions to Deepen Learning</u> <u>Teaching Action 4: Generating Questions</u> Students to watch a video on Energy Balance from SLS. Students to be given an authentic task on a specific target group, analyse their food preferences and suggest appropriate dishes with reference to nutritional tools, e.g., MHP / RDA. Students are to provide justifications on their decision for the dishes selected and complete a time plan for the execution of the dishes chosen. Allow students to ask questions throughout the process using the Revised Bloom's Taxonomy.	CIT, CGC	Students to prepare and cook: One selected dish from the prior task (Execution individual work - coursework process skill).					Decision making Planning of execution Execution	
		Meal Analysis (a) Evaluate and modify recipes / meals using the food guide recommended by HPB and Recommended Dietary Allowances to meet different dietary / nutritional needs									
S3 T2W9&10											
Sec 3 Term 3											
S3 T3W1&2	FOOD SCIENCE A. The Science of Food Preparation and Cooking	Preparation and Cooking of Food (a) Explain the reasons for cooking food (b) Explain the choice (in terms of nutrients, uses and effects of preparation and cooking) of: (i) meat (ii) poultry (iii) seafood (iv) eggs (v) dairy products (vi) cereals (vii) fruit (viii) vegetables (ix) pulses and legumes	<u>Teaching Area: Using Questions to Deepen Learning</u> <u>Teaching Action 5: Challenge Me</u> Students to create innovative and interesting dishes using a given food commodity with a convenience food. Students are to provide justifications for their creations.	CCI, CIT	Students to prepare and cook: <i>Roti Jala</i> (local dish) and creamy sauce with chicken / <i>tofu</i> or caramelised banana.	Gelatinisation (batter / roux sauce) Maillard browning (batter) Caramelisation (banana)	Batter Roux sauce	Fry (batter) Boil (sauce)	Wheat (batter / roux sauce) Milk (batter / roux sauce) Meat / tofu / fruits	Conceptualisation	Batter used to wrap filling like a spring roll / in a cone shape

Year / Term / Week	Strands and Topic	Learning Outcomes	Learning Activity	21 st CC	Proposed Culinary Food Science	Scientific Reactions	Skills	MOC	Commodities	Coursework Process Skills	Recipe Variation
Sec 3 Term 3											
S3 T3W3,4&5	FOOD SCIENCE B. Reactions in Food during Preparation and Cooking	Reactions in Food during Preparation and Cooking (a) Explain the following terms that occur in the preparation and cooking of food: (i) carbohydrates: gelatinisation, caramelisation, dextrinisation (ii) fats: shortening, emulsion, melting point, smoke point (iii) proteins: denaturation, foaming, coagulation, gluten development, Maillard browning (iv) fruit / vegetables: enzymatic browning (O Level only) Explain the functions of the key ingredients (flour, sugar, raising agent, fat, egg, liquid) and justify the procedures in the preparation and cooking of the following products: cakes, biscuits, pastries, batters, sauces (including local dishes) (b) (N(A) Level only) Demonstrate the skills required and justify the procedures in the preparation and cooking of the following products (including local dishes): (i) cakes, biscuits (creaming, rubbing-in, whisking) (ii) shortcrust pastry (iii) batters (thin and thick) (iv) sauces (roux and blended)	<u>Teaching Area: Providing Clear Explanation</u> <u>Teaching Action 2: Demonstration</u> Teacher to do a live demonstration on the caramelisation of sugar (as a trigger) and explain the reaction in the process. <u>Teaching Area: Using Questions to Deepen Learning</u> <u>Teaching Action 3: Refine3</u> Students to be given an authentic task such as a faulty recipe. Students to plan and carry out an investigation, collect data and analyse results to solve the issue of faulty recipe.	CIT	Students to prepare a fruit salad by making a dressing (unstable and stable emulsion) and experiment various methods to prevent enzymatic browning on fruit. Food Science Activity: use of universal indicator to find out the changes in pH when fruits are placed in a different solution. Students to prepare and cook: Whisked cakes, varying the whisking time; Shortcrust pastry, varying the types of fats.	Emulsion (making of dressing) Enzymatic browning (fruit) Foaming (egg in whisked cakes) Gelatinisation (wheat flour) Maillard browning (cake / pastry crust) Caramelisation (cake crust) Melting point (of various fats in shortcrust pastry)	Whisking Shortcrust pastry	Bake (cake and pastry)	Egg Fats and oils Wheat (flour) Fruit	Investigation plan Data collection Analysis of results	
S3 T3W6,7&8	Coursework										
S3 T3W9&10											
Sec 3 Term 4											
S3 T4W1	Coursework										
Semestral Examinations											
Sec 4 Term 1 (O Level)											
S4 T1W1	FOOD SCIENCE A. The Science of Food Preparation and Cooking	(O level only) Food Safety (a) State causes of food spoilage: microbial, chemical and physical spoilage (b) Explain how to avoid and reduce the risk of food spoilage and food contamination when preparing, cooking and storing food (including hygienic practices)	<u>Teaching Area: Arousing Interest</u> <u>Teaching Action 1: Using Stories and Images</u> Teacher to bring rancid fish / prawn crackers, stale biscuits and mouldy food items, like bread / oranges and get students to discuss causes of the food spoilage.	CIT							

Year / Term / Week	Strands and Topic	Learning Outcomes	Learning Activity	21 st CC	Proposed Culinary Food Science	Scientific Reactions	Skills	MOC	Commodities	Coursework Process Skills	Recipe Variation
Sec 4 Term 1 (O Level)											
S4 T1W2&3	FOOD LITERACY B. Smart Consumer	<p>(O level only) Sustainable Food Consumption</p> <p>(a) Define the term sustainable food consumption</p> <p>(b) Identify current food consumption practices and their impact on the environment</p> <p>(c) State sustainable food consumption guidelines:</p> <p>(i) selecting food from sustainable sources</p> <p>(ii) aiming to be waste-free</p> <p>(d) Apply sustainable food consumption guidelines in the preparation and cooking of food</p> <p>Convenience Food</p> <p>(a) List the different types of convenience food (ready-to-cook and ready-to-eat: bottled / canned food, dried food, frozen / chilled food)</p> <p>(b) Explain the advantages and disadvantages of convenience food</p> <p>(c) (O level only) Explain the functions of the following additives:</p> <p>(i) salt</p> <p>(ii) sugar and sweeteners (aspartame, saccharin, stevia)</p> <p>(iii) sodium nitrite</p> <p>(iv) monosodium glutamate</p> <p>(d) (O level only) State the health concerns of excessive consumption of these additives:</p> <p>(i) salt</p> <p>(ii) sugar and sweeteners (aspartame, saccharin, stevia)</p> <p>(iii) sodium nitrite</p> <p>(iv) monosodium glutamate</p> <p>(e) Interpret and apply information found on food and nutrition label</p> <p>(f) Evaluate the benefits of food and nutrition labels to the consumer</p>	<p><u>Teaching Area:</u> <u>Encouraging Learner Engagement</u> <u>Teaching Action 2:</u> <u>Explore, Engage, Apply</u> Students to go on a learning journey to a supermarket and identify different food labels <i>(for O-level: include sustainable produce)</i>. They then interpret information on the different food labels, especially nutritional claims and Nutrition Information Panels (NIP). Students are then required to select a product, compare the NIPs and make recommendations on the healthier choice.</p> <p><u>Teaching Area:</u> <u>Exercising Flexibility</u> Variation: get students to bring some food labels to class instead of going to the supermarket.</p> <p><u>Teaching Area: Using Questions to Deepen Learning</u> <u>Teaching Action 1: IRF Chains</u> Students are to identify food additives on various food labels and teacher to initiate by asking students the functions of the food additives in a particular product and follow up with asking if the food additive poses any health concerns.</p>	CIT, CGC	Students to prepare and cook: Pizza with toppings; students then compare the handmade dough with commercial dough.	Gelatinisation (dough) Maillard browning (pizza crust)	Yeast dough	Bake (dough)	Wheat Convenience food		Use of popular ingredients as toppings, e.g., <i>otak otak</i> , <i>chendol</i> strips

Year / Term / Week	Strands and Topic	Learning Outcomes	Learning Activity	21 st CC	Proposed Culinary Food Science	Scientific Reactions	Skills	MOC	Commodities	Coursework Process Skills	Recipe Variation
Sec 4 Term 1 (O Level)											
S4 T1W4	FOOD SCIENCE A. The Science of Food Preparation and Cooking	Methods of Cooking (a) Explain how heat is transferred (conduction, convection and radiation) in the different methods of cooking (grilling, baking, dry-frying, stir-frying / sautéing, shallow-frying, deep-frying, boiling, simmering, steaming, microwave cooking) (b) State the advantages and disadvantages of each method of cooking (c) (O level only) Use a variety of cooking methods in the preparation of meals	<u>Teaching Area: Check for Understanding and Providing Feedback</u> <u>Teaching Action 4: Share my Learning</u> Teacher to brief students that they need to share the advantages and disadvantages of the various MOC after executing the practical. Students to take note, discuss and clarify with their partners on the advantages and disadvantages identified. Teacher to walk around the class to listen to the conversation and check on their understanding. Teacher then consolidate the learning and correct any misconceptions.	CCI	Use different MOC to prepare eggs	Coagulation Foaming		Boiling Frying Steaming Baking	Egg		
S4 T1W5		National Coursework Assessment									
Sec 4 Term 1 (N(A) Level)											
S4 T1W1	FOOD SCIENCE A. The Science of Food Preparation and Cooking	Methods of Cooking (a) Explain how heat is transferred (conduction, convection and radiation) in the different methods of cooking (grilling, baking, dry-frying, stir-frying / sautéing, shallow-frying, deep-frying, boiling, simmering, steaming, microwave cooking) (b) State the advantages and disadvantages of each method of cooking	<u>Teaching Area: Check for Understanding and Providing Feedback</u> <u>Teaching Action 4: Share my Learning</u> Teacher to brief students that they need to share the advantages and disadvantages of the various MOC after executing the practical. Students to take note, discuss and clarify with their partners on the advantages and disadvantages identified. Teacher to walk around the class to listen to the conversation and check on their understanding. Teacher then consolidate the learning and correct any misconceptions.	CCI	Use different MOC to prepare eggs	Coagulation Foaming		Boiling Frying Steaming Baking	Egg		

Year / Term / Week	Strands and Topic	Learning Outcomes	Learning Activity	21 st CC	Proposed Culinary Food Science	Scientific Reactions	Skills	MOC	Commodities	Coursework Process Skills	Recipe Variation
Sec 4 Term 1 (O Level)											
S4 T1W2&3	FOOD LITERACY B. Smart Consumer	<p><i>(N(A) level only)</i></p> <p>Convenience Food</p> <p>(a) List the different types of convenience food (ready-to-cook and ready-to-eat: bottled / canned food, dried food, frozen / chilled food)</p> <p>(b) Explain the advantages and disadvantages of convenience food</p> <p>(c) State the types of information found on food and nutrition labels</p> <p>(d) Interpret and apply information found on food and nutrition labels</p>	<p><u>Teaching Area:</u> <u>Encouraging Learner Engagement</u> <u>Teaching Action 2:</u> <u>Explore, Engage, Apply</u> Students to go on a learning journey to a supermarket and identify different food labels (<i>for O-level: include sustainable produce</i>). They then interpret information on the different food labels, especially nutritional claims and Nutrition Information Panels (NIP). Students are then required to select a product, compare the NIPs and make recommendations on the healthier choice.</p> <p><u>Teaching Area:</u> <u>Exercising Flexibility</u> Variation: get students to bring some food labels to class instead of going to the supermarket.</p>	CCI, CIT	Students to prepare and cook: Pizza with toppings; students then compare the handmade dough with commercial dough.	<p>Gelatinisation (dough)</p> <p>Maillard browning (pizza crust)</p>	Yeast dough	Bake (dough)	Wheat Convenience food		Use of popular ingredients as toppings, e.g., <i>otak otak</i> , <i>chendol</i> strips
S4 T1W4		National Coursework Assessment									