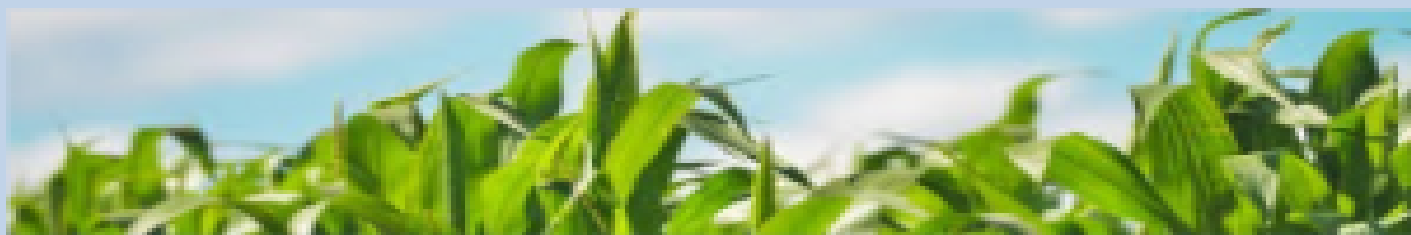




Professional Development
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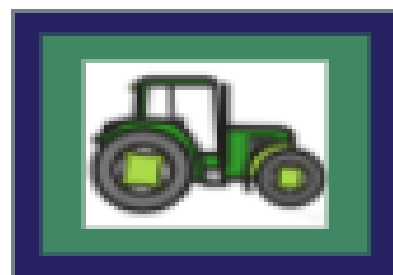
An tSeirbhís um Fhorbairt
Ghairmiúil do Mhúinteoir



Leaving Certificate Agricultural Science

Phase 2

National Workshop 3



www.pdst.ie

PDST
Professional Development Service for Teachers



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Key Messages

1. Learning outcomes are written statements used to describe knowledge, understanding, skills and values. Action verbs are needed so that students can demonstrate their learning and teachers can measure learning outcomes.
2. Using farm based case studies and project based learning as pedagogical approaches to enhance key skills, research skills and active learning.
3. Using scientific practices, to develop students' abilities to understand how the principles of economics permeate all strands within the agricultural science specification.

The New Specification Aims

Leaving Certificate Agricultural Science aims to enable students to:

- Appreciate the natural environment and human interactions with it and the sustainable use of its resources, recognising the need for a rationale and balanced approach to the exploitation of these resources in a local and global context
- Recognise the need for, and global importance of, relevant strategies and policies to promote the agri-food industry while insulating it from future challenges (e.g. climate change, novel crop and animal diseases) and identify opportunities for innovation and entrepreneurship in the context of local, regional and world markets
- Develop their scientific knowledge and skills, in the context of agricultural practices, and increase their awareness of health and safety issues associated with these practices.

(Aims, Agricultural Science Specification 2018, Page 7)

Objectives

Students should:

- Develop an ecological awareness in the context of the provision of food and non-food materials
- Recognise the impact of various agricultural practices on the environment and appreciate how the application of science and technology affects the individual, the community and the environment
- Become aware of the contribution of agriculture to the economy of the locality and the nation and its importance in EU and world contexts
- Make informed evaluations of contemporary agricultural science issues locally and globally
- Understand that the study and practice of science are primarily co-operative activities which are subject to social, economic, technological, ethical and cultural influences, and legislative and economic considerations
- Develop independent thinking, problem-solving and self-directed learning skills through active engagement in their own learning and through project work
- Understand the need for safety in conducting laboratory and field investigations.

(Objectives, Agricultural Science Specification 2018, Page 8)

Overview of the specification

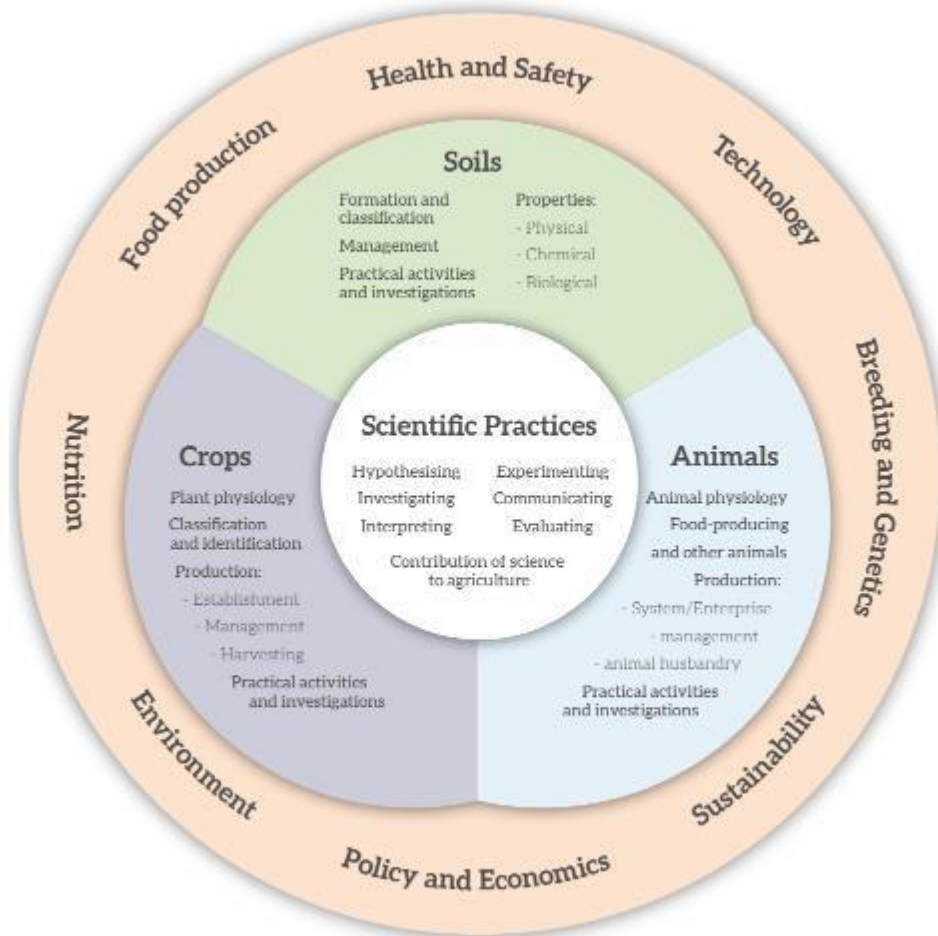





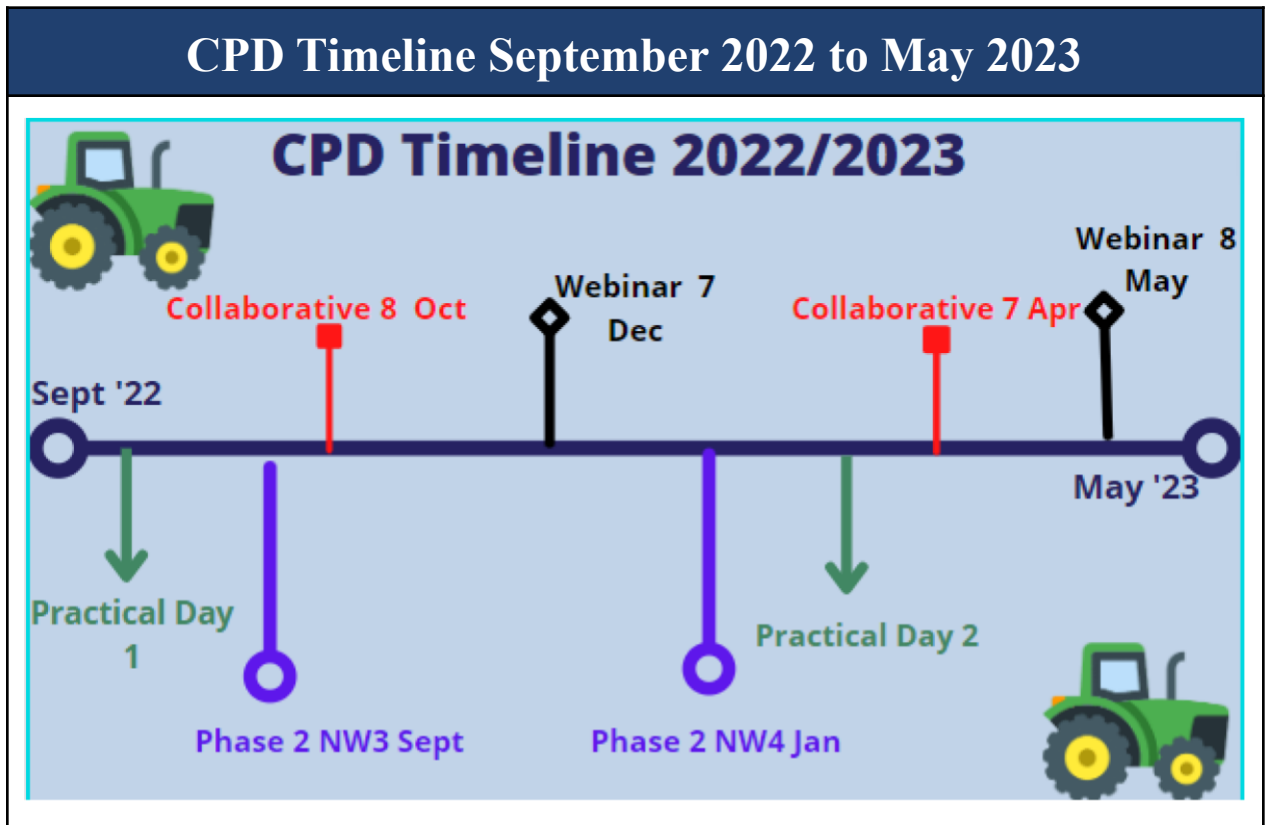
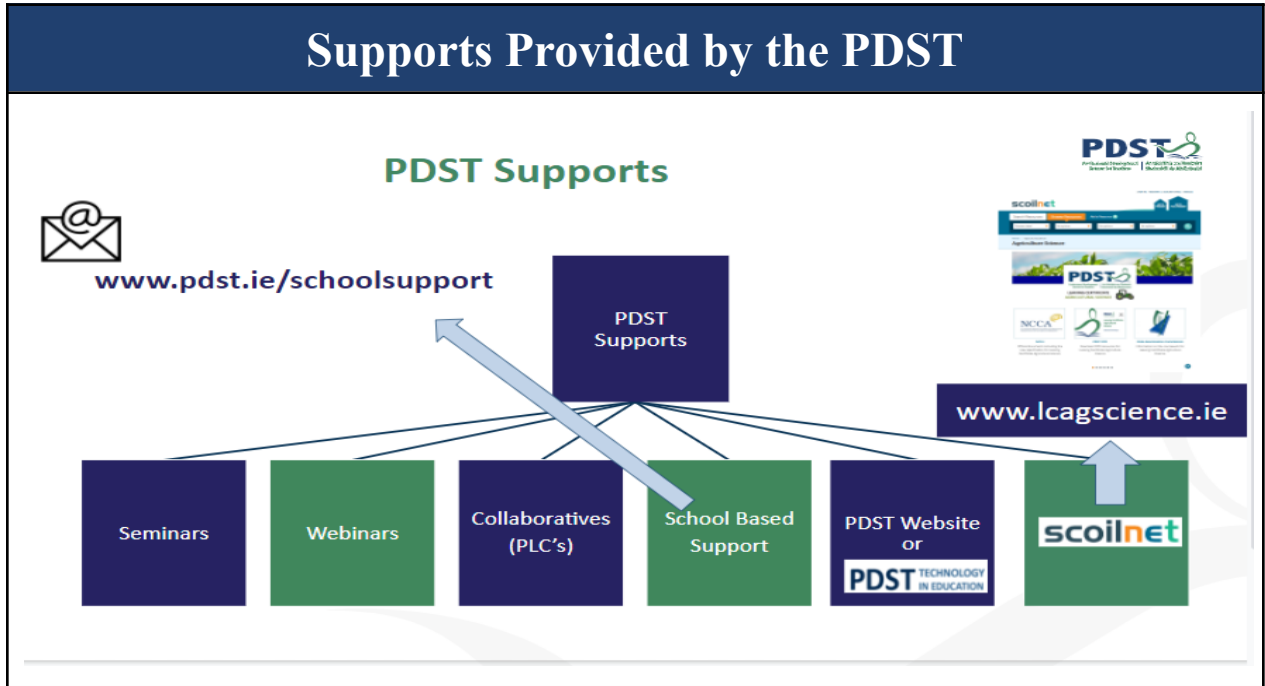
Figure 4: Structure of the specification

(Overview of the specification, Agricultural Science Specification 2018, Page 11)

3 Documents supporting the IIS



Specification 2018	IIS Guidelines December 2019	SEC IIS Brief 2022
https://www.curriculumonline.ie/getmedia/9ad3071d-b58d-4988-9afc-f4e229ceb864/NCCA-Specification-for-Leaving-Cert-Agricultural-Science.pdf	https://www.curriculumonline.ie/getmedia/c509fc4d-848e-49b8-8c35-d7fc47683c85/AgScience-GL-Fin-al-Dec-19.pdf	https://www.examinations.ie/misc-doc/EN-EX-25906961.pdf
		



Working with Learning Outcomes

Learning outcomes, learning intentions and success criteria – Making the connection



Figure 1: Planning teaching learning and assessment

Learning outcomes provide the building blocks for teachers to plan their teaching, learning and assessment. Teachers can then use learning intentions and success criteria to take forward their planning and enable the learning outcomes to come alive in practice with their students.

The Figure 1 above shows the relationship between learning outcomes, learning intentions and success criteria.

What are learning outcomes?

Learning outcomes are statements in curriculum specifications to describe the knowledge, understanding, skills and values students should be able to demonstrate after a period of learning.

What are learning intentions?

A learning intention for a lesson or series of lessons is a statement, created by the teacher, that describes clearly what the teacher wants the students to know, understand, and be able to do as a result of specific learning and teaching activities. Clear learning intentions should help students focus not just on the

task or activity taking place but on what they are learning. Learning intentions are always linked to one or more learning outcomes in the specification.

What are success criteria?

Success criteria are linked to learning intentions and therefore to the learning outcomes. They are developed by the teacher and/or the student and describe what success looks like. They help the teacher and student to make judgements about the quality of student learning.



Resources to help you in planning using learning intentions, success criteria can be found on the [NCCA website here](#).

(NCCA, Focus on Learning, Learning Outcomes, Workshop 5)

Bloom's Taxonomy of Critical Thinking - Sample Command Words					
A		B		C	
1	2	3	4	5	6
Knowledge / Remembering	Comprehension / Understanding	Application	Analysis	Synthesis / Creating	Evaluation
Count Choose Define Describe Draw Identify Label Match Name Outline Quote Read Recall Recite Recognise Record Select State Write 5 - W's - who, what, when, where, why	Associate Classify Contrast Compare Compute Convert Defend Demonstrate Discuss Distinguish Estimate Explain Extend Extrapolate Generalise Give examples Infer Interpret Outline Paraphrase Predict Rewrite Rephrase Summarise	Add Apply Build Calculate Change Classify Construct Complete Demonstrate Divide Examine Graph Manipulate Modify Organise Prepare Produce Present Show Solve Use	Analyse Arrange Breakdown Combine Design Detect Develop Diagram Differentiate Discriminate Dissect Examine Illustrate Infer Investigate Observe Outline Point out Relate Relationship Select Separate Subdivide Utilise	Categorise Combine Compile Compose Create Design Devise Generate Invent Imagine Modify Order Organise Plan Rearrange Reconstruct Reorganise Revise Summarise Transform Specify	Appraise Assess Compare Conclude Contrast Criticise Critique Debate Deduce Determine Disprove Evaluate Grade Interpret Judge Justify Measure Opinion Prove Rank Rate Recommend Support Test

Please note: Some words can be used as an outcome verb in more than one level depending on context

Learning Outcome Task 1

Learning Outcome	Action Verb	Key Learning	Learning Intentions
<p>Learning Outcome 4.3E <i>Investigate the factors that determine the output and quality of produce from a chosen enterprise breed variety, nutrition, housing, management</i></p>	<p>Observe, study, or make a detailed and systematic examination, in order to establish facts and reach new conclusions</p>		

Learning Outcome Task 2

Learning Experiences	Success Criteria

Action Verbs to support Assessment

Q.11 Higher Level (SEC Sample Paper)

Action Verb "Discuss"

Question 11

- (a) Discuss the factors that determine the output and quality of produce from a chosen animal enterprise under the following headings.

Name of enterprise:
(i) Breed variety:
(ii) Nutrition:
(iii) Housing:
(iv) Management:

Q13 Ordinary Level (SEC Sample Paper)

Answer question 13 (iii) from the SEC Ordinary Level. Pay attention to the action verb/ command word and to the content.

(iii) State three reasons for reseeding grassland in Ireland.

1.
2.
3.

Action Verb	Topic: Reseeding grass
Discuss	
Explain	
List	
Outline	
Describe	
Identify	

Skills based question

Q14. (c) Higher Level (SEC Sample Paper)

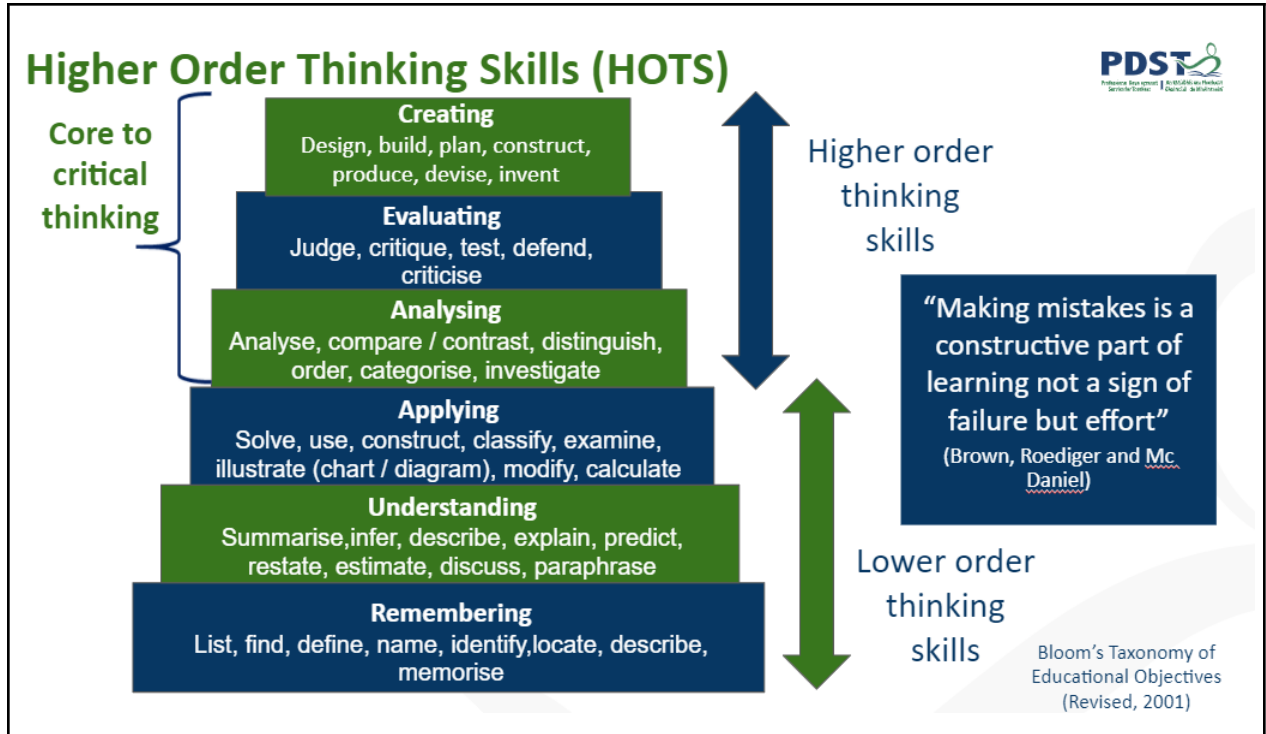
- (c) Due to the nature of Derek's autumn and spring calving suckler enterprise, silage quality is vitally important. This is to ensure that his concentrate feeding is kept to a minimum and to enhance the economic sustainability of his farm. His local feed merchant representative took a number of samples of silage for analysis. The table below contains the results.

Farm		
Derek, Millbrook, Co. Cavan		
Forage type: First cut pit silage (cut 3 rd June 2020)		
Date received	14 th August 2020	
Lab report number	12345	
Analysis (Dry Matter)	Results	
Dry Matter	%	26.5
Protein	%	13.1
DMD	%	68.7
Metabolisable Energy	MJ / kg	10.7
Sugars	%	3.2
Ash	%	7.3
Non Digestible Fibre	%	46.7
Lignin	g/kg	19.1
pH	-	4.8

- (i) Based on the results shown, discuss the quality of Derek's silage.

- (ii) Outline the implications for the level of concentrate feeding required for the winter for both his dry cows and freshly calved cows. Support your answer with evidence from the table.

Session 2



Question Stems for Students

Remembering	Understanding
<ul style="list-style-type: none"> ● Who, what, where, why, when, which....? ● Describe or define...? ● Can you find....? ● Can you list...? ● Can you recall...? ● Can you select...? ● Label...? 	<ul style="list-style-type: none"> ● Describe in your own words... ● Summarise ● Classify.... ● Interpret..... in your own words ● Compare and contrast..... ● The main idea is..... ● Can you explain what is happening.....? ● Can you explain what is meant.....? ● Which is the best answer....?
Analysing	Applying
<ul style="list-style-type: none"> ● What conclusions can you draw from.....? ● What evidence can you find....? ● What is the relationship between...? ● Classify or categorise the evidence...? ● Can you make a distinction between? ● Examine closely and explain how did...? ● What is the function of...? ● What ideas justify...? 	<ul style="list-style-type: none"> ● What examples can you find...? ● What facts show that...? ● How would you organise ... to show...? ● What would happen if...? ● How could you use what we have learned today...? ● How would you solve.... using what you have learned? ● How would you show your understanding of....? ● What approach would you use to....?
Evaluating	Creating
<ul style="list-style-type: none"> ● Do you agree that...? ● What would you advise...? ● What do you think is the most important...? ● Why do you think .. is/is not important....? ● Prioritise.... ● How would you rate...? ● What would you recommend...? ● How could you determine...? ● What is your opinion of....? ● How could you prove / disprove that....? ● Can you assess the value / importance of..? ● Would it be better if....? 	<ul style="list-style-type: none"> ● Can you propose an alternative...? ● How could you adopt / modify...? ● How could you test...? ● What would happen if...? ● Can you predict the outcome if....? ● Can you think of an original way....? ● What solutions would you suggest...? ● What changes would you make to solve....? ● How would you improve...? ● What could be done to minimise / maximise? ● Suppose you could... What would you do?

Steps of critical thinking		
1. Identify the problem or question	Be as precise as possible: the narrower the issue, the easier it is to find solutions or answers.	The level of reseeded taking place on farms is far too low. Is reseeded good farm practice?
2. Gather data, opinions, and arguments	Try to find several sources that present different ideas and points of view	Teagasc research indicates a newly reseeded sward can increase annual DM yield by > 4 t DM / ha
3. Analyse and evaluate available data	Are the sources reliable? Are their conclusions data-backed or just argumentative?	Greater nutrient efficiency – more responsive to N (+24%) provided pH levels and P & K indices are correct
4. Identify assumptions	Are you sure the sources you found are unbiased? Are you sure you weren't biased in your search for answers?	Reseeding increases sward productivity by 25-30%
5. Establish significance	What piece of information is most important? Are all opinions and arguments even relevant to the problem you're trying to solve?	Teagasc estimates that every extra tonne of dry matter utilised is worth €183/t DM to a dairy enterprise and €105 for a dry stock farm. Very often it is possible to increase the grass harvested off a paddock by 4t DM/year. If this is achieved the cost of reseeded will be paid off in just over one year when it is reseeded.
6. Make a decision/reach a conclusion	Identify various conclusions that are possible and decide which (if any) of them are sufficiently supported. Weigh strengths and limitations of all possible options	Reseeding is one of the best-returning investments that a grassland farmer can make! Farms that carry out frequent grass reseeded, generally have a higher net profits

Enhancing Key Skills in the Agricultural Science Classroom through Debating

Formal Debates

The purpose of debating and developing arguments is to persuade an audience to accept a particular point of view. Debates provide pupils with practice in giving and justifying opinions. Pupils will be required to research topics to provide relevant information to support their point of view. Debates can be used for exploring issues and different points of view such as topics from literature being studied in class or local concerns such as pollution, phone masts and current affairs

Structure	Low Level	Moderate Level	High Level
Introduction			
State position	<ul style="list-style-type: none"> ● I think/I don't think ● Yes/No ● I like/I don't like ● I agree/disagree ● My favourite 	<ul style="list-style-type: none"> ● I have mixed feelings ● I prefer ● I strongly agree/disagree ● In my opinion ● I believe ● I feel 	<ul style="list-style-type: none"> ● I strongly/thoroughly/firmly believe ● I agree/disagree that ● Firstly, secondly, next ● I would like to start off by saying... ● I propose the following.... ● The problem with _____ is.... ● To begin ● In my opinion....
Provide supporting evidence	<ul style="list-style-type: none"> ● Because 	<ul style="list-style-type: none"> ● For instance ● Unless 	<ul style="list-style-type: none"> ● It is believed/widely believed that ● It has been found/discovered/proven ● On one hand/other hand ● Consider the following ● To further illustrate my point ● To reinforce my point ● Furthermore ● In fact ● As with ● Likewise ● Owing to ● Equally ● Significantly ● Indeed ● In particular ● For instance ● An example of this can be found... ● In other words...

			<ul style="list-style-type: none"> • That is to say... • What is important to remember... • I'd like to emphasise.... • I like to stress the importance of... • I would like to highlight.... • Here I'd like to refer to.... • As you may well know.... • As you are probably already aware.....
Present alternative position		<ul style="list-style-type: none"> • Can be found..... • For example • However/although • Except 	<ul style="list-style-type: none"> • Similarly, conversely • Alternatively • In the case of • Others believe... • According to.... • Although others believe.... • Regardless of.... • Contrary to.... • _____ stated that..... however....
Conclusion	<ul style="list-style-type: none"> • Thank you for listening 	<ul style="list-style-type: none"> • Thank you for your attention • To summarise.... • In conclusion.... 	<ul style="list-style-type: none"> • Therefore • Because of that • Overall • In conclusion • In summary • Consequently • As I have already said earlier... • As previously stated... • I'd like to summarize/sum up • Let me summarise by saying... • So that concludes my • At this stage I would like to run through/over the main points... • So, as we have seen today.... • In conclusion I would like to say that... • My final comments concern... • I would like to finish by reminding everyone that... • I am confident that you will all agree that

Example of a Rubric for Arguments and Debates

	1	2	3	4
Text Structure				
<i>Thesis</i>	No clear opening statement presented.	Some attempt to make an opening statement.	Opening statement made.	Opening statement made very clear to audience.
<i>State position</i>	No clear position stated.	Some attempt to state position made.	Position of speaker stated.	Position of speaker explicitly stated with appropriate language used.
<i>Provide supporting evidence</i>	No supporting evidence.	Evidence provided with no support.	Evidence provided with some support.	Series of detailed arguments made with supporting evidence.
<i>Present alternative position</i>	No alternative position presented.	Alternative position presented with no support.	Alternative position presented with some support.	Alternative position explicitly stated with supporting evidence.
<i>Summary argument</i>	No summary argument.	Some attempt made at summary argument.	Summary argument evident but without logical approach.	Explicit and logical summary of points made to conclude.
Language				
<i>Language features associated with the text type</i>	Limited connectives and verbs used with no facts and statistics.	Some connectives and verbs used with limited facts and statistics.	A range of connectives and verbs used with some facts and statistics.	Logical connectives, powerful verbs, facts and statistics used accurately throughout.
<i>Topic specific vocabulary</i>	No technical vocabulary used.	Some attempts to use technical vocabulary and emotive language.	Technical vocabulary used with evidence of research done. Some attempts to use emotive language.	Technical vocabulary, evidence from experts and emotive language used accurately throughout.
Speaking and Listening Skills				
<i>Broad rules that govern social interaction</i>	Poor turn taking. Did not hold the floor.	Some attempt to take turns during argument. Did not successfully hold the floor when given the opportunity.	Took turns appropriately for the most part and managed to hold the floor for a time.	Took turns and interjected appropriately throughout. Held the floor effectively receiving attention when stating position.
<i>Use of voice</i>	Poor projection. Mumbled speech without clear pronunciation. Audience disengaged.	Some projection with most words pronounced accurately.	Good projection and pronunciation. Delivery needs work.	Smooth, effective delivery with clear pronunciation and projection throughout. Audience engaged.
<i>Non-verbal behaviours</i>	Poor eye contact with audience. Stiff presentation with no gesture. Over reliant on speaking cues.	Some attempts at eye contact made. Repetition of gesture throughout. Speaker used some appropriate movements and attempted to use speaking aids appropriately.	Speaker had good posture and attempted to use speaking aids appropriately.	Sustained eye contact with audience, appropriate repair and gesture used throughout. Appeared relaxed, using comfortable movement and posture with appropriate use of speaking aids.

Case Study Activity

<p>1. What problems did you identify with on farm practice</p>	
<p>2. List and discuss suggested improvements for Tom and Mary's farm</p>	

<p>3. Rank your improvements for impact time / costs on the farm</p>	
<p>4. List the key skills and strand 1 opportunities from this activity</p>	

Project based Unit of Learning : Where is the money in reseeded?		
CONTENT BASED LEARNING OUTCOMES	PRACTICAL BASED LEARNING OUTCOMES	LEARNING INTENTIONS
<p>3.3.1(a) – The effect of soil quality on grass growth</p> <p>2.3(a) – Discuss the importance of good soil management in terms of soil testing and analysis of results and fertiliser application</p> <p>2.2(a) – What are the benefits of liming soil</p> <p>3.3.2(a) – Reseeding is good crop management. What is the impact of this on managing food producing animals? Stocking rates, grazing quality & fodder quality</p>	<p>2.2.1(e) – Testing soil pH</p> <p>2.2.3(b) – isolate and grow bacteria from clover root nodules</p> <p>Own ideas – Does soil pH affect the growth of various grass species? pH 6.3 – 6.5 favours rye grasses, pH < 6 favours bent grasses</p>	<p>Investigate how soil quality affect grass growth</p> <p>Explain why soils may need lime and fertiliser applications based on analysing soil tests.</p> <p>Discuss the effect of soil quality, soil preparation and sowing on the productivity of grass.</p> <p>Explain the reasons for reseeding grassland.</p> <p>Discuss the effect of seed selection on the productivity of grass.</p> <p>Produce written arguments to discuss financial viability of reseeding.</p> <p>Use secondary data discuss the impact of reseeding on managing food producing animals, grazing quality and fodder quality</p>
Leaving Certificate Agricultural Science		
YEAR: 5		
DURATION: 20 LESSONS		
<p>AIM: In this unit students will explore aspects of grassland management, good soil management, discussing the effect of soil quality and seed selection on grass productivity</p>		
<p>Key Concepts and Processes:</p>		
<p>KEY SKILLS</p> <p>Processing information – analysing & concluding</p> <p>Critical & creative thinking – proving or disproving</p> <p>Working with others – group work</p> <p>Problem solving – applying solutions to new contexts</p>		
<p>Making and Applying Decisions</p> <p>Students can make decisions on the benefits of reseeding and liming. Teagasc states it is possible to increase grass harvested off a paddock by 4 t/DM /Yr. How can this be achieved?</p> <p>What are the benefits of liming?</p>	<p>EXTENSIONS FOR IIS / POSSIBLE RESEARCH QUESTIONS</p> <p>From conducting this unit of learning what possible research questions / SPA extensions, modifications or adaptations can you come up with?</p> <ul style="list-style-type: none"> What grass species would you recommend to give the best annual yields, persistency & PPD Is re-seeding farm paddocks a sustainable farm practice? How does soil pH affect optimum grass growth? How does soil pH affect PRG v Bent grass growth? <p>Does liming affect the amount of DM/ha/Yr</p>	<p>RESEARCH SOURCES</p> <ul style="list-style-type: none"> Teagasc Agri aware Agri land Farmer Journal <p>Teagasc papers estimate that every extra tonne of DM produced is worth €183 per t/DM to dairy farmers and €105 per t/DM to dry stock farmers.</p>
<p>Making Informed Choice about Grassland Reseeding</p> <p>Management</p> <p>Throughout your project you should make decisions on:</p> <ul style="list-style-type: none"> Why do farmers reseed Is it financially beneficial to reseed Reliance on imported feed Grazing & stocking rates Winter fodder (quantity & quality) <p>Profitability of the farm</p>	<p>Assessment</p> <p>Q & A, Formative and summative assessment, use of plenary, questioning, peer assessments, self-assessments</p>	<p>Student Experience</p> <p>A student in the class is reseeding 5 ha of grassland at home. They are going to provide pictures and data relating to varieties, fertiliser used etc. and build a case study to share their experience with the whole class.</p>
<p>Cross Cutting Links</p> <ul style="list-style-type: none"> Sustainability Breeding & Genetics Policy & Economics 		

Reseeding Storyboard

Reseeding Grassland – Steps to Produce Good Quality Grassland			
			
Permanent pasture prior to reseeding. Soil test carried out – pH 6.0 and soil index of 2 for P & K	Field was sprayed with total herbicide	Grass dying off	Land being ploughed
			
Spreading 2 ton / acre lime on land	Land being harrowed	Sowing grass seed and clover mix and 150 kg 10:10:20 / acre (based on soil results)	Field after rolling
			
Grass emerging	Perennial RyeGrass and Clover mix	Sheep grazing – light and increase tillering	Fertilising the land post grazing

Trends and Patterns for Sheep

Trends and Patterns for Beef

Trends and Patterns for Dairy

Trends and Patterns for Pigs

Trends and Patterns for Tillage

Additional Information



info@pdst.ie | pdst.ie  



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