



Agricultural Science Phase 2 National Workshop 3

LEAVING CERTIFICATE AGRICULTURAL SCIENCE



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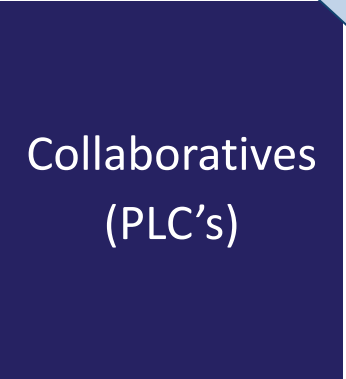


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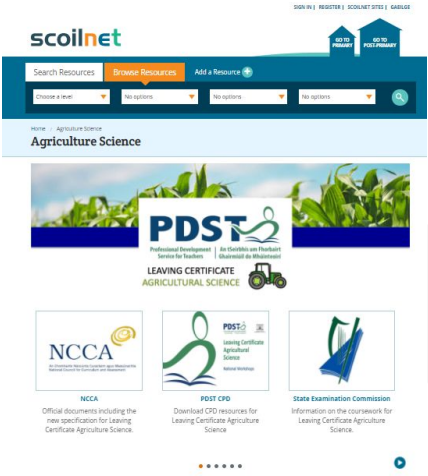
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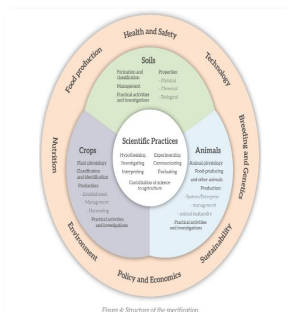
CPD Timeline 2022/2023



Purpose for Today



To appreciate the importance of learning outcomes, action verbs and success criteria within the agricultural science classroom



To explore the use of student centred methodologies in promoting the key skills of critical and creative thinking in the agricultural science classroom



Recognise how scientific practices can be used to support policy and economics within the specification

Session 1
9:30 - 11:00

- Appreciate the role of learning outcomes in Agricultural Science
- The importance of Bloom's Revised Taxonomy in understanding the role of action verbs in learning outcomes.
- Devise learning Intentions & success criteria to support learning and assessment

Tea/Coffee Break
11:00 - 11:20

Session 2
11:20 - 1:00

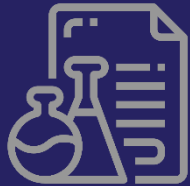
- Critical and creative thinking in Agricultural Science
- Promoting key skills and student centred learning
- Exploring case studies and project based learning as an inquiry approach

Lunch
1:00 - 2:00

Session 3
2:00 - 3:30

- Supporting scientific practices through policy and economics

Key Messages



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.



Using an array of different pedagogical approaches to enhance key skills, research skills and active learning.



Using scientific practices, to develop students' abilities to understand how the principles of economics permeate all strands within the agricultural science specification.

Session 1

By the end of this session participants will have:

- Understood the function of learning outcomes in supporting learning and teaching
- Appreciated the importance of action verbs and how they are classified according to Bloom's Revised Taxonomy
- Used success criteria to support learning and assessment



Differentiation in the Agricultural Science Specification

The Leaving Certificate Agricultural Science specification is differentiated in three ways:

1. Learning outcomes
2. Teaching and learning
3. Assessment



(Specification pg. 25)

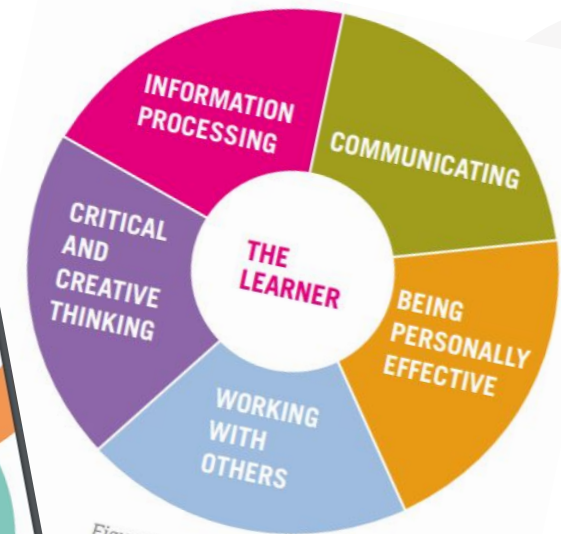


Figure 5: Key skills of senior cycle

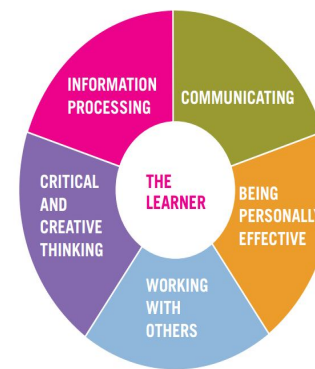
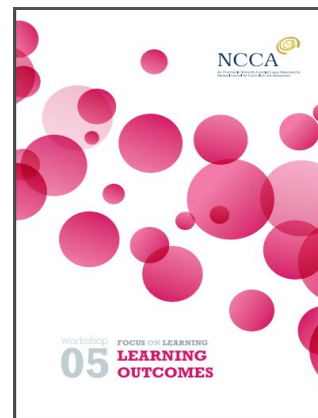


Understanding Learning Outcomes

Learning Outcomes:

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

(Focus on Learning Learning Outcomes, NCCA 2019 pg. 6)



The flexible nature of learning outcomes can challenge the most able students in their learning as well as meeting the needs of students with special educational needs.

Working with Learning Outcomes

Understanding action verbs within Learning Outcomes

- The action verb is described in terms of what the learner should be able to do.
- The action verb glossary is aligned with the command words used in the assessment. (Specification P.30)
- Action verbs have been carefully chosen to inform the teacher what is expected of the students and the verbs used ensure that students can achieve a range of skills and knowledge.
(Focus on Learning Learning Outcomes, NCCA, 2019, p. 12)

Glossary of action verbs

This glossary is designed to clarify the learning outcomes throughout the specification. The action verb is described in terms of what the learner should be able to do. This glossary will be aligned with the command words used in the assessment.

ACTION VERB	STUDENTS SHOULD BE ABLE TO
Analyse	study or examine something in detail, break down in order to bring out the essential elements or structure; identify parts and relationships, and interpret information to reach conclusions
Annotate	add brief notes of explanation to a diagram or graph
Apply	select and use information and/or knowledge and understanding to explain a given situation or real circumstances
Appraise	evaluate, judge or consider text or a piece of work
Appreciate	recognise the meaning of, have a practical understanding of
Briefly describe/ explain	provide a short statement of only the main points
Argue	challenge or debate an issue or idea with the purpose of persuading or committing someone else to a particular stance or action
Calculate	obtain a numerical answer showing the relevant stages in the working
Classify	group things based on common characteristics
Comment	give an opinion based on a given statement or result of a calculation
Compare	give an account of the similarities and (or) differences between two (or more) items or situations, referring to both (all) of them throughout
Consider	describe patterns in data; use knowledge and understanding to interpret patterns, make predictions and check reliability
Construct	develop information in a diagrammatic or logical form; not by factual recall but by analogy or by using and putting together information
Convert	change to another form
Criticise	state, giving reasons the faults/shortcomings of, for example, an experiment or a process
Deduce	reach a conclusion from the information given
Define	give the precise meaning of a word, phrase, concept or physical quantity
Demonstrate	prove or make clear by reasoning or evidence, illustrating with examples or practical application

- *In order to fully understand the action required, candidates' understanding of the different action verbs used in the brief and the reporting booklet should be explored in class, e.g. evaluate, analyse, state, identify, etc.*

(SEC Information Note, 2021, p.6)



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Coursework

Information note for four Leaving Certificate subjects with new subject specifications

- Agricultural Science – Individual Investigative Study
- Computer Science – Coursework Project
- Economics – Student Research Project
- Physical Education – Physical Activity Project

Classifying Action Verbs in Agricultural Science

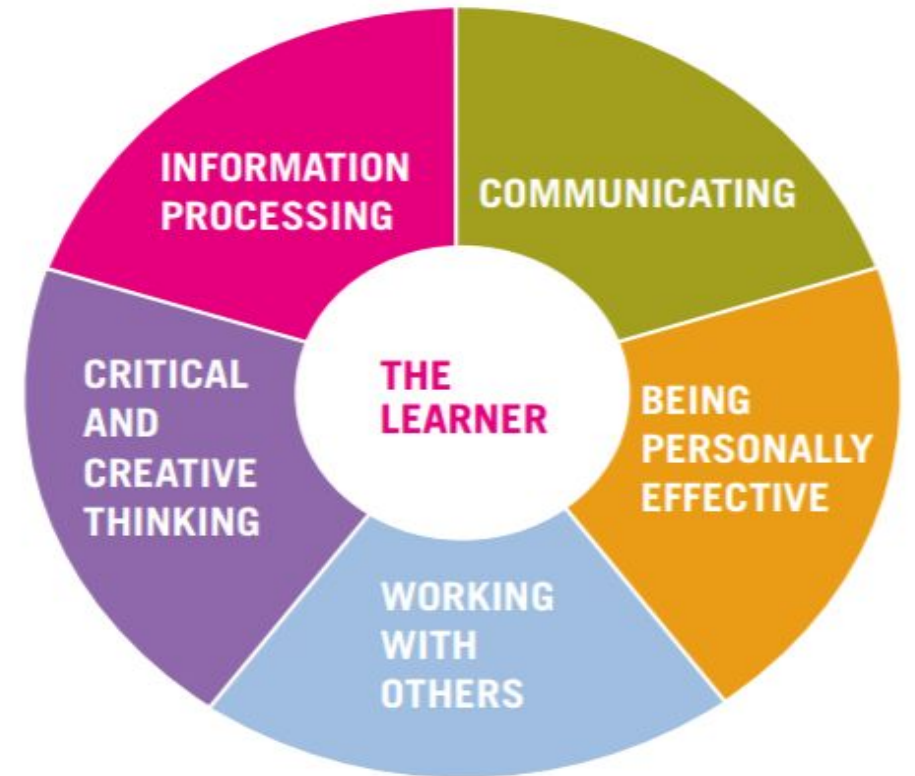
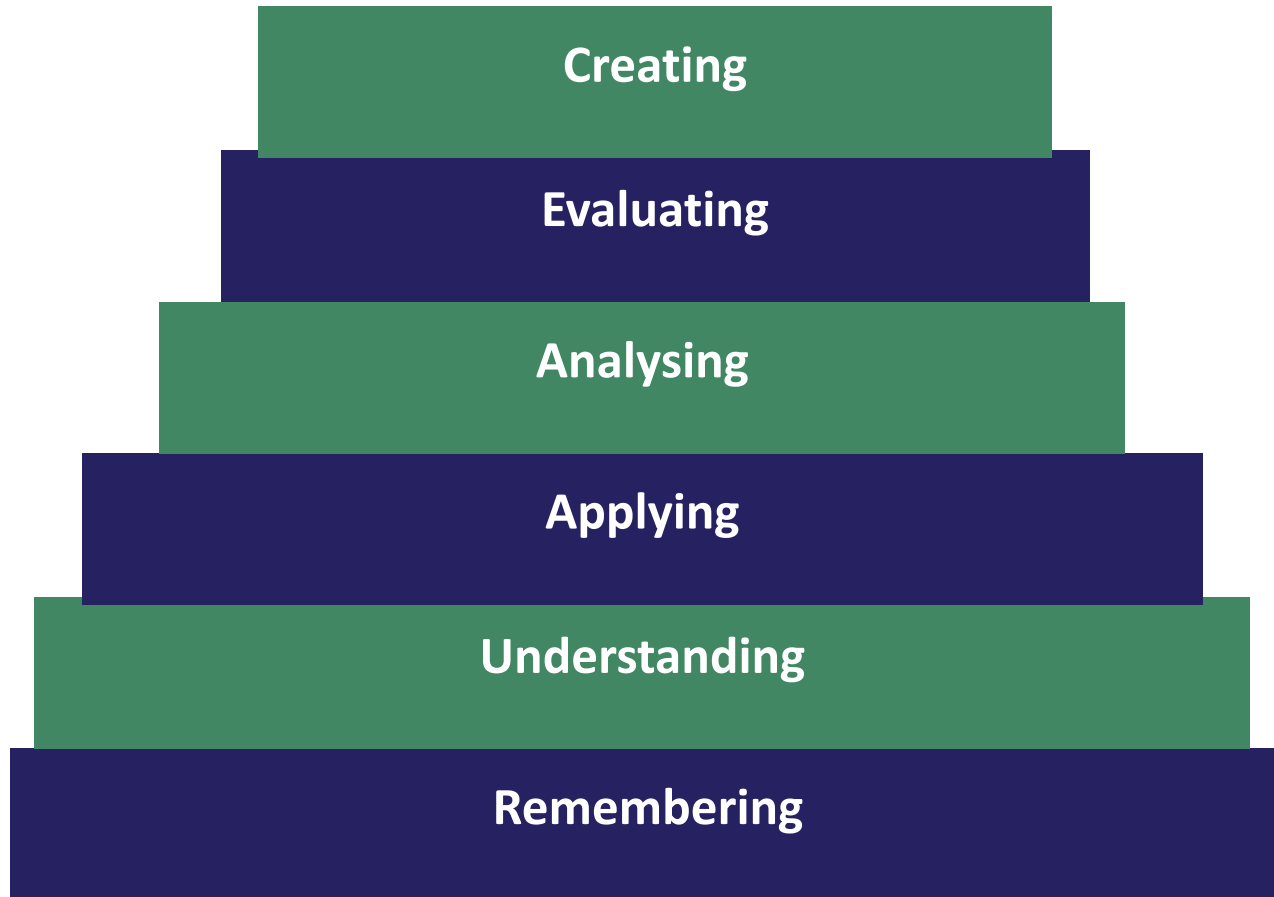


Figure 5: Key skills of senior cycle

Adapted from “NCCA - Focus on Learning - Effective Questioning 2015”
Bloom’s Taxonomy (Revised, 2001)

Working with Learning Outcomes

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



Figure 1: Planning teaching learning and assessment

Learning Intentions

Can be for a lesson or series of lessons

Learning Intentions

Describes clearly what the teacher wants the students to know, understand, and be able to do as a result of learning and teaching activities

Statement(s) created by the teacher



Learning Outcome Task



Pg 10

1. Developing Learning Intentions

Learning Outcome 4.3(e)

*“**Investigate** the factors that determine the output and quality of produce from a chosen enterprise (breed variety, nutrition, housing, management)”*

In groups:

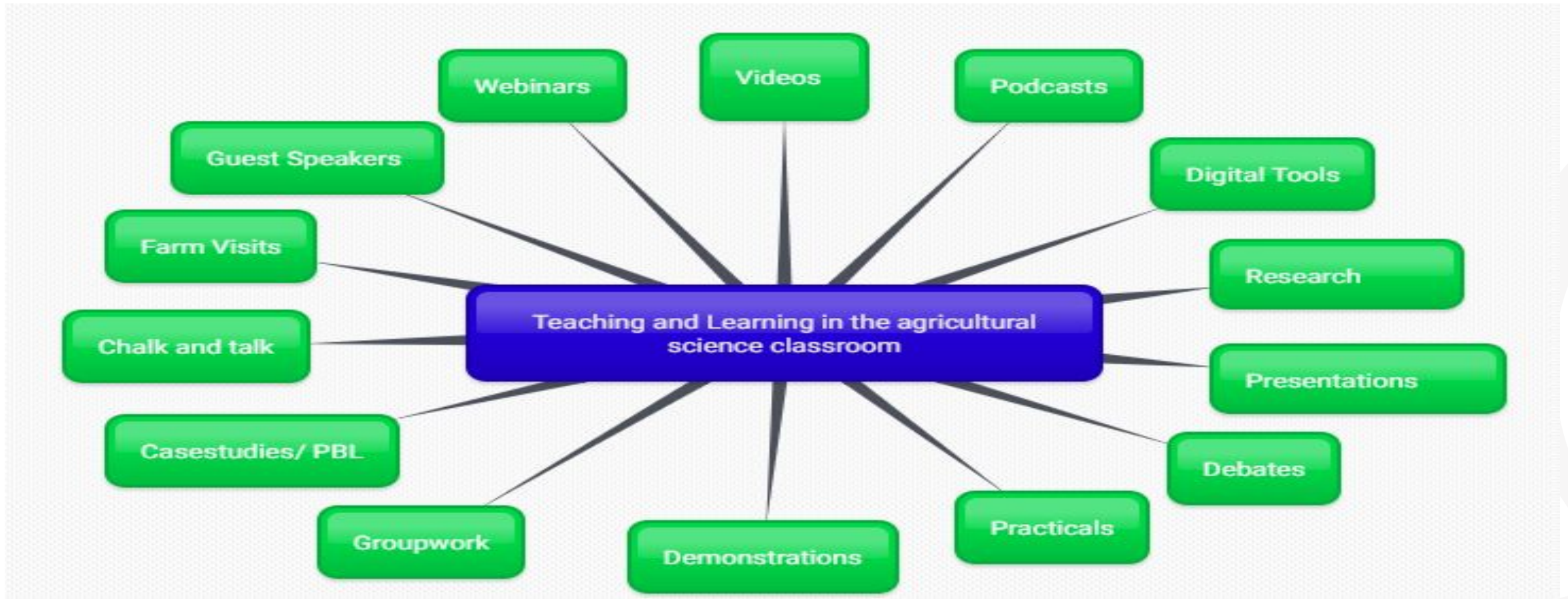
Develop learning intentions for learning outcome 4.3 (e)

Action Verb:

Investigate

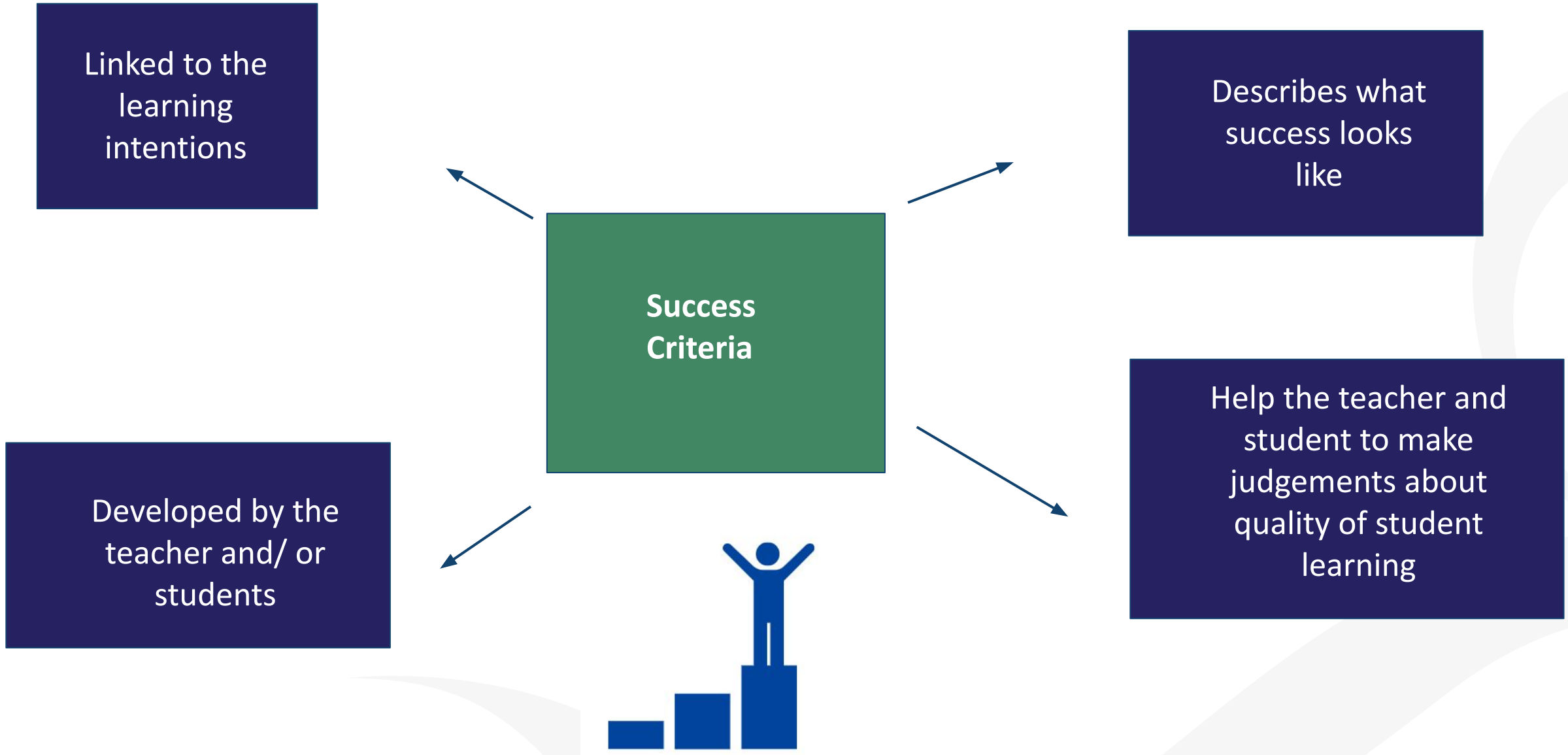
Observe, study, or make a detailed and systematic examination, in order to establish facts and reach new conclusions

Engaging with Learning Outcomes in the Agricultural Science Classroom



“Students will develop their key skills as they engage with the fundamental principles and concepts of agricultural science through participation in a wide range of activities”.(Specification P13-14)

Success Criteria



Learning Outcome Task 2



2: Teaching and Learning: Learning Outcome 4.3(e)

“Investigate the factors that determine the output and quality of produce from a chosen enterprise (breed variety, nutrition, housing, management)”

By setting appropriate and engaging tasks, asking *higher order questions* and giving *feedback* that promotes learner autonomy, assessment supports learning as well as summarising achievement
(Specification, pg 15)

In groups develop:
Learning Intentions
Learning Activities
Success Criteria

3. Teaching and Learning to Support Summative Assessment

Learning Outcome 4.3E

“Investigate the factors that determine the output and quality of produce from a chosen enterprise (breed variety, nutrition, housing, management)”



Pg 12-14

Using the action verb “discuss” consider possible student responses.

How does the action verb determine the way the learning outcome is assessed?

How do you support students to apply their knowledge to an unfamiliar context?

“Examination questions will require candidates to demonstrate knowledge, understanding, application, analysis and evaluation appropriate to each level”

(Specification pg. 26)

Feedback: How could you use this in your classroom?

Would it help students to engage with synoptic style questions?

Have you a better understanding of how to use action verbs in your teaching and learning?

Can you see the importance of the success criteria?



Session 1

By the end of this session participants will have:

- Understood the function of learning outcomes in supporting learning and teaching
- Appreciated the importance of action verbs and how they are classified according to Bloom's Revised Taxonomy
- Used success criteria to support learning and assessment



Tea/Coffee Break

Enjoy!



Session 2

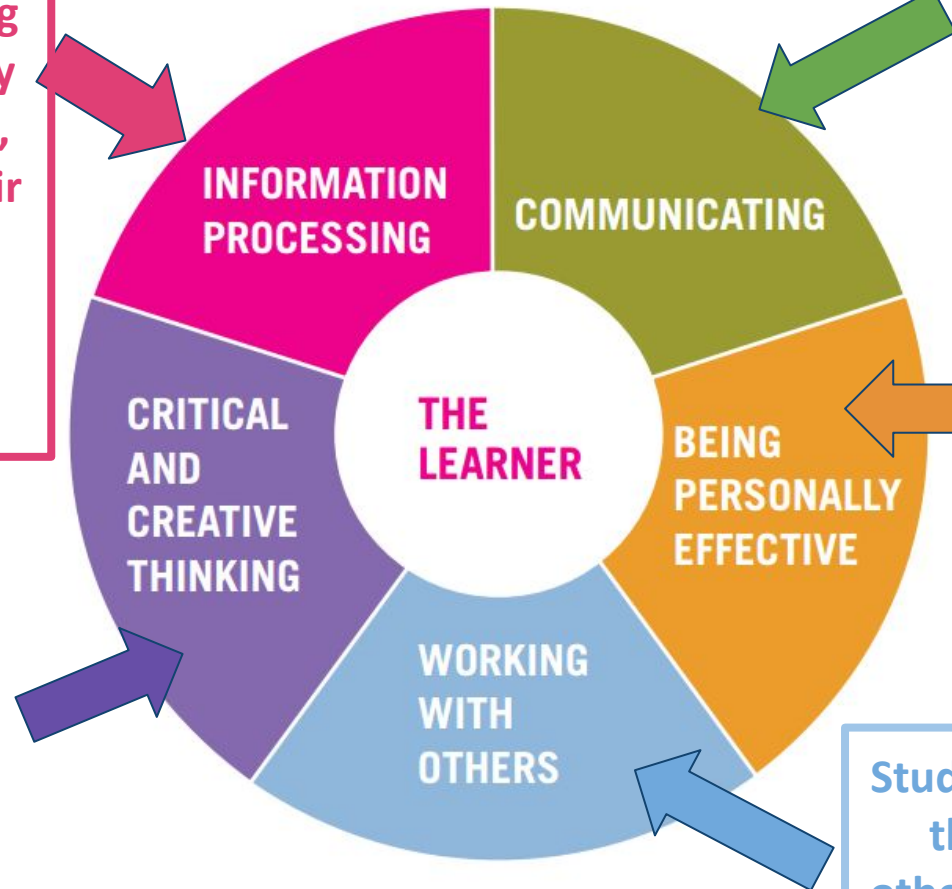
By the end of this session participants should be able to:

- Discuss critical thinking as an open and investigative approach to learning
- Assess how debating can help the development of key skills
- Recognise how farm - based case studies can be used to enhance teaching and learning
- Consider how project based units of learning allow students to develop their key skills, conduct research and explore scientific practices



Key Skills and the Agricultural Science Student

Students will solve relevant problems using careful observation, managing data, thoughtful analysis and clarity of expression to evaluate evidence, and make clear presentation of their proposed solution. Students will research up to date and balanced information and understand the limitations of science



Through the act of practical investigations and report writing, students will collaborate with each other and present their findings

Students will develop the skill of being personally effective as they develop strategies for managing, monitoring and evaluating their learning

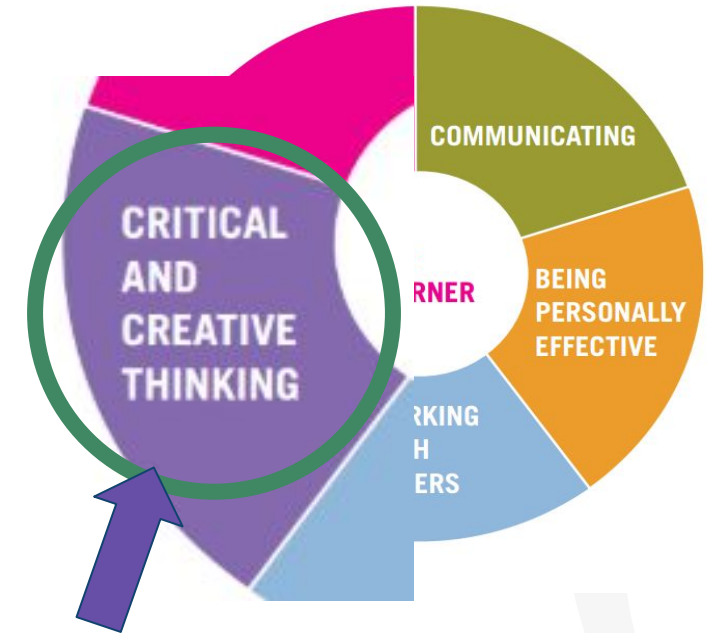
Students may work collaboratively and through this they will learn from others, but more importantly they will be engaged in a social experience involving the understanding of interpersonal dynamics



Developing Critical and Creative Thinking Skills



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What are critical thinking skills and why are they important?

Are we creating a teaching environment that allows the student voice to be heard?

How are we promoting curiosity in our classrooms?

How would critical thinking skills help students with answering synoptic questions and the IIS?

Students will develop their critical and creative thinking skills by examining relationships, developing and testing hypothesis, designing experimental tests to prove or disprove assumptions, exploring options, solving problems and applying those solutions to new contexts

Critical Thinking in the Specification

Written paper will assess:

Critical thinking, the ability to analyse and evaluate information and to form reasonable and logical argument, based on evidence

Problem solving based on integration, analysis and evaluation of qualitative and quantitative information and data
(pg 26 Specification)



L.O. 1.3.a **Critically** examine the scientific process that was used to present a scientific claim

Make judgements and draw conclusions from your analysis taking into account any relevant limitations
(pg 5 SEC Report Structure)

Conclusions should be drawn and justified by the analysis of data
(pg 9 NCCA guidelines)

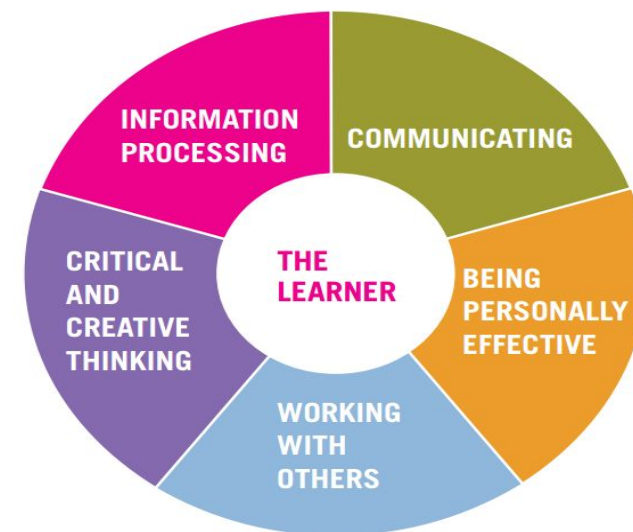
L.O. 1.4.b Discuss, debate, reflect on and **critically** evaluate the outcomes of investigations, their own and those of others

Developing Critical and Creative thinking in the Agricultural Science Classroom

Using debates to develop:

- Critical and creative thinking
- Information processing skills
- Communication skills
- Teamwork skills and collaboration

*“Critically evaluating scientific texts and debating statements about science”
 Specification, P14*



Specification, 2019 P.13



Strongly Disagree

Disagree

Neutral/Undecided

Agree

Strongly Agree



Statements for Debate

1. *“An ounce of breeding is better than a tonne of feeding”*
2. *“Farmers are the ones who have been looking after the environment for generations”*
3. *“Intensive dairy farming is the way forward for Irish farming”*



Action Verbs Relevant for Debating

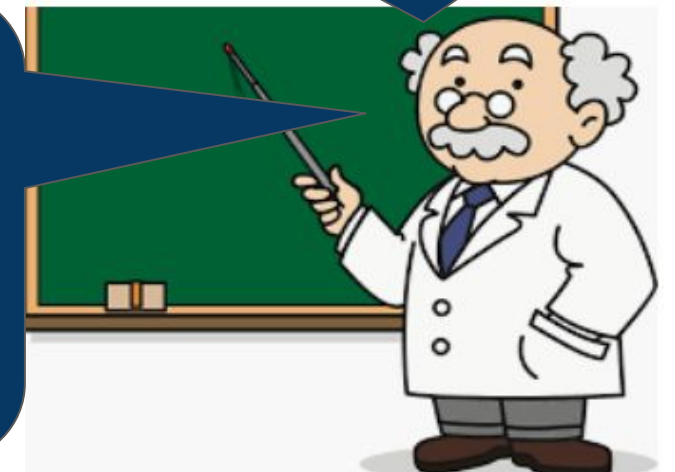
Argue	Challenge or debate an issue or idea with the purpose of persuading or committing someone else to a particular stance or action
Criticise	State, giving reasons the faults/shortcomings of, for example, an experiment or a process
Justify	Give valid reasons or evidence to support an answer or conclusion
Evaluate (ethical judgement)	Collect and examine evidence to make judgements and appraisals; describe how evidence supports or does not support a judgement; identify the limitations of evidence in conclusions; make judgements about the ideas, solutions or methods
Verify	Give evidence to support the truth of a statement

Using a Case Study as a Teaching Methodology

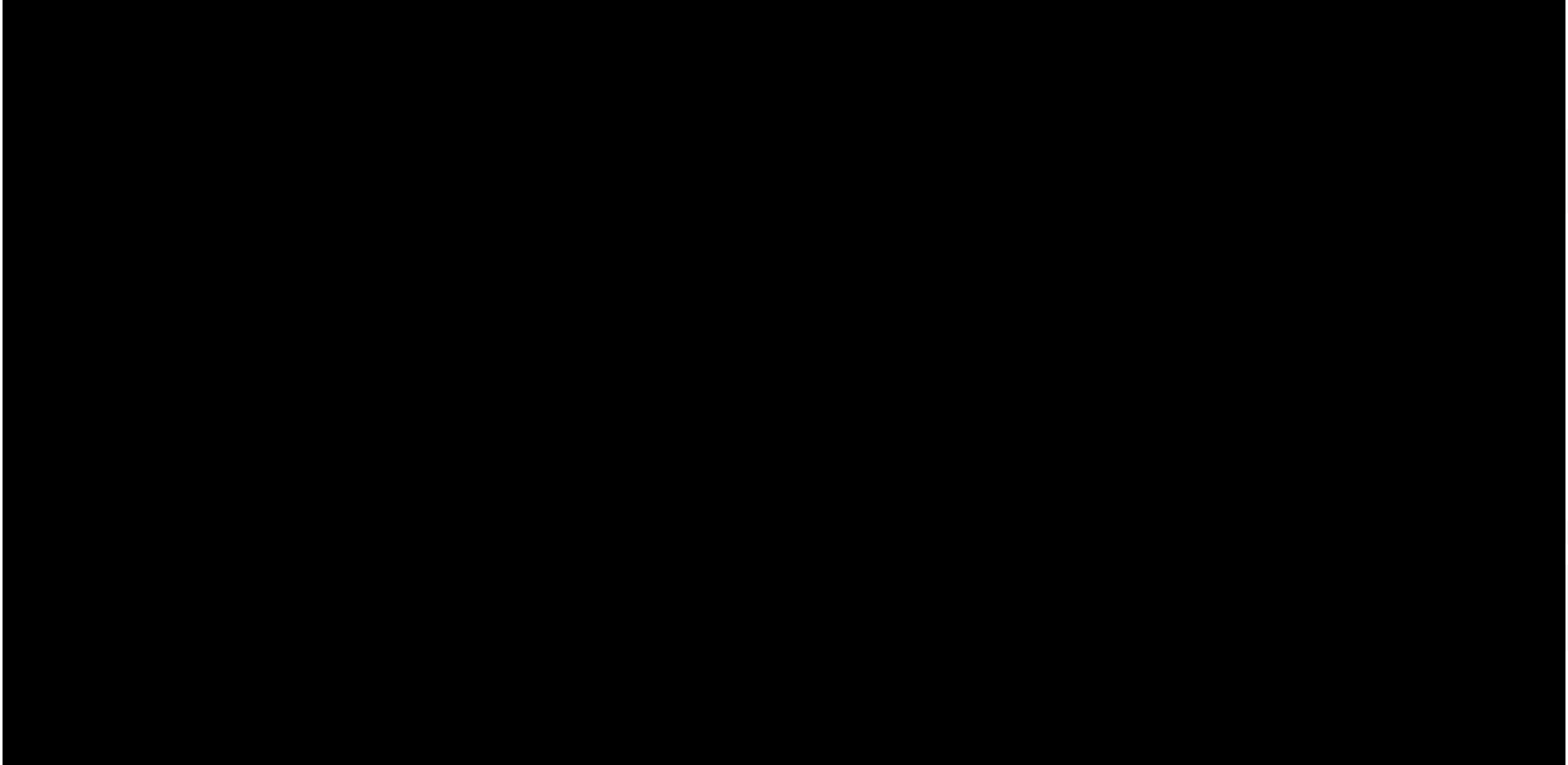
- Students review a real agricultural situation (a case) that poses a thought-provoking problem or dilemma
- The nature of a case study brings interest and relevance to the application of abstract concepts and theory in practice

“Case studies facilitate development of higher levels of Bloom’s taxonomy of cognitive learning; moving beyond recall of knowledge to analysis, evaluation and application”
(Bonney, 2015)

“Involves learning by doing, the development of analytical and decision making skills, the internalisation of learning, learning how to grapple with messy real-life problems, the development of skills in oral communications and often team work. It’s a rehearsal for life”
(Herreid, 1994)



Real Life Scenario - Dairy Case Study



Student Centred - Farm Based Case Study



Using the digital case study and the information in the workbook as a stimulus

1. What problems did you identify with on farm practice?

2. List and discuss suggested improvements for Tom and Mary's farm

3. Rank your improvements for impact time / costs on the farm

4. List the key skills and strand 1 opportunities from this activity



Appendix

Glossary of action verbs

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Convert	change to another form
Criticise	state, giving reasons the faults/shortcomings of, for example, an experiment or a process
Define	reach a conclusion from the information given
Define	give the precise meaning of a word, phrase, concept or physical quantity
Demonstrate	prove or make clear by reasoning or evidence, illustrating with examples or practical application

Focus less on knowledge and more on comprehension, application, analysis, synthesis and evaluation

Exposed to diversity of decision contexts for defined problems

Increased participation in class activities and performance in assessment

Learn through application of knowledge and concepts

Increased student autonomy

Case Study Advantages

Learning through active critical thinking, analysis and debates

Opportunities to learn interpersonal relations, teamwork and communication in controlled settings

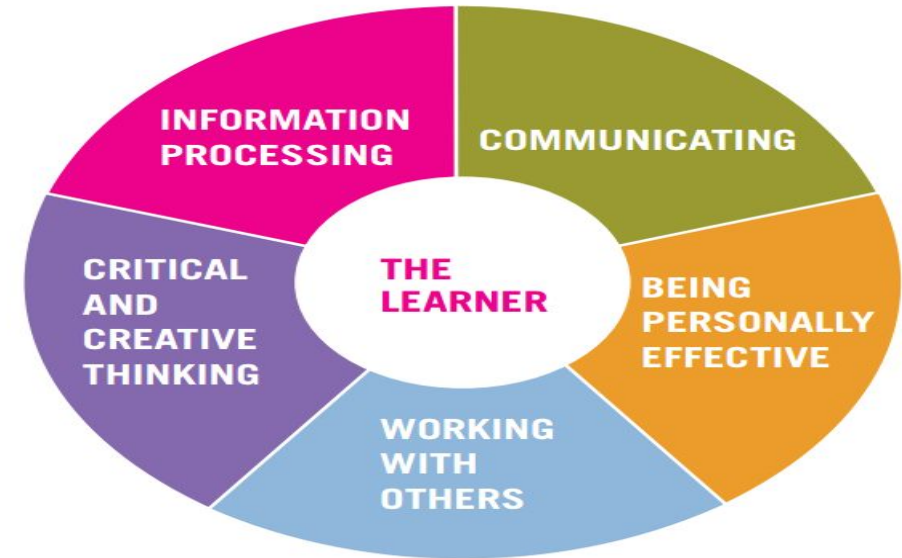
Involves problem - based learning and promotes development of analytical skills

Improve students' ability to synthesise complex analytical questions about real-world issues associated with scientific topics

Project Based Learning in the Agricultural Science Classroom



What Happens When
Students Engage in
Project-Based Learning?



Key skills of senior cycle
Pg 13 Specification

Benefits of Project Based Learning

- Student centered approach to learning
- More enjoyable, satisfying and engaging
- Develops life long learning skills
- Increased autonomy
- Empowering
- Actively involved in own learning
- Central to the spirit of the specification

“Through engaging in self-directed activities and reflection, students assume responsibility for planning, monitoring and evaluating their own learning and, in so doing develop a positive sense of their own capacity to learn”

Pg 14 Specification

Promoting Project Based Learning (PBL) in the Agricultural science Classroom

“Helps raise achievement of all learners”

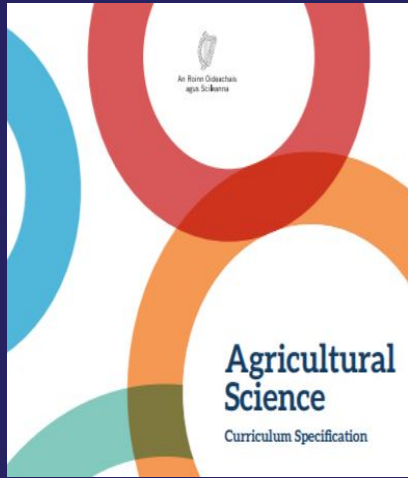
“Stimulates learners through hearing the ideas and opinions of others, giving them opportunities to react and discuss concepts”

“Helps to build positive relationships among learners, creating a learning community in which diversity is valued”

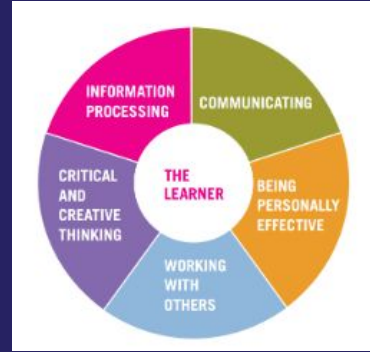
(Johnson, Johnson & Houlbec, 1994)



Learning Outcomes and Intentions



Key Skills



Practical Activities



Literacy and Numeracy

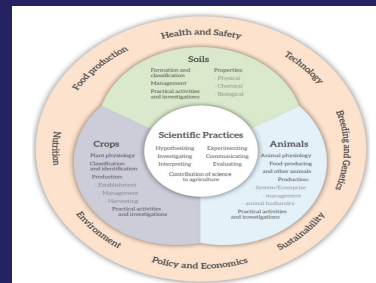


Creating a Project Based Unit of Learning

Assessment



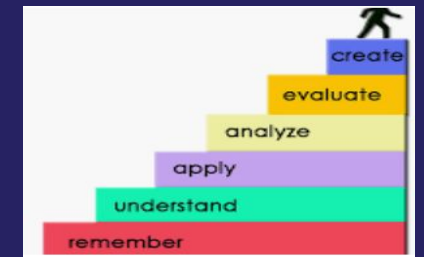
Cross Cutting Themes



Research Opportunities



Differentiation



Feedback: How would you use Project Based Learning in the Agricultural Science Classroom?

Would it help students to engage with synoptic questions?

What skills would your students use in PBL that are transferable to other parts of the course?

Would you use PBL as part of your teaching and learning?



Session 2 - Plenary

By the end of this session participants will have:

- Discussed critical thinking as an open and investigative approach to learning
- Explored how debating can help the development of key skills
- Recognised how farm - based case studies can be used to enhance teaching and learning
- Considered how project based units of learning allow students to develop their key skills, conduct research and explore scientific practices



Lunch Break

Enjoy!



Session 3

By the end of this session participants will be able to:

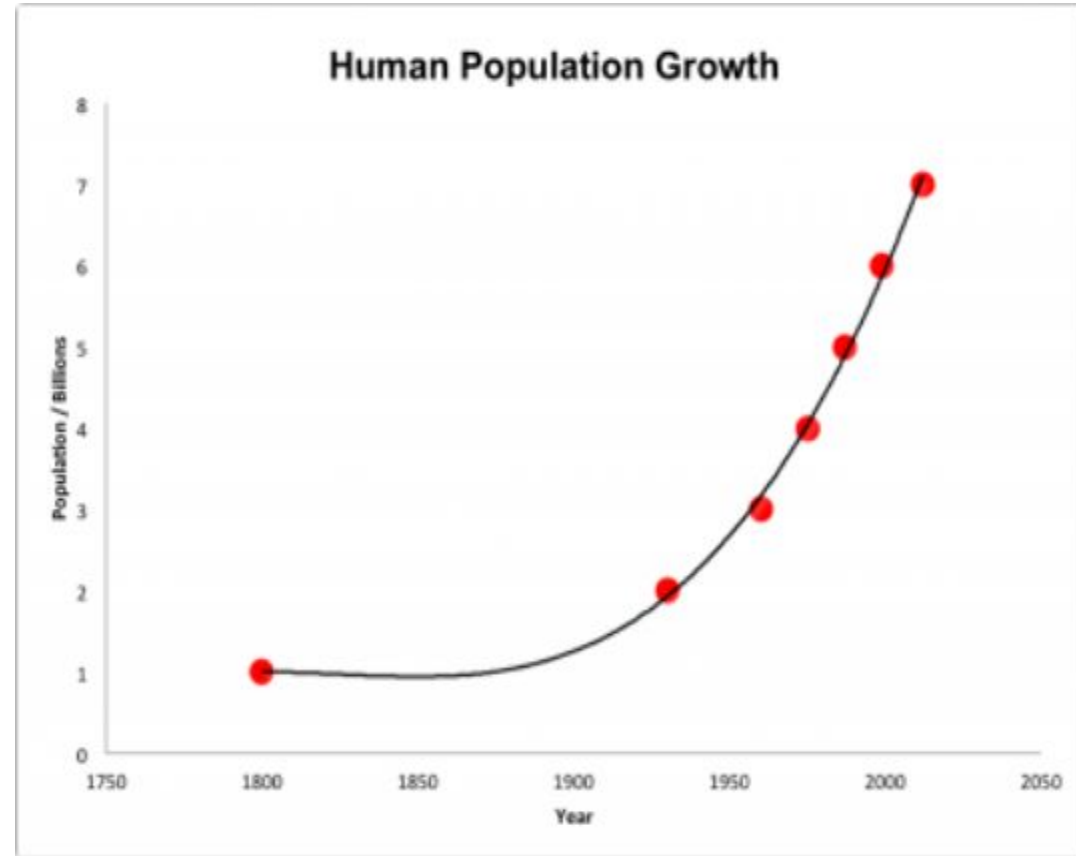
- Use an active teaching tool to explore economic trends
- Recognise how scientific practices can be used to support policy and economics within the specification



Using digital technologies to interpret data



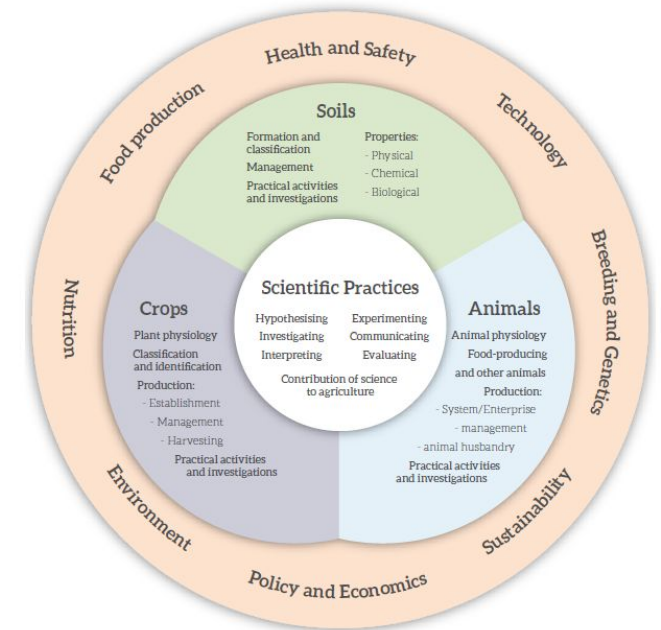
- 1.1 c Compile and interpret data or other information gathered from print, laboratory, and electronic sources (including websites), to research a topic or solve a problem
- 1.2 d Describe relationships (qualitatively and/or quantitatively) between sets of data, recognising the difference between causation and correlation



Policy and Economics in the Specification

- 4.3.1 b Recognise the importance of market trends and requirements, including value added/niche markets/artisan produce/export markets
- 4.3.1 c Use secondary data to discuss the impact of milk quality on milk price
- 4.3.1 d Appreciate the impact on farm economics of different animal production systems

Leaving certificate specification p23

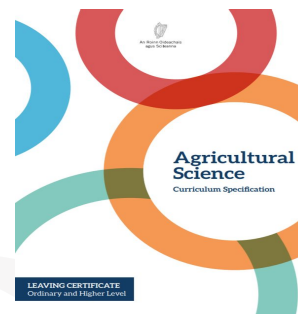
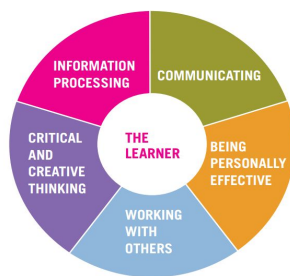
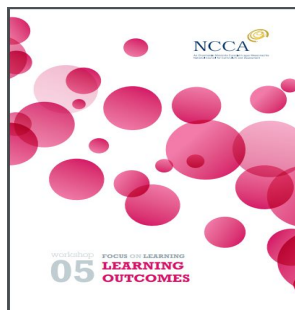


Appreciate The Role of Economics in Agricultural Science



Pg 26-30

- Use the given data sheets to carry out a marketplace activity on the economic trends in the various sectors
- Discuss possible teaching methodologies that you could use in your classroom
- Describe relationships between different sets of data, does the data correlate to current economic trends?



Reflecting on the use of Scientific Practices

Did we get opportunities to engage with the following aspects from Strand 1?

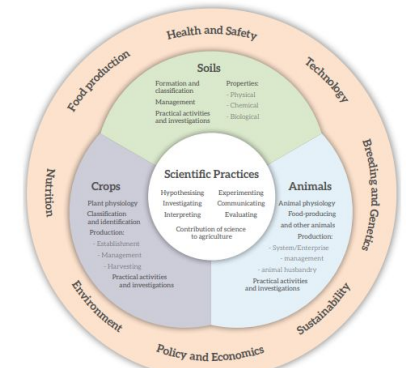
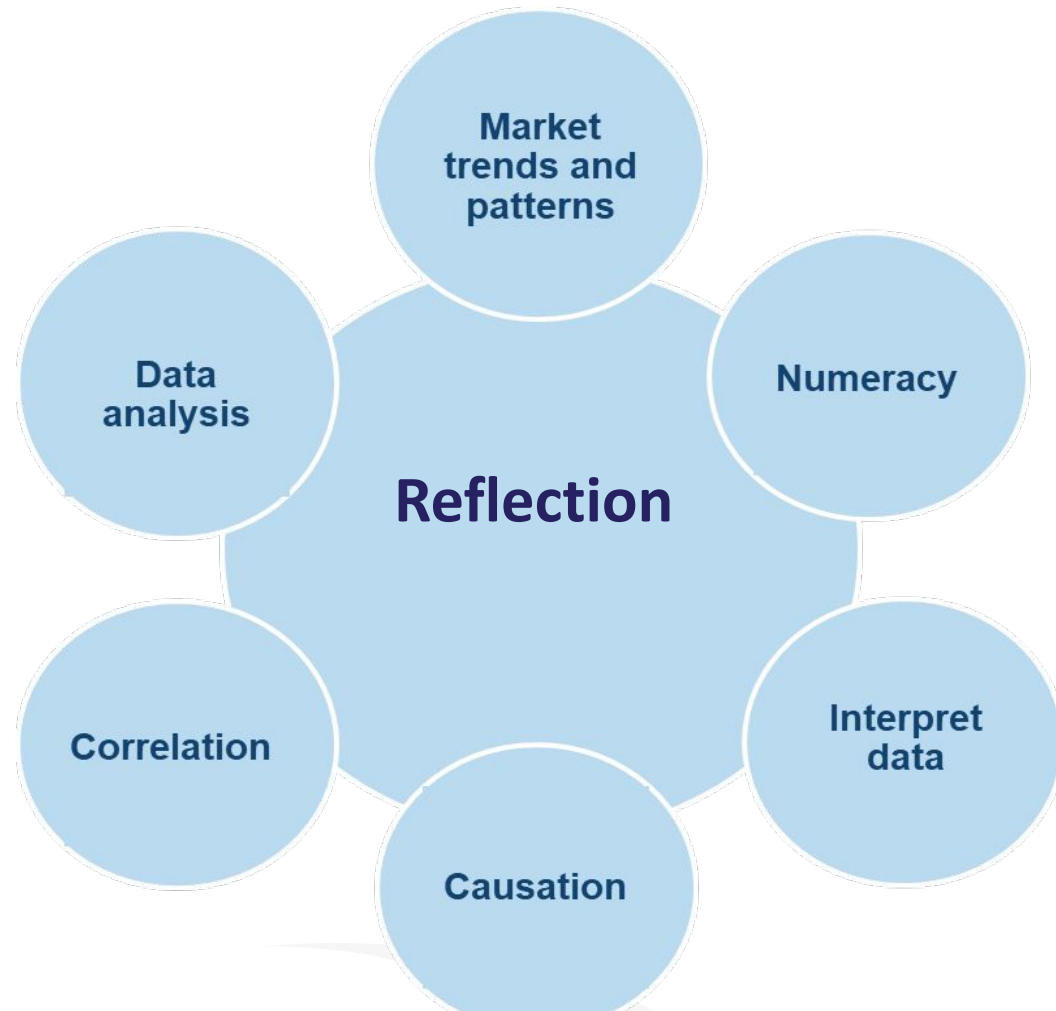


Figure 4: Structure of the specification



Session 3 - Plenary

By the end of this session participants will have:

- Used an active teaching tool to explore economic trends
- Recognised how scientific practices can be used to support policy and economics within the specification

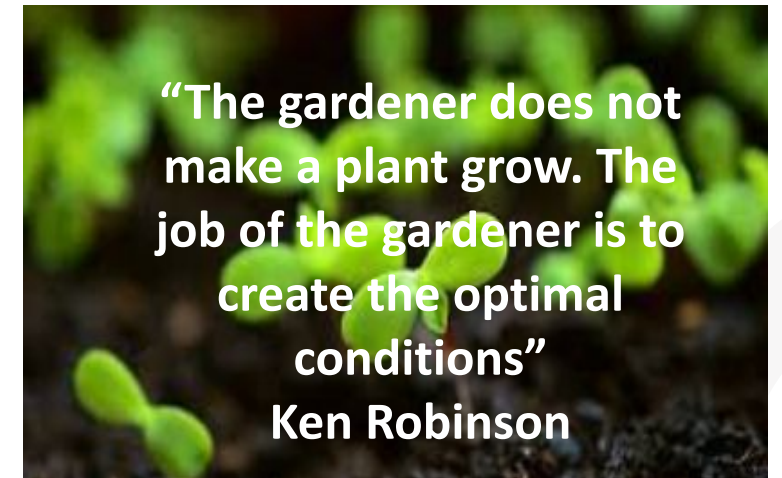


Evaluation

Please scan the QR code to log on:



<https://docs.google.com/forms/d/1aMcMaLhRskg8pT&dTF0/edit#settings>



Bibliography

Bonney, K. M. (2015). Case study teaching method improves student performance and perceptions of learning gains. *Journal of microbiology & biology education*, 16(1), 21.

Dori, Y. J., & Herscovitz, O. (1999). Question-posing capability as an alternative evaluation method: Analysis of an environmental case study. *Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching*, 36(4), 411-430.

Herreid, C. F., Schiller, N. A., Herreid, K. F., & Wright, C. (2011). In case you are interested: results of a survey of case study teachers. *Journal of College Science Teaching*, 40(4), 76.

Konopka, C. L., Adaime, M. B., & Mosele, P. H. (2015). Active Teaching and Learning Methodologies: Some Considerations. *Creative Education*, 6, 1536-1545.

William, Thompson (2007), Leahy et al., 2015

Johnson, Johnson & Houlbec, 1994