An tSraith Shóisearach do Mhúinteoirí

Junior CYCLE for teachers

Resource Booklet

Science

Jan - Mar Cluster

2018

Ionad Oideachais Mhúineachtáin

An Roinn Oideachais agus Scileanna | Department of Education and Skills

Contents Page

3-2-1 Activity

3
things you know

2
questions you have

1
thing you would like to leave with today

Planetary Data

	Diameter (Km)	Density (Kgm^{-3})	Rotation period (hours)
Mercury	4879	5427	1407.6
Venus	12,104	5243	-5832.5
Earth	12,756	5514	23.9
Mars	6792	3933	24.6
Jupiter	142,984	1326	9.9
Saturn	120,536	687	10.7
Uranus	51,118	1271	-17.2
Neptune	49,528	1638	16.1

See www.jct.ie/science/resources **for more Earth & Space resources.**

Action Verbs as Defined in the Specification

Verb	Students should be able to …
Analyse	study or examine something in detail, break down something in order to bring out the essential elements or structure; identify parts and relationships, and interpret information to reach conclusions
Apply	select and use information and/or knowledge and understanding to explain a given situation or real circumstances
Appreciate	recognise the meaning of; have a practical understanding of
Calculate	obtain a numerical answer, showing the relevant stages in the working
Classify	group things based on common characteristics
Compare	give an account of the similarities and/or differences between two (or more) items or situations, referring to both/all of them throughout
Conduct	to perform an activity
Consider	describe patterns in data; use knowledge and understanding to interpret patterns; make predictions and check reliability
Demonstrate	prove or make clear by reasoning or evidence; illustrating with examples or practical application

Verb	Students should be able to …
Describe	develop a detailed picture or image of, for example, a structure or a process; using words or diagrams where appropriate; produce a plan, simulation or model
Design	to conceive, create and execute according to plan
Develop	to evolve; to make apparent or expand in detail
Discuss	offer a considered, balanced review that includes a range of arguments, factors or hypotheses: opinions or conclusions should be presented clearly and supported by appropriate evidence
Evaluate (data)	collect and examine data to make judgments and appraisals; describe how evidence supports or does not support a conclusion in an inquiry or investigation; identify the limitations of data in conclusions; make judgments about ideas, solutions or methods
Evaluate (ethical judgement)	collect and examine evidence to make judgments and appraisals; describe how evidence supports or does not support a judgement; identify the limitations of evidence in conclusions; make judgments about ideas, solutions or methods
Examine	consider an argument or concept in a way that uncovers the assumptions and relationships of the issue
Explain	give a detailed account including reasons or causes
Explore	observe, study, in order to establish facts
Formulate	express the relevant concept(s) or argument(s) precisely and systematically
Identify	recognise patterns, facts, or details; provide an answer from a number of possibilities; recognise and state briefly a distinguishing fact or feature
Illustrate	use examples to describe something
Interpret	use knowledge and understanding to recognise trends and draw conclusions from given information
Investigate	observe, study, or make a detailed and systematic examination, in order to establish facts and reach new conclusions
Justify	give valid reasons or evidence to support an answer or conclusion
Measure	quantify changes in systems by reading a measuring tool
Model	generate a mathematical representation (e.g., number, graph, equation, geometric figure); diagrams; physical replicas for real world or mathematical objects; properties; actions or relationships
Organise	to arrange; to systematise or methodise
Outline	to make a summary of the significant features of a subject
Plan	to devise or project a method or a course of action
Produce	to bring into existence by intellectual or creative ability
Research	to inquire specifically, using involved and critical investigation
Review	to re-examine deliberately or critically, usually with a view to approval or dissent; to analyse results for the purpose of giving an opinion
Recognise	identify facts, characteristics or concepts that are critical (relevant/appropriate) to the understanding of a situation, event, process or phenomenon
Reflect	to consider in order to correct or improve
Use	apply knowledge or rules to put theory into practice
Verify	give evidence to support the truth of a statement

(Adapted from the Specification for Junior Cycle Science, www.curriculumonline.ie)

Research Statements

Individual

When presented with the following statement - "invasive species should be eradicated", consider the following pieces of evidence and decide how reliable each one is.

	Very reliable	Somewhat reliable	Not reliable
According to invasivespeciesireland.com, most non-native species do not cause problems, and some are even used for financial gain.	○	○	○
The Convention on Ecological Biodiversity claims that since the 17th century invasive species have contributed to nearly 40% of all animal extinctions for which the cause is known.	○	○	○
Rhododendrons, a tall plant with pink flowers, is an invasive species that grows in Killarney National Park. When the flowers bloom, they are visually pleasing and provide a source of nectar for bees.	○	○	○
Williams et al, 2010, estimated the annual cost of invasive species to the Irish economy at €261,517,445.	○	○	○
In a scientific paper published in February 2011, ecologist Martin Schlaepfer said that in time invasive species would not be a worry. If anything, they would be desirable.	○	○	○
Japanese Knotweed is an invasive species of Ireland found commonly on roadsides and river banks. Research shows that this plant lowers biodiversity by crowding out native plants, as well as affecting plants and animals in rivers and streams due to its leaf litter.	○	○	○

In Pairs

What makes evidence reliable?

Evaluating Media Articles

Learning Log

When evaluating media articles are there other points you might consider?

Reading and the Science Classroom

Why might students read in Science class?

- To solve a problem
- To gain basic knowledge
- To research
- To develop vocabulary
- To follow procedural steps
- For enjoyment
- To peer assess

What might students read in Science class?

- Books
- Worksheets
- Internet websites
- Newspapers
- Magazines
- Work from peers

"Working with children on science-text reading in science class is much more successful than trying to do it in language class"

(Kim Gomez, UCLA, 2007).

Some challenges for Science teachers

- Reading science text requires different skills to those needed to read narrative text.
- Students' previous experience of reading science text may have focussed them on recording isolated, disconnected facts rather than reading for understanding.
- We may assume that basic literacy skills will allow our students to engage with scientific text in rigorous critical investigations. Research suggests that this is not the case.

See our website for 'Reading Science' resources
www.jct.ie/science/resources

Classroom Strategies- to assist ALL your students in their engagement with science text.

Screencast - to introduce online tools that TEACHERS can use to adapt resources for less able readers.

Screencast - to introduce online tools that STUDENTS can use to make electronic text and internet sites more readable.

Search Vs Research

Research – To inquire specifically, using involved and critical investigation	**Examine** – Consider an argument or concept in a way that uncovers the assumptions and relationships of the issue
Discuss – Offer a considered, balanced review that includes a range of arguments, factors or hypotheses: opinions or conclusions should be presented clearly and supported by appropriate evidence	**Evaluate (ethical judgement)** - Collect and examine evidence to make judgments and appraisals; describe how evidence supports or does not support a judgement; identify the limitations of evidence in conclusions; make judgments about ideas, solutions or methods

- Working in pairs, choose a LO from the table below.
- Write a research question by either reworking the search question given, or writing a new one that relates to your chosen LO.
- When finished, share your research questions around the table and discuss.

Learning Outcome	Search question	Research Question
BW 10. Students should be able to evaluate how humans can successfully conserve ecological biodiversity and contribute to global food production; appreciate the benefits that people obtain from ecosystems	How does the Varroa mite affect the honey bee?	
E&S 8. Students should be able to examine some of the current hazards and benefits of space exploration and discuss the future role and implications of space exploration in society	What experiments have been conducted on the International Space Station in the last year?	
CW 10. Students should be able to evaluate how humans contribute to sustainability through the extraction, use, disposal, and recycling of materials	What is the process of fracking?	

Making Comparative Judgements

A teacher was developing their first-year students' abilities to design and plan their own scientific investigations. Students were given the following question **– How does the temperature of water affect the solubility of a common substance?** A section of the work submitted by 3 of the students is presented below.

Instructions:

- First read the **blue** method and discuss its merits with your neighbour.
- Now read the **red** method and decide if it is better or worse.
- Then read the **green** method and again, decide if it is better or worse.

Referring to the agreed success criteria, discuss in your pairs what feedback you would give each student to help improve their learning.

Blue Sample

Method

1. We weighed out 10.5g of jelly and measured out 100mls of different temperatures of water.
2. First, we put it in 71℃ temp water and measured the time it took to dissolve.
3. Then 57℃ temp water and measured the time it took to dissolve.
4. Then 18℃ (room temperature) and measured the time it took to dissolve.
5. After this we put it in 88℃ and finally we put it in 100℃.
6. We graphed our results.

Red Sample

Method

1. Fill a 400ml beaker up to the 100ml mark with cold water.
2. Measure 100g of salt into a measuring boat using a mass balance and record the mass.
3. Using a thermometer measure and record the temperature of the water.
4. Using a spatula add small amounts of salt into the 100ml of water.
5. When no more salt can be dissolved by the water, calculate the mass of the salt remaining using the mass balance.
6. Subtract the reading from the original 100 grams to calculate the mass of salt used.
7. Fill another 400ml beaker up to the 100ml mark.
8. Heat the water until it reaches 50℃ using a hot plate, carefully remove the beaker using tongs.
9. Repeat steps 2-6.
10. Repeat this method using water at other temperatures.

Green Sample

Method

1. I measured 50g of sugar into a beaker.
2. I measured 80ml of cold water, cooled by ice, in a beaker.
3. I then measured the temperature of the water with a thermometer.
4. I then added sugar (in small amounts) into the water until the water would not dissolve anymore sugar.
5. Then I measured the mass of the sugar left and wrote my results down.
6. I repeated this with lots of different temperatures.
7. I repeated this using salt and coffee.

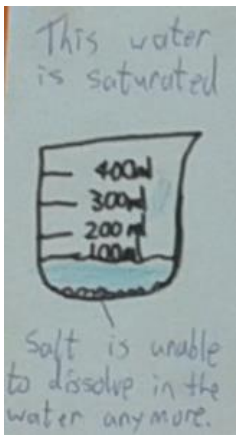
Red Sample

Method

1. Fill a 400ml beaker up to the 100ml mark with cold water.
2. Measure 100g of salt into a measuring boat using a mass balance and record the mass.
3. Using a thermometer measure and record the temperature of the water.
4. Using a spatula add small amounts of salt into the 100ml of water.
5. When no more salt can be dissolved by the water, calculate the mass of the salt remaining using the mass balance.
6. Subtract the reading from the original 100 grams to calculate the mass of salt used.
7. Fill another 400ml beaker up to the 100ml mark.
8. Heat the water until it reaches 50℃ using a hot plate, carefully remove the beaker using tongs.
9. Repeat steps 2-6.
10. Repeat this method using water at other temperatures.

Results

Temperature	Mass
18℃	26.9g
50℃	50.7g
90℃	70.2g



Conclusion

After doing this experiment I have come to the conclusion that the hotter the water the more salt it takes to saturate the water.

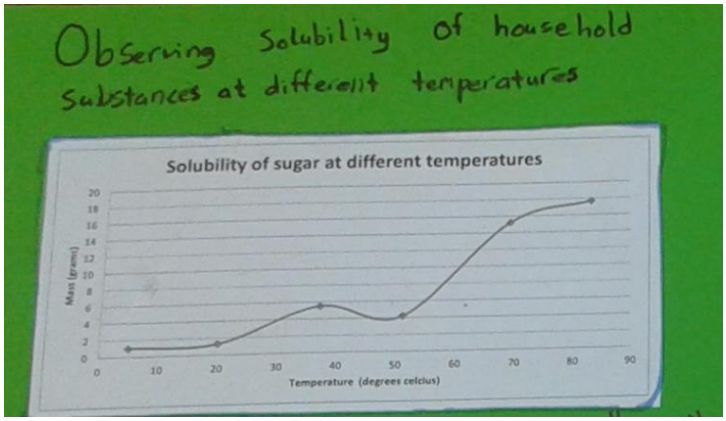
Green Sample

Method

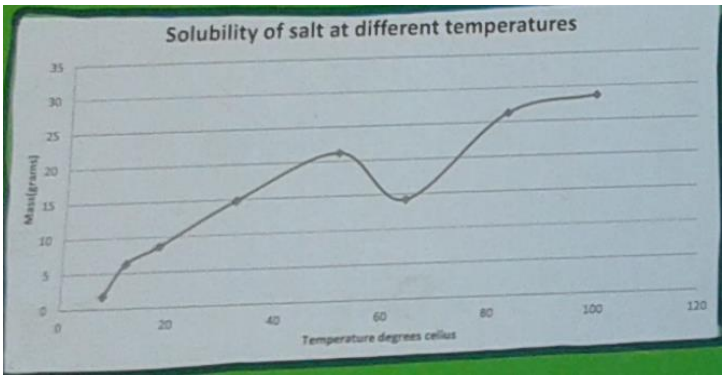
1. I measured 50g of sugar into a beaker.
2. I measured 80ml of cold water, cooled by ice, in a beaker.
3. I then measured the temperature of the water with a thermometer.
4. I then added sugar (in small amounts) into the water until the water would not dissolve anymore sugar.
5. Then I measured the mass of the sugar left and wrote my results down.
6. I repeated this with lots of different temperatures.
7. I repeated this using salt and coffee.

Results for Solutes: Sugar, Salt and Coffee

Temperature of water	Mass of sugar
5℃	**10g**
20℃	**13g**
32℃	**55g**
51℃	**42g**
69℃	**152g**
83℃	**177g**



Temperature of water	Mass of salt
8℃	**1.2g**
12℃	**6.3g**
18℃	**8.6g**
32℃	**14.8g**
51℃	**21.2g**
64℃	**14.2g**
83℃	**26.3g**
100℃	**28.6g**



In the 4th test with sugar even though the water temperture was higher than our 3rd test and the mass of sugar able to dissolve decreased but our tests showed that water at higher tempertures needs a higher mass of sugar to satuarate it. We made another error on the salt on the 6th test, as the result does not following the pattern of the curve.

Temperature of water	Mass of coffee
18℃	**0.2g**
76℃	**Couldn't see when it was saturated**

Conclusion

I have proven that my hypothesis was correct the higher the temperture of water (solvent) then the more mass (solute) is needed to saturate it. The lower the temperture of water the less mass of solute is needed to saturate. Salt and sugar both become more soluble when the temperature of the solution is increased. The solubility is different for both substances. Sugar is more soluble than salt at all temperatures.

Using Features of Quality

Applying FoQ for the First Time

Sample Identifier	Notes	Provisional Descriptor

Applying FoQ for the SLAR Meeting

Sample Identifier	Notes	Provisional Descriptor

Map of the Website

Framework
Science Specification
Assessment Guidelines
Science Info Leaflet

Latest News
Twitter Feed
Newsletters

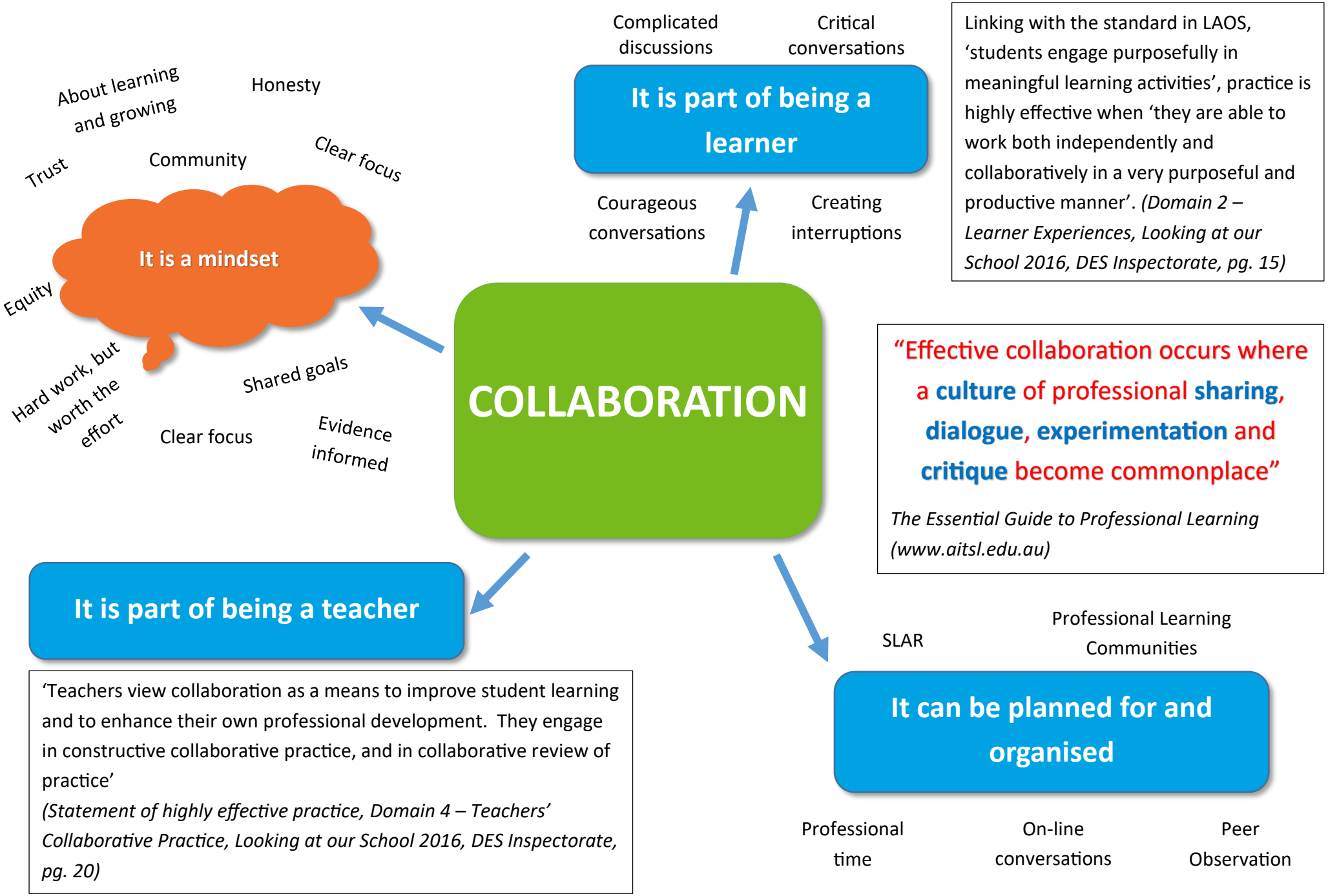
CPD Workshops / Elective workshops
Presentations
Resource booklets
Materials used during workshops

Planning First Year / Planning Next Steps / Working with Learning Outcomes / Planning Documents
Planning Resources
Resources to help your department when working with learning outcomes
Posters, plans and templates to help with planning

An Overview of Assessment for Junior Cycle / Classroom Based Assessments / Subject Learning and Assessment Review
Overview of changes in assessment for Junior Cycle Science
Formative assessment in the science classroom
Information regarding Classroom-Based Assessments
Supports for the SLAR process

Various resources including:
Posters, reading strategies, videos, links to websites
Introducing the Specification, the Nature of Science strand and inquiry based learning

Le fáil trí mheain na Gaeilge.


COLLABORATION
It is a mindset
About learning and growing
Honesty
Trust
Community
Clear focus
Equity
Hard work, but worth the effort
Shared goals
Clear focus
Evidence informed
It is part of being a learner
Complicated discussions
Critical conversations
Courageous conversations
Creating interruptions
Linking with the standard in LAOS, 'students engage purposefully in meaningful learning activities', practice is highly effective when 'they are able to work both independently and collaboratively in a very purposeful and productive manner'. (Domain 2 – Learner Experiences, Looking at our School 2016, DES Inspectorate, pg. 15)
"Effective collaboration occurs where a culture of professional sharing, dialogue, experimentation and critique become commonplace"
The Essential Guide to Professional Learning (www.aitsl.edu.au)
It is part of being a teacher
'Teachers view collaboration as a means to improve student learning and to enhance their own professional development. They engage in constructive collaborative practice, and in collaborative review of practice'
(Statement of highly effective practice, Domain 4 – Teachers' Collaborative Practice, Looking at our School 2016, DES Inspectorate, pg. 20)
It can be planned for and organised
SLAR
Professional Learning Communities
Professional time
On-line conversations
Peer Observation

It changes things:

"Educators need to see collaboration as a powerful mechanism for exploring beliefs, scrutinizing practice, and getting better, and therefore, teams benefit from considering how to improve collaboration" (*Donohoo & Velasco, 2016, pg.74)*

"Professional learning should make a difference to teacher learners **and** to the students that they teach." *(Nolan and Huber 1989)*

"To be most effective, collaborative learning should be driven by analysis of **student work** and be focused upon the development of teachers' knowledge, skills and understanding." *(Harris and Jones, 2012)*

"Professional Learning happens as a part of **the everyday work** of each teacher in each classroom" (*Fullan 2007)*

Schools that effectively collaborate "create a base of pedagogical knowledge that is distributed among teachers within a school as opposed to being held by individual teachers". (*Brook et al 2007)*

A Professional Learning Community – "An **inclusive** group of people, motivated by a shared learning vision, who **support** and **work with** each other, to **enquire into their own practice** and together learn new and better approaches that will **enhance all pupils' learning."** (*Stoll, 2006*)

The Thread of Learning: Key Messages

Ensure that our students are clear about what the intended learning is.

Ensure that our learning intentions are linked to learning outcomes.

There is no "right way" to share the learning. We might use a number of ways:

- Might share at the beginning and refer back to often
- Might be written on the top of a worksheet
- Might be in the form of a question
- May emerge as a consequence of students and teacher assessing where they currently are
- May evolve through an inquiry process

Learning intentions should give equal billing to Nature of Science learning and Contextual Strand learning.

The action verbs in learning outcomes provide clarity as to what the students should be able to do. This helps when developing learning intentions from learning outcomes.

Consider how evidence of student learning related to the learning intention will be gathered.

Learning Intentions

Don't have to be a checklist at the start of a lesson/activity - could emerge from doing work and then considering what makes work good

Should not limit students but allow students to excel

Should be revised in a developmental fashion

It is not appropriate to develop SC for every lesson and activity

Should be co-constructed as appropriate - this is developmental

Success Criteria

Should be targeted and based on success criteria

Can be in many forms - written, spoken, etc.

Can be in many directions – peer to peer, teacher to peer, self-directed feedback

Should be focused on the quality of student's work

Should prompt student thinking

Is a stepping stone to improving learning for the future - helps students set goals for the next time.

Should be more work for the student and less work for the teacher

Feedback

Developmental, not rehearsal

Craft Knowledge

Professional Judgement

For support on developing formative assessment practices, see http://www.juniorcycle.ie/Assessment/Focus-on-Learning

The Nature of Science and Our Classrooms

'Science is not a heartless pursuit of objective information. It is a creative human activity, its geniuses acting more as artists than as information processors.' *(Stephen Jay Gould)*

'Science makes people reach selflessly for truth and objectivity; it teaches people to accept reality, with wonder and admiration, not to mention the deep awe and joy that the natural order of things brings to the true scientist.' *(Lise Meitner)*

....a process of discovery towards a deeper understanding of the natural world

...a living, vibrant body of knowledge

...useful: Science generates new knowledge used to develop technologies which can enhance our quality of existence and help us to care for our planet

The World of Science is ...

...an exciting human endeavour which brings us to know the Universe of the past, the present and the future

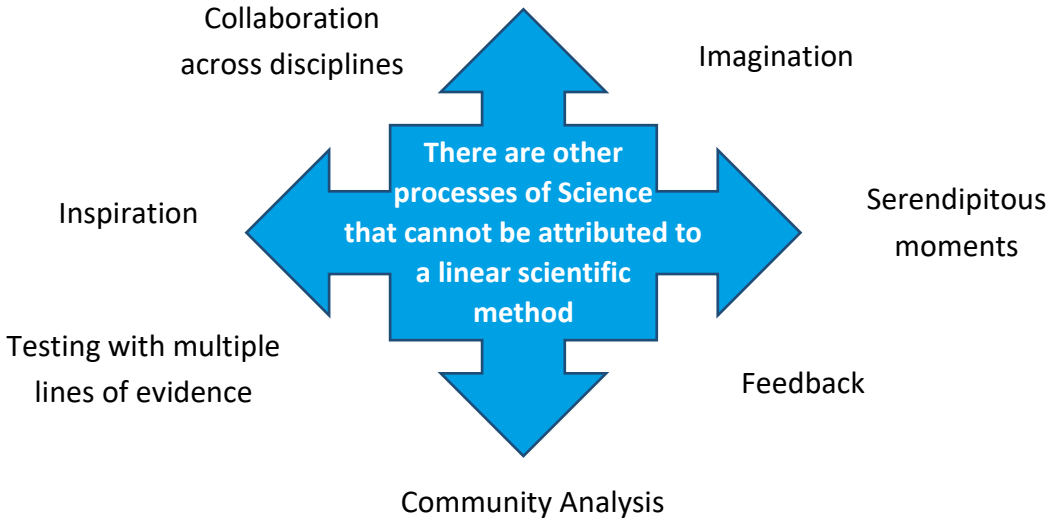
...ongoing: Science is never finished: *Somewhere, something incredible is waiting to be known* (Carl Sagan).

...a global human endeavour: Science is a social activity, historically located and globally relevant

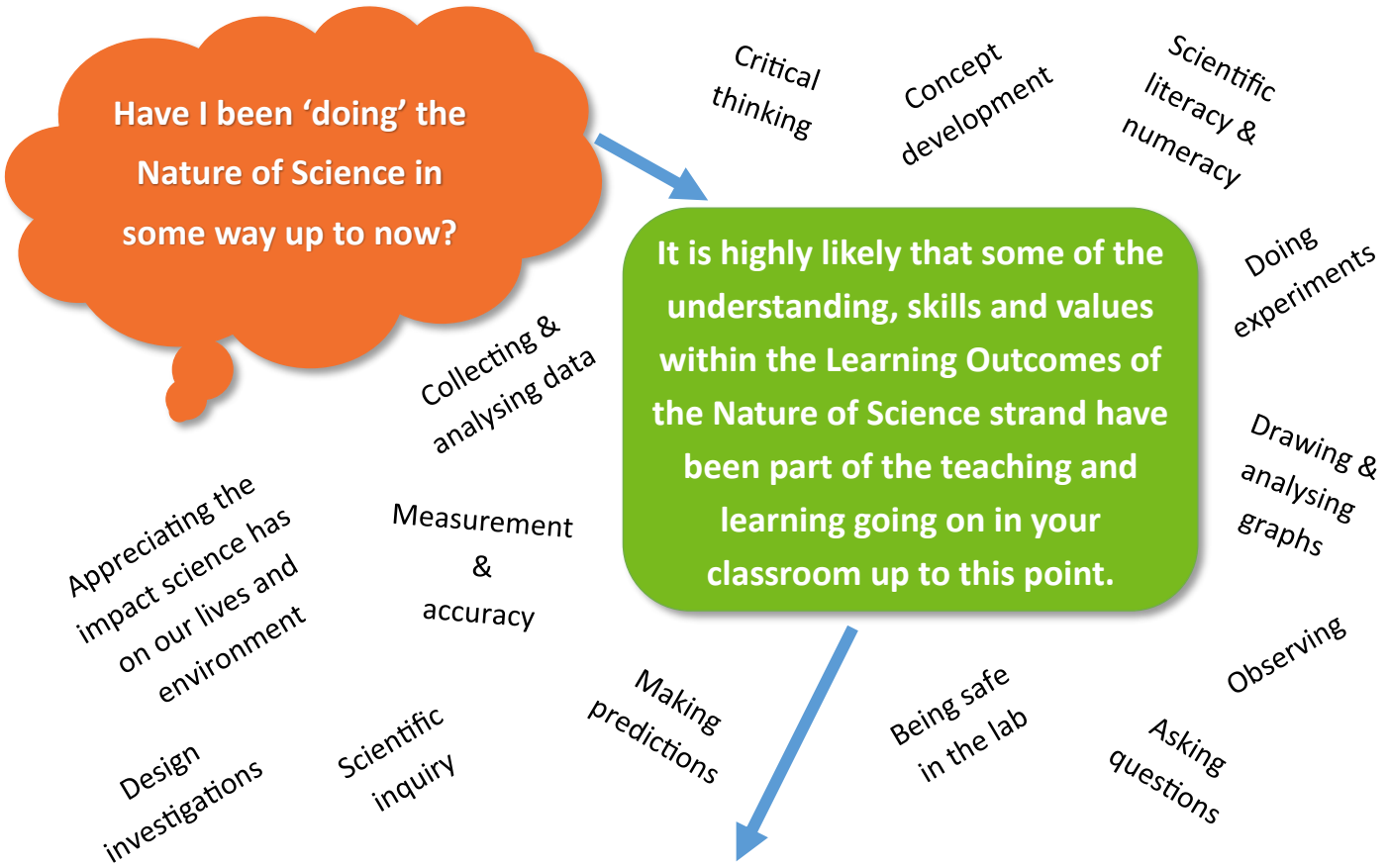
How is this exciting, vibrant world represented in our classrooms?

School science sometimes projects to teachers and students a rather simplistic account of science. This view is problematic in that it introduces students to a narrow version of the nature of scientific inquiry. It suggests:

- **Linearity of steps**
- **Bias towards experimental investigations**



You can find out more about the World of Science at
http://undsci.berkeley.edu/article/0_0_0/howscienceworks_02



BUT – Remember – The Nature of Science is not something that 'just happens'….it must be planned for in teaching, learning and assessment.

The Learning Outcomes of the Nature of Science strand are realised through the content and activities in the contextual strands.

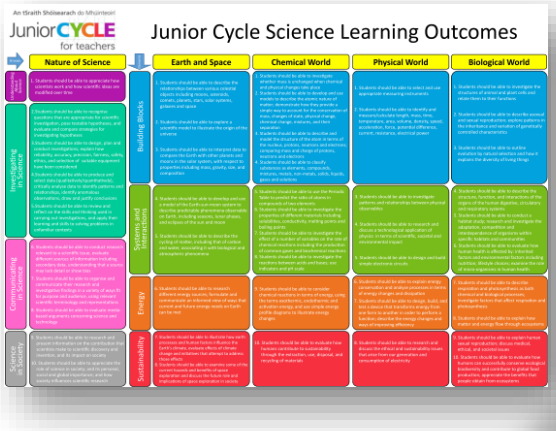
Nature of Science should be a part of EVERY LESSON that you teach, rather than something that is done separate to the learning in the contextual strands

In other words –
Nature of Science
IS NOT
all of it some of the time…..
IT IS
some of it, ALL OF THE TIME

Expectations – by the Teachers and Students of Ireland, for the Teachers and Students of Ireland

Teacher Developed

Teachers were an integral part of the subject development group for JC Science and the various consultation processes. They helped to shape, in a direct way, the learning outcomes of JC Science, which informed the Features of Quality for the Classroom Based Assessments (CBAs).



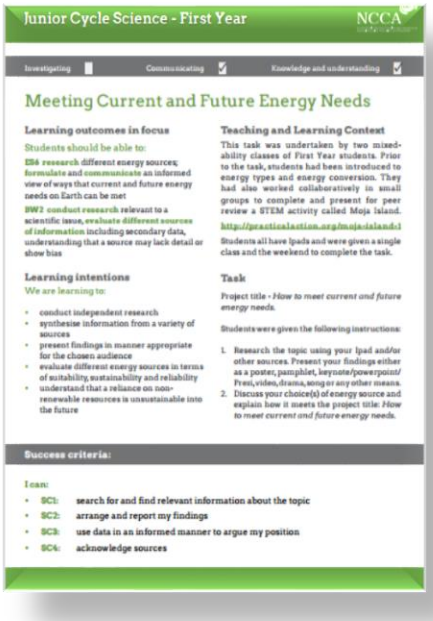
Teachers draw on their craft knowledge and professional judgement to realise expectations **every day in the classroom**. These expectations are developmental, and are part of the formative process of JC Science teaching, learning and assessment. The CBA moments are opportunities for students to celebrate their science learning journey. The moments of Subject Learning and Assessment Review meetings are opportunities for teachers to celebrate professional learning, ensure coherence of expectations, collaboratively assure our professional judgements and enhance our craft as science teachers.

Teacher Realised

Teacher Assured

To support coherence of our expectations of the students, there is a quality assured process of exemplifying the curriculum, facilitated by the NCCA. **Teachers lead this process**.

- ✓ Teachers develop examples of classroom work in Irish classrooms
- ✓ These examples are brought to the NCCA for consideration to enter a quality assurance process.
- ✓ At the quality assurance process, these examples of classroom work are presented for review by a group of independent teachers, NCCA, DES, SEC and JCT. Final examples are then published on www.curriculumonline.ie. These paint a national picture of our expectations of student learning and learner progression throughout JC Science.



Timeline of Key Dates

Spring 2018 – annotated examples of EEIs available on www.curriculumonline.ie

Friday 20th April to Friday 18th May 2018 – period during which students spend 3 weeks completing the EEI

Monday May 28th 2018 – latest date for SLAR meeting

Autumn 2018 – annotated examples of SSIs as well as examples of Assessment Tasks available on www.curriculumonline.ie

Friday 7th December to Friday 25th January 2019 – period during which students spend 3 weeks completing the SSI

Friday 1st February 2019 – final date for completion of Assessment Task

Thursday 7th February 2019 – latest date for completion of SLAR meeting

June 2019 – Final Assessment

Descriptor Definitions

Deciding the level of achievement for the Classroom-Based Assessments

Teachers use the Features of Quality to decide the level of achievement in each Classroom-Based Assessment. The Features of Quality are the criteria used to assess the student work, as best fitting one of the following Descriptors:

- **Exceptional** describes a piece of work that reflects all of the Features of Quality for the Classroom-Based Assessment to a very high standard. While not necessarily perfect, the strengths of the work far outstrip its flaws, which are minor. Suggestions for improvement are easily addressable by the student.

- **Above expectations** describes a piece of work that reflects the Features of Quality for the Classroom-Based Assessment very well. The student shows a clear understanding of how to complete each area of activity of the investigation, and the work is praised for its rigour. Feedback from the teacher might point to the necessity to address some aspect of the work in need of further attention or polishing, but, on the whole the work is of a high standard.

- **In line with expectations** describes a piece of work that reflects most of the Features of Quality for the Classroom-Based Assessment well. It shows a good understanding of the task in hand and is free from significant error. Feedback might point to areas needing further attention or correction, but the work is generally competent and accurate.

- **Yet to meet expectations** describes a piece of work that falls someway short of the demands of the Classroom-Based Assessment and its associated Features of Quality. Perhaps the student has made a good attempt, but the task has not been grasped clearly or is marred by significant lapses. Feedback will draw attention to fundamental errors that need to be addressed.

Sourced from the 'Junior Cycle Science Guidelines for the Classroom-Based Assessments and Assessment Task', First Edition.

Frequently Asked Questions on the CBAs

NOTE: All page references are to the

Junior Cycle Science Guidelines for the Classroom-Based Assessments and Assessment Task, First Edition, 2016

1. Is there a prescribed booklet to fill in?

No, there is no prescribed booklet to fill in. Students will report their research and findings in a format of their choice as specified in the Guidelines (pg. 17 and pg. 28).

2. Where do we store CBAs?

Once the SLAR is completed, provisional descriptors have been reviewed and final descriptors awarded, the work is given back to the student and does not need to be stored.

3. Do I give students feedback on the CBAs?

Providing effective feedback is a crucial step in using the EEI and the SSI to support learning in science. Students will be informed of the descriptor they have been awarded once the SLAR meeting has taken place and its outcomes have been processed. However, effective feedback goes beyond the naming of the descriptor awarded. Feedback on the strengths of the student's work, and on areas for improvement can be used to support their future learning. Information gathered during the completion of the EEI and SSI, and from the Subject Learning and Assessment Review meeting can be used to inform planning for future teaching and learning (pg. 21 & pg. 34).

4. When do the titles come out?

There are no titles. The students choose a research question (EEI) and a scientific topic or issue (SSI) linked to one of the topic options listed in the Guidelines (pg. 15 & pg. 26).

5. Can all students do the same topic?

The Guidelines highlight that the CBAs **promote student engagement** through providing opportunity for **student choice** about the topic or issue to investigate or research. For the EEI and SSI, students are expected to choose a topic for investigation from the list provided in the Guidelines. From this, they must formulate a question to investigate and "under normal circumstances, each student / group should complete a different investigation" (pg. 12).

6. Do all students have to have a separate report?

For both CBAs, teachers should ensure that each student is individually able to produce evidence related to the Features of Quality of this assessment. For the EEI, whilst students are encouraged to work in groups they must work individually to compile the report of their investigation. The SSI is an individual research report.

7. Can students work together?

The SSI is an individual research project. Whilst students may collaborate with classmates in gathering relevant information and data, each student must individually produce evidence to meet the Features of Quality of this assessment.

For the EEI students are encouraged to work in groups and will participate in four activities (not necessarily in a linear fashion) (pg. 15 - 17):

- Questioning and predicting: individually or in groups (each student must contribute to the work of the group)
- Planning and conducting: individually or in groups (each student should work on their own to write their Investigation Plan (pg. 21) but must contribute to the collection of data)
- Processing and analysing: should be done as individuals
- Reflecting and reporting: whilst students can reflect on their investigations together, they must report as individuals

8. Does it have to be a completely new investigation?

During the EEI, students will be required, amongst other things, to gather and analyse primary data. Similarly, during the SSI, students will be required to gather and analyse secondary data. In keeping with the spirit of the Guidelines, it is envisaged that students would engage with gathering new data for these investigations. In this regard, students would be carrying out new investigations. However, these investigations could be extensions of classroom work or areas of interest to students that were part of the teaching and learning process up to the point of the CBAs.

9. When should I share the Features of Quality with my students?

During your CPD with JCT science, we discussed the need to develop students' understanding of the features of a good investigation, as a **developmental process**, through the use of **formative assessment practices**. This supports students' understanding of the expectations of the features of an investigation, in line with the Features of Quality in the Guidelines. The Guidelines state that "From an early stage, students should be familiar with and **understand** the Features of Quality used to judge the quality of their investigation. This is best achieved when students use success criteria for ongoing assessments throughout first, second, and third year" (pg. 13). The teacher is the person best situated to decide on the rate at which this development progresses and will be guided by their professional judgement and their students' age and stage of learning.

10. How were the Features of Quality developed?

They were developed by the NCCA in consultation with the various educational stakeholders, based on the Nature of Science learning outcomes.

11. What is the purpose of the investigation plan?

As part of planning the investigation, "Students should be given time to have hands-on experience in the laboratory to plan and refine their experimental design, decide what equipment and materials will be necessary, and assess any possible risks" (pg. 16). After this planning session, the students submit an investigation plan individually to their teachers. This should take no more than a single class period to complete. The plan details the research question, equipment and materials request and the proposed method. This information is important for the teacher to ascertain whether the proposed method is dangerous, if the method is unworkable or unmanageable for logistical reasons, or if the question does not lend itself to scientific investigation. This may prompt the teacher to suggest changes, or to provide assistance which in individual cases may be beyond reasonable support. This may inform teachers' overall consideration of the descriptor awarded when using the Features of Quality (pg. 16).

12. Why must each student submit an individual plan?

Submitting an investigation plan is good scientific practice for now and later life. By submitting an individual plan, each student takes active ownership of their investigation from the outset. The individual plans also provide the teacher with early evidence relating to the Features of Quality for each student. This may inform teachers' judgements when considering the level of achievement of their work.

13. What provisions can I make for my students with special educational needs (SEN)?

Special provisions may be put in place for a student with a specific physical or learning difficulty to remove as far as possible the impact of the disability on the student's performance in both Classroom--- Based Assessments and the Assessment Task so that he/she can demonstrate his/her level of achievement. The accommodations – for example, the use of Irish Sign Language, support provided by a Special Needs Assistant, or the support of assistive technologies – should be in line with the arrangements the school has put in place to support the student's learning throughout the school year and are not designed to compensate for a possible lack of achievement arising from a disability (pg. 9).

14. Can I consider my student's research records when awarding a descriptor to their investigation?

No, only a student's investigation report is considered when awarding a descriptor. However, the idea of students keeping records is a good scientific practice to develop. Part of this practice involves students recognising the need to transfer relevant information into their final report. It is important to remember that the CBA moment is also a formative process and therefore feedback can be given to the student from the evidence that existed in his/her research records but did not appear in his/her final report.

15. Do Features of Quality carry different weighting?

No, all Features of Quality carry equal weighting. When awarding a descriptor, remember that it is a case of 'all or nearly all' of the features that will lead you to awarding an 'on balance' descriptor.

16. For the EEI, does experimental mean "hands on" laboratory work?

Yes, it does. Students need to be given the opportunity to demonstrate evidence of learning related to the Features of Quality of the EEI, and "hands on" experimental investigation work provides this opportunity (pg. 16).

Supporting the Process

The CBA process is a part of normal classroom practice. Like normal classroom practice, students will always require some support. To facilitate developmental feedback to students during their engagement with the task, the process of completing the Classroom-Based Assessment should be viewed as part of teaching and learning, and not solely for assessment purposes. It is envisaged that teachers will guide and supervise throughout the process through 'reasonable support'.

Reasonable support may include:

- Clarifying the requirements of the task
- Using annotated examples of student work provided by NCCA to clarify the meaning and interpretation of the Features of Quality to students
- Providing instructions at strategic intervals to facilitate the timely completion of the investigation and report
- Providing supports for students with special educational needs (SEN)

It is not envisaged that this level of support involved requires teachers to edit draft reports, or to provide model text or answers to be used in the student's evidence of learning.

CBA 1 – Extended Experimental Investigation (EEI)

If a student requires more than what is deemed to be 'reasonable support', the teacher can make a note of the level of assistance provided, in the following areas:

• formulating hypotheses/predictions	where a teacher gives an investigation question or excessive guidance in forming a testable hypothesis/prediction with justification
• planning	where a teacher has to provide assistance in the design of the investigation—because, for example, the proposed method was dangerous, incomplete, or unworkable
• conducting the investigation	where a teacher has to provide assistance to ensure the safe assembly and use of equipment

CBA 2 – Science in Society Investigation (SSI)

The teacher can review their own notes to check whether a student required more than what is deemed 'reasonable support' in choosing a topic for investigation, deciding a specific research question, or finding and recording information.

Adapted from the 'Junior Cycle Science Guidelines for the Classroom-Based Assessments and Assessment Task', First Edition.

Investigation Plan for CBA1

Student name:	Date: Class:
Research Question:	
Equipment and materials request:	
Proposed method:	
Approved by:	Date:

Sourced from the 'Junior Cycle Science Guidelines for the Classroom-Based Assessments and Assessment Task', First Edition.

Sharing Samples of Work for the Subject Learning and Assessment Review Meeting

Each teacher of second-year students should submit four samples of student work for the Subject Learning and Assessment Review Meeting. Where feasible, these samples should **contain an example at each of the four descriptor levels.** The information will be used to create a running order for our upcoming Subject Learning and Assessment Review (SLAR) meeting. As we may not have time to discuss all the samples, please number the pieces 1 to 4, where 1 should indicate the sample that you would most like to discuss.

Please return this form by: _____ Date of SLAR meeting: _____

Name of Teacher: _____

Sample 1	Investigation topic: Provisional descriptor: Preference for use at SLAR: ☐ Format:
Sample 2	Investigation topic: Provisional descriptor: Preference for use at SLAR: ☐ Format:
Sample 3	Investigation topic: Provisional descriptor: Preference for use at SLAR: ☐ Format:
Sample 4	Investigation topic: Provisional descriptor: Preference for use at SLAR: ☐ Format:

Running Order of Samples for the Subject Learning and Assessment Review Meeting

Facilitator: _____

Date of SLAR Meeting: _____

Venue & Time: _____

Order	Teacher Name	Sample Collected	Provisional Award 'Exceptional'	Provisional Award 'Above Expectations'	Provisional Award 'In Line with Expectations'	Provisional Award 'Yet to Meet Expectations'

Guidelines for Carrying out a Subject Learning and Assessment Review Meeting

Subject Learning and Assessment Review meetings enable teachers to collaboratively reach consistency in their judgments of student work against common, externally set Features of Quality. Greater understanding of standards and expectations will develop over time as teachers come together in professional discussion to reflect on the quality of their own students' work, informed by the subject specification, assessment guidelines and other support material including annotated examples of students' work provided by the NCCA.

Overview

The review process is centred on **teachers discussing student work at structured** meetings. It will play an important role in helping teachers to **develop an understanding of standards and expectations** by enabling them to reflect on the evidence of students' work and to share the learning and teaching strategies supporting that work.

The **objectives** of the review process are to achieve:

- greater consistency of teachers' judgement,
- better feedback to students,
- greater alignment of judgements with expected standards,

and to assure parents and others that students are receiving appropriate recognition of their achievements in line with standards and expectations.

The time for review meetings will be provided for in the school calendar from the allocated 22 hours of professional time for each full-time teacher each year. **One teacher (facilitator) of each subject will be allocated two additional hours by school management to prepare for and coordinate each review meeting.** This role will normally be rotated among the relevant teachers.

Each meeting will:

- be subject specific
- be approximately two hours long
- take place at a time as near as possible to the completion of the Classroom-Based Assessment
- involve the review of student work related to a specific Classroom-Based Assessment

Where there is a single teacher of a subject in a school, the teacher can be facilitated to participate in a Subject Learning and Assessment Review meeting in another school. In the case of an Irish-medium school, the single teacher of a subject can participate in a Subject Learning and Assessment Review meeting in another Irish-medium school.

Facilitator's Guide

Teachers will fulfil the role of facilitator during Subject Learning and Assessment Review meetings on a rotational basis. The facilitator will model effective questioning during the discussion of the samples of student work focusing on how well students' work matches the Features of Quality. During review meetings, where it is not clearly evident which descriptor should apply, the group should look for the evidence in the student's work that matches **all or nearly all** of the Features of Quality associated with a particular descriptor. This '**best fit**' approach allows teachers at the review meeting to select the descriptor that '**on-**

balance' best matches the work being assessed. The facilitator will submit a **short report** (see pg. 27) of the review meeting to the school principal.

Teachers should not assume that the results of a group of students being assessed will follow any particular distribution plan as the student's work is being judged only against the Features of Quality rather than other students' performance.

Before the meeting

As a first step, teachers may find it helpful to review some of the relevant **NCCA annotated examples** prior to coming to decisions about their own students' work.

Once students have completed their Classroom-Based Assessment, the teacher will carry out a **provisional assessment** of the students' work based on the Features of Quality. These provisional assessments may be modified in light of the discussions that take place at the Subject Learning and Assessment Review meeting.

The teacher will make a note of the descriptor allocated to each student and any other point they may wish or find useful to refer to during and after the Subject Learning and Assessment Review meeting. This note will be for the teacher's own use.

In preparation for the Subject Learning and Assessment Review meeting, each teacher will **identify one sample of student's work for each descriptor**, where feasible, and will have these available for discussion at the meeting.

During the meeting

The facilitator leads the meeting and keeps the record of the decisions made in a template, which is used to generate the report of the meeting (see pg. 27) It is recommended that the meeting should generally follow this sequence:

- The facilitator explains that the purpose of the meeting is to support consistency of judgement about students' work and to develop a common understanding about the quality of student learning. The value of the meeting in providing feedback to students on how they might improve their work should also be highlighted.

- The facilitator asks one member of staff to introduce a sample of work they have assessed as ***Yet to Meet Expectations***.

- Following a **short introduction** by the teacher, the facilitator leads a general discussion on the extent to which the student's work matches the relevant Features of Quality. If the meeting affirms the judgement, this is noted in the meeting record by the facilitator.

- **Where there is a lack of agreement, the facilitator should refer to relevant annotated examples of student work provided by the NCCA and, if appropriate, a couple of examples of student work that other teachers in the group have assessed and awarded that descriptor to.**

- The facilitator should look to establish consensus during the discussion of examples but the emphasis should be on developing teachers' professional knowledge and skills rather than on seeking unanimous agreement over every Feature of Quality in every example.

- The emphasis in affirming judgements during the review meetings should always be on a 'best fit' approach which allows teachers to agree the descriptor that 'on-balance' is most appropriate for the work being assessed.

- While reasonable time should be allowed for discussion, the facilitator should use his/her professional judgement to decide when it would be appropriate to proceed to the next sample.

- **If possible, there should be discussion of at least two samples for each descriptor and the facilitator should ensure that each teacher has at least one of their samples discussed during the meeting.**

- **The process is repeated, in turn, with samples assessed as *In Line with Expectations*, *Above Expectations* and *Exceptional* being discussed and shared in the group. At the end of the meeting, the facilitator briefly summarises the key points from the discussion**.

- It's important that each teacher **notes the implications of the decisions** made during the meeting for the rest of the student work they have already assessed, particularly in the case of descriptors where their judgement did not align with the view of the majority of teachers at the meeting.

After the meeting

After the meeting, each teacher considers the assessment of their students' work based on the outcomes of the meeting and, where it is considered necessary, makes the **appropriate adjustments to their provisional assessments**.

Following the Subject Learning and Assessment Review meeting, the **facilitator submits their report** from the meeting focusing on the outcomes of the discussion of student work at the meeting, and submits it to the school principal.

The facilitator may also ask teachers, should they wish, to **contribute some student work to a bank of examples**:

- To support the induction of new teachers

- To support future Subject Learning and Assessment Review meetings

- To use with students and parents in demonstrating the standard of work achieved.

Adapted from www.juniorcycle.ie/Assessment/Review-Meeting

Facilitator's Report

Subject Learning and Assessment Review Meeting

Subject:	**Date/time**
Attendance	
Key decisions taken	
Points of note for future review meetings	
Any further comment?	
Facilitator Date	

Sourced from www.juniorcycle.ie/Assessment/Review-Meeting

Contact Information

Information and resources are available on our website: www.jct.ie

For any queries, please contact us on one of the following:

Email: info@jct.ie

Phone number: 047 74008

Follow us on Twitter @JctScience and @JCforTeachers

The Science Specification and Guidelines for Classroom-Based Assessments and Assessment Task, First Edition, are available at www.curriculumonline.ie

Notes