Extended Experimental Investigation

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It will be helpful if teachers familiarise themselves with the NCCA document *Junior Cycle Science Guidelines for the Classroom-Based Assessment and Assessment Task* which is available at:
https://www.curriculumonline.ie/getmedia/02768f26-b9f4-45e7-8e19-f5efdf223d71/Assessment-guidelines_Science_Jan-2016-(1).pdf

This document will henceforth be referred to as the ‘NCCA Guidelines’.

The following are some key points relating to the Classroom-Based Assessments (CBA):

- In the case of Classroom-Based Assessment the teacher’s judgement is recorded for the purpose of subject learning and assessment review, and for the school’s reporting to parents and students. (NCCA Guidelines p. 6)
- The level of achievement in each Extended Experimental Investigation is decided by the teacher using the ‘Features of Quality’ described on pp. 19 and 31 of the NCCA Guidelines.
- The school supports the completion of the assessments by reporting the outcomes of Classroom-Based Assessments to students and their parents/guardians as part of the school’s reporting procedures and through the Junior Cycle Profile of Achievement (JCPA). (NCCA Guidelines p. 8)
- 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’. (NCCA Guidelines p. 8)

Table 1 summarises the key areas of the Extended Experimental Investigation (EEI):

<table>
<thead>
<tr>
<th>Classroom-Based Assessment</th>
<th>Format</th>
<th>Student preparation</th>
<th>Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extended Experimental Investigation (EEI)</td>
<td>A report may be presented in a wide range of formats</td>
<td>A student will, over a three-week period, formulate a scientific hypothesis, plan and conduct an experimental investigation to test their hypothesis, generate and analyse primary data, and reflect on the process, with support/guidance from the teacher.</td>
<td>Towards the end of Year Two</td>
</tr>
</tbody>
</table>

Table 1 Summary of key points about the Extended Experimental Investigation

The actual dates for carrying out the Extended Experimental Investigation will be decided at school level by the science teachers at a Subject Learning and Assessment Review (SLAR) meeting.

- It is encouraged, but not required, that students collaborate with classmates, except where it is indicated that students must work on their own. Teachers should ensure that each student is able to individually produce evidence related to the Features of Quality of this assessment. Under normal circumstances each student/group should complete a different investigation. (NCCA Guidelines p. 12)
The main learning outcomes assessed by the Extended Experimental Investigation are located in the Nature of Science strand as shown in Table 2. The sections in Essential Science showing where these learning outcomes are addressed are also shown in Table 2.

<table>
<thead>
<tr>
<th>Elements</th>
<th>Strand One: The Nature of Science</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Learning Outcome</td>
</tr>
<tr>
<td>Understanding about science</td>
<td>1. Appreciate how scientists work and how scientific ideas are modified over time.</td>
</tr>
<tr>
<td>Investigating in science</td>
<td>2. Recognise questions that are appropriate for scientific investigation, pose testable hypotheses, and evaluate and compare strategies for investigating hypotheses.</td>
</tr>
<tr>
<td></td>
<td>3. Design, plan and conduct investigations; explain how reliability, accuracy, fairness, safety, ethics and selection of suitable equipment have been considered.</td>
</tr>
<tr>
<td></td>
<td>4. Produce and select data (qualitatively/quantitatively), critically analyse data to identify patterns and relationships, identify anomalous observations, draw and justify conclusions.</td>
</tr>
<tr>
<td></td>
<td>5. Review and reflect on the skills and thinking used in carrying out investigations, and apply their learning and skills to solving problems in unfamiliar contexts.</td>
</tr>
<tr>
<td>Communicating in science</td>
<td>7. Organise and communicate their research and investigative findings in a variety of ways fit for purpose and audience, using relevant scientific terminology and representations.</td>
</tr>
</tbody>
</table>

Table 2 The learning outcomes assessed by the Extended Experimental Investigation and their locations in Essential Science
The Extended Experimental Investigation comprises four areas of activity:

A. Questioning and predicting
B. Planning and conducting
C. Processing and analysing
D. Reflecting and reporting (NCCA Guidelines p. 12)

**A. Questioning and predicting in preparation for the investigation**

The topic should be chosen from one of the following areas:

<table>
<thead>
<tr>
<th>Water</th>
<th>The Earth-Sun-Moon system</th>
<th>Food</th>
<th>Plant growth and behaviour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical reactions</td>
<td>Plastics</td>
<td>Forces</td>
<td>Energy conversions</td>
</tr>
</tbody>
</table>

- Students must formulate an open-ended research question involving a hypothesis which can be tested and links the variables.
- Students collect background information and include references to where they obtained this background information.

**B. Planning and conducting the investigation**

- Students plan the investigation and submit it individually to the teacher for approval. Students cannot proceed without teacher approval.
- Students decide what equipment and materials are needed, assess risks and carry out the investigation in the laboratory.
- The teacher notes the level of assistance given by him/her to the student and takes this into account when judging the level of achievement of the work.

**C. Processing and analysing the data**

- Students work individually to analyse their own data, carry out calculations and consider how to represent the data.
- Students identify patterns and relationships between variables in the data, draw conclusions and discuss if their hypothesis has been supported.

**D. Reflecting and reporting on the investigation**

- Students discuss the design and possible improvements of the investigation, limitations of the data and other investigations that they might conduct.

(NCCA Guidelines pp. 15–17)

**Format of the report of the Extended Experimental Investigation**

Students must work individually to compile the report of their investigation (NCCA Guidelines p. 17). A number of formats are listed on p. 23 of the final draft of the Junior Cycle science syllabus as follows:

- A handwritten/typed report
- Model building
- Multimodal presentation
- Podcasts
- Webpage

It is pointed out on p. 23 of the final draft of the Junior Cycle science syllabus that the above list is not exhaustive.

If the format chosen is a typed or handwritten report, the recommended length is 400–600 words (excluding tables, graphs, reference list and research record), i.e. about 2 to 3 pages.
The NCCA has provided four levels of descriptors of achievement to help teachers decide the level of achievement reached by the student in the Extended Experimental Investigation. These are described in Table 3.

<table>
<thead>
<tr>
<th>Level</th>
<th>Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exceptional</td>
<td>• Describes a piece of work that reflects all of the Features of Quality for the Classroom-Based Assessment to a very high standard.</td>
</tr>
<tr>
<td></td>
<td>• Not necessarily perfect, the strengths of the work far outstrip its flaws, which are minor.</td>
</tr>
<tr>
<td></td>
<td>• Suggestions for improvement are easily addressable by the student.</td>
</tr>
<tr>
<td>Above expectations</td>
<td>• Describes a piece of work that reflects the Features of Quality for the Classroom-Based Assessment very well.</td>
</tr>
<tr>
<td></td>
<td>• The student shows a clear understanding of how to complete each area of activity of the investigation.</td>
</tr>
<tr>
<td></td>
<td>• The work is praised for its rigour.</td>
</tr>
<tr>
<td></td>
<td>• 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.</td>
</tr>
<tr>
<td>In line with expectations</td>
<td>• Describes a piece of work that reflects most of the Features of Quality for the Classroom-Based Assessment well.</td>
</tr>
<tr>
<td></td>
<td>• It shows a good understanding of the task in hand and is free from significant error.</td>
</tr>
<tr>
<td></td>
<td>• Feedback might point to areas needing further attention or correction, but the work is generally competent and accurate.</td>
</tr>
<tr>
<td>Yet to meet expectations</td>
<td>• Describes a piece of work that falls someway short of the demands of the Classroom-Based Assessment and its associated Features of Quality.</td>
</tr>
<tr>
<td></td>
<td>• Perhaps the student has made a good attempt, but the task has not been grasped clearly or is marred by significant lapses.</td>
</tr>
<tr>
<td></td>
<td>• Feedback will draw attention to fundamental errors that need to be addressed.</td>
</tr>
</tbody>
</table>

Table 3 The four categories used to describe the levels of achievement reached by the students in the Extended Experimental Investigation (NCCA Guidelines pp. 6–7)

The NCCA Guidelines (pp. 19–20) provide teachers with the ‘Features of Quality’ to help them to assign the appropriate level of achievement. These are included in Table 4 as part of the Teacher’s Record of Student’s Level of Achievement.
Template of Teacher’s Record of Student’s Level of Achievement in the Extended Experimental Investigation

Name of student ____________________________  Date __________

Subject area of investigation

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>Water</td>
<td>☐</td>
<td>The Earth-Sun-Moon system</td>
</tr>
<tr>
<td>☐</td>
<td>Food</td>
<td>☐</td>
<td>Plant growth and behaviour</td>
</tr>
<tr>
<td>☐</td>
<td>Chemical reactions</td>
<td>☐</td>
<td>Plastics</td>
</tr>
<tr>
<td>☐</td>
<td>Forces</td>
<td>☐</td>
<td>Energy conversions</td>
</tr>
</tbody>
</table>

Format of presentation of Classroom-Based Assessment

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>Handwritten report</td>
<td>☐</td>
</tr>
<tr>
<td>☐</td>
<td>Poster</td>
<td>☐</td>
</tr>
<tr>
<td>☐</td>
<td>PowerPoint presentation</td>
<td>☐</td>
</tr>
<tr>
<td>☐</td>
<td>Podcast</td>
<td>☐</td>
</tr>
</tbody>
</table>

Exceptional

<table>
<thead>
<tr>
<th>Investigating</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Forms a testable hypothesis or prediction with justification.</td>
<td></td>
</tr>
<tr>
<td>• Describes considerations related to reliability and fairness.</td>
<td></td>
</tr>
<tr>
<td>• Outlines appropriate safety considerations, and describes the method used to accurately collect and record good quality, reliable data in a manner that could be easily repeated.</td>
<td></td>
</tr>
<tr>
<td>• Uses an innovative approach that truly enhances the work.</td>
<td></td>
</tr>
<tr>
<td>• Records a sufficient amount of good quality data.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Communicating</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Presents data in the most appropriate way using relevant scientific terminology and informative representations; calculations, if any, are performed to a high degree of accuracy.</td>
<td></td>
</tr>
<tr>
<td>• Describes the relationships between the variables.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Knowledge and understanding</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Provides a justified conclusion supported by the data; identifies and explains any anomalous data.</td>
<td></td>
</tr>
<tr>
<td>• Uses relevant science knowledge to assess and describe whether the hypothesis has/has not been supported.</td>
<td></td>
</tr>
<tr>
<td>• Describes in detail the strengths and weaknesses of their own investigations, including appropriate improvements and or refinements, or explains fully why no further improvements could reasonably be achieved.</td>
<td></td>
</tr>
</tbody>
</table>

☐ The standard of work of this student satisfies the above features of quality.
### Above expectations

| Investigating | • Forms a testable hypothesis or prediction with justification.  
|               | • Identifies the variable to be measured and the variable to be changed.  
|               | • Outlines appropriate safety considerations, and describes the method and equipment used to collect and record data.  
|               | • Records a sufficient amount of good quality data.  
| Communicating | • Displays data neatly and accurately, using relevant scientific terminology and informative representations; calculations, if any, are performed to a high degree of accuracy.  
|               | • Describes the relationships between the variables.  
| Knowledge and understanding | • Draws a conclusion consistent with the data and comments on whether the conclusion supports the hypothesis.  
|               | • Identifies the strengths and weaknesses of the investigation and suggests appropriate improvements, or explains why the procedures were of sufficient quality.  

☐ The standard of work of this student satisfies the above features of quality.

### In line with expectations

| Investigating | • With limited guidance, forms a testable hypothesis/prediction.  
|               | • Describes a safe method used to collect data – some of the steps are understandable but lack some detail.  
|               | • Records raw/primary data.  
| Communicating | • Displays data on simple tables, charts or graphs, allowing for some errors in scaling or plotting.  
|               | • States a relationship between the variables.  
| Knowledge and understanding | • Draws a conclusion based on data collected, identifies some features of the investigation that could be improved and suggests improvements.  

☐ The standard of work of this student satisfies the above features of quality.

### Yet to meet expectations

| Investigating | • Uses a given investigation question.  
|               | • Is directed in using equipment to collect and record data.  
|               | • Data collection method described is not repeatable.  
| Communicating | • Displays data on incomplete tables, charts or graphs, allowing for significant errors in scaling or plotting.  
| Knowledge and understanding | • Comments on the investigation without making a conclusion/refinement to the investigation.  

☐ The standard of work of this student satisfies the above features of quality.

Table 4 This table may be used to record the level of achievement reached by each student in the Extended Experimental Investigation
Note 1: The Subject Learning and Assessment Review (SLAR) meeting allows teachers to bring their own examples of student work, compare their judgements with colleagues and, if necessary, adjust the level of achievement awarded.

Note 2: Feedback should be given to students on the strengths of the work and areas for improvement.

Note 3: If queries arise about the Extended Experimental Investigation, these queries must be dealt with by the school. (NCCA Guidelines p. 22)

This document may be downloaded from: https://www.folensonline.ie/home/library/programmes/essential-science/resources/