2020 Scientific Studies Subject Assessment Advice

Overview

Subject assessment advice, based on the 2020 assessment cycle, gives an overview of how students performed in their school and external assessments in relation to the learning requirements, assessment design criteria, and performance standards set out in the relevant subject outline. They provide information and advice regarding the assessment types, the application of the performance standards in school and external assessments, and the quality of student performance.

Teachers should refer to the subject outline for specifications on content and learning requirements, and to the subject operational information for operational matters and key dates.

School Assessment

Assessment Type 1: Inquiry Folio

The Inquiry Folio must include three tasks with a focus on science inquiry skills (to a maximum of 12 single-sided A4 pages, or equivalent, with a minimum of 10 point font), one investigation with a focus on science as a human endeavour, and one individual inquiry design proposal (to a maximum of four single‑sided A4 pages).

In 2020, Board-approved changes due to COVID-19 permitted teachers to implement a reduced number of SIS tasks (minimum of 2) for their cohort, if they felt it was necessary. Many teachers implemented this enhanced flexibility into their LAP, although there were still cohorts that completed the 3 SIS tasks as per the subject outline.

The more successful responses commonly:

* included a four page proposal which clearly stated the investigable question or hypothesis, problem, need, or opportunity, identified and discussed all variables, an outline (with reasons and in sufficient detail) of the proposed research approach or method, or engineering design of a model
* provided a deconstruction that identified and explained the impact that a range of variables/changes to a design have on a question or problem, before determining the most appropriate method/design and materials to investigate a possible solution
* devised a suitable method for an engineering design proposal that aimed to improve the functionality or performance of a prototype for an identified problem or purpose and indicated how this would be tested
* represented data, evidence and/or results clearly and effectively using an appropriate type and number of tables and graphs, including appropriate titles, labels and trend lines
* identified trends in patterns of data and explained this in relation to scientific knowledge and understanding
* identified errors that were specific to the task (rather than generic errors) and discussed the impact of these errors on your data or, in the case of a design, identified specific faults or failures in the design and the impact these had on the function of the solution or model
* used appropriate terminology consistently when discussing errors (validity, accuracy, precision, reliability etc.)
* used a range of research and resources to support their conclusions with good scientific understanding
* adhered to the page count, word or time limit, and font size as specified in the subject outline.

The less successful responses commonly:

* resulted when the teacher had provided excessive scaffolding that limited student exploration of the task that limited opportunities for students to demonstrate the depth and breadth of their capability
* included a proposal for an investigation that was not of a Stage 2 standard and/was not scientifically based or, for which the outcome was not uncertain. In many cases they contained proposals that presented a poor, or limited deconstruction of the problem with minimal discussion of the possible variables or variations to consider in the design
* did not indicate how the results of the proposed investigation or the success of the engineering design would be measured or identified. In some examples, students selected dependent variables that were discrete, when a continuous one would have been more appropriate and would have enhanced their analysis
* in some examples of engineering design, there was limited/no evidence of any testing, or the testing procedure focused on user surveys or observations rather than scientifically testing the design of the prototype
* provided a method for practical tasks without clearly showing how decisions were made
* included excessive amounts of raw data in their table instead of averages (or other analysed data). Often, this proved challenging when trying to match this to graphs
* featured data that was displayed in an incorrect format or graph type, limiting how students interpreted the graph and therefore the accuracy of any conclusions
* identified the strengths and weaknesses of an investigation or suggested improvements. These are not requirements of the current subject outline. Improvements would be integral to testing and modifying an engineering design and the success or otherwise of these should part of the evaluation of the process
* completed a SHE task that was predominantly a research-based assignment in a science context without attempting to highlight the interaction between science and society. In many cases, there was no mention of science or scientists or any of the key concepts of science as a human endeavour as identified in the subject outline. Source analysis tasks did not lend themselves well to the SHE task
* identified that errors occurred during a practical, with limited or no discussion regarding the impact these errors had on their results
* drew conclusions from a single data point to justify their results or conclusion
* resulted when teachers attempted to assess too many specific features in each folio task. Teachers are encouraged to be selective about when to assess each of the performance standards.

Teachers should note that:

* The proposal for the Individual Inquiry should be a maximum of four sides of an A4 page if written or diagrammatic, or the equivalent in multimodal form and should include: a deconstruction of the problem, a method designed as the most appropriate, and a justification of the plan of action
* The subject outline indicates a total weighting for each assessment type. There is no task-by-task weighting within an assessment type, for example in the inquiry folio
* The tasks in the set of inquiry skills tasks include a balance in the type of evidence that students are able to provide.

Assessment Type 2: Collaborative Inquiry

In this assessment type, students provide evidence of their collaboration to design and conduct an investigation related to the program and for which the outcome is uncertain. They record individually, in a personal journal the initial thinking, formulation of the questions and deconstruction of the problem, their own and other group members’ contribution to the scientific investigation or engineering solution.

The more successful responses commonly:

* undertook an investigation for which the outcome was uncertain
* emerged from a broad topic where students had control over the design and direction of the task, leading to investigations that were sufficiently different from other groups in the class, showing originality and innovation in thinking
* divided the 12-page journal into separate sections (e.g. deconstruction, planning, method, iterations, improvements, etc.) thus helping students produce a well laid-out report
* provided evidence that collaboration was an ongoing part of the inquiry throughout the journal e.g. by agreeing to a timeline, a list of tasks, assigning individual roles to team members and team rules for effective collaboration
* included documentation of discussions made with group members identifying problems and justifying decisions made or tweaks in design
* included evidence with justification of the progress of the investigation. This may have been data collected, notes, annotated photographic evidence, or evidence of multiple testings/iterations
* included sophisticated graphs with appropriate conventions which were well labelled that matched the aim of the investigation. e.g. line graphs for continuous data, bar graphs for discontinuous data
* clearly evaluated the investigation that was undertaken rather than reflecting on the investigation
* presented a pitch that did not simply repeat what was in the journal; combined a PowerPoint and audio in a pitch that is less than 5 minutes
* evaluated the role that the writer undertook during the inquiry and included an evaluation of collaboration with members of the community where this was appropriate.

The less successful responses commonly:

* resulted from investigations that had limited engineering or scientific inquiry, hence restricting the quality of the student evidence
* featured generic engineering tasks that provided little overall achievement or data to comment on effectiveness of design
* resulted from investigations that were closed or linear limited student responses. Additionally, investigations where an entire class completed the same experiment or design, limited students’ ability to go into depth for IAE 1, especially at the higher grade-bands
* retrospectively created a journal
* conducted an investigation for which the outcome was predictable
* contained a method that had limited detail or was confusing to read
* included a journal that lacked background information relating to the study and/or any evaluation of the procedures used
* described the collaboration of group members rather than evaluated the effectiveness of collaboration and its impact on results/outcomes
* made generic comments about the group rather than considering specific contributions of group members, evaluating their effectiveness
* did not consider how the collaboration contributed to the successful or unsuccessful outcome of the investigation
* submitted a traditional practical report rather than a journal which documented deconstruction, decisions, justification, trialling, improvements for an engineering design, evidence of contributions of group members, data, analysis, or connections to relevant science concepts
* read the text in a PowerPoint presentation rather than made a pitch
* repeated in the pitch the same information that was to be found in the journal
* did not include a pitch either as a recorded oral or as a multimedia presentation
* did not maximise the use of the 12 pages that were permitted for the journal to provide evidence of deconstructing the problem, formulating investigable questions, selecting and trialling suitable models, and so on (see exemplars on the SACE Website: Scientific Studies)
* were simulations which limited student capacity to be creative, solve problems and find solutions
* featured vague justifications throughout that lacked clarity of purpose.

Teachers are advised that the Collaborative Inquiry should not be undertaken so late in the year that students run out of time to collect sufficient data or to deal with unexpected outcomes. When pitches are uploaded, teachers should ensure that it is audible.

In Assessment Type 2, teachers should avoid investigations that repeat those undertaken in Assessment Type 1.

External Assessment

Assessment Type 3: Investigation

In this assessment type, students provide evidence of having undertaken one individual inquiry using the proposal developed and assessed in Assessment Type 1: Inquiry Folio. Students use the design proposal (incorporating changes made as a result of the feedback, if appropriate) from Assessment Type 1: Inquiry Folio to conduct a practical investigation for which the outcome is uncertain. They produce a report in which they that summarise the proposal, identify any modifications made to the procedure as a result of feedback from the teacher, analyse the data obtained, and evaluate the method or model(s) used. If the results are unexpected, the student discuss the reasons for these results as part of their evaluation using the format specified in the subject outline.

The more successful responses commonly:

* tested a feature of their designed prototype when completing an engineering design task. Students then went on to collect and analysed experimental data, make modifications and conduct further testing of their design (IAE1–4)
* included a succinct summary of the design of the investigation or model enabling the results in the report to be readily interpreted (KA4)
* provided tables of data displaying the independent variable in the first column followed by the dependent variable showing repeats and the average in the following columns. Effective graphs displayed only the independent and dependent variables and a single line of best fit, if continuous data was used (IAE2)
* provided a clear analysis of the primary data by showing a clear understanding of accuracy, precision and reliability in the context of their investigation (IAE3)
* identified trends and/or patterns found, citing data that supported this. Additionally, successful students were able to draw conclusions from their data and support these using their understanding of scientific concepts (IAE3)
* were able to refer to the sample size or number of repeats as a means to draw reliable and valid conclusions from their primary data (IAE4)
* provided clear background theory or concepts which provided evidence that led to the development of a robust hypothesis (KA1)
* showed a deep understanding of the science related to the investigation and used this to explain the data collected (KA1)
* recognised that any conclusion was limited by the constraints of their investigation (IAE2)
* used in-text referencing, provided a reference list at the end of their investigation and, used appropriate terms, conventions and representations highly effectively (KA4).

The less successful responses commonly:

* selected investigations that were potentially unethical, such as nutritional supplement testing, or investigations that had no clear Independent Variable but rather, just an observation of a single outcome. (IAE3)
* included the same information that was in their proposal, a lengthy method or background research in the report which reduced the remaining word count and thus, limited the student’s ability to address IAE 3 and 4
* chose investigations that could not collect ‘real time’ data. This limited capacity to analyse result and draw conclusions (IAE3 and IAE4)
* lacked a summary of the design (KA4)
* gathered data for two dependent variables, thus limiting the students’ ability to achieve well at IAE 3 and 4 within the word count (IAE2)
* collected data that was inconsistent with the dependent variable stated in the hypothesis (IAE2)
* collected subjective data that was difficult to analyse and/or evaluate (IAE2)
* represented their findings using photographic evidence alone (qualitative). This meant students were unable to produce a graph, analyse data, evaluate procedures and draw conclusions against their hypothesis (quantitative) (IAE2)
* relied on electronic graphing tools e.g. Microsoft Excel, in which the appropriate data and style of graph was not selected. This prevented students from providing a direct comparison between the independent and dependent variables, for example choosing a line graph instead of a scatter graph and then a line of best fit (IAE2)
* represented data unconventionally in tables and graphs, which often included control variables or more than one dependent variable. In some cases, the students’ selection of graph type (line or bar charts) was inappropriate for the data they had collected (IAE2)
* incorrectly or inconsistently labelled tables and graphs (IAE2)
* only provided averages in their table, which limited students’ ability to discuss precision, identify errors and make an evidence-based conclusion about reliability. This method of representing data confused students when it came to drawing conclusions relevant to their hypothesis (IAE2)
* included multiple, repetitive individual tables and/or graphs which could have been combined (IAE2)
* provided only a description of the data without identifying a trend or pattern and without linking this to scientific theory (IAE3)
* used excessive statistical justification of their data, including the explanation of standard deviation and r2 calculations without evidence of their understanding of these processes (IAE3)
* provided conclusions that were unrelated to the hypothesis they were investigating. In many cases, students did not provide any justification for their conclusion or any limitations of their conclusion based on the investigation that was undertaken (IAE3)
* showed confusion between what random and systematic errors are and did not link these to their effect on the data. In many cases, students cited examples of poor experimental design as errors, when these should have been factored into their procedures from the beginning (IAE4)
* provided background information that was either unrelated to the investigation being conducted or too general to have any significance on the student’s outcome (KA1)
* misused terminology when evaluating their method, i.e. random, systematic, precision, reliability, validity and accuracy (KA4).