Scientific Studies

2013 Chief Assessor's Report

Government of South Australia

SACE Board of SA

SCIENTIFIC STUDIES

2013 CHIEF ASSESSOR'S REPORT

OVERVIEW

Chief Assessors' reports give 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, the quality of student performance, and any relevant statistical information.

SCHOOL ASSESSMENT

Assessment Type 1: Investigations Folio

Most tasks undertaken were of an appropriate Stage 2 standard, covered a variety of topics, and were competently assessed against the performance standards. However, the student evidence presented for a large number of classes did not warrant the grades awarded. This was largely due to limited analysis and evaluation of information in the issues investigation and of procedures and results in the practical investigations. It is important for teachers to continue to develop clear, informative task sheets that prompt students to explain and discuss rather than simply present information.

Practical Investigations

As in the issues investigation, it was evident that some students would benefit from more practice at writing about their formative practical work before they tackle summative reports. Standard features of scientific reports, such as the presentation of tables with appropriate headings and units, and correctly formatted graphs, were poorly done in many cases. Often there was confusion in the use of terms such as 'accuracy' and 'reliability' and superficial discussion of errors. Students need to practise using these terms in order to discuss specific aspects of each activity, and not just state rote-learnt definitions. Students also need to practise analysing trends in data and writing scientific explanations that connect data to relevant scientific concepts.

The design practical allows students to provide evidence for the assessment of specific feature I1, Design of scientific investigations. Students should have had formative opportunities to design investigations as this area is assessed in this assessment type as well as in the external component. Teachers' feedback on the design is essential to give students the best chance of conducting an investigation that will produce data worthy of discussion.

It was pleasing to see more evidence presented this year for specific features I3, on the use of apparatus, and A3, on work skills. Moderators can confirm grades for these specific features only on the basis of the evidence presented.

Issues Investigations

Teachers are encouraged to help students with the selection of an appropriate issue and the relevant science behind the issue. Students must formulate a question that can be considered from at least two points of view. The use of drafts is also important in directing the students to stay focused on the issue and providing feedback about the appropriate citing and listing of sources.

The information gathered from sources should be evaluated for bias, credibility, suitability, and accuracy. Some students find it helpful to have a pro forma to complete but the more able students should be encouraged to present their evaluation in different formats that allow for more depth where appropriate and less repetition in areas such as credibility. An example of an annotated bibliography is available on the SACE Scientific Studies minisite. This format allows students to write a range of diverse comments across many sources without using too many words.

Reports were still presented by students who appeared to have had little practice at formative report writing. Teachers are advised to provide small formative tasks that allow students to select and evaluate relevant information from a source and discuss points of view expressed in articles.

Assessment Type 2: Skills and Applications Tasks

A variety of tasks were evident in this assessment type. Best-practice tasks provided questions of developing complexity in familiar and unfamiliar contexts, allowing students to demonstrate achievement at all levels of the performance standards. Questions should range from simple recall questions to those requiring the application of learnt knowledge. Tasks should include interpretation and analysis of unfamiliar diagrams or sets of data presented in different forms so that students have opportunities to meet the highest levels of the performance standards. There were several cases where students were given few such opportunities and consequently the grades allocated for this assessment type were reduced at moderation. The conversion of marks to grades is not appropriate when the task design has not allowed students to present in-depth answers, as they cannot reach the A level in the performance standards.

It was pleasing to see that many programs had been tailored to students' needs and interests. Some tasks were, however, very open ended and students seemed to struggle to understand what was actually required. Specific detail on the task sheet, with references to the performance standards, is helpful in guiding students.

EXTERNAL ASSESSMENT

Assessment Type 3: Practical Investigation

General Comment

Teachers should guide students in selecting an investigation of an appropriate standard for a Stage 2 subject. Although the quality of the reports has improved substantially, the choice of investigation prevented many students from potentially achieving an A. Some students had no opportunity to choose anything but a recipe investigation and this is of concern as it limits the evidence a student can present for

the assessment of specific feature I1, on designing investigations. Some teachers narrowed the choices available to their students to a particular theme, such as osmosis or fermentation, for which a range of hypotheses were submitted.

Students who had access to the assessment design criteria and performance standards inevitably presented better investigations than those who did not. Teachers are urged to use the specified assessment design criteria and performance standards as a guide to designing their task sheet for the investigation. This will also help them to apply the performance standards consistently when assessing students' work.

It is imperative that each student submits his or her own individual proposal and individual report, as specified in the subject outline. Some classes conducted the experiments in pairs or groups, modifying a class practical that had been done earlier as a trial. This resulted in the sharing not only of results but also of extensive information in their introductions and methods. This made it difficult for the markers to discriminate between what was provided by the teacher and what was the work of each student.

Many investigations had relatively small sample sizes. A good investigation will produce results from more than one trial so that averages can be obtained, minimising the effects of random errors. Investigations that seek a quantitative result rather than just a trend can also benefit from repeating trials to check for systematic errors.

It was apparent that the time available for carrying out the investigation varied dramatically between schools, from one lesson for the experiment and about 2 or 3 weeks to write it up, to several lessons for the experiment and 2 months to hand in the final piece of work. This significantly affected the overall quality of reports. The former example seems totally inadequate for the external component, which is worth 30% of the overall grade for Scientific Studies, but the latter may be too long.

The use of headings and subheadings in the report is strongly encouraged as they help students to structure their responses appropriately.

Proposal

Some teachers gave students a pro forma to use in presenting their design. This practice often significantly restricted the depth, and hence the quality, of the designs. If students are simply given headings as a guide they may be able to produce more comprehensive designs.

Markers expressed concern about situations where the submitted proposals were identical to the final version of the method in the report. It was not clear whether the proposal was the original version or the edited version or perhaps had even been prepared after the final report was completed. In reports that lacked the proposal it was unclear whether or not a proposal had ever been prepared as they contained crucial design errors that should have been addressed before the experiment was performed.

Investigation

There is no requirement for students to provide an abstract in their report and valuable words can be better used elsewhere. Although the introduction should be

succinct and relevant, it can provide evidence for the assessment of specific feature KU1, on knowledge and understanding of concepts.

The method was generally prepared well, with many students detailing the materials needed and describing the procedure used. Some students included labelled photographs of complicated experimental set-ups and this helped to explain the method more clearly. A common fault was the absence of one or two crucial instructions, making it difficult for another person to replicate the investigation.

Writing hypotheses is difficult for some students. There was evidence of poorly worded hypotheses that failed to link an independent variable with a dependent variable. Some gave two independent variables, or linked one independent variable with two dependent variables, often with confused results. Teachers should give students feedback to help them to think about the results they will collect, and how they will connect to their hypothesis, and generally suggest the use of only one of each variable.

As in past years, there were copious tables and graphs that would have been better displayed as summary tables and combined graphs. When multiple data are supplied, the use of average results is appropriate. However, students must remember that any average listed must contain no more significant figures than in the original data.

Some students did not realise that, if the data are continuous (such as concentration, time, pH), the correct format is a line graph showing the points with a line of best fit, whereas, for non-continuous data (such as mineral type, age group, or gender), a histogram is appropriate.

If students draw graphs with programs such as Excel, they should take time to check the correctness of the scales and line of best fit and also to format the finished graph so that titles are not disproportionately large, and to correct or remove meaningless legends. When multiple graphs of similar data are produced, students should check that the same scale is used on the *y*-axis in each graph so that results can be accurately compared. Frequently the *y*-axis of the graph had been truncated and the resulting trend line appeared to display significant trends that, in reality, were not significant. The subsequent analysis of the results obtained was therefore inaccurate.

A number of reports submitted were printed in black and white, although they contained graphs and diagrams that had originally been in colour. Interpretation depended on a comparison of the lines, which could not be discerned in greyscale.

Some investigations, for which quantitative results could have been collected, included only qualitative results. For example, some experiments involving microorganisms were simply analysed by photographs, whereas the zones of inhibition of bacterial growth, or the height/volume of foam produced by fermenting yeast, could have been measured, allowing a much higher level of analysis.

Many students were unable to analyse their data meaningfully. Some did not realise that, if they had used average values instead of raw data, their hypotheses could have been confirmed instead of refuted.

A consistent problem was the understanding of errors and the terms ‘accuracy’, ‘precision’, ‘scatter’, and ‘reliability’. Systematic errors will affect all the data in the same direction and may be identified by a shift in all the data if the experiment is repeated with new equipment. Examples could include contaminated solutions, old

enzyme samples of low activity, and incorrectly calibrated equipment. Random errors cannot be prevented and are due to difficulty in making an accurate reading. Hence scatter occurs in the results of repeated trials. Careless mistakes in using equipment are not random errors. Teachers and students are advised to check the definitions of these terms in the 'Skills' section of the subject outline.

Most reports included discussion of possible improvements to the investigation. However, many students neither identified improvements relevant to their investigation nor attempted to explain how they would improve the results. Often only a listing of possible improvements was given. Simplistic investigation designs often hampered discussion.

Given that the report is worth 30% of the total subject assessment, it is disappointing that many students did not make full use of the word count available to provide a more comprehensive report.

OPERATIONAL ADVICE

Variations — Moderation Materials forms were not always submitted when tasks were missing; this made it difficult to determine how a student's final grade had been derived. The form should clearly identify the reasons for missing or incomplete work. Grades allocated should reflect the granting of special provisions or reductions in the overall grade of non-submitted work.

When student materials are packaged, it is useful for an overall summary of assessment decisions for all tasks, indicating the performance standards used, to be included.

Teachers' marks and comments must not appear on either the proposal or the report submitted for external marking. Neither the school name/SACE number, nor the student's name, must appear anywhere in the report. Students should be identified only by their SACE registration number.

GENERAL COMMENTS

Teachers are encouraged to attend a clarifying forum to become more familiar with performance standards and task design and to use information provided on the Scientific Studies minisite.

Scientific Studies
Chief Assessor