

Contemporary Issues and Science

2010 ASSESSMENT REPORT

Science Learning Area



**Government
of South Australia**

SACE
Board of SA

CONTEMPORARY ISSUES AND SCIENCE

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GENERAL COMMENTS

In 2010 it was encouraging to see the diverse range of plans and assessments used in Contemporary Issues and Science. In most cases the teachers were able to take the students' interests, their own interests, and local resources into account when planning the curriculum. The vast range of themes and topics offered was a welcome sign of the many opportunities that students had for participating in engaging and relevant science.

Most teachers made good use of the information and resources provided on the SACE website. Teachers are encouraged to access materials provided by the SACE Board to ensure that they are following required procedures and also to explore other innovative ideas to incorporate within their own programs. These materials are updated at various times through the year and it is recommended that teachers check them each term. This assessment report should also be regarded as a valuable resource in that it explains the details of the assessment process, and provides an insight into which student and teacher practices the assessors have found to be successful.

The externally marked components, namely the individual study and the practical investigation, were generally well executed by students. Many students produced evidence of high-quality science experimentation and research. It is important that these externally marked assessment items are de-identified with regard to student, school or teacher names on the students' work.

Several incidents of plagiarism were identified during the marking of the external components and, in a few cases, the penalties applied resulted in significant changes in marks. Teachers are required to verify each student's work at least once, but preferably several times, throughout the students' progress in order to reduce the occurrences of plagiarism. The supervision and verification form provided in the learning area manual and on the website is a very useful tool for teachers to keep track of student progress, and it also provides students with small achievable goals and due dates in these large assessment tasks.

One method of decreasing the likelihood of plagiarism is to require students to submit a draft. This allows teachers to discuss the work with the students and to monitor progress, as well as providing students with valuable feedback and enabling students to improve their work. The rubrics in the online support materials are an effective and comprehensive tool for providing students with relevant feedback and re-focusing them on the assessment criteria. Poor spelling and grammar in the submitted external components was evidence of limited drafting by some students.

It is advisable that students start the practical investigation early in the year so that they have adequate time to complete investigations, and draft and write reports. This also allows students time to carefully plan their investigation and to undertake additional experimentation if necessary. It was evident from some student reports that they had allowed insufficient time to obtain, display, and analyse their data and to produce a quality report.

Formative assessment can be a valuable tool for teachers and students. Teachers are encouraged to carefully plan all summative assessments early in the year so that opportunities for formative assessment can be incorporated into teaching programs. Students can gain significant benefit from formative tasks covering all assessment components if constructive feedback is provided.

Moderators trained by the SACE Board were appointed to all schools with classes of Contemporary Issues and Science. Many teachers took advantage of the assistance provided by these moderators and were able to develop appropriate assessment tasks, manage individual student issues, and utilise resources based on the advice they received.

ASSESSMENT COMPONENT 1: COLLABORATIVE PRESENTATION

The Science Learning Area Manual asked teachers to send in sample student reflections on the group process and evidence of student work for the collaborative presentation so that this component can be centrally moderated. By working in groups and presenting their findings on a contemporary science issue to an audience of their choice, students are able to reflect the way that many scientists operate when they work towards achieving a common goal.

There are three criteria for judging performance in this component: collaboration, communication, and reflection. Moderators made particular comments on two of them.

- *Communication*

When a presentation is based on a topic, rather than an issue as specified by the curriculum statement, students have a reduced opportunity to meet the assessment criteria.

- *Reflection*

Students are asked to write a reflection of the positive and negative aspects of the group process, and provide a personal assessment. Moderators noted that those who chose to deliberate on their own contribution to the process and how well other students worked as a team were able to write reflections that addressed the criteria very well. It was encouraging that many students used this process to provide a thorough reflection of their experience, although some exceeded the 500 word-limit specified in the curriculum statement.

ASSESSMENT COMPONENT 2: PRACTICAL INVESTIGATION

The practical investigation provides an opportunity for students to undertake an extended experiment of the student's own choice. Some students were inventive and innovative with their selections. Many of the investigations showed an excellent grasp of the scientific method.

The practical investigation is marked by independent markers, trained and appointed by the SACE Board. When these marks are compared with the teachers' own marks, the differences, ideally, between teacher marks and the SACE Board marks will be small. Occasionally, significant differences in marking are noted, but systematic errors, where teachers misinterpret the criteria in the curriculum statement, can be avoided. Teachers whose assessment was clearly based on the criteria in the curriculum statement showed a high correlation with the assessment of the external marker. Students who worked with the criteria at hand and with a relevant mark scheme predictably presented better investigations than those who did not.

Choice of topic was a problem for some students. Most students carried out appropriate investigations; however, some were too simplistic or too complex. Ideally, the experiment reveals something of interest and relevance to the student and involves a challenging, but not too demanding, method. Simplistic hypotheses do not allow the students to demonstrate their skill in analysing data. Some classes, seemingly under teacher guidance, were restricted in their choices. This tended to produce many investigations with similar results, in a similar style, and this resulted in little discrimination between students. Students are encouraged to develop more varied hypotheses.

- *Design Skills*

The practical investigation design sheet was a useful tool for students to make their initial plans. Early in the process, teachers should require students to submit their design sheet for assessment before undertaking the practical part of the investigation. At this stage it is recommended that the teacher photocopy and mark the design sheet. The copy, with comments, can then be returned to the student who may then be able to improve their design, if they wish, based on the teacher's comments. The original design sheet is left unmarked and kept for submission to the SACE Board. Some classes did not have their design sheets included when the SACE Board marked the investigations. This disadvantages the students because the SACE Board marker does not have a clear idea of the method and hypothesis.

Similarly, when reports were submitted with a method that did not appear on the design sheet, students were disadvantaged. External markers did not know if the method was the students' original work or had been improved by teacher input. In these cases, the marker had to assume that the method presented was better than the students' original.

A hypothesis is a testable statement of predicted results which links the dependent and independent variables. For example, 'Boys are taller than girls' is a hypothesis, whereas 'Are boys taller than girls?' is not a hypothesis. Students with clear, testable hypotheses usually found it easier to prepare a satisfactory method on their design sheet.

Common errors in students' method writing included omitting numbers in describing the number or size of apparatus; neglecting to mention how many times a procedure occurred, or for how long it occurred; and omitting to replicate the procedure, preferably with alternative sources of equipment or materials, to help identify systematic errors. In too many cases, students concluded their method with instructions such as 'measure and record results', rather than specifying exactly what was to be measured and how. Sample sizes were often too small for reliable results to be recorded, due to the effects of random error. It can also be a good idea to add a simple, labelled diagram to help explain the method. One way of checking that the method is clearly written is to ask other Year 12 students to read it. If they have difficulties understanding the method, then it probably needs improvement.

- *Reporting*

It is important that all tables and graphs have appropriate labelling, including title, axes, and units. In a table, the independent variable is usually on the top. In a graph, the independent variable is almost always on the horizontal (x) axis, and the dependent variable is on the vertical (y) axis.

The most successful reports provided a summary results table and graph, rather than multiple individual tables and graphs. It is recommended that students place all their raw data in a single table, or set of tables, and then compare their dependent and independent variables (the averages, and range) in a summary table. A summary graph can be drawn from the summary table. Not all experiments make it easy to summarise data, but every effort should be made to simplify the final set of results. The summary table or graph can then be easily used to analyse the data and prepare a conclusion.

Some students presented only qualitative data (such as digital photos or drawings) without any accompanying quantitative data. This proved problematic for data analysis. For quantitative data, a line graph should be used for continuous data and a bar/column graph for discrete data. Continuous data can be interpolated (for example, it is possible to measure between 3 and 4 seconds), but discrete data is disconnected (for example, apple and oranges).

It was evident that some students worked in groups for their investigation. While the curriculum statement does not indicate that all students must work individually in this component, group practicals are best undertaken in the portfolio component. Individual work makes discrimination between students easier, and avoids plagiarism of other students' work. If students do work in groups, they should organise their data independently of each other, and prepare their own tables and graphs. Where several students had identical tables and graphs, it was obvious that plagiarism had occurred, and this attracted a penalty.

The report's conclusion should relate back to the original hypothesis. A statement indicating whether or not the hypothesis was supported should be included. Students could also potentially rewrite the hypothesis to accommodate the experimental findings. Teachers and students should note that, at this level, a hypothesis cannot be 'proven', but can be 'supported' by experimental evidence. A hypothesis can, however, be disproved by contrary evidence.

- *Evaluation*

Marks are allocated for clear, logical, and sequential presentation. Students are encouraged to arrange their work in the order that it is marked. Headings help the marker to allocate marks. This is particularly relevant in the evaluation section of the report where students should present their arguments logically and sequentially.

The use of scientific terms is recommended, but they must be used appropriately. The curriculum statement does not provide definitions, so students need to be advised carefully. Comments on the following terms are provided:

- The term 'accuracy' is poorly understood. The accuracy of an experimental value indicates how close the result is to the true value and depends on the extent to which systematic errors are minimised. Almost all students discussed accuracy in terms of deficiencies in their equipment, rather than the accuracy of the actual measurements.
- Students are encouraged to use the terms 'precision' and 'resolution', but it is not a requirement. Measurements are more precise when there is less scatter in the results. A range column in a data table can be useful for determining precision. The resolution of a measuring instrument is the smallest increment measurable by the measuring instrument.
- Students are expected to identify sources of error, and both 'random' and 'systematic' errors can be discussed. Random errors are present when there is scatter in the measured values. Increasing the number of measurements (increasing sample size) minimises the effects of random errors and increases the reliability of the data. Systematic errors are present when measured values differ consistently from the true value. Systematic errors can be identified and results verified by repeating an experiment and using an alternative source of equipment and materials.

The majority of students successfully completed the investigation within the word-limit. Students who exceeded the word-limit tended to have extra sections not required by the criteria. Long introductions and reviews of literature are outside the requirements of this component.

ASSESSMENT COMPONENT 3: INDIVIDUAL STUDY

The individual study enables students to research and discuss an issue of their own choice within the field of contemporary science. The range of issues selected was impressive and reflected the diversity of the students. Feedback from markers suggests that this component was the most difficult. It is a complex task for students to discuss alternative aspects of an issue

within an 800 word-limit. Despite this, it is clear that students enjoyed the opportunity to research issues in which they had interest.

Teachers and students are reminded that the definition of a 'contemporary issue', as given in the curriculum statement, is 'a proposition which is relevant to current and future society, and about which people hold a range of opinions' (p. 10). Some students, and some class sets of students, presented reports on topics that had no discussion of an issue, or that presented only one side of an issue. Such reports, while they may be informative, tend to lose many marks compared to what may have been achieved.

Teachers are also advised that the contemporary issue must allow students to discuss the science behind the issue. Many students chose issues that were based on social aspects only and, therefore, were less successful in meeting the criteria for judging performance.

- *Research*

Citing the sources of information used (or in-text referencing) provides an important opportunity for verification. It also demonstrates that the student has performed appropriate research, an essential part of the process of scientific enquiry. For further information about referencing see the SACE Board Guidelines for Referencing (in the Support Materials section of the SACE website). Students who made specific statements without citing the source did not receive maximum marks for research from the marking panel.

The reference list should complement, not replace, citing. Many students lacked a detailed reference list that should include all material cited in the text, plus other sources that have been used to enhance the student's understanding. Internet sources in particular were poorly listed. The title, URL, and date of viewing are minimum requirements. The reference list should only include sources that have been seen and used. The SACE Board Guidelines for Referencing can also be used to assist students in preparing the reference list. Teachers may need to actively teach the process of referencing, rather than relying on it having been learnt in previous years or taught by other subject teachers.

- *Analysis*

It is most important that teachers and students are aware of the marking criteria as a basis for preparing their reports. Some individual studies only presented one point of view, with the teacher awarding high marks for analysis.

Students need to ensure balance in their arguments. This is partly related to choice of issue. Some issues make it difficult for students to access unbiased resources on alternative points of view. The most successful studies usually had a few well-reasoned points on each alternative, rather than a large number of poorly explained or simplistic points. Teachers and students should also note that there is no longer any need for students to express their own point of view.

A challenging aspect of this assessment component is to ensure that not only are the alternative views presented, but also that the reasoning behind those views is discussed. Students who confined their arguments to two or three major points for each alternative view were able to more successfully present the reasoning behind those points within the word-limit.

- *Communication*

It is best for students to introduce their report with a clearly identified specific scientific (not general) issue that is best posed as a question. Students should try to choose a narrow topic and debate it well, rather than a broad topic that cannot be adequately covered within the word-limit. The more successful individual studies chose a small aspect of a big topic, and framed it within a historical or social context. Genetic engineering, for example, is too broad

an issue for most students to explore within the word-limit. A smaller aspect of this, for example, whether genetically modified foods should be labelled, is a much simpler, yet satisfactory, issue. Sometimes whole classes wrote on a limited number of issues presumably provided by the teacher. This often allowed little discrimination between students and may have disadvantaged some students.

The science behind the selected issue was not always well explained. This was often caused by poor choice of issue, or by lack of adequate research. Teachers should note that it is not sufficient for students to simply list statistics related to the issue. They need to adequately explain the science of the issue.

Most students expressed themselves well. Good use of drafting can result in high-quality prose with sophisticated discussion on an issue. Dot points can be used, but students may not be awarded full marks for reasoning and communication.

Verification of student work is an essential part of the individual study process. Appropriate due dates should be negotiated with students and adhered to. In this way teachers will see the development of the report, and can discuss it with the student. The student benefits by having regular teacher input, and the teacher benefits by knowing that the student's work is their own. Teacher feedback is a valuable tool for the students as it can assist them in identifying aspects that need improving.

ASSESSMENT COMPONENT 4: PORTFOLIO

The portfolio provided teachers and students the opportunity to cover a wide range of assessment tasks and styles. The huge variety of tasks which was viewed at final (central) moderation was evidence of how well teachers had used the flexibility of the curriculum.

The tasks do need to reflect the fact that this is a Stage 2 subject and hence they need to be more substantial than similar tasks which may have been undertaken in earlier years. Better assessment tasks are usually prepared when the teacher has a clear idea of how each item fits into the assessment pattern. A well-prepared assessment summary gives a clear guide for each item. It is recommended that each item indicates the relationship between the marks and the criteria so that the students can gain insight into what is required of them. Well-informed students inevitably have increased confidence and perform better.

Students are often penalised because assessment tasks are poorly designed. Each task should have a range of cognitive requirements so that there are enough opportunities for students to display evidence of their learning across all grade bands.

Teachers are strongly encouraged to label each item within a task with criteria to guide the students on the style of answer required. This labelling would also greatly assist the moderators in confirming the assessment for each student. Good planning in the initial stages should result in a portfolio that gives students every chance of success.

Teachers should ensure that an annotated mark scheme appears with each portfolio task. While reliability demands that the individual studies and practical investigations be submitted to the SACE Board unmarked, that is not so for the portfolio. Annotation can provide valuable feedback to students and is encouraged on portfolio tasks.

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