# Design and Technology

2013 Chief Assessor's Report

Government of South Australia

SACE Board of SA

# DESIGN AND TECHNOLOGY

# 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.

*Focus Areas*
The content of Stage 2 Design and Technology is organised into three focus areas: communication products, material products, and systems and control products.

This report should be read in conjunction with previous chief assessor reports for the subject.

## GENERAL COMMENTS

Teachers were consistent in their use of assessment design criteria to design opportunities for students to provide evidence of their learning at the highest level of achievement. Such consistent use of assessment design criteria resulted in close correlation of school assessment and external results.

### School assessment

Teachers should ensure that evidence required to support the moderation process is supplied. This includes:

- marks schemes demonstrating how students have achieved against the relevant performance standards

- sets of high quality images indicating either performance in a task (e.g. materials application, product record) or final outcome (product record)

Other forms of evidence can be provided as long as it clearly demonstrates to the moderator achievement against the relevant performance standards. Such evidence should not identify the student.

Moderators noted that successful programs of work enabled students to meet mandated assessment design criteria. For example, in Assessment Type 2: Product, evidence was available for Pr1, Pr2, Pr3, E2 and Pl 3

It should be noted that all nominated assessment design criteria carry equal weighting.

Several schools submitted work that no longer accurately reflected the details provided in the original learning and assessment plan. It is understood that teachers modify courses to suit cohorts and available resources, but such changes must be validated and recorded by using the learning and assessment plan addendum.

For Assessment Type 2, a product record is required for both minor and major products. The product record is used to provide evidence of modification and planning, production, and/or evaluation aspects of the design process that occur during the creation of the product, to inform assessment of the product(s) and support the evaluation in Assessment Type 3.

It is essential that schools ensure that adequate product records are provided to support the grades submitted by the teacher. Incomplete or missing product records may compromise the moderation process.

The more successful students understood the difference between a product record, which is a record of realisation, and the design sequence often used in the planning section of the external folio. Students who made this distinction were often able to achieve a performance standard in the 'A' band.

**External assessment**

The majority of student responses addressed the requirements for submission as outlined in the subject operational information. The use of spiral bound or plastic display folders is discouraged. Teachers should verify word-counts before submitting assessments to the SACE Board, and refer to the *SACE Word Count Policy* on the SACE website. The names of schools, teachers or students should not be used.

Folios submitted in electronic format should run for no more than 12 minutes. Commercial promotional material imported into or linked to such narratives was of little help in determining a student's grade. Teacher prepared templates also restricted the ability of a class to show their full potential and often resulted in little differentiation in grades between students. Students who used correct assessment design criteria were more likely to be successful.

Schools should submit only the folio for marking. The product record and materials application task should not be included with this assessment type. For this assessment type, students provide evidence of their learning in relation to all of the assessment design criteria of investigating, planning, and evaluating.

The folio provides students with an opportunity to detail their engagement in a design process in order to realise a product. To this extent, students who pursued a service type task or who engaged in kit assembly activity found difficulty in addressing all aspects of the assessment design criteria.

It is of paramount importance that relevant Workplace Health & Safety practices across South Australian schools be maintained at all times. Markers were especially concerned about the fabrication of prohibited materials in school workshops and attention to electrical safety.

## SCHOOL ASSESSMENT

## Assessment Type 1: Skills and Applications Tasks

The assessment design criteria most relevant to this set of tasks include:

*Investigating*

I4 Investigation of product material options and analysis for product use (Materials Application)

*Planning*

Pl3 Testing, modification, and validation of ideas or procedures (Materials Application)

*Producing*

Pr1 Application of skills, processes, procedures, and techniques to create a product or system to a chosen standard and specification (Specialised skills)

Pr2 Use of resources, equipment, and materials to create a product or system safely and accurately (Specialised skills)

Pr3 Development of solutions to technical problems that may arise during product or system realization (Specialised skills)

*Evaluating*

E3 Reflection on materials, ideas, or procedures, with recommendations (Materials Application)

*Task Design*

This assessment type requires all assessment design criteria to be met, i.e. investigating, planning, producing, and evaluating. However, the selection of relevant specific assessment design criteria varied, dependent on course context, cohort and available resources.

*Skills Tasks*

The moderation panel believed that students were most successful in courses where skills tasks were finely balanced between teaching new skill and knowledge levels, but still requiring appropriate depth and rigor.

The use of templates or highly scaffolded tasks did not give students the opportunity to meet the higher levels of the performance standards.

Successful tasks targeted the most relevant performance standards for each activity, resulting in meaningful assessment, which allowed students to effectively demonstrate achievement against each of the criteria.

It is recommended that teachers deconstruct the assessment design criteria before commencing each task in order to clarify the requirements of each task.

The most successful tasks provided opportunities for all students to achieve to the highest level. These tasks were indicative of careful performance standard selection, i.e., those standards that were closely linked to the actual work being done and

clearly linked the task to other tasks in the subject, developing a meaningful experience for students.

Such tasks were also worded carefully to encourage students to explore advanced techniques and skills. This encouraged self-directed learning and allowed students to take ownership, and to explore and develop unique and creative solutions, allowing students to demonstrate significant engagement in Pr3.

*Material Applications Task*

The moderation panel believed that the most successful student responses came from tasks that allowed students to identify, test and analyse materials or components likely to be used in the realisation of their major and/or minor products. These tasks prepared students for the realisation process to follow in their product. To a lesser extent, the task helped with the investigation section in the folio, where materials and/or components could be discussed meaningfully.

At least two tests should be conducted. Students are encouraged to design and conducted their own tests, rather than downloading pre-existing test data.

The most effective student responses also came from tasks which:

- required students to identify two or more materials or components
- were designed to promote their ideas thorough primary and secondary investigation/research, (primary being where students had conducted their own research, and secondary being the results of others)
- often included qualitative and quantitative testing
- encouraged accurate reflection on the results
- proffered a conclusion from the analysis

Students studying Systems and Control contexts, in particular electronics and automotive courses found the process of selection or identification of appropriate materials or components for analysis and testing challenging.

The best assessment design provided students with the opportunity to enrich their understanding of the materials or components they would use in Assessment Type 2.

There were numerous examples of meaningful and valuable materials application activities resulting in enhanced understanding of materials and how their characteristics and properties could best be used in the realisation process.

The material applications task has a nominated 800 word count. This is an exercise in concise, relevant and informative communication, and the SACE Board word count policy applies to this task.

Examples included:

*Communication Products*

- A 3D modelling test, requiring a completed 3D model, high quality render and a dimensioned orthogonal drawing, all of which provided scaffolding for Assessment Type 2. In web design, alternate web page coding methods were studied and tested with great effect.

*Systems and Control Products*

- Many courses this year used a relatively simple numeric code generating exercises, designed to initially teach the use of algorithmic canned cycles, which formed the basis of more sophisticated work in Assessment Type 2. In automotive, alternate exhaust systems were studied, preparing students for their later design and manufacture of an exhaust system.

*Material Products*

- In Material Products studies of knockdown fittings, glues and finishes provided an insight for students for use later in furniture design and manufacture.

The more successful student responses were analytical and included relevant images, diagrams, charts, and photographs, all of which significantly value added to the task without compromising the word count. These responses also contained student generated concluding statements indicating a synthesis of knowledge.

Images should not identify the student or school. Secondary data should be clearly referenced

Students should ensure that a relevant medium is used when considering an alternate means of presentation.

## Assessment Type 2: Product 50%

The assessment design criteria most relevant to this set of tasks include:

*Planning*

Pl3 Testing, modification, and validation of ideas or procedures (Materials Application)

*Producing*

Pr1 Application of skills, processes, procedures, and techniques to create a product or system to a chosen standard and specification (Specialised skills)

Pr2 Use of resources, equipment, and materials to create a product or system safely and accurately (Specialised skills)

Pr3 Development of solutions to technical problems that may arise during product or system realization (Specialised skills)

*Evaluating*

E2 Evaluation of the effectiveness of the product or system realisation process

Please note that the inclusion of Planning and Evaluating assessment design criteria is mandated, but the selection of performance standards is a school based decision.

*Product Records*

The presentation of product records improved greatly in 2013. These product records provided accurate information and assisted moderators to support the teacher's grade. Most included quality photographic evidence and teacher comments supporting the allocated grade.

The moderation panel has identified the following features to be indicative of successful product records this year:

*Material Products*

- clear images/photographs of the product being realised.
- 10-12 images in total
- at least one image of the final product
- a copy of the design brief (I1)
- appropriate evidence of planning (Pl3) and evaluation (E2)
- a final orthogonal drawing
- provided clear teacher evidence to support the school grade

*Communication Products* and *Systems and Control*

- clear images/photographs where applicable
- 10-12 images in total
- the use of screen capture software for example, to demonstrate the development of coding, the steps used to build up a map in game making, or the progression of an electronic circuit
- the use of links to allow moderators to access their Product online (web sites and computer games)
- appropriate evidence of planning (Pl3) and evaluating (E2)
- final annotated sketches, orthogonal drawings or renders (as appropriate).
- provided clear teacher evidence to support the school grade

*Task Design*

Assessment is divided between the major and minor product, however it is recommended that all nominated assessment design criteria specific features for the assessment type are assessed in both major and minor tasks.

There is no individual percentage weighting attached to either the major or minor product.

Assessment Type 2 provides an opportunity to differentiate and negotiate individual student outcomes. There were some truly inspiring, diverse and brilliant student responses across all three contexts. Examples included hand held gaming/controllers for people with disabilities, designed and manufactured remote controlled vehicles and aircraft, 'Tall Boys', bedside cabinets, a 'Tardis' DVD storage unit, interactive

web sites, interactive computer games, exhaust systems, and stunning photographic work in a variety of formats.

Product outcomes that had a degree of student/teacher negotiation resulted in very high success. This was evidenced in Communication Products for example, when within the same class, where students completed individual projects of web page design, game making, and even a relational database.

In courses where the curriculum on offer is narrower, for example when all students are realising furniture items, teachers were still able to set pathways leading to very high level achievement.

There is no nominated word count associated with the product record for this assessment type.

The moderation panel supported the tasks as they were outlined in all SACE Board approved learning and assessment plans.

## EXTERNAL ASSESSMENT

## Assessment Type 3: Folio

### Investigation

*Identification of a need, problem or challenge*

This criterion was addressed well by those students who were able to thoughtfully identify and comprehensively describe a real need or problem that required a solution. From this need, those students were able to establish a closely linked design brief which set the intent for the product. Teacher directed requirements for specific skills, processes or materials to be addressed were found to not be particularly useful. Such teacher directions are better addressed as constraints in the design brief.

*Creation and validation of an initial design brief based on needs analysis and task identification*

The marking panel considered this section was well-addressed by most students.

*Investigation and critical analysis of the characteristics of existing products, processes, systems, and / or production techniques*

This analysis should be closely linked to the design brief. It should be contextual (materials, communications or systems) and involve an analysis of existing solutions. Previous reports have provided examples of design principles that could be used for such context focussed analysis. Genuine reflective comments that informed final choices and production were superior to contrived statements fabricated to address assessment criteria. The best student responses provided analysis of a variety of existing feasible solutions and resulted in clarification of the ideas of the student. Actual interaction with existing products (as opposed to visiting a website) resulted in superior opportunities for investigation and analysis. Effective investigation also

included thorough exploration and documentation of potential processes or production techniques that students could then critically evaluate for their own solution. For example, some students compared 3d printing or computer aided milling as a more effective means of realisation.

*Investigation and analysis of product materials options and analysis for product use*

The best responses involved genuine consideration of materials use based on application, cost, availability and tooling. There is little point in students considering materials that are not available to them. Those students who were prepared to source materials (sometimes recycled) from outside of their schools had a greater degree of freedom in their designs. When determining material options, a reference to Assessment Type 1 would be advantageous. There is no need to mention specific tooling in this criterion except for when material choice impacts directly on tooling decisions. For example, the use of Jarrah may necessitate the use of tungsten tipped tooling. Similarly, programming in Visual Basic may require the use of VB Net.

*Investigation into the impact of products or systems on individuals, society and/or the environment*

Effective responses progressed beyond a description of industrial processes to consideration of social and environmental impacts of the product or systems they intended to use. The best responses addressed contemporary problems. Referencing indicated the depth of such investigation. Responses that relied solely on expression of personal opinion were found to be of little benefit to the candidate. Teacher directed investigation into the impacts of products or systems are expected but such teacher direction should not limit the scope of student response.

## Planning

*Analysis of information to develop appropriate solutions to an identified design brief*

The best student responses reflected on their initial investigation. The resulting range of possible solutions were then presented in graphical format and discussed. Selection of a final idea was then based on initial design criteria. It should be noted that students who used kits or who could not engage in a design activity were restricted to sometimes only one outcome. Students should consider a variety of possible outcomes. Such a variety might include for example, programming variations, alternate manufacturing methods, changes in algorithmic arrangement in Numeric Code, different PCB layouts or variations of photographic compositions. In each case the aim is to seek the most aesthetic and functional solution. The solution must be contextually based. For example, it is expected a candidate presenting in Systems and Control (electronics) should pursue a solution predominantly electronic.

*Communication of product design ideas using relevant technical language*

This criterion is applied across the folio. It is expected students will communicate in a most efficient manner. The best responses responded through a mix of written and graphical means. Graphical communication ranged from clear sketches and line drawings to complete computer aided drawings detailing designs in both orthogonal and pictorial drawing styles. Some students used scale 3d models to communicate their ideas in either electronic or physical format.

In Design and Technology, it is vital to be able to communicate ideas graphically. Successful students were able to show their development of ideas with sketches and clearly communicated their proposed solutions. This was fine as a scaled pencil drawing but better still as fully dimensioned CAD generated drawings and parts lists. The use of formal CAD drawings (Google Sketch Up, Inventor) is encouraged but so too is the use of other graphical packages (Blender, 3D Max). Other design tools such as Circuit Wizard are also encouraged.

The marking panel noted that in general, students were more prepared to detail their final design using CAD and that skill acquisition in this medium is improving.
Whatever medium is used it is important that final solutions are detailed and clear. Such representation will be context dependent. Communication needs to be relevant to the proposed product outcome and repetitive data should be refined. For example, photographic proof sheets should be included in the product record, not the folio however some indication of decision making should be included in the folio.

*Testing, modification and validation of ideas or procedures*

This criterion refers to testing that might be carried out before arriving at the final product. For most students, this means validating their final proposal before production or completion of the product. Such validation might be in the form of photographic evidence of fit during assembly, screenshots of error reporting when programming, or reports of interference fits in CAD drawings. Such validation needs to be relevant to contextual conventions. The use of testing or assembly jigs, scale models and bread boarding is encouraged, but their design and production needs to be student initiated.

**Evaluation**

In general, the marking panel felt that it would have been beneficial for responses to include an image of the finished or nearly finished product.

*Evaluation of product success against design brief requirements*

The best student responses evaluated the product objectively using initial design criteria established during the Investigation. This process led the student on to make qualitative statements about how design criteria could have been better formulated. Such comments were considered insightful.

*Evaluation of the effectiveness of the product or system realisation process.*

Students used this section as a forum to detail the strengths and weaknesses of the product or system, and students provided a brief indication of the depth of their engagement in the process.

*Reflection on materials, ideas and procedures, with recommendations*

The best student responses noted shortcomings throughout the project and suggested means by which those shortcomings would not be repeated or were overcome.

*Analysis of the impact of the product or system on individuals, society & or environment*

The foremost question students tended to pose was does the product work? However the best student responses reflected on their investigation into the impact of their outcome on individuals, society, and/or the environment. Such responses included considered statements discussing topics such as: the life cycle of the product, recyclability of the product, the product's ecological footprint or how the user's life is made better by the product. The best responses were of a global nature.

## OPERATIONAL ADVICE

- Using a product record or a Materials Application task as an addendum to the folio (Assessment Type 3) is not a supported practice. See the SACE Board of South Australia word count policy.
- The following are requirements to be included in the 'white' bags for central moderation:
  (i) all required (sampled) student work is included
  (ii) student work to be clearly labelled, and sorted into assessment types
  (iii) a copy of the learning and assessment plan
  (iv) summative task sheets
  (v) marking schemes for each student, providing details how they have satisfied the performance standards

- De-identification of external materials where relevant Assessment Type 3 requires there to be no evidence of student, teacher or school identity.

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