National Qualifications Framework Levels 1–3, 2008

Technology

National Moderator's Report

National Moderator's Report for Technology

General Guidance for assessors of Achievement and Unit Standards

The purpose of external moderation is to provide assurance that teacher judgments are at the national standard and are made on the basis of assessment materials that are fair and valid.
All assessment materials are expected to:

- give the student the opportunity to meet the requirements of the standard
- have an assessment schedule that gives evidence of appropriate student responses and clear judgments at all levels.

The Ministry of Education contracted subject experts to write assessment resources for achievement standards. These are not pre-moderated. The intention is that they are modified to suit teaching programmes and student needs. They do not provide 'rules' but suggest different ways of assessing to the nationally registered standard.

General Overall Comment

It is recommended that the whole of the national moderators report is read especially for feedback about the achievement standards around technological practice. Some comments made under a particular standard may also be informative for another standard.

Teacher material submitted for moderation must be sufficient to allow the moderator to see that students are able to meet the requirements of the standard. In general, the Ministry of Education assessment templates (teacher guidelines, student guidelines and assessment schedules) at www.tki.org.nz have been used effectively. Teachers should ensure they are using the latest version of the TKI generic templates to ensure these match the current version of the standard. Resources such as these work best when schools customise them for their own situation. Additional material was often effectively incorporated into the existing templates to provide support for students. The 'alternative assessment schedules' that can be found in a Techlink (www.techlink.org.nz) Beacon Practice ICT case study, titled 'Teaching ICT', have also been successfully used and adapted.

The New Zealand Qualifications Authority (NZQA) asks that teachers show moderators how judgements were made. This is stated in guidelines for presenting work for moderation which can be accessed via the subject specific resource for technology on the NZQA website (see http://www.nzqa.govt.nz/ncea/resources/technology/). This is especially important for skills based standards (achievement and unit standards). Some teachers are submitting annotated assessment schedules. These schedules reflect best practice for moderation and have also been used effectively as a formative assessment tool.

The assessment of unit standards will most likely involve assessment strategies such as on-site teacher observation or verbal questioning. In this case, for moderation purposes, teachers are required to provide commentary of what they observed/heard to support their judgments.

This teacher derived evidence could be presented in many ways, such as on specific documents set up for each student or as notations on the body of the student work. On many occasions, this evidence has been crucial in allowing the moderator to validate the

teacher judgments. It has also allowed more informative feedback to be given from the moderator to the teacher.

Teacher verification can be achieved through formally "signing off" the appropriate criteria or judgement statement. When teachers do this, it helps moderators to confirm that the related criteria of the standard have been met. However, teacher verification alone does not constitute sufficient evidence for moderation in technology. The most effective and successful unit standard submissions were those that contained combinations of written and photographic evidence from the student and detailed commentary/ verification evidence from the teacher.

In technology, where there are often large volumes of student work submitted for moderation, it is preferable for the moderators to receive a hard copy as this is easier to organise, read and revisit. Where material is submitted digitally, it would enhance the moderation process if students were to collate information into fewer documents that had a logical sequence. Please refer to Assessment Matters Circular A2008/016 - 2 May 2008 for acceptable CD / DVD file format types when submitting moderation digitally. The following file format types are acceptable:

- Portable Document Format (.pdf)
- JPEG Image Format (.jpg, .jpeg, .jpe ...)
- Graphics Interchange Format (.gif)
- standard formats as used in Windows Media Player
- PowerPoint
- QuickTime.

Other graphics formats may not be able to be read.

Apple Macintosh users must ensure that submitted files can be read easily on a PC. All work, whether digital or not, must be clearly named. Original, rather than photocopied, student work is generally easier to read. This needs to be secured together in some way.

Some submissions indicate a misinterpretation and confusion of terminology. For example, key factors allow for focussing on what is important in terms of the issue, whereas key stages are the significant parts of a process. The glossary on Techlink (www.techlink.org.nz) is useful for ensuring other terms such as 'needs/opportunities' and 'issue' are understood as they are used in relation to these standards. The explanatory notes attached to each achievement standard also provide clarification.

The requirements around the random selection process, introduced in July 2008, may have meant that some teachers thought that particular work had to be submitted, even when it was not yet completed. The moderator's job is to validate, or otherwise, the teacher's judgements. If work is not ready for assessment, it is also not able to be moderated. Where this situation occurs, student work from the previous year should be submitted for moderation. This was necessary for the majority of schools.

In 2008 many teachers utilized the suite of unit standards available within the technology domain. The majority were used in conjunction with technology achievement standards.

Selection of a unit standard(s), used to assess student competencies, should match the skills that students are expected to perform. While teachers can select the specific unit standard(s) that they intend to use for assessment when planning technology programmes, confirmation of the standard's appropriateness for assessment purposes

can only really be validated once students actually engage in the unit. This notion can also be applied to achievement standards.

Teachers should ensure that students are given assessments that guide them to produce evidence which sufficiently matches all performance criteria. In some instances, teachers using unit standards, in particular, have not supplied the same level of specific guidance for the evidence required as they have for achievement standards. Students assessed through these unit standards were often disadvantaged with aspects of the required evidence missing from their submission as a consequence of the lack of guidance.

Specific Unit Standards

Level one

7522: Select and use materials to make products or prototypes
Significant evidence was presented that indicated students assessed in this standard were perceptively selecting and using appropriate materials to develop very good outcomes.

Evidence was sometimes presented that included research of a range of materials, some of which were not possibilities for the intended product/prototype. This does not sufficiently match the requirements of element one of the standard. Students should show evidence that they have *independently* identified and researched materials that they think are *likely* to be suitable for the requirements of the brief/design and selected those that are most appropriate, with reasons for that selection. Evidence should also show that students have clearly described the selected materials in terms of their physical properties relevant to the requirements of the design.

Students must adequately demonstrate that they have *independently* selected appropriate manufacturing processes and techniques that enable the requirements of the brief and the design to be met. In some submissions, the selection of processes to be followed was determined by the teacher. This disadvantaged students as they were then unable to meet the requirement of the standard for independent selection.

Some very good evidence of selecting manufacturing processes has been gathered through the use of job-sequence planning sheets. These have included such things as a description of processes to be undertaken in logical sequence, the material to be used and tools/machines/other resources that will be required.

Evidence to show that students have employed safe practices when organising, handling, and finishing the materials should be presented. Photographs of both the completed product and techniques/processes used, and teacher verification/commentary of what they observed/discussed with students is important here. Refer to the *general comments* above in relation to this.

7523: Use, and care for, standard hand tools in materials technology
Evidence needs to be submitted for moderation that, under supervision, students can select hand tools for a process or operation; demonstrate their safe operation and attend to their safety and maintenance aspects. Teachers should ensure that students present evidence that relates to those hand tools outlined in special note 3 of the standard.

For those criteria related to the safe operation of and attending to maintenance requirements teacher verification/commentary is important. Where insufficient evidence was presented to support that students had demonstrated these criteria in class, assessment judgements were not able to be validated in the moderation process. Refer to the *general comment* above in relation to this.

7524: Use cutting, shaping, assembly, and finishing processes in materials technology
Significant evidence was presented to show that students assessed with this standard had developed some good skills based outcomes. Students need to demonstrate that they can mark out materials for further processing; cut them to size; shape them, assemble the product components and apply finishing processes. This must be done to the requirements set out in the related design and working drawings.

The design and working drawings should be included in the moderation submission. These can be generated by the student or the teacher. Without these, the moderator can not judge if the design requirements have been met.

To satisfactorily provide evidence for the use of marking out, cutting and shaping tools, photographic evidence and teacher verification/commentary will most likely need to be included in the submission. In some submissions, moderators were unable to validate teacher decisions in relation to this as insufficient evidence of this type was present. Refer to the *general comment* above in relation to this.

7536: Develop sequence of operations for one-off construction in process technology
To allow students to effectively meet the requirements of this standard, the drawings/ specifications used must provide sufficient detail. Such things as material requirements, finishing requirements and detail of the component parts should be included. These drawings/specifications should be included in the moderation submission to enable moderators to accurately judge if the related criteria have been met.

7546: Construct an electronic circuit using kitset componentry in systems technology
Elements 1 and 2 require students to identify components, their values and functions in relation to a circuit diagram or schematic layout. In order for students to meet the requirements of this standard, diagrams/layouts should be sufficiently detailed. This information should be included in the moderation submission.

Photographic and teacher verification are important in evidencing that the electronic components have been fitted to the circuit board in accordance with manufacturer's and worksite requirements, that care has been taken in relation to polarity of components and that jointing of the electronic circuitry has been carried out in accordance with manufacturer's and worksite requirements. Refer to the *general comment* above in relation to this.

13406: Design and construct a prototype to solve a mechanism design problem
The special notes of this standard state that the outcomes identified in this unit standard are derived from *Technology in the New Zealand Curriculum* and that teaching programmes covering the outcomes of this unit standard should be based on this curriculum statement. Teachers should be mindful of this when developing the assessment material to ensure that this is adequately reflected in the student evidence.

Level two

7525: Select materials and establish processes for a manufacturing task
In order to allow students to effectively meet the requirements of this standard, the assessment task needs to contain an appropriate level of detail within its design criteria and specifications.

Students need to demonstrate that they can independently select materials for this task, and establish manufacturing processes for the selected materials. When selecting materials, students are required to describe the properties of the materials in relation to their application to the design. Some students were disadvantaged when they were prompted to identify the properties of a general range of materials that sometimes bore little relationship with the identified task.

Students were able to show they have established manufacturing processes for the selected materials through various means. Job sequencing was used to good effect. The method used should give sufficient detail of the planned processes to show they are appropriate.

7526: Use, and care for, portable machine tools in materials technology
Students often demonstrated good knowledge of unsafe situations and where to use electrical safety equipment when appropriate. However, evidence that the student had demonstrated their use where necessary was sometimes lacking.

Similarly, there was often solid evidence to show that appropriate portable machine tools had been selected for the task but insufficient evidence to show that these had been used in accordance with manufacturer's recommendations. Also, there was sometimes little evidence present that safety requirements had been met or appropriate safety equipment worn.

These criteria could be easily evidenced through teacher verification of / commentary on their observations of such evidence in class. Note the *general comment* above in relation to this.

7527: Apply fabrication, assembly, and finishing methods in materials technology
Moderation submissions for this standard should include the working drawings / specifications / designs. Without these, it is not possible for the moderator to establish that criteria have been sufficiently addressed. Such working drawings / specifications / designs must contain an appropriate level of detail in relation to materials and dimensions. These could be teacher or student generated.

Evidence presented for moderation should show that the student has evaluated the constructed product against the drawings and specifications to identify any needed corrections. Any necessary corrections/modifications must be seen to be completed.

Photographic evidence of the outcome and teacher verification/commentary on how students had met design/drawing requirements allowed moderators to establish if all elements had been satisfactorily achieved. Note the *general comment* above in relation to this.

7528: Work to design tolerances using marking out and measuring tools safely in materials technology
Students assessed in this standard, should be working with design information and working drawings that have sufficient detail in relation to dimensions and tolerances. Tolerances should include the acceptable margin for error during manufacture.

Teachers need to ensure that students have been prompted to identify tools which fall within the scope of this standard as outlined in special note 3.

The use of photographic evidence and teacher verification/commentary is important in verifying that marking out and measuring tools are used in accordance with manufacturer's requirements and site practice and that the maintenance aspects of marking out and measuring tools are attended to. Note the general *comment section* above in relation to this.

Level three

7530: Use, and care for, fixed machine tools in materials technology
Care should be taken that the student task contains machining requirements that are of an appropriate difficulty. Appropriate health and safety guidelines for schools should be considered when developing assessment tasks for this standard.

This standard stipulates that tools should be used under supervision. Therefore, it is likely that a significant proportion of evidence for moderation will need to be provided by teacher verification and commentary on those things observed/discussed by the teacher with the student in class. Note the general comment section in regard to this.

Specific Achievement Standards

Level one

90045: Develop a technological solution to address a given brief

This achievement standard involves the development of an outcome within technological practice through informed planning to address a given brief. The given brief may be one that the student has developed, or one given by the teacher. Where a student-developed brief is used, teachers are encouraged to check that it provides sufficient challenge to allow students to present evidence at the national standard.

Although students start their practice from a given brief, it is expected that they will explore the situation surrounding it. Such exploration is likely to lead to refinement of the conceptual statement and specifications as new knowledge is gained. This refinement is important as it can have a large bearing on demonstrating fitness for purpose of the developed outcome.

Evidence of planning to guide practice should be mostly forward-looking, outlining a pathway with appropriate stages for the whole of the technological practice undertaken in the development of the outcome. Consideration for resources that will be needed throughout should be an important component of this. In some submissions, planning tended to be mostly retrospective, outlining practice that had already been undertaken. While reflection is an important ingredient in the review of planning it should not constitute the bulk of planning evidence. It is important to see a clear linkage between the evidence of planning presented and the actual practice undertaken by the student.

Some students failed to attain the standard as they had written evaluations on completion of their outcomes that outlined mainly their personal likes/dislikes and what they did/did not do well in terms of their own practice, but contained little reference to the conceptual statement and/or specifications of the brief and/or the outcomes fitness for purpose against them. Sufficient evidence must be present for students to demonstrate how well requirements of the brief have been addressed. Photographic evidence of the outcome, preferably being used for the intended purpose, is also important as it can offer considerable support in relation to fitness for purpose.

90046: Formulate a brief to address a given issue

Some students were disadvantaged as the assessment task they were working with generated evidence that did not sufficiently match the requirements of the standard. While this standard may be used as an assessment tool for a unit of work that provides evidence for other standards, teachers must be mindful that students are meeting its particular requirements. Simply carrying out technological practice for the development of a product from a teacher given brief will more than likely not allow students to access this standard.

Brief development is a key aspect of technological practice and evidence of it is a requirement of most technology achievement standards. The key point of difference for this standard is the starting point for practice. In broad terms students are being asked to provide evidence that they have:

- looked at an issue
- come up with some possible ways to resolve the issue
- chosen one
- developed a brief for it.

An issue is something that that could or should be resolved. To enable students to meet the requirements of this standard the issue should also allow for a range of needs/opportunities for an outcome to be identified.

Students must demonstrate they have identified key factors and their implications in relation to that issue. In some 2008 submissions, students were given tasks asking them to design and make a specified product. As this is not an issue, students were disadvantaged from the outset. In these instances students have also tended to identify key factors that relate to the requirements of the specified product rather than the issue, and are, therefore, not submitting evidence that matches the requirement of the standard.

90047: Develop a technological solution by widening the use of an existing technology

Achievement of this standard requires students to provide evidence that they have identified possible needs/opportunities and considered key factors to widen the use of an existing technology. As part of their technological practice, students are required to formulate a brief that provides a clear description of both the desirable outcome sought and the constraints to be met by a successful solution. As practice unfolds and knowledge of the need/opportunity and other related key factors increases, it is likely to lead to refinement of the conceptual statement and specifications. Such refinement is important as it can have a large bearing on the fitness for purpose of the developed outcome.

Explanatory Note 4 states that, for this standard, widening the use of an existing technology requires students to develop an outcome that adapts, modifies or integrates existing technology(ies) into a new outcome. This could be achieved through such things as:

- extending the performance of the existing technology beyond that which it was originally designed to achieve.
- altering the existing technology to incorporate it into a different context in order that it may perform a different function.

Technologies can take many forms. However, it is important to consider that all of the examples given in Explanatory Note 5 of this standard refer to technological products or components of them, i.e. a hairdryer, hangi food, vacuum flask, and database, or their components, e.g. the heating coil of the hairdryer, the system of cooking the hangi food, the insulation system of the vacuum flask and the computer program for a database.

Teachers should ensure that students demonstrate sufficient change to the existing technology in this adaption, modification or integration to ensure the rigour expected at level 1 National Certificate of Educational Achievement (NCEA) is not lost.

90048: Develop a means for ongoing production of a technological solution

There was a significant variance in the quality of evidence presented within this standard. In general, students have evidenced the stages of the proposed production process well, with good use of production symbols evident. However, other aspects of the standard have not always been sufficiently addressed. This achievement standard involves identifying a means to allow for the ongoing production of an outcome. To gain an achieved grade, students must:

- identify key factors that underpin the suitability of an outcome for ongoing production

- make design adjustments to ensure it is suitable
- formulate a brief for the ongoing production of the outcome
- identify the stages of, and a means to allow for, the ongoing production of an outcome.

It is not sufficient to simply formulate a plan for the ongoing production of a student developed outcome. To satisfy the requirements of this standard the outcome will need to be revisited to determine its suitability for on-going production and the changes that will be needed so that it is suitable. This may include such things as its method of construction and the materials used in its construction.

Students have also tended to present briefs with specifications that target the qualities the outcome needs in order to do its job when implemented (as is required in most other standards) rather than the ongoing production of it (which is what is needed here). Explanatory Notes 6 and 7 give guidance on what specifications an appropriate brief could target. This includes such things as uniformity of quality, tolerance for variations, suitable materials, aesthetic appeal and other requirements to satisfy of the target market.

90050: Present a technological solution that addresses the requirements of the brief.
Although the quality of the outcome in relation to the brief is the focus here, there must be sufficient evidence present that it has been developed through technological practice. Sometimes student material was submitted that contained very creditable outcomes, including aspects of a design process. However, there was insufficient evidence present that outcomes were developed through students undertaking technological practice, to allow them to achieve the standard. Explanatory Note 5 of the standard outlines aspects that would be appropriate here such as:

- ongoing consideration of stakeholder opinions, brief refinement, research, idea design and development, ongoing planning, outcome development and evaluation
- environmental factors that may impinge on the outcome of its development, including where the solution will be finally located.

To meet the requirements of merit and excellence, students should be encouraged to develop briefs that clearly describe, in detail, both the desirable outcomes sought and the constraints to be met. This will help them to demonstrate that they have developed a quality outcome. To move beyond achieved, students must also demonstrate how they have developed the outcome using relevant codes of practice. The codes of practice that are important here include those that relate to the developed outcome. These could include legal requirements, accepted practice in regard to appropriate materials choices and construction methods for the intended environment and health and safety considerations for its use.

Level two

90338 – 90344: Develop and model a conceptual design in <area specific> technology

Students who achieved this standard clearly formulated a brief and used planning to develop and model a conceptual design to address an identified issue. Those students at merit and excellence have shown the influence of prioritised key factors. They have also developed planning techniques that enabled them to review and revise ongoing development work. The conceptual designs have been modelled to show fitness for purpose.

For technological practice based standards such as these, students must be given the opportunity to identify their own authentic issue. In some cases in 2008, the teacher predetermined the issue and the way to resolve it. Although students are encouraged to use their creativity in technology, development should be based on authentic technological practice. Students should be presented with genuine opportunities to enhance their learning in technology. That is, the issue identified and people used in the development process should be real.

Some students have included a lot of research and this practice is encouraged. However, students need to ensure they are analysing material in terms of how it relates to key factors and the development of a brief. In this way, research can be seen to be informing practice.

To meet the requirements of this standard, students have identified specific key factors that were important to the development of their conceptual designs and analysed their research and conceptual ideas in terms of those key factors. The identification and research of key factors to determine their appropriate influence on brief development is paramount to sound technological practice at this level. Other students identified key factors that could have related generally to any practice and which did not strongly reflect the needs of their major stakeholder/s. This approach proved less effective in demonstrating appropriate technological practice. Generally, these students did not carry out the research and investigation of their key factors as expected.

To move beyond achieved, final specifications should be reflective of the prioritisation of researched key factors. Some students were disadvantaged as, although they identified and attempted to prioritise some general key factors early on in their practice, later work identified more key factors but these were not prioritised or discussed in terms of their implications and interactions.

It is important that students identify stakeholders who are relevant to the practice they are undertaking and that they do, in fact, consult with these stakeholders regularly and not just at the beginning and end of practice. This feedback would have often strengthened work presented and supported that the modelling of the conceptual design is potentially fit for purpose. Other students included informative critical feedback from stakeholders.

For these standards, the briefs developed by students should contain specifications for developing a conceptual design (rather than a one-off solution). In some cases, the work presented may have been more appropriately assessed using one of the standards that relate to developing and implementing a one-off solution.

The glossary on the Techlink site states that planning should set out how resources such as time, expertise, materials and finance will be used in a coherent and systematic manner during the development of a technological solution. It should establish key milestone outcomes (intermediate project accomplishment points which are usually also key decision points), and state how each of the resources is to be used to achieve the outcome at each milestone stage. It should also establish how consultation with stakeholders and resource people (e.g. experts) will be carried out to ensure that all constraints and requirements are met (http://www.techlink.org.nz/glossary). This is the type of evidence expected to be seen for this standard and it is not always apparent. Those students who are mostly planning on a day-to-day basis should be encouraged to break their planning into 'bigger picture' key milestone stages. This would provide better evidence that planning is guiding their overall practice.

Students should be encouraged to choose planning tools that are useful for the nature and the stage of the technological practice being undertaken. Planning tools could include such things as plans of action, Gantt charts, flow charts, block sequence diagrams, 'to-do' lists, stakeholder interview sheets and journal notes.

Explanatory Note 8 also states that planning must reflect the dynamic and evolving nature of development work. Regular reviews of planning should be undertaken and required changes made to ensure remaining time and resources are allocated to achieve the desired technological outcome. This practice was not always sufficiently evident in student work to enable the requirements of higher grades to be met.

Rather than merely producing a journal of what has been done, students are encouraged to provide more evidence of forward-looking planning. They could include such considerations as "What am I going to do? What resources do I need? What changes do I need to make?" Students should be encouraged to explain why they have made particular planning decisions.

Modelling media needs to demonstrate potential fitness for purpose. That is, modelling should be used to effectively judge the potential ability of their outcomes to serve their purpose in 'doing the job' within the intended location, where the 'job to be done' is clearly defined by the brief. This might include using a combination of things such as sketches, computer modelling, and samples of materials or physical models of particular parts of the proposed outcome. The modelling seen in some student work was insufficient to show potential fitness for purpose.

Although some students developed outcomes that addressed an identified issue, critical aspects of their practice were sometimes missing and therefore they did not meet all the requirements of this standard. Teachers who provide templates sometimes confine student practice at this level by restricting student's ability to show evidence of planning their own practice. Teachers should also allow for individual students to investigate what is relevant to their particular practice.

90345 – 90351: Develop and implement a one-off solution in <area specific> technology

Achievement of these standards requires students to identify an issue, formulate a brief to address the issue, use planning to guide their practice and develop and implement a one off solution within a specific technological area.

This standard requires students to identify their own issue from a teacher given context (see Explanatory Note 3). Determining that all students in a class make a particular product does not allow for this requirement to be met. At this level, good practice was seen when students identified an issue from a teacher given context. The issue must allow students to identify a range of needs or opportunities from which students can select one to develop an outcome. A need in technology refers to an identified requirement of a person, group or environment. An opportunity in technology refers to an identified possibility for a person, group or environment. Some students identified very good ideas for products that could have been the result of investigating an issue but this link was not made.

Teachers need to ensure that students are developing briefs that address issues. Some students are identifying key factors for a chosen outcome, rather than exploring the key factors associated with a particular issue. In a number of cases, classes of students are producing the same general key factors. Explanatory Note 9 describes the sort of key factors that could be considered. At this level, students should be thinking deeply about the implications of the key factors associated with their issue. This might include such things as showing evidence of appropriately referenced and processed research and investigations and making subsequent evaluations. The resulting refined brief should be robust and provide a clear description of both the desirable outcomes sought and the constraints to be met (Explanatory Note 6) for the particular outcome chosen. Specifications should describe the nature of attributes, for example, quantity, size, colour, time frame and movement. The specifications should provide guidance for ongoing evaluation during the development of outcomes, as well as serving as an evaluative tool against which the final outcome can be justified as 'fit for purpose'.

For students to move beyond achieved, key factors need to be prioritised. This requires more than simply assigning a rank or rating to a list of key factors. More so, refined briefs should reflect that students have determined the most important key factors in the development of their outcomes and why they have been considered particular ones to be above others. This prioritisation of factors should have arisen out of appropriate research including key and wider community stakeholder consultation around the issue and needs/opportunities identified. It should also be evident as to how some factors impinge on others.

The comments made about key factor research included in AS90338 – AS90344 apply here also.

Students need to show they are using planning to guide the entire practice and it should reflect the evolving nature of it. The evidence of planning in some submissions needed to be more than just for the production/manufacture stage. Students should be encouraged to show detail about the allocation of resources. At this level, students should be supported to develop their own overall plan, rather than follow a prescribed step-by-step process established by the teacher.

It is expected that there would be evidence of ongoing consultation with stakeholders. Some students planned and held regular meetings with stakeholders and this effectively

enabled them to review and revise their development work, address issues and maximise opportunities.

Planning should be used to structure technological practice into manageable stages. While Gantt charts are good, they need to show something like proposed key stages and time frames rather than merely plot the actual tasks done. Evidence of planning which clearly guided practice was seen when detailed planning occurred at each key stage as the practice progressed. Running records of problems and strategies were seen as an effective tool used by some students to guide their practice.

To move beyond achieved, students should be showing evidence of on-going reflecting and evaluating and making subsequent modifications and/or refinements to their planning.

Some students could enhance their practice through more meaningful stakeholder consultation. For example, sometimes students asked people to answer questions about their desires when the product was for the student themselves and, thus, the feedback was not relevant. Stakeholder consultation should be with those potentially affected, directly or indirectly, and positively and/or negatively, by one or more of the problems to be solved, or by some aspect of the desired solution itself, or by the development process.

Too many students are still developing conceptual design ideas or looking at existing designs that show little relevance to addressing the issue. It was more informing to their practice when students developed possibilities and analysed them in terms of identified key factors that related to their issue, choosing the most suitable on that basis.

Those students who have employed functional modelling techniques have generally used them effectively to explore the feasibility of design concepts. This helped students to determine whether changes or refinements should be made to the development of the outcome. This practice could be more widely encouraged as an integral part of the development of a one-off solution.

Teachers must ensure that students are developing outcomes that can be implemented. Explanatory Note 5 of this standard states that implement means to locate and test the solution in its intended environment to demonstrate its fitness for purpose. That is, the outcome is required to be put into practical effect. In textiles, even if a planned occasion did not happen, students could provide evidence of wearing their outfit to another occasion and then evaluating it in terms of how it met requirements. The inclusion of photographs of the outcome placed in the environment for which it was planned and being used successfully very much helps to demonstrate that the outcome has been implemented. Feedback from stakeholders also helps to validate that the issue and key concerns of stakeholders has been addressed and that the outcome is fit for purpose. There should also be appropriate evidence around how the specifications of the brief have been met. For example, ‘table needs to seat 6’ could be met by showing a photo of 6 people sitting at the table. In some cases, it would be pertinent to show fitness for purpose by testing and evaluating the outcome after it has been used for some time. In general, it is pleasing to note the high quality of outcomes and a delight to see outcomes that clearly demonstrated creativity, flair and innovation.

At excellence level, the current version of these standards requires that students justify the viability of the solution. Explanatory Note 10 states that viability of the one-off solution refers to the capacity to meet the specifications of the brief, address possible

social and environmental impact(s), meet likely future demand, and address availability of resources for its maintenance. It seems that some students are not aware of this requirement. However, those students who have been made aware of the requirement, generally have provided adequate evidence of this aspect of the assessment criteria.

In some cases these standards were used to assess student work when it clearly was difficult to implement the outcome. In this circumstance it may have been more appropriate to assess against one of the standards around developing a conceptual design.

It should be noted that there needs to be sufficient evidence to support when a student changes from one particular product idea to an entirely different product (e.g. a table rather than a chair or a dress for a ball rather than a casual outfit). A few students did not update their brief to include specifications that could be matched against the final product. Most of the investigation, conceptual and development work referred to a product that was not produced.

Students must adequately address all components of practice to an extent that is reflective of level 2. It must be clear that all three bullet pointed achievement criteria have been met. For example, sometimes students may show sound evidence of using planning to guide their development and implementation of a one-off solution but their work around brief development is insufficient to meet the requirements of the standard. In other cases, the evidence to support the planning criteria is inadequate. Notes made by the teacher about individual practice observed have been very much appreciated in understanding evidence that may not have been apparent in the student work. A lot of students have produced very worthwhile products that address real needs or opportunities. They have identified key requirements, determined what needs to be done and planned accordingly.

While it is acceptable to achieve both this standard and a standard related to developing and modelling a conceptual design within one unit of work, teachers must be mindful that they are addressing the requirements of both standards. Although key factors may have been identified for a conceptual design and a brief developed for a conceptual design, these criteria need to be re-addressed for this standard. Because the issue is the same, there may not be significant changes to the initial key factors. However the requirement to manufacture a prototype, implement it and gain sufficient feedback on its performance to demonstrate fitness for purpose, will generate new key factors that will have to be identified and researched. This should then lead to further refined briefs and planning to ensure the implementation is successful.

90352: Develop a means for multi-unit production of a technological outcome
To achieve this standard, students must identify key factors and formulate a brief that allows for the multi-unit production of a technological outcome to address an identified issue. They must identify the suitability of the design of the technological outcome for multi-unit production. Necessary design adaptations must be made to enable its production. A suitable mode of production must be identified and the process stages described. Students must estimate key resource requirements and their availability for multi-unit production.

The assessment material must ensure that students have the opportunity to meet the requirements of this standard. There is some confusion around the intention of this standard. Some teachers have asked students to present evidence for the production

process, but for only one unit of the product. The standard states that a production process is to be outlined for multi-unit production, i.e. more than one unit. Other teachers have interpreted the standard as outlining the production of a number of different items. This standard is usually applied when students are looking at the multi-unit production requirements for something like a corporate or sports team uniform or the multi unit production of a piece of furniture like a set of chairs.

Teachers must be mindful that they are allowing students the opportunity to formulate a brief that allows for the multi-unit production of a product that addresses an issue. Generally, adaptations will need to be made to the original design to enable its multi-unit production.

Explanatory Note 3 states that multi-unit production includes consideration of such things as procedures for uniformity of quality, tolerance for variations, and organisation of the production process (e.g. equipment needs, labour needs, material supplies), economic viability, regulatory compliance. A number of students who presented evidence for this standard needed to show more knowledge of these aspects.

Students also needed to show understanding and reasoning around selecting a suitable mode of production for their technological outcome. They should be showing how the characteristics of the process match the requirements of their product, and the site of the production process. In developing a suitable mode of production, the design of the initial outcome will need to be revisited. Students should be considering such things as why it might be better for all components to be completed at a workstation before they move to the next one (batch production) as opposed to continuous production where materials are processed without interruption

In general, the process stages also need to be addressed in more detail than is being noted in the work submitted for moderation. This includes describing and making real decisions around such things as storage, transport, delay, inspection, transformation operation. Students must be demonstrating knowledge and understanding of the purpose (e.g. to achieve a material transformation), inputs and outputs, and the interrelationships of the process stages. Process stages may be described using annotated flow charts, layout diagrams and/or written explanations (see Explanatory Note 7).

90362, 90364, 90366, 90368, 90370 and 90372: Demonstrate skills in <specific technological area>

Achievement of these standards requires students to demonstrate that they can perform skills in undertaking technological practice, to develop a technological outcome(s) that addresses an issue identified by the student. Students who have been given the opportunity to explore a real issue are generally well set up from the beginning to achieve these standards.

Sometimes students are demonstrating skills, but they are not developing a technological outcome that addresses the identified issue. Technological outcomes are developed through technological practice for a specific purpose. As well as developing outcomes, to show evidence of technological practice, students need to be showing evidence of doing such things as organising and managing resources and time, fully researching the issue, developing briefs and interacting with stakeholders. Some teachers demonstrating best practice have included assessment documentation within their submission for this standard that describes the technological practice undertaken. In some cases, teachers have more than likely made correct judgements. However, because the evidence of technological practice was not submitted, the moderator was unable to validate the judgement. Although photographs may indicate that students have demonstrated skills at a particular level, they alone are insufficient evidence. The skills themselves may well be sound, but the moderator needs to be able to determine that a technological outcome was developed.

On the whole, students have been provided with the opportunity to demonstrate complex skills when developing their outcomes. These skills were clearly evident in some very impressive outcomes. Although insufficient in themselves, trialling and modelling has also been an effective way of adding evidence to illustrate the skills undertaken to develop a technological outcome. Teachers should be mindful that students have the opportunity to develop outcomes and display the subsequent skills involved that are of a rigour that is reflective of this level.

At a merit level, students may be demonstrating skills within different applications. It is helpful for the moderator when skills are categorised according to these different applications. For this standard applications refer to things such as transformation, manipulation and modification of materials (see Explanatory Note 3). Explanatory Note 4 describes possible skills that could be found within these different applications. Likewise, suggested applications and skills for the other area-specific skills standards can be found in the relevant Explanatory Notes 3 and 4. Note that at merit level, the skills demonstrated may be from only one application but that it must be shown that the technological practice or the technological outcome itself has been enhanced.

At excellence level, the skills demonstrated must come from different applications and again must be seen to enhance the technological practice or the technological outcome itself. It is expected that technological outcomes will not have major operational flaws. At this level, references to where they have shown evidence of adhering to relevant codes of practice, legal requirements and/or ethical and cultural ways of practising should also be included.

Although students have usually been given a copy of an assessment schedule that is appropriate for these standards, it is generally accepted practice that students will also be given some instructions that relate to the requirements of this standard. Students need to know they are required to present evidence of the skills used when developing a

technological outcome. The skills demonstrated must be relevant to the area specific achievement standard(s) that students are being assessed in. Some teachers are giving very sound guidance on these skills and how best to present evidence of these.

A number of teachers are very effectively showing the moderator how judgements were made by providing such things as individual, annotated assessment schedules. The TKI assessment schedules were sometimes expanded to include headings for the different applications and the skills observed have been documented under the appropriate heading. This greatly assists the moderators in being able to validate or provide feedback about the judgement. Other teachers are very effectively providing a commentary to support their judgement.

Alternatively, or as well as the above, teachers can assure that students provide the necessary evidence needed to see that the standard has been achieved. Some students more than likely used skills within different applications to develop their outcomes but they have not always provided adequate evidence of them. Photographic evidence of the final outcome and stages along the way can help show that particular skills were applied. Additional comments made by the teacher often enabled the moderator to be confident that students had indeed met the requirements of the standard.

Level three

90613: Develop a conceptual design to address a client issue

This standard requires students to present evidence of technological practice from the identification and exploration of their chosen client's issue through to the modelling of a conceptual design, to demonstrate that the conceptual design has the potential to address the identified issue. Project management tools must be seen to be guiding practice.

Because this standard requires that students develop a conceptual design for a client, it is important that this relationship is clearly established and maintained throughout the process. Those students who have been most successful in meeting the requirements of this standard have clearly considered client and other stakeholder feedback in the development of their conceptual designs. It is important that students are aware of client needs and that this is reflected in the development of their conceptual design. Some work was most impressive in showing the interactions between outside experts and specific research.

Explanatory Note 4 outlines what is expected in the development of a brief at this level. Students needed to explore and critically evaluate the issue. Steering students to identify issues that were individual and challenging allowed more opportunity to overcome problems during their practice. In a situation where students may not be able to develop a one-off solution, developing a conceptual design allows for a more difficult problem to be addressed

Some students have tended to identify broad, generic key factors only. At this level, it is expected that students will be identifying a range of key factors that relate specifically to the client issue and that these will be thoroughly researched. The decisions made as a result of this exploration should be apparent in the final design. This work should help to ensure the breadth and depth of practice expected at this level.

Brief development should be on-going so that refinements and/or modifications are made based on the student's developing understanding. Some briefs were limited in the specifications that describe the requirements of the outcomes themselves. Final briefs should include specifications and constraints that communicate detail of the nature of the conceptual design for the realisation of the identified client opportunity. To obtain an excellence grade at Level 3 the issue should be thoroughly explored, the prioritisation of key factors justified and implications and interactions between key factors explained.

Some student work showed evidence of choosing appropriate project management tools to best guide them in their practice. Effectively used project management tools that are somewhat different to the norm include such things as: using a research plan to identify what needs to be found out and where the information will be accessed; meeting schedules; templates for such things as milestones or stakeholder consultations; and progress reports. Explanatory Note 7 states that project management tools include effective communication between the student, client and other stakeholders. Some students recognised that face to face communication was sometimes difficult and therefore effectively implemented other communication strategies such as using phones and emails.

Explanatory Note 9 states that modelling a conceptual design involves the investigation and construction of a representation to explain, explore and evaluate the conceptual design idea against the specifications of the brief. Students could be encouraged to show more evidence of choosing the most effective method of modelling conceptual design ideas to best test for potential fitness for purpose. This may include selecting appropriate materials to develop the model and also include things such as anticipated actual costing and details of materials to be used in the actual outcome. Photographs may also help to simulate the proposed outcome. Students must be mindful that the conceptual design is discussed in terms of how it is fit for the client's purpose. In some cases, students have discussed how they think it is fit for purpose and have not strongly made that essential link to the client. That is, more feedback needed to be received from the client rather than the student themselves, justifying the conceptual design's potential fitness for purpose. For students to attain this standard at a merit level, potential fitness for purpose needs to not only be demonstrated to the client but also to other key stakeholders.

Students must be mindful that they are developing a conceptual design it its own right and not just using modelling to explore and evaluate feasibility of design concepts for an outcome that is to be implemented. The Techlink website includes an explanatory paper on technological modelling that teachers may find helpful. This can be found at: http://www.techlink.org.nz/curriculum-support/papers/knowledge/tech-model/

90620: Develop a one-off solution to address a client issue

Achievement of this standard requires learners to formulate a brief to address a client issue, and use project management tools to develop and implement a one-off solution that addresses a client issue.

Students should be guided to ensure they take particular care in choosing a suitable client. Occasionally students developed outcomes for themselves which were not acceptable at this level. Other students chose a general group or several clients and this made it difficult to address client requirements. Clients need to be authentic. Using organisations, groups (e.g. famous music bands) or individuals that the student has little or no chance of interacting with makes it very difficult to meet the requirements of this standard.

Choosing an appropriate and authentic issue is a significant consideration at this level. Explanatory Note 6 states that an issue must generate a range of needs or opportunities for technological practice. Some students were disadvantaged as they chose to make a particular product without sufficient exploration of the issue.

At this level, students should be undertaking rigorous brief development. It is good to note that some students are not only identifying and investigating key factors that are related to the physical development of a product, but that they are also addressing social, ethical and cultural factors around their chosen issue. In these cases, the practice is more reflective of level 3 NCEA. It is expected that the exploration around key factors should be more extensive at this level than what would be accepted at lower levels. Students should be encouraged to show the link between research and how it has affected their practice.

To move beyond achieved, students are required to prioritise and explain the implications and interactions of key factors. Sometimes, later research identified other key factors but students did not always include these factors in the discussion.

Some students have been well guided to include wider/community stakeholder consultation into their practice. It is the feedback from these people that often provides the critical comment required to strengthen the outcome in terms of fitness for purpose. Student work sometimes alluded to people or groups who could be part of the consultation process but these contacts were not always established. Other research work identified a number of things that were to be investigated but no evidence for this was provided.

Evidence of project management tools being used to guide practice should be clear at this level. Students should be using a range of appropriate planning tools in an effective way to manage, document and justify decisions. It is suggested that some teachers look at the possibility of encouraging students to structure their own practice to a greater degree. By this level, students should have a sound understanding of the practice required of them and they should be doing such things as setting up their own project management templates and selecting appropriate tools to guide their practice. Students at excellence were using project management tools to good effect to pre-empt problems.

Some students are still presenting a range of initial conceptual ideas but not sufficiently analysing them in terms of how they address identified key factors. Annotated comments would provide more insight into this development work.

A number of students have produced very fine outcomes. It is extremely pleasing to see outcomes that are addressing real problems and showing evidence of innovation.

However, in some cases, although the quality is high, the teacher should consider whether outcomes are reflective of Level 3 NCEA.

Exploration of relevant codes of practice, legal requirements and understandings of ethical and cultural ways of practising, are important aspects of establishing fitness for purpose (see Explanatory Note 5). These aspects were not always strongly evident in student practice**.** In demonstrating fitness for purpose, students are also expected to incorporate and evaluate feedback from relevant stakeholders. To gain excellence, fitness for purpose needs to be demonstrated to the wider community.

Students must ensure that chosen outcomes are able to be implemented. In some cases, it may have been better to have chosen to develop a conceptual design rather than a one-off solution. Because of the nature of the outcome and the project itself, some outcomes were unable to be put into effect, and therefore not implemented, but their potential fitness for purpose could have been tested.

Video clips have been used effectively by some students to demonstrate fitness for purpose. This enabled them to clearly show such things as how particular features meet the requirements of their brief.

Teachers are reminded that a discussion around the viability of the outcome is a requirement for excellence. Explanatory Note 10 states that viabilit*y* refers to such things as the sustainability of the one-off solution for the estimated life cycle in terms of the potential social and environmental impact, likely future demand, and the availability of resources for maintenance and disposal.

90679, 90681, 90683, 90685 and 90687: Demonstrate techniques in <area specific> technology

To attain this standard, students are required to demonstrate techniques when developing a technological outcome. A technological outcome is something that is developed through technological practice. The implication is that students will consider such things as: ongoing consideration of stakeholder opinions, brief refinement, research, idea design and development, ongoing planning, outcome development and evaluation. Also environmental factors should be considered, including where the outcome will be finally located. A small number of submissions did not show sufficient evidence to see that technological practice was occurring.

New Zealand Qualifications Authority (NZQA) asks that assessors show moderators how judgements were made (Assessment Matters, 26 May 2006). Either students or the assessor could list the complex techniques used in the development of their outcome. Those submissions that included information such as individual annotated assessment schedules that described the transformation, manipulation and modification techniques used within the development of each outcome (in this case, for materials technology), very clearly described how assessor judgements were made. Photographs of students demonstrating techniques or that showed the complex parts of an outcome also provided sound evidence of how students met the requirements of this standard. For students at excellence, references to where they showed evidence of adhering to relevant codes of practice, legal requirements and/or ethical and cultural ways of practicing was also seen as good practice.

Explanatory Note 1 states that this standard is derived from the Technology Curriculum Level 8. Some teachers should consider whether outcomes are of the rigour expected at

that level. The context given by teachers sometimes limited students' ability to demonstrate a range of techniques to enable them to move beyond an achieved grade. A number of students submitted outcomes that had relatively simplistic designs, but complex techniques were still demonstrated in the development of the outcomes and this enabled them to meet the requirements of the standard.

Apart from the outcome itself, other experiences contributed to demonstrating techniques. Including modelling within their development work, enhanced student's opportunity to demonstrate techniques. This was also apparent when students were encouraged to go beyond the confines of the classroom to look for suitable ways to test, trial and develop their outcomes.

From the evidence presented, it was sometimes difficult to justify that some students had demonstrated complex techniques when developing their outcomes. Complex techniques require a combination of techniques to be carried out in a particular order for a particular purpose (see Explanatory Note 4). Explanatory Note 3 gives examples of techniques for the different areas, and while they may not be exhaustive lists, they do offer some direction as to the expected level of complexity.

90792: Develop a proposal for a production process for a client

This achievement standard involves the development of a proposal for a production process for the multi-unit production of a client's one-off solution(s).

In general, client one-off solutions were chosen that were suitable for multi-unit production. The evidence around identifying and making any necessary design adaptations to the one-off solution to ensure it is suitable for multi-unit production was not always so apparent.

This standard requires that students identify key factors and their implications in developing a brief for the multi-unit production of a client's one-off solution(s). Explanatory Note 4 states that the development of a final brief will provide specifications for the student, teacher, and key and wider community stakeholders, which includes a means of evaluating the proposal for multi-unit production of the client's one-off solution(s) as being fit for purpose.

Students should be encouraged to carry out in-depth research of the full range of key factors they identify as important to accurately determine their priority / effect in relation to the proposed production process. This might include aspects such as the number of outcomes, the colour, the materials used, acceptable tolerances, target production time frame, wastage targets or the maximum production cost per unit. Student briefs that lacked specifications describing the nature or attributes for the proposed multi unit production of their client's one-off solution did not allow for the success of the production process to be measured.

Students need to ensure they are identifying a suitable mode of multi-unit production and describing the process stages for their multi-unit production. Possible modes of multi-unit production include batch production, continuous production, and semi-continuous production (see Explanatory Note 5).

Some students chose modes of production where the characteristics of the process did not match the requirements of the one-off solution and the social and physical environment where the production process was to be sited (see Explanatory Note 6).

Students did not always describe production processes for their particular multi unit production in sufficient detail to reflect Level 3 NCEA. Explanatory Note 7 states that a range of possible processes may include such things as storage, transport, delay, inspection, transformation operation, production management. At excellence level, students need to discuss the process stages in relation to feedback requirements and known and potential variables that require accurate management. These variables may include such things as temperature, volume, length, quantity of output, labour availability, protocols including cultural and professional (Explanatory Note 7).

This standard also requires that students estimate resource requirements and their availability for the multi-unit production of a client's one-off solution. Resource requirements are the quantities of the major resources (e.g. materials, energy, labour) required for the process to operate in an ongoing manner (Explanatory Note 8). Students tended to talk generally about resource requirements rather than determine quantities needed.

The supporting research that should be evident around estimating benefits and costs for the client was not always apparent in student work. Estimated benefits refer to likely positive impacts from the production, distribution and/or sales of the units produced in terms of economic, social and environmental considerations. Explanatory Note 9 gives examples of considerations. When discussing benefits and costs, Explanatory Note 9 states that these can be approximate but that they do need to be realistic.