Guideline for determining Overall Positions (OPs) and Field Positions (FPs)

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The current version of the Guideline for determining Overall Positions (OPs) and Field Positions (FPs) is accessible on the QSA website.

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Contents

List of tables

List of figures

1. Introduction

The Queensland Studies Authority (QSA) inherited tertiary entrance procedures and requirements from two of the its predecessor organisations, the Queensland Board of Senior Secondary School Studies and the Tertiary Entrance Procedures Authority. The procedures were developed following an extensive review of Queensland's tertiary entrance system conducted by Professor Nancy Viviani in 1990.[1] The system today remains largely unchanged from the procedures and requirements developed in the 1990s.

The processes for calculating Overall Positions (OPs) and Field Positions (FPs) are complex. The Viviani Report determined that, in the context of ranking students for tertiary entrance, simplicity and fairness would be conflicting. The review decided that it was better to be complex but fair rather than simple but unfair. This guideline describes the procedures used by QSA to calculate OPs and FPs. It is, therefore, a technical document, which is highly complex in parts, and aimed at an informed audience.

Readers seeking a more accessible introduction to the calculation of OPs and FPs should visit the QSA website www.qsa.qld.edu.au/637.html.

1.1 Structure of guideline

This guideline is structured as follows:

- **Section 1** introduces the guideline and outlines the legislative requirements for developing a tertiary entrance guideline.
- **Section 2** is the longest and most detailed. It introduces basic concepts (e.g. OPs, FPs, scaling) and eligibility requirements for ranking students for tertiary entrance in Queensland. It then outlines the complex processes and calculation methods used in the various stages of scaling.
- **Section 3** outlines QSA's methods and processes for detecting group or individual anomalies that may have occurred in the calculation of OPs in any given year. It also describes the structures in place for resolving anomalies.
- **Section 4** specifies the processes for individual students to seek a review of the OP they have been awarded on their Tertiary Entrance Statement.
- **Section 5** identifies the range of tertiary admissions data QSA provides to the Queensland Tertiary Admissions Centre (QTAC) and other appropriate bodies each year.
- **Section 6** describes the method used and circumstances in which Australian Tertiary Admission Ranks (ATAR) are calculated for Queensland's OP-eligible students.

1.2 Legislative requirements

Under section 15 of the *Education (Queensland Studies Authority) Act 2002* (QSA Act), the QSA has the following functions in relation to tertiary entrance:

(a) after consulting with the Minister, to decide the authority's tertiary entrance procedures and requirements;

(b) to rank persons as a basis for tertiary entrance as provided for under the authority's tertiary entrance procedures and requirements;

(c) to issue tertiary entrance statements;

(d) to monitor, review, and recommend to the Minister changes to the tertiary entrance requirements of tertiary institutions established in the State;

(e) to inform the public about tertiary entrance procedures and requirements;

(f) to confer and collaborate about tertiary entrance with the following, and other, entities having an interest in tertiary education—

[1] Department of Education 1990. *The Review of Tertiary Entrance in Queensland 1990: Report submitted to the Minister for Education*, report prepared by N Viviana, DoE, Brisbane.

(i) universities;

(ii) TAFE institute councils of TAFE institutes established under the *Vocational Education, Training and Employment Act 2000;*

(iii) Queensland Tertiary Admissions Centre Ltd ACN 050 542 633;

(iv) the department in which the *Education (General Provisions) Act 2006* is administered;

(v) Association of Independent Schools Queensland and Queensland Catholic Education Commission;

(vi) the principals of schools;

(vii) the vocational education and training department;

(viii) group training organisations recognised under the *Vocational Education, Training and Employment Act 2000*;

(ix) boards of statutory TAFE institutes established under the VETE Act;

(g) to review, and to make recommendations to the Minister about, tertiary entrance.

This guideline provides information in accordance with section 80 of the Education (Queensland Studies Authority) Regulation 2002 (QSA Regulation), which enables the QSA to make guidelines relevant to the performance of its functions under section 15 of the QSA Act.

The QSA also meets the requirement to develop guidelines that address the following sections of the QSA Regulation:

- **s. 52 (a) Eligibility for ranking for tertiary entrance** — a guideline is required to specify alternatives to the typical requirements for OP-eligibility
- **s. 55 (2) List measuring comparative achievement** — a guideline is required to specify the list of information about persons who have finished senior secondary education in a year, ranking the comparative achievement of the persons in the study of tertiary entrance subjects
- **s. 80 (2) Tertiary entrance functions** — a guideline is required to define what is meant by the term *tertiary entrance subject*.

Various QSA officers implement the procedures and requirements described in this guideline under a delegation from the Authority (the QSA board) in accordance with section 55 of the QSA Act.

2. Calculating OPs and FPs

As already mentioned, the processes for calculating OPs and FPs are complex. This section introduces the basic concepts and eligibility requirements for ranking students for tertiary entrance in Queensland before outlining the processes and calculation methods.

2.1 What are OPs and FPs?

2.1.1 OPs

OPs are a statewide rank order of students based on their relative achievement in Authority subjects. They show how well students performed in their senior studies, compared with the performance of all other OP-eligible students in the state. Importantly, these comparisons account for the fact that different students study different subjects and attend different schools.

The term *overall* has three meanings: the rank order compares all eligible students (over all students); the rank order represents achievement in general rather than achievement in specific subjects (over all subjects); and the rank order compares achievement based on any combination of subjects (over all subject combinations).

The term *position* is used to emphasise that this is a rank order of competing students, in the same sense that a race results in *positions* from *first* to *last*. Each eligible student receives a single OP. OPs are reported in 25 bands, from 1 (first) to 25 (last). Therefore, there are many ties for each position (i.e., many students in each band) because each OP represents a group of students whose achievements are comparable enough to place them in the same band. The standard of overall achievement represented by each OP is maintained by pegging the standard from year-to-year. OPs are broadly comparable between years. There is no fixed quota for any OP band. The distribution of OPs is not artificially constrained to fit an assumed normal distribution (bell curve).

2.1.2 FPs

FPs give additional rank orders which are supplementary to OPs. An FP indicates a student's rank order position based on their overall achievements in Authority subjects in one of five fields. A field is an area of study that emphasises particular knowledge and skills — a particular emphasis in the senior curriculum (see Glossary for field descriptions).

FPs are calculated for OP-eligible students only. The calculation of FPs involves the use of field-specific weights for each subject, referred to as *subject weights*. These weights reflect the emphasis of the skills within the definition of each field in the particular subject syllabus. An OP-eligible student will not necessarily be eligible for all five Field Positions. This will depend on the pattern of subjects taken. Whereas for OPs, subjects count equally, for FPs subjects count unequally. FPs are reported in 10 bands, from 1 (first) to 10 (last).

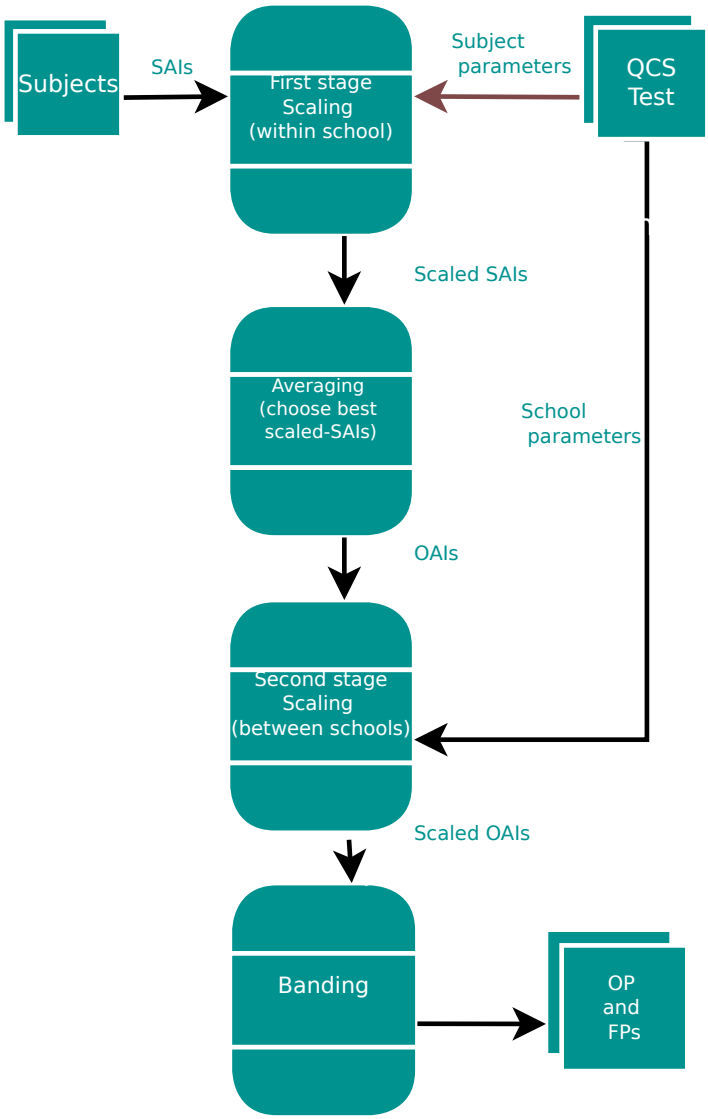
2.2 Overview of process

The QSA is responsible for issuing Year 12 students with Senior Education Profiles (SEPs), which provide information about their demonstrated achievements when they leave school. A component of the SEP is the Tertiary Entrance Statement, which is issued to students who are eligible for an OP, and information appearing on it may be used to make tertiary entrance decisions.

OPs and FPs are determined by using information provided by schools about each student's relative (within school) placement in each of their Authority subjects. Authority subjects are tertiary entrance subjects as defined under the QSA Act. They are based on a QSA-approved syllabus from which a school develops a work program that is accredited and subject to the full moderation procedures of the QSA. A full list of these subjects is available on the QSA website www.qsa.qld.edu.au/670.html.

A statewide rank order is created by combining the information from schools with information from the Queensland Core Skills (QCS) Test and subjecting it to scaling processes to remove bias that may be caused by differences in the strength of the competition in different subject-groups and school-groups. There are two stages of scaling: the first is within-school and the second is between-school.
The various processes used in the calculation of OPs and FPs are illustrated in Figure 1 (page 4).

Figure 1: Overview of OP and FP calculations



As illustrated in Figure 1, the calculation of OPs involves five important steps:

1. Subject achievement indicators (SAIs) are assigned to OP-eligible students by their teachers.
2. SAIs are scaled using QCS Test information for OP-eligible students to allow comparisons of the achievement of groups within the school.
3. Scaled SAIs are averaged (from the best twenty semesters) to form overall achievement indicators (OAIs).
4. OAIs are scaled using QCS Test information to allow comparisons of the achievements of students in different schools.
5. Scaled OAIs are banded to produce OPs.

FPs are based on only ten bands and are more coarse-grained than OPs. There is no second stage of scaling for FPs. These five steps are discussed in detail in this guideline.

2.3 Eligibility

To gain an OP or equivalent OP, a student must study a certain number of Authority subjects and satisfy other requirements. The basic eligibility requirement is 20 semester units in Authority subjects, with at least three

subjects taken for four semesters.

Authority subjects are developed using syllabuses that the QSA has approved and issued. The QSA designates them as tertiary entrance subjects because they are regarded as appropriate preparation for university studies, especially in terms of their emphasis on academic content and skills. Students' achievements in these subjects are externally moderated, ensuring the application of standards across the state is similar.

Each completed semester of a subject gives a student one unit of credit; studying a subject for four semesters gives four units. Therefore, taking five subjects for four semesters gives 20 units.

Subjects not used in OP and FP calculations are:

- Authority-registered subjects, which are developed from study area specifications (SASs) and generally include substantial vocational and practical components
- short courses, which are one-semester courses developed to meet a specific curriculum need. (These may include subjects studied at university).

Students are also required to complete Year 12 and sit the QCS Test. In special cases, such as illness, these requirements may be waived. As required under section 52(a) of the QSA Regulation, the alternatives to the typical requirements for OP-eligibility are also outlined in this section.

2.3.1 OP and FP eligibility

To be eligible for an OP, a student must:

- complete Year 12
- not be a visa student
- study at least three QSA subjects, each for four units of credit or be exempted from this requirement
- have a total weight (units of credit multiplied by the subject weight) of at least 100 weighted semester units (i.e. the equivalent of five complete subjects) or be exempted from this requirement
- sit the QCS Test or be exempted from this requirement.

To be FP-eligible a student must:

- be OP-eligible
- have a total weight (units of credit multiplied by the subject weight) of at least 60 in a field.

2.3.2 Equivalent OP for full fee paying international students

Visa students do not receive OPs and FPs. Instead, they are eligible for equivalent OPs and equivalent FPs. Provided the proportion of visa students in a school-group is small, their results are determined by those of matching students in the OP-eligible population.

To be eligible for an equivalent OP a student must:

- complete Year 12
- be a visa student
- study at least three Authority subjects, each for four semester units or be exempted from this requirement
- have a total weight (units of credit multiplied by the subject weight) of at least 100 weighted semester units or be exempted from this requirement
- sit the QCS Test or be exempted from this requirement.

To be eligible for an equivalent FP a student must:

- be eligible for an equivalent OP
- have a total weight (units of credit multiplied by the subject-weight) of at least 60 in a field.

2.3.3 Exemption from QCS Test

The QSA recognises that some Year 12 students eligible for an OP or equivalent OP (visa students) may not be able to sit the QCS Test. If the QSA exempts an OP-eligible student from the requirement to sit the test, their OP eligibility will not be affected.

The rationale for the policy and procedures for varying the standard conditions is based on:

- principles of justice and equity
- the need to give students with impairments the opportunity to participate in the test on the same basis as students without impairments
- the need to ensure that varying the conditions for sitting the test does not provide an unfair advantage to any student
- the need to assess actual achievement, not perceived ability or potential
- compliance with the *Disability Discrimination Act 1992*
- compliance with the Queensland *Anti-Discrimination Act 1991*.

Students may apply for exemption from the requirement to sit the QCS Test by completing the form provided on the QSA website. An officer of the QSA with delegation to decide the matter will consider the case and make a decision.

2.3.4 Minimum semester units required

A basic eligibility requirement is for students to complete 20 semester units in Authority subjects. In special circumstances, a student may apply to the QSA to be exempted from this requirement in order to be eligible for an OP.

In such cases, an officer of the QSA with delegation to decide the matter considers the case and makes a decision. The decision is made after considering the following matters:

- precedent cases
- the student's reasons for not meeting the requirement
- the extent to which the student's own decisions have resulted in them not meeting the requirement
- the extent to which poor advice provided to the student has resulted in them not meeting the requirement
- the magnitude of the shortfall in units
- the practicality of undertaking further studies to cover the shortfall in units
- fairness to other students who have met the requirements
- other matters deemed relevant by the decision-maker.

2.3.5 Required pattern of study

A basic eligibility requirement is for students to complete at least three Authority subjects for four semesters each. In special circumstances, a student may apply to the QSA to be exempted from this requirement in order to be eligible for an OP.

In such cases, an officer of the QSA with delegation to decide the matter will consider the case and make a decision. The decision is made after considering the following matters:

- precedent cases
- the student's reasons for not meeting the requirement
- the extent to which the student's own decisions have resulted in them not meeting the requirement
- the extent to which poor advice provided to the student has resulted in them not meeting the requirement
- the magnitude of the shortfall in subjects
- the practicality of undertaking further studies to cover the shortfall in subjects
- fairness to other students who have met the requirements

- other matters deemed relevant by the decision-maker.

2.4 School inputs

2.4.1 Levels of achievement

OP calculations begin with students' results in the subjects they have studied. Results in each subject are reported on the Senior Statement in terms of five levels of achievement:

- Very High Achievement
- High Achievement
- Sound Achievement
- Limited Achievement
- Very Limited Achievement.

These results are awarded according to specified standards and are verified through statewide moderation.

The descriptors for each level of achievement describe a range of performance. This means that levels of achievement are too broad for calculating OPs. Finer grained comparisons of student achievement are necessary. These comparisons are provided by subject achievement indicators (SAIs).

2.4.2 Subject achievement indicators (SAIs)

SAIs are the main input into the calculation of OPs and FPs. The assignment of SAIs by schools is the first major step in the calculation of OPs.

Each OP-eligible student is awarded an SAI for each subject studied. Students who are ineligible for an OP are not awarded SAIs and are not included in any OP calculations. SAIs are an acknowledgement that schools possess the assessment information necessary to make finer distinctions between students than are reflected in their levels of achievement.

An SAI represents a student's achievement in an Authority subject relative to all other students in the subject-group at that school. A subject-group consists of all the students who have taken a particular subject in a particular school. SAI distributions represent the considered and professional judgments of teachers. The interval properties of these distributions are important and represent a linear scale of student achievement in that subject at that school.

2.4.3 SAI assignment

Initially, teachers place students in a rank order within a level of achievement in each Authority subject. They do this using all of the assessment evidence accumulated in the subject. They then determine how far apart students should be placed both within each level and across levels. This SAI is assigned on a scale from 400 (for the student who has the highest achievement in that subject in that school regardless of their level of achievement) to 200 (for the student who has the lowest achievement in that subject in that school, regardless of their level of achievement).

Scaling of SAIs is necessary to remove bias that may be caused by differences in the strength of the competition in different subject-groups and school-groups. This process is discussed in detail in Section 2.8.

2.4.4 Communicating SAIs to students

As a condition of the QSA issuing certificates to students, Queensland schools agree to make SAIs known to students in a suitable form and at a suitable time. This is an important part of the accountability process to help ensure the integrity of the OP calculations. A suitable form for such communication of SAIs involves students being able to see their placements in each group relative to each of the other students in that group. It is not required, nor desirable, that they view the SAIs of students in subject-groups they are not in.

A suitable time for such publication of SAIs is on or before the date set by the QSA for the end of Year 12 but in any case no later than the Wednesday following that final day. Before October in any year, participating schools must provide the QSA with a statement indicating the form and timing of their communication to students of SAIs for that year. Participating schools must also agree to retain a copy of the communicated SAIs in the form in which they were displayed to students and to make such a copy available to the QSA on request.

When informing students about their SAIs, it is important to remember that:

- the best guarantee of fairness is making sure that students know about their relative placements
- the QSA requires that SAI decisions be made known to students
- student names are necessary
- graphical displays are sufficient
- numbers are not necessary
- it is not sufficient to show to each student a number in isolation
- QSA-developed software provides facilities to produce suitable displays.

Schools submit their subject-group SAIs to the QSA. They are checked prior to commencing the scaling processes.

2.5 Quality assurance

The QSA uses a specially developed software package, known as BonSAI, to check SAIs. This application is also available free of charge to schools and it is recommended it be used by them to assign, check and display SAIs.

2.5.1 School checking

SAI distributions should resemble the placement of students on the official agreement between the school and QSA (Form R6). This is because decisions are being made about the same group of students, using the same information — completed assessment.

BonSAI uses a basic *average points per rung* calculation i.e. the number of rungs covered (inclusive) is divided by the number of points used. To calculate average points per rung:

- count the number of rungs covered inclusively, if a student is on SA2, and the next student is on SA6 then this is 5 rungs
- determine the number of points used in this part of the distribution, if a student on SA2 is on 220, and a student on SA6 is on 240 then this is 20 SAI points
- divide the number of points used by the number of rungs covered, if 20 points ÷ 5 rungs = average 4 points per rung.

This calculation can then be used to compare different points in the distribution. BonSAI produces tables and graphs based on this calculation that provide a quick and easy way to check the reasonableness of SAI distributions.
Three things should be checked to ensure SAI distributions are reasonable:

- odd gaps, e.g. students on adjacent rungs would be expected to have closer SAIs than students several rungs apart.
- increasing amounts of difference should appear between students from the bottom of the distribution to the top, i.e. a smaller ratio in Very Limited Achievement or Limited Achievement should appear compared with High Achievement or Very High Achievement. This is because of the increasing complexity and amounts of work required as levels of achievement increase. Distributions should not be linear (see below).
- double the difference should not appear. When comparing average points per rung used in different parts of the distribution, the difference will never be double, e.g. if points per rung in LA is 3.2, points per rung should never be 6.4 or greater anywhere else in the distribution.

2.6 Scaling

The most important process in the calculation of OPs and FPs is scaling. Scaling is a procedure for positioning two sets of results on a scale in such a way as to establish their equivalence. For example, the two sets of results can be subject results in two subjects or overall results in two schools. Equivalence means that a particular point on the scale indicates the same level or quality of performance in both sets of results.

The raw ingredients for calculating OPs and FPs are each student's subject results. The aim is to compare those subject results with the subject results of all other students, whatever subjects they took and whatever school they attended. This is complicated because different students take different subjects and attend different schools.

Scaling is necessary so that students' OPs and FPs depend on their own achievements and not on the achievements of the group of students who studied the same subjects and attended the same school.

Even in the states or territories where students sit for statewide external examinations, scaling is necessary for comparing the results in different subjects. In Queensland, where there is school-based assessment and no statewide external subject-based examinations, the approach is different to account for differences between schools as well as between subjects.

Scaling allows fair comparison of the results in different subjects and from different schools. If all students took exactly the same subjects and attended the same school, scaling would be relatively simple. Roughly speaking, it would mean scaling the top, middle and bottom results in each subject to match respectively the top, middle and bottom results in every other subject. However, the real situation is more complicated. The issue is that students with different overall capability choose different subjects and attend different schools.

2.6.1 The stages of scaling

First-stage scaling: The within-school stage

The within-school stage uses QCS Test results for OP-eligible students in all Authority subject-groups within the school to compare the relative achievement of each subject-group. To do this, SAIs for each subject-group are scaled to the mean and mean-difference (a measure of spread) of the QCS Test scaling scores for that subject-group. The relativities of SAIs within a subject are not changed. This allows a scaled SAI in one subject to be compared with a scaled SAI in another subject in the same school. For each student, these SAIs are combined by averaging the best 20 semester units of credit in Authority subjects, including at least three subjects studied for four semesters. This average is called an overall achievement indicator (OAI) and reflects the relative placement of a student within a school-group.

A similar process is used to calculate FPs in each of the five fields. However, when scaled SAIs for each field are combined the results are weighted according to the subject weight for that subject in that field. The QCS Test scaling scores used for scaling FPs reflect performance on aspects of the QCS Test relevant to each field. The combined scaled SAIs are known collectively as a field achievement indicator (FAI). Only a student who has studied a combination of subjects with sufficient total subject weights in a particular field will receive an FP for that field.

Subjects are weighted equally in the OP calculations. That is, no assumptions are made about the difficulty of subjects or overall achievements of students who complete particular subjects or combinations of subjects. However, this does not mean that the same SAI or the same level of achievement in different subjects is taken to indicate the same achievement.

Second-stage scaling: The between-school stage

The between-school stage uses QCS Test results for school-groups to compare the relative achievement of students in different schools. OAIs for each school are scaled to the mean and mean-difference of QCS Test scaling scores for the school, while preserving the relativities of OAIs within the school. The resulting scaled OAIs are banded into 25 bands that are reported as OPs. Twenty-five bands is a degree of precision to which the outcomes can be justifiably reported and upon which tertiary institutions can make appropriate entrance selection decisions (given that they can also use FPs).

2.7 Queensland Core Skills (QCS) Test

The QCS Test assesses students' achievements in the 49 testable Common Curriculum Elements (CCE) that underpin the senior curriculum. The test consists of four papers — a Writing Task (of about 600 words), a Short Response paper and two Multiple Choice papers. The results achieved for each of the four test papers are combined into one grade, ranging from A (the highest grade) to E (the lowest).

A student's individual result on the QCS Test (from A–E) is reported on their Senior Statement or Statement of Results. However, their individual QCS Test result is not used on its own in the calculation of their OP — instead, group results are used as part of the statistical scaling processes.

The QCS Test is used to find scaling parameters for school subject-groups and school-groups. This process

uses information about groups of students in ways that take into account differences between performances at school and on the QCS Test. For school-groups, this involves finding the weighted mean and the weighted mean difference of the scaling scores, with weights determined from the relationship between measures of each student's overall within-school achievement and the QCS Test within-group achievement.

2.7.1 Determining QCS Test scaling scores

Fielding

The aim of QCS Test Fielding is to determine the weights applied to each item from the QCS Test for the calculation of QCS Test field scores for OP-eligible and equivalent-OP-eligible students. These scores are subsequently used in the determination of Field Positions (FPs) on the Tertiary Entrance Statement. There are five field scaling scores (A–E) as well as the scaling score for the OP field.

Calculation method

A meeting is held each year to determine the contribution of each QCS Test item to the scaling score for each field. Field positions form part of the profile of measures on the Student Education Profile, and as such it is intended that each field measures something different. Decisions about weights for items must therefore take into account not only which field is of most relevance for each item, but must also minimise the correlation between field scores for students. Weights can be assigned using any number of methods but a helpful starting point for assigning weights is to use a *principal components analysis* of the items on the test.

Principal components analysis, by its nature, seeks to maximise the amount of variation explained by each component. The first principal component is normally associated with the difficulty of the items. The second and third principal components, however, mostly distinguish between items in terms of the verbal or quantitative nature of the problem and the quantitative/verbal (Q/V) nature of the items. This makes it an ideal starting point for the fielding meetings. Because the items are either dichotomous (right/wrong for multiple choice) or graded (for short response) a polychoric correlation matrix is generally used as the input to the principal components analysis.

A starting point for the assigned weights is often the projection of items onto lines within each field in the two-dimensional space defined by the second and third principal components. The boundaries between fields are chosen by examining items on the test and seeing where items that probably belong to each field cluster together. The item projection is chosen from one of three methods. Items mostly have a weight in one only of Fields A to D; every item mostly has a weight in Field E, with most having a small weight and a small subset having much larger weights.

There are two considerations that must be taken into account when constructing field scores:

- Scores in each field should hang together as a coherent group of items. This is measured by Cronbach's α for the group of items. Cronbach's α is a measure of how coherently the group of items seems to be measuring the same thing as a test, and is also affected by the number of items that are used to construct it. Generally, each field score aims to have a Cronbach's α at least greater than 0.7.
- Scores in different fields should correlate as poorly as possible. If individual field scores correlate highly, it indicates that they are measuring the same thing as each other, thus defeating the purpose of having different fields in the first place. Generally, no two field scores out of A, B, C and D should correlate at higher than 0.7, and no one of fields A, B, C or D should correlate more highly than 0.8 with the field E score.

The construction of the scores, then, is a trade-off between curriculum considerations, such as whether the item matches the description of the field and the desirable properties of the scores. QSA constructs an item correlation matrix and then finds the eigenvalues of that matrix. The first eigenvector is the first principal component, the second eigenvector is the second principal component and so on.

In considering the principal components, the first principal component tends to measure some sort of overall ability/difficulty, and so is of little use. The second principal component invariably seems to differentiate between items that are quantitative in nature and those that are verbal in nature. The third principal component then further differentiates within the Q/V split according to how different items were, after taking into account the overall properties and then the Q/V nature of the items. The result is that the second and third components split items into four groups with the lowest possible correlation between the items in each group. A plot of the second and third principal components will give four quadrants that might describe items that could belong to A and B (the two halves on the V side) and C and D (the two halves on the Q side).

Having provided a map showing the second versus third principal component (colour coded by MC vs. SR and V vs. Q), the meeting then considers the nature of the items in each area and which field they might naturally align with out of the first four — A, B, C and D. Boundaries between the areas that seem to naturally define fields are then determined and weights are assigned to the items depending on how far into the area they are.

Items near the middle of the map will have low weights because they do not seem to align strongly with any field. Generally, areas defining fields are bounded by straight lines, and weights are assigned according to the perpendicular distance they are along a line that bisects the boundaries (or that passes through a prototypical item in that field), and the standard deviation of responses to that item. After doing this, the properties of the field scores are checked and adjustments made as needed.

Considerations taken into account when checking and making any adjustments may include:

1. Which corner of the graph seems to correspond with which item — generally the Writing Task will suggest a position for field A, but it might not be immediately obvious. The principal components analysis does not account for curriculum considerations, and so might place items to the left or right or top or bottom of the graph more or less without reason.
2. Items could be assigned to more than one grouping of CCEs (basket) with different weights. This could be necessary for a number of reasons: for example, to increase the Cronbach's α of a field or to provide enough hard or easy items in a specific field to discriminate across all abilities (a particular problem often with fields C and D).
3. Definitional problems often exist with fields A and B or C and D. Sometimes, one is seen as the easy field and the other the hard field of a pair. Fields, however, are not about degrees of difficulty — they measure different things and must provide discrimination that will work for both FP1 students and FP10 students.
4. Items could be moved from one basket to another despite their location for curriculum reasons.
5. The locations of the boundaries end up being quite unlike the quadrant starting position. After agreement has been reached, the distribution of field scores in the four fields is checked, particularly for problems with discrimination at the top and bottom. This would be indicated by 'lumpiness' where a lot of students are tied on the same score. Finally, field E scores must be constructed. The default weight for all items in field E is 1 (multiplied by the standard deviation as always, taken as given in the rest of this section). Items that require some skills that are associated with practical performance are then identified and given a much higher weight (such as 10 or 20). These items should be ones that contribute weight in a range of the first 4 fields to ensure that the correlation of field E with any of the first 4 field scores is not too high. Sometimes the Writing Task may be assigned a higher weight to the Field E score as well as other items.

2.7.2 Determining group parameters

The purpose of scaling is to set the location and scale of a distribution of student achievement measures to that of the same group's performance on the QCS Test. To achieve this, the mean and mean difference of both distributions are calculated.

2.7.3 Calculating SAI parameters

For all OP-eligible students in the subject-group, QSA calculates the weighted mean and mean difference of the SAIs, with weights given by the semester units of each student:

$$\mu_\beta = \frac{\sum_{i=1}^{n} u_i \beta_i}{\sum_{i=1}^{n} u_i}$$

$$\sigma_\beta = \frac{\sqrt{\pi}}{2} \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} u_i |\beta_i - \beta_j|}{(n-1) \sum_{i=1}^{n} u_i}$$

n is the number of OP-eligible students in the subject-group
u_i and β_i are the semester units and the SAI respectively for student i.

2.7.4 Calculating QCS Test parameters

QSA calculates the weighted mean and mean difference of the QCS Test scores of OP-eligible students in the large subject-group:

$$\mu_Q = \frac{\sum_{i=1}^{n} u_i w_i s_w QCS_i}{\sum_{i=1}^{n} u_i s_w w_i}$$

$$\sigma_Q = \frac{\sqrt{\pi}}{2} \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} u_i s_w \ w_i \ |QCS_i - QCS_j|}{(n-1)\sum_{i=1}^{n} u_i s_w w_i}$$

n is the number of OP-eligible students with a QCS Test result in the subject-group
s_w is the field weight for the particular subject
w_i is the QCS Test score weight for student i

2.7.5 Within school measures (WSMs)

Within-school measures (WSMs) are used to estimate overall within-school achievement. The calculation of the within-school measure is a two-step process. First, the measures themselves are calculated for the Overall Position and for each Field Position (that is, six values for each OP-eligible student). Essentially, this consists of comparing the subject achievements of students at the school, keeping tally of the weighted number of times a student wins and loses these comparisons.[2] Secondly, the measures are transformed to the same scale as the QCS Test scaling scores.

The calculation of WSMs for OP-eligible students may be represented by the following equation,[3] which uses standard vector notation:

$$\mathbf{WSM} = (\mathbf{W_1} + \mathbf{W_2}) - (\mathbf{L_1} + \mathbf{L_2})$$

W_1 is the vector of (weighted) wins of students
W_2 is the vector of the total (weighted) wins of persons beaten by each student
L_1 is the vector of (weighted) losses of students L_2 is the vector of the total (weighted) losses of the students to whom each student lost.

The steps used to construct the WSM vector are as follows:

- find the Authority subject with the largest number of OP-eligible students. Denote this number N
- for each common subject taken by each pair of OP-eligible students at the school:

1. Compare the SAIs of the two students in the common subject, with the three possibilities being that the first SAI is more $(SAI_i > SAI_j)$, equal to $(SAI_i = SAI_j)$, or less than $(SAI_i < SAI_j)$ the second SAI
2. Associate a weight with each comparison:

$$W_{ijk} = W_k \bullet \ min(U_{ik}, \ U_{jk}) \bullet \ \frac{\mathrm{N}-1}{\mathrm{N_k}-1}$$

[2]The method is based on the paper by David, HA 1987, "'Ranking from unbalanced paired-comparison data"', *Biometrika* 74.2, pp. 432–436.
[3]Historically, this equation has been represented as after David (1987). It has been recast here using more traditional vector notation.

W_{ijk} is the weight for student i, student j, and subject k
W_k is the field weight for subject k
U_{ik} and U_{jk} are the units of credit for the two students N is the largest subject (from 1 above)
N_k is the number of OP-eligible students in subject k. Clearly only subjects with a non-zero field weight in the relevant field can give a non-zero comparison weight.

3. Depending on the result of the SAI comparison in step i, increment the two vectors W_1 and L_1 which are the accumulated wins and losses respectively for students at the school:

$$W_{l,a} = \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} \sum_{p=1}^{n_i} \sum_{q=1}^{n_j} k\ W_{ijpq}, a = \begin{cases} i, SAI_{ip} > SAI_{jq} \\ j, SAI_{ip} < SAI_{jq} \\ i, j, SAI_{ip} = SAI_{jq} \end{cases}$$

$$L_{l,b} = \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} \sum_{p=1}^{n_i} \sum_{q=1}^{n_j} k_{W} ijpq, b = \begin{cases} i, SAI_{ip} > SAI_{jq} \\ j, SAI_{ip} < SAI_{jq} \\ i, j, SAI_{ip} = SAI_{jq} \end{cases}$$

$$k = \begin{cases} 1, SAI_{ip} \neq SAI_{jq} \\ \frac{1}{2}, SAI_{ip} = SAI_{jq} \end{cases}$$

Here, OP-eligible students i and j take n_i and n_j subjects respectively, there are n OP-eligible students at the school, W_{ijpq} is the weight of the comparison, and the multiplier k deals with ties (which count as half a win and half a loss). The two subjects p and q must be the same for each comparison. This formula may be summarised by the following steps.

For each OP-eligible student i, compare subject results with every other OP-eligible student j who has a subject in common:

1. Convert SAIs of common subjects into wins and losses. Treat ties as half a win and half a loss.
2. Associate a weight W_{ijk} to each win and loss. Halve the weights for ties.
3. Sum the weights of the wins of the student, giving $W_{1,i}$.
4. Sum the weights of the losses of the student, giving $L_{1,i}$.

Following the calculation of the W_1 and L_1 vectors, the process is repeated. This time, however, the two vectors W_2 and L_2 are accumulated, where instead of being simply the weighted number of wins and losses of a student, they are the weighted sums of the corresponding components of the W_1 and L_1 vectors. Using the same notation as above, we have:

$$W_{2,a} = \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} \sum_{p=1}^{n_i} \sum_{q=1}^{n_j} k\ W_{ijpq}\ \ W_{1,b}$$

$$L_{2,b} = \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} \sum_{p=1}^{n_i} \sum_{q=1}^{n_j} k\ W_{ijpq}\ \ L_{1,a}$$

These formulas may be summarised by the following steps below.
For each OP-eligible student i, compare subject results with every other OP-eligible student j who has a subject in common:

1. Calculate W_{ijk} as before.
2. Sum the total number of wins $W_{1,j}$ of the students beaten by this student, giving $W_{2,i}$.
3. Sum the total number of losses $L_{1,j}$ of the students who beat this student, giving $L_{2,i}$.
4. The vector of within-school measures is the difference between the win vectors and the loss vectors.

Use of WSMs in calculation of school parameters

The consistency between a student's QCS Test result and their achievement at school (as given by the scaled WSM) is related to the difference between these two measures. The weight used in the calculation of school and subject-group QCS Test parameters is based on the magnitude of this difference.

2.7.6 Weighting (Iso-weights)

Some students' performances on the QCS Test are not consistent with their in-school performance. This may take the form of a student who seemingly underperforms on the QCS Test or a student whose QCS Test results are much higher than would have been expected given their school-based achievement. Where there is a significant mismatch between performance on the QCS Test and performance in school, less significance is placed on the contribution of that student's achievements to the group scaling parameters. Students at the top of the school cohort who achieve exceptionally well on the QCS Test are not significantly affected because the measures of relative achievement within the school might not reflect how far they are ahead of the school-group.

The weights used in calculating the mean QCS Test scaling score for a school-group or subject-group are related to the differences between a student's QCS Test measure and achievement at school – measured by the WSM. The greater the difference between the QCS and WSM for an individual student, the lower the weight given to that student's QCS Test scores when finding school and subject parameters. A statewide plot of QCS versus WSM for OP-eligible students at large schools yields an interval above and below the line $QCS = WSM$ within which all students are assigned the same weight. Outside this region, the weights are calculated according to the distance of the (QCS,WSM) pair from the region of equal weights.

The following procedure is applied to each position (OP, FP A, ..., FP E). As described elsewhere, weighted QCS Test parameters are not calculated for small subject-groups or schools, so the following only applies to large and intermediate schools.

The result of the calculation of the regions of equal weights is a table for each position giving the location of the curve bounding the region (one curve above the line $QCS = WSM$ and one curve below it). The entries in the table consist of intervals along the model line and the corresponding perpendicular distance of the curves from the line. Along with this information, the WSM and QCS of eligible students in large groups (schools and subjects) is needed.

2.7.7 Linear scaling

Linear scaling changes the location and scale of a set of numbers. It preserves the order and relative gaps. Given a distribution $x_1, x_2, ..., x_n$, a measure of location, μ, and of scale, σ, of this set of numbers and given a desired location μ' and a desired scale σ' then a linear scaling on this set of numbers is the new set of numbers $x'_1, x'_2, ..., x'_n$.

Where:

$$x'_i = \frac{(x_i - \mu)}{\sigma}.\sigma' + \mu'$$

In the OP and FP calculations, the measure of location is the arithmetic mean (weighted), and the measure of scale is the mean-difference (weighted).

2.8 Scaling SAIs (first stage scaling)

The first stage of scaling involves transforming the SAIs of students in a subject-group to the same scale as the group's QCS Test scores.[4] For groups with a large number of students, the distributional descriptors used for this change of scale are quite stable. As the size of a group decreases, however, so does the stability of these statistics. Therefore, an alternative method is applied to groups with too few students. The SAIs of students in such groups consist of rungs[5] within levels of achievement. The scaled SAIs from students in the larger groups together with a knowledge of their levels of achievement are then used to convert rung placements into scaled SAIs for students in the smaller groups.

2.8.1 Calculating large subject-group scaled SAIs

The process for determining a scaled SAI for a student's subject:

- varies depending on the size of the group
- is a linear transformation of a distribution from one location and scale to another location and scale for large groups

[4] Results on the QCS Test, with a statewide mean of 175 and mean difference of 25.
[5] Whole numbers on a scale of 1 to 10, with a higher value indicating higher attainment within the level of achievement.

- uses interpolation from a statewide table rather than scaling for small groups (< 9 OP eligible students)
- is a combination of interpolation and scaling on a sliding scale for intermediate groups
- does not alter internal relativities
- uses weighted mean as the measure of location
- uses weighted mean difference as the measure of scale, which is:
  - more stable than standard deviation
  - equivalent to standard deviation for very large groups.

The SAIs of OP-eligible and equivalent OP-eligible students in a large subject-group are transformed to the same location and scale as the weighted QCS Test scaling scores of OP-eligible students in the subject-group. Students have just a single SAI for each subject, but six QCS Test scaling scores (one for each position).

2.8.2 Calculating small group scaled SAIs by R6 rung interpolation

The scaled SAI for an OP-eligible student in a small subject-group is found by linear interpolation from the boundary values. For a student with a rung of r within level achievement j, the scaled SAI is:

$$SAI_{j,r}scaled = M_j + (M_{j+1} - M_j)\frac{2r-1}{20}$$

M_j is the lower boundary
M_{j+1} is the upper boundary for level of achievement j.

Values for small groups for scaled SAIs at boundaries are obtained from analysis of statewide (and school) data for large groups using this procedure:

- scale all large groups
- for each boundary between levels of achievement in each subject:

1. select the large groups across the state (for this subject)
2. find lowest SAI above
3. find highest SAI below
4. use average of these as estimates of the position of boundary
5. use difference of these as (inverse) of importance to be given to this estimate
6. use the statewide set of these estimates to make a single estimate of the scaled SAI for this boundary in this subject.

Note that the values will be different for OP and Fields A, B, C, D and E. The maximum (minimum) statewide values are used for upper (lower) limit on VHA (VLA) interval.

2.8.3 Calculating scaled SAIs for intermediate groups

Depending on the number of students in the subject-group, a sliding scale is used to produce a smooth transition between the large-group and small-group procedures.

This process uses the scaled SAIs derived from the small subject-group-boundaries process together with the rung placement of a student in a small or intermediate group to interpolate a value for the student's scaled SAI.

The rung placements of students in intermediate subject-groups are converted to scaled SAIs using the small-group procedure. Using the large-group procedure, these scaled SAIs are then placed on the same scale as the subject-group's QCS Test scores. The weighted average of the resulting two values for each student is then found, with the weights determined by the number of students in the group. For each Authority subject taken by an OP-eligible or equivalent OP-eligible student, there is a scaled SAI for each position (OP, FP A, FP B, FP C, FP D, FP E).

Table 1: Intermediate group proportions

Number of OP eligible students	Large-group contribution	Small-group contribution
10	20%	80 %
11	40%	60 %
12	60%	40 %
13	80%	20 %

The final scaled SAI for a student in an intermediate subject-group is found from a sliding scale based on the proportion of OP-eligible students in the subject-group:

$$SAI_{scaled} = \frac{14-n}{5} SAI_A + \frac{n-9}{5} SAI_B, \;\; 9 < n < 14$$

14 is the lower bound on the size of a large subject-group
9 is the upper bound on the size of a small subject-group
5 is the difference between these two bounds
n is the number of OP-eligible students in the intermediate subject-group under consideration.

2.8.4 External subjects

External examinations (up to two subjects) may be taken by OP-eligible students:

- on application to the QSA in advance
- where the student is unable, for good and sufficient reasons, to study the subject at the school (not a timetabling problem)
- where the student has transferred and the subjects are not available at the new school.

External examination markers assign an Interim Achievement Indicator (IAI) between 1 and 50 to students completing an external exam. Results in external subjects are treated similarly to internally assessed subjects. Specifically:

- if the group is small, then the small-group procedure applies and the IAI represents the rung
- if the group is intermediate or large, scaling using QCS Test parameters will be used.

2.8.5 Visa subjects

In the standard procedures for calculating the parameters of SAI distributions and QCS Test scaling score distributions for a subject-group, visa students do not generally contribute. This standard procedure breaks down in the circumstance where there is a large subject-group with all visa students. In this case, another procedure is used for subject-groups with a sufficiently high proportion of visa students. In this procedure, the QCS Test parameters for that subject-group are estimated using WSM information. The final parameters are a combination of the standard and alternate procedures on a sliding scale according to the proportion of visa students in the subject-group.

The following procedure is used to calculate first-stage scaling parameters for school groups containing a high proportion of visa students. QSA calculates the QCS Test parameters for each large and intermediate subject-group in the school. For a school with such subject-groups, the set of QCS Test parameters is:

$$Q_{nv} = \{(\overline{X_1}, md_1), (\overline{X_2}, md_2), ..., (\overline{X_n}, md_n)\}_{QCS}$$

$\overline{X_i}$ is the weighted QCS Test mean
md_i is the weighted QCS Test mean difference for (non-visa) subject-group i.

QCS Test parameters for visa subject-groups (excluding visa students)

QSA calculates the QCS Test parameters for each visa subject-group in the school, **excluding** the visa students from the calculation. For a school with n visa subject-groups, this set is denoted by:

$$\mathrm{Q_v} = \{(\overline{\mathrm{X_1}}, \mathrm{md_1}), (\overline{\mathrm{X_2}}, \mathrm{md_2}), ..., (\overline{\mathrm{X_n}}, \mathrm{md_n})\}_{\mathrm{QCS}}$$

The elements of $\mathrm{Q_v}$ are combined with the derived parameters for each visa subject-group to produce the actual QCS Test parameters to be used for scaling.

WSM parameters for all subject-groups (including visa students)

1. QSA calculates a scaled WSM for each student at the school, **including** visa students from the visa subject-groups. Visa students from non-visa subject-groups will not be included in this calculation.
2. QSA finds the mean and mean difference of the scaled WSMs for each subject-group, **including** the visa subject-group. Denote the list of WSM parameters as **W**:

$$\mathrm{W} = \{(\overline{\mathrm{X}_1}, \mathrm{md}_1), (\overline{\mathrm{X}_2}, \mathrm{md}_2), ..., (\overline{\mathrm{X}_\mathrm{n}}, \mathrm{md}_\mathrm{n})\}_{\mathrm{WSM}}$$

QCS Test parameters for visa subject-groups (including visa students)

QSA calculates:

1. For each visa subject-group, find the scaling score parameters which place the group in the same relative position in the distribution of QCS Test parameters (Q_{nv}) as on the distribution of WSM parameters **W**. The situation may be illustrated by the following table:

QCS Test parameter	Q_1	Q_2	Q_3	Q_4	$\hat{Q}_v$	Q_6	Q_7
WSM parameter	W_1	W_2	W_3	W_4	W_v	W_6	W_7

   where Q_i and W_i are the mean or mean difference of each group's QCS and WSM respectively and subscript v refers to the visa group.

   The unknown parameter $\hat{Q}_v$ is estimated by:

$$\hat{Q}_v = \overline{Q_{NV}} + \frac{SQ_{NV}}{SW} W_v - \overline{W}$$

   where $\overline{Q_{NV}}$ and SQ_{NV} are the arithmetic mean and the sample standard deviation respectively of the QCS Test parameters (mean or mean difference) for non-visa subject-groups, $\overline{W}$ and Sw are the arithmetic mean and the sample standard deviation respectively of the WSM parameters for each subject-group (including the visa subject-group).

2. The final set (**Q**) of QCS Test parameters for the visa subject-groups consists of the weighted averages of the two sets of parameters (those calculated **without** visa students and those calculated with visa students) **with** the weights being the proportion of visa students in the subject-group. Hence for any visa subject-group:

$$Q = f_j\, Q_v + (1 - f_j)\hat{Q}_v,\ \ j = 1, ..., n$$

   f_j is the fraction of visa students in visa subject-group j; for a subject-group with only visa students, this fraction is 1.

SAI parameters for visa subject-groups

The SAI parameters for each visa subject-group are found in the following way:

1. QSA calculates the mean and mean difference of the SAIs of students in each visa subject-group, weighting by semester units and excluding visa students from the calculation. The set of SAI parameters is denoted S_{nv}.
2. QSA calculates the mean and mean difference of the SAIs of students in each visa subject-group, but including visa students. This set is denoted S_{v} .
3. The final SAI parameters (**S)** are the weighted average of the SAI parameters calculated without the visa students and with the visa students, with the weights again being the proportion of visa students in the subject-group. For any visa subject-group:

$$S = f_j\, S_v + (1 - f_j) S_{nv}$$

Once the QCS Test and SAI parameters for each visa subject-group at a school have been calculated, the scaling of SAIs can proceed as usual.

2.8.6 Concessional units of credit

Concessional units of credit apply to students who:

- transfer from interstate/overseas
- repeat Semesters III and IV of Year 12
- re-enter after an absence of three or more years after completion of Year 10 or its equivalent.

They are given these concessional units in order to place them on the same footing as the cohorts they join at the time of enrolment in the school.

2.9 Aggregating achievement in best subjects (OAIs)

Following the calculation of scaled SAIs for all OP-eligible and equivalent OP-eligible students in an intermediate subject-group, the values for each student are aggregated to produce an overall achievement indicator (OAI).

2.9.1 Find an OAI

QSA determines the weights for each scaled SAI by multiplying:

- number of units of credit
- OP subject weight (5).

Scaled SAIs are selected to count in the calculations by:

- arranging scaled SAIs in order
- selecting best scaled SAIs to give a total weight of 100 provided this includes at least three subjects each studied for four units of credit.

Then OAI is the weighted mean of these scaled SAIs.

2.9.2 Find an FAI

QSA determines the weight for each scaled SAI by multiplying:

- number of units of credit
- subject weight.

Scaled SAIs are selected to count in the calculations by:

1. arranging scaled SAIs in order
2. selecting best scaled SAIs to give a total weight of 60.

The FAI is the weighted mean of these scaled SAIs using these weights.

2.10 School cohort scaling (second stage scaling)

OAIs are scaled to school-group scaling parameters:

- no scaling for small schools ($<$16 students)
- compromise on a sliding scale for intermediate schools(16 $<= n <$ 20 students).

FAIs are not scaled.

2.10.1 OAIs scaled to school-group scaling parameters

A large school has more than 19 OP eligible students. A small school has fewer than 16 OP eligible students. An intermediate school has between 16 and 19 OP eligible students. For large schools (20 or more students):

- find mean and mean-difference of OAIs of entire OP eligible school-group
- find weighted mean (M') and weighted mean-difference (S') of scaling scores of these students, where the weight for each student is determined from the relationship between the student's overall within-school achievement (WSM) and scaling score

- do the linear scaling to school-group scaling parameters.

For small schools (15 or fewer students):

- scaled OAI equals OAI.

For intermediate schools (more than 15 and fewer than 20 students):

- find large-school scaled OAI as above
- find small-school scaled OAI as above

The scaled OAI is the weighted mean of large-school scaled OAI and small-school scaled OAI where weights are determined according to Table 2).

Table 2: Intermediate school proportional weighting

School Size	Proportion of scaled OAI	Proportion of unscaled OAI
16	0.2	0.8
17	0.4	0.6
18	0.6	0.4
19	0.8	0.2

2.11 Banding OPs

2.11.1 Banding OAIs into OPs and FAIs into FPs

Once OAIs have been determined, these fine-grained measures are banded into OPs and FPs with the following properties:

- 25 bands for OPs
- 10 bands for FPs
- OP bands are set to give approximate comparability of standards with OPs over time by calculating equivalent cut-offs on scaled OAIs.

FP bands are constructed to give:

- smooth distribution
- unequal divisions
- discrimination at the upper end.

2.11.2 Determining OP band boundaries

Comparing OAI scales using levels of achievement

There are two ways in which levels of achievement can be used to compare OAI scales in different years. Both involve assuming that levels of achievement represent, broadly speaking, comparable standards from year-to-year.

Using multiple regression

Perform a multiple regression for OAIs as a function of dummy variables representing levels of achievement in QSA subjects. Find the linear mapping which results from the regression coefficients for each corresponding level of achievement in the two data sets being as close (in a weighted least squares sense) as possible. Each corresponding pair of regression coefficients corresponding to a level of achievement in a subject is weighted by the proportion of the total number of OP-eligible students with that level of achievement in that subject.

Using Matching

Match students in the one data file with corresponding students in the other file. Use their matched OAIs to estimate the relationship of the two OAI distributions. Students in the two files correspond on the basis of their subject results (levels of achievement in corresponding subjects) and their QCS Test results. The required estimates of a_0 and a_1 are then found as those values which minimise the weighted differences of the OAIs of matched students, where the weighting is in terms of the strength of the match.

Using QCS Test year-to-year equating

A mapping between OAI scales is established from QCS Test data:

- the two sets of raw QCS Test scores are equated using IRT modelling with links through trial data.
- this correspondence of the two sets of raw scores is converted to correspondence of the two sets of QCS Test scaling scores.
- the linear relationship between each set of QCS Test scaling scores and the corresponding set of OAIs provides the desired relationship.

2.11.3 Combining the estimated relationships of OAI across years

Estimates made using levels of achievement are combined with those made using QCS Test grades with possibly unequal weightings on the basis of measures of their probable uncertainties.

2.11.4 Banding FAIs

Take the statewide distribution of FAIs. Divide into five regions:

- upper (4% of total)
- lower (6% of total)
- intermediate above
- middle
- intermediate below.

Construct bands in each region as follows:

- upper and lower: one band
- intermediate above: two bands to give a steady change in size from the upper band to the highest of the middle bands
- middle: five bands with the cut-offs set as an average of those cut-offs required to produce equal numbers of persons and equal bandwidths divisions of the FAI scale
- intermediate below: one band.

Choose the two divisions on the FAI scale:

- between the middle and the intermediate above
- between the middle and the intermediate below; to maximise the objective that:
  - intermediate above is about 14–15%
  - middle is about 62–66%
  - intermediate below is about 9–10%
- subject to the constraint that:
  - there must not be a change in the direction of the change in band size at any of the interfaces between the five regions.

3. Anomaly detection and resolution

Although quality control imposed on the inputs used to calculate OPs and FPs is essential, quality control imposed on the outputs is equally important. The QSA routinely examines the data to identify anomalies.

A powerful anomaly detection technique is to estimate a measure of each student's overall achievement from their levels of achievement in the absence of QCS Test scaling information. These QCS-free measures are called *polyscores*. They can usefully be compared against the conventional OAIs, especially for groups of students.

3.1 Determining polyscores

A method known as *polyweighting* in the literature[6] on polytomous scoring of test items was used to derive the alternative measure. Polyweighting is a procedure that calculates a person's percentile rank (or polyscore) as the mean of the scoring weights of the person's response categories on an examination. Correct answers to difficult questions are given more credit than correct answers to easy questions, and incorrect answers to difficult questions are penalised less than incorrect answers to easy questions. This approach, which can readily be modified for our purposes by treating levels of achievement as response categories, does not treat response categories on different items as equivalent nor does it assume that response categories represent an equal interval scale.

The aim of the procedure is to estimate a percentile score for each level of achievement in each subject and then use a student's subject results to calculate an average percentile score. Since students' scores are used to estimate the subject scores, and vice versa, this is an iterative process.

Calculate starting values for the subject scores:

1. Count the number of students in each level of achievement in each Authority subject. For subject i the list of counts is $N_i = \{N_{iVL}, N_{iL}, N_{iS}, N_{iH}, N_{iVH}\}$.
2. Estimate the starting value S_o for subject i and level of achievement j as

$$S_{o,ij} = \sum_{k=1}^{j-1} N_{ik} + \frac{1}{2} N_{ij}$$

   which may be described as a percentile rank. Repeat the following steps until convergence (defined below) is achieved or until the iteration limit is reached.

3. For each student, calculate a weighted average score based on the table of subject scores. For student s with n Authority subjects this average is:

$$P_s = \frac{\sum_{i=1}^{n} u_i \, S_{ij}}{\sum_{i=1}^{n} u_i}$$

   n is the units of credit in subject i
   S_{ij} is the current estimate of the score for subject i and level of achievement j.

4. Convert each student's score to a percentile rank of the distribution of all students' scores. For student s the percentile score (or polyscore) becomes:

$$P_{s'} = 100 \, \frac{r_s}{N}$$

   r_s is the rank (in ascending order, with ties) of student s
   N is the total number of students with a result in Authority subjects.

[6] Sympson, JB & Haladyna TM 1988. "'An evaluation of 'polyweighting' in domain-referenced testing"', paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA, April 5–9, 1988.

The polyscore will be in the range 0–100 with a higher value representing higher overall achievement in Authority subjects. Because of their definition, polyscores cannot be zero but can be 100.

5. Update the matrix of subject percentile scores. For each subject and level of achievement, calculate the new score as the average of the percentile scores of students with the relevant subject result. If there are N students with level of achievement j in subject i:

$$S_{ij} = \frac{\sum_{k=1}^{N} u_k \; P_{k'}}{\sum_{k=1}^{N} u_k}$$

u_k are the units of credit.

6. Check the matrix of scores for instances where the percentiles for any subject are not monotonic across levels of achievement. This may happen for subjects or levels of achievement with very few students. In this situation the two out-of-order scores are replaced by their weighted averages, with the weights being the number of units of credit for the levels of achievement:

$$S_{ij} = S_{i'k} = \frac{\sum_{k=1}^{N} u_k \; P_{k'}}{\sum_{k=1}^{N} u_k}$$

Here, S_{ij} is the derived score and u_{ij} are the student units for subject i and level j, and S_{ik} is the derived score and u_{ik} are the student units for subject i and level k.

7. The convergence criterion used here is to stop iterating when the **largest** change in the matrix of subject scores from one iteration to the next reaches a defined minimum. For iteration n and the subject score matrix S_n the change ΔS is:

$$\Delta S_n = \max|\mathrm{Sn, ij} - \mathrm{S_{n-1,ij}}|$$

8. Transform the percentile scores of students so that they form a Gaussian distribution:

$$P_{s'} = \Phi^{-1}\left(\frac{r}{N+1}\right)$$

r is the rank of the polyscore (with ties, 1 = lowest, N is highest)
N is the number of students with a polyscore,[7]
Φ is the value of a standard Gaussian variate.

9. The transformed polyscores may be placed on a commensurate scale by re-scaling them so that their mean and mean difference are the same as that of the scaled OAIs[8] for OP-eligible students. These transformed, re-scaled polyscores are also commonly referred to as polyscores. It is these final, derived values which are of interest.

3.2 Group anomaly detection

For each group of sufficient size, scaling parameters are examined and compared with other information about the group. This other information may be levels of achievement or rankings of students within the school. Using this information, unusual or unexpected group scaling parameters can be found and adjusted if necessary. Each year the Scaling Anomalies Committee, which includes people from outside the QSA, considers cases that arise from the QSA's internal checking and also considers concerns raised by individual schools. As a result, some adjustments may be made to the scaling parameters for school-groups or subject-groups within a school.

[7] Note that polyscores may be calculated for all students taking one or more semesters of Authority subjects or just for OP-eligible students.
[8] If scaled OAIs are not available (if they have not been calculated yet, for instance) then scaling scores may be used until they are.

3.2.1 Scaling Anomalies Committee (SAC)

Schools can appeal to the QSA's Scaling Anomalies Committee if they believe that there are special circumstances that mean the usual scaling procedures may disadvantage their students. This should be done as early as possible to ensure issues are considered by this committee before OPs are calculated. The SAC meets only once per year, as soon as possible after the database closes during the end-of-year processes.

The responsibilities of the SAC are to:

- consider applications from schools for an examination of their QCS Test data
- examine data for schools that have a significant negative or positive mismatch between within-school achievement and QCS Test data
- check that visa school procedures for the calculation of equivalent OPs are working appropriately.

The committee will consider a request from a school to examine its data in the event of special circumstances that may have affected the performance of students during the QCS Test.

Membership of the committee is comprised of:

- Authority member (Chair)
- academic representative
- Education Queensland representative
- Queensland Catholic Education Commission representative.
- Independent Schools Queensland representative
- Deputy Director, Assessment and Reporting Division
- Assistant Director, Analysis and Reporting Branch
- Manager, Qualitative Analysis Unit (Executive Officer)
- Manager, Quantitative Analysis Unit.

The decisions of the committee are reported to the Director of the QSA. A report is submitted to the Authority (QSA board) for consideration at its first meeting in the following year (usually February).

3.3 QCS within-school mismatch

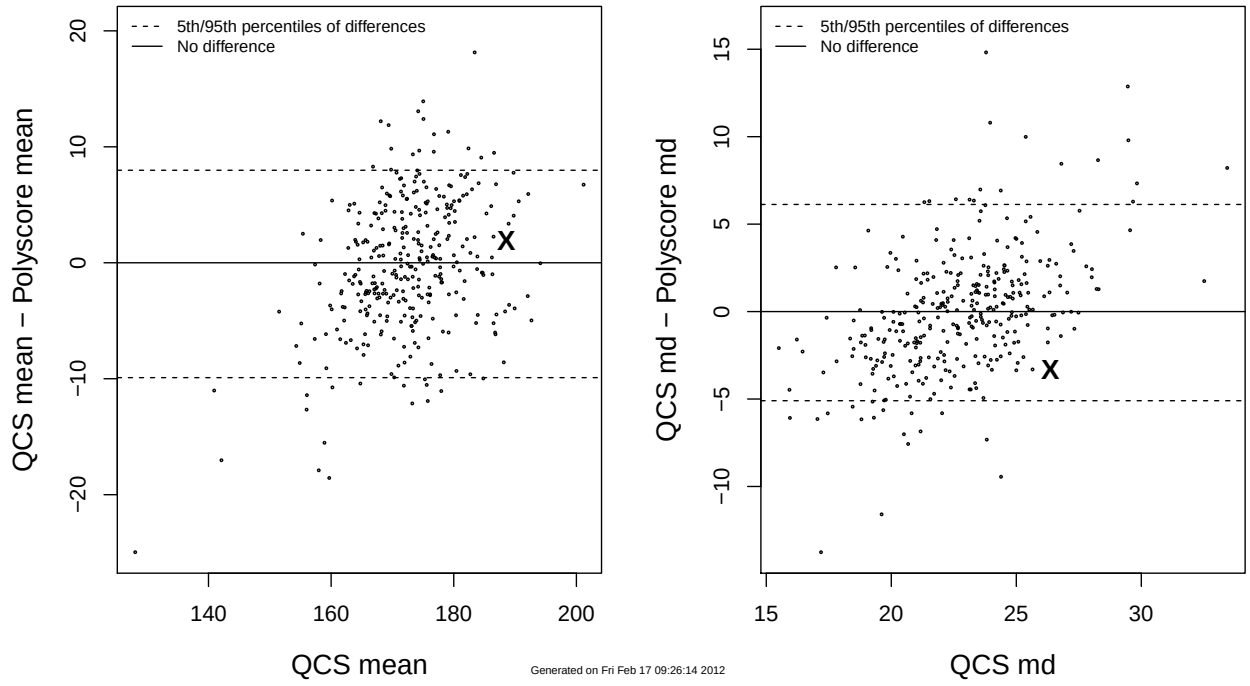
QSA develops intervention plots to determine whether the cases of individual schools should be referred to the SAC (see Figure 2 for an example). Each point on an intervention shows a school's QCS-Polyscore relationship. If a school is below the lower broken line its circumstances will be referred to the SAC. This is because the data falls below the cut-off line of about the lowest five per cent of schools, and there is a significant negative mismatch. If there is enough evidence to support a change, the committee can recommend an intervention.

The change will mean that students OPs more closely reflect their level of achievement information. The school will be notified if an intervention has been made. When this happens the QSA usually offers professional development in the following year so that school staff can identify areas to focus on to reduce or eliminate the mismatch. These might include a consideration of:

- assessment practices
- coverage of the Common Curriculum Elements
- bolt-on practice for the QCS Test
- use of feedback
- assessment task design.

The committee does not move schools up to the zero line. If a school is below the lower dotted line drawn across the graph, the mean or mean difference (or occasionally both) may be moved 75 per cent of the way towards that line by the SAC. No school can leapfrog over any other school. While an intervention reduces the mismatch, it does not eliminate it. Once QSA has examined these data and made the interventions that have been approved by the committee, OPs are finalised. Schools are informed if this occurs.

Figure 2: School intervention plot



Schools where there is a significant positive mismatch are also checked to ensure that over-performance on the QCS Test does not result in OPs that are significantly outside the range that could reasonably be expected. These interventions are less frequent and professional development is also offered.

3.4 Individual anomaly detection

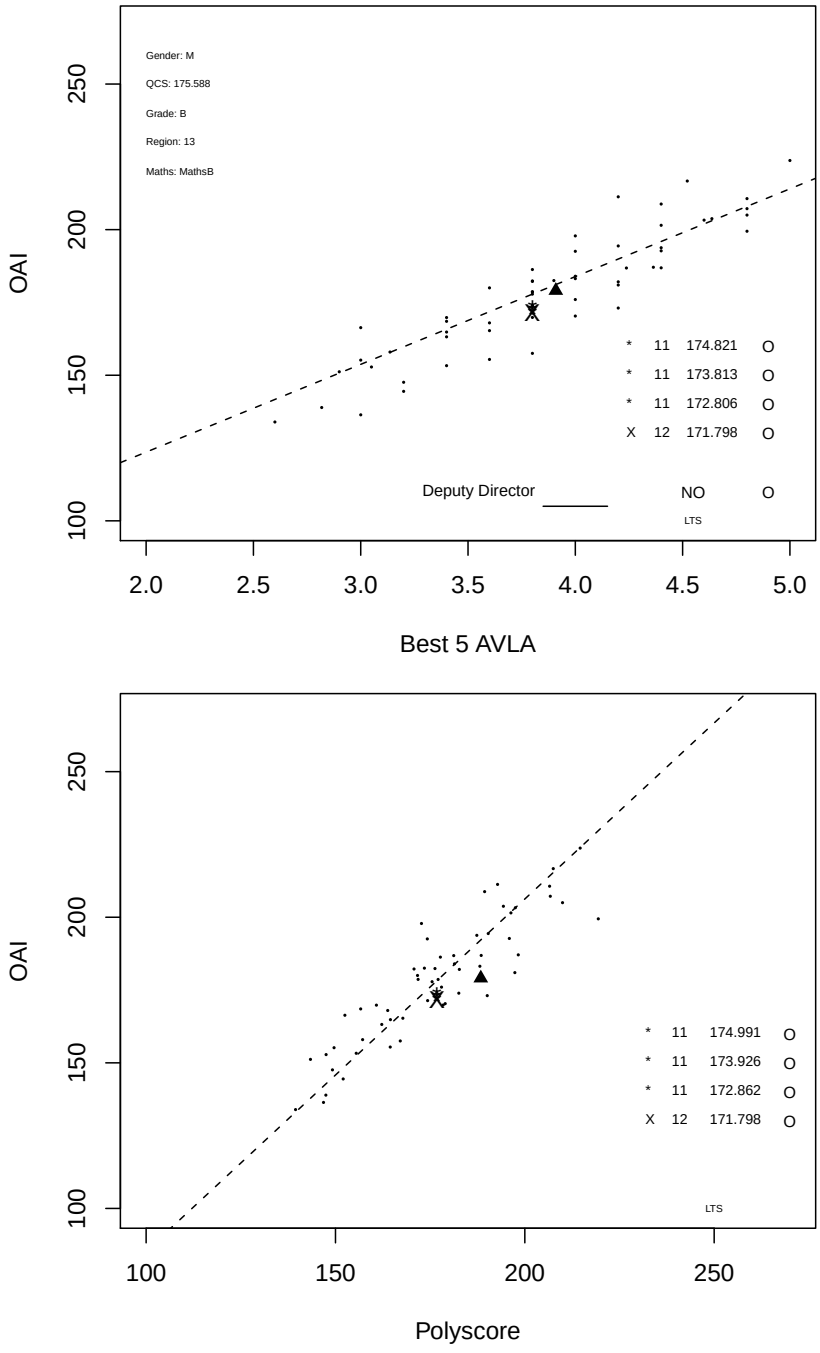
The outcomes of the tertiary entrance calculations for individual students also undergo quality control processes. Before Tertiary Entrance Statements are issued, data for all students is examined for anomalies in their OPs.

Each student's OP is compared with those of students who studied a similar combination of subjects across the state and achieved similar results. For any student whose OP seems anomalously low, a summary report and graphs illustrating the student's relative achievement are produced and the cases are brought to the attention of a QSA committee chaired by the Deputy Director of the Assessment and Reporting Division. This report consists of information about achievement in subjects, comments made by moderation panels about the school's application of assessment standards in subjects that the student studied, QCS Test performance and other information. The committee then makes a decision about the case for intervention on the student's OP. Such intervention, typically, will change a student's OP by only one position (see the example plots in Figure 3).

In making its decision, the panel must examine the individual intervention plots and determine if the student's OP (OAI) constitutes an outlier when compared with other students in the state. The plot includes four modelled options for adjusting the OP (OAI) to reduce the extent of the mismatch. The panel must reach an agreement on whether an adjustment should be made and, if so, the magnitude of the adjustment.

Similar checking processes take place when students apply for a review of their OP after the Tertiary Entrance Statement is issued.

Figure 3: Individual intervention plots



4. Review of Tertiary Entrance Statement

Appeals from students about their OPs are submitted on the *Application for Verification or Review* form that is sent with their Senior Education Profile in December. These reviews involve a complete check of the data used for the calculation of a particular OP and schools are requested to verify the data provided to QSA in November.

4.1 Making an application

A student may apply to the QSA for the review of information on their Tertiary Entrance Statement. The application must be:

- in the approved form
- submitted before the closing date stated on the form
- accompanied by the review fee.

4.1.1 Receiving late applications

Applications made after the closing date will be considered by the Deputy Director, Assessment and Reporting, or the QSA Director by giving consideration to:

- the lateness of the application
- the applicant's reasons for exceeding the closing date (family commitments, natural disasters)
- the content of the review request, including the likelihood that the initial decision was unfair
- the extent to which the applicant could have their case dealt with by an information amendment request under the *Information Privacy Act 2009*.

The decision-maker must determine if it would be manifestly unfair to reject the application. If an application is rejected, the applicant should be informed of the avenues available to them including:

- an information amendment request under the *Information Privacy Act 2009* (and inform them of any information QSA holds that would support their application)
- direct contact with the learning provider requesting them to notify the QSA that a mistake has been made
- court appeal (*Judicial Review Act 1991*).

4.1.2 Application fees

Applications without the prescribed fee cannot be accepted. The applicant should be directed to make an information amendment request under the *Information Privacy Act 2009* and will need to provide evidence that their personal information held by the QSA is incorrect.
The QSA should make the applicant aware of any information it holds that may be relevant to their application.

4.2 Making appropriate enquiries

In processing a review, the QSA must make appropriate enquiries. The decision-maker must explore all information available that will allow a determination about whether the ranking is fair, including:

- information referenced by the applicant
- information provided by the school upon request
- internal QSA analyses that provide information about the relative achievement of the applicant in Authority subjects.

Of primary interest is information that helps answer the following questions:

- were the standard procedures as stated in this document applied correctly and fairly with no input data errors and no errors of process?
- is there sufficient evidence to conclude that the standard procedures should not be applied?

4.2.1 Were the standard procedures correctly applied?

The school must confirm that all input data are correct. The decision-maker should examine the applicant's SAIs and subjects for any abnormal patterns that may require further investigation, noting that the calculations have already been replicated on independent computer systems.

4.2.2 Concluding that the standard procedure should not be applied

The process is similar to interventions made when individual anomalies are detected. The student's OP is compared to other students across the state with similar levels of achievement. If the student's OP is significantly lower than all other students (an outlier), the OP may be adjusted to reduce this mismatch.

4.2.3 Assessing fairness

If the standard procedures were correctly applied and there is insufficient information to conclude that the standard procedure should not be applied, then the information on the Tertiary Entrance Statement is fair. In making this determination, the decision-maker should bear in mind that:

- the OP and FPs are determined solely by relative achievement in Authority subjects
- schools are responsible for assessment in Authority subjects and their SAI decisions are the preferred instrument for determining an individual's achievement within a group
- the QCS Test is the preferred instrument for comparing achievement of groups.

4.2.4 Special provisions

The QSA does not retrospectively grant special provisions for circumstances experienced by the student during school-based assessment. Special provisions can be granted by the school during assessment according to its *Policy on special provisions for school-based assessments in Authority and Authority-registered subjects*. Students can also apply to the Queensland Tertiary Admissions Centre (QTAC) for special consideration.

4.3 External review

The QSA's review decision is not subject to a subsequent internal or external review as provided for under Part 9 of the QSA Regulation. If an applicant is not satisfied by the review decision, they may apply for a court review under the *Judicial Review Act 1991*.

5. Provision of tertiary admissions data to appropriate bodies

The QSA collates student information and ranking information and provides this primarily to the Queensland Tertiary Admissions Centre (QTAC), but also to interstate tertiary admission centres, usually with the assistance of QTAC.

Under section 55 (2) of the QSA Regulation, the QSA is required to specify this list of information in a guideline.

5.1 Content of order of merit list

QSA includes all information from the Student Education Profile in the list, including the following elements:

Table 3: Contents of order of merit list

Element	Notes
Name	
Address	
Date of birth	
Sex	
Student categories	Visa, repeat, re-entry, interstate, overseas
Learner Unique Identifier	
Names of learning providers	
Learning enrolments and outcomes	Subjects, VET, Other courses, Individual Learning Programs
QCS Test Grade	
OP and FPs	
ATAR	

6. Calculating ATARs

The Australian Tertiary Admission Rank (ATAR) allows tertiary admissions centres to compare students from across Australia when they apply for tertiary places.

In Queensland, all students who complete Year 12 are considered tertiary eligible, not just those who are eligible for an OP. In other states, only students who get the equivalent of an OP are considered tertiary eligible and receive an ATAR. Therefore, in Queensland, only OP-eligible students get an ATAR.

Because participation rates at school, subject weightings, statistical adjustments and eligibility rules for a tertiary entrance rank vary significantly from state to state, ATARs are calculated using the entire potential Year 12 population as a base. The model used provides an estimate of the achievement of the senior student population within the statewide population. It estimates the achievement of students at school compared to the overall population, including those not at school, and ranks them within this population.

The ATAR is calculated in Queensland using the same underlying fine-grained scale as the OP, but is broken up in a different way. An ATAR is a percentile ranking of the achievement of OP-eligible students within the total population.

Each state is responsible for determining ATARs for its students and every year an independent statistician analyses each state's calculations to determine if there are anomalies or practices that seem to be inappropriate.

Occasionally, where it is not possible to separate applicants for very popular courses in Queensland using OPs and FPs, the ATAR may be used at the discretion of the tertiary institution.

7. Glossary

arithmetic mean The sum of a collection of numbers divided by the size of the collection.

Australian Tertiary Admission Rank The Australian Tertiary Admission Rank (ATAR) allows tertiary admissions centres to compare students from across Australia when they apply for tertiary places.

ATAR See *Australian Tertiary Admission Rank*.

Authority subject A subject which meets **all** of the following criteria:

- the syllabus has been approved and issued by the Authority
- a school's work program has been accredited
- student achievements are moderated
- student results may contribute to Overall Position and Field Positions.

AvLoA The average level of achievement (AvLoA) is the weighted mean of the student's level of achievement, weighted by number of semester units for each subject.

basket A term used in the construction of the QCS Test. Each item is designed (or assigned) to a basket (or criterion) based on the 49 Common Curriculum Elements. There are five baskets:

- α — comprehend and collect
- β — structure and sequence
- θ — analyse, assess and conclude
- π — create and present
- ϕ — apply techniques and procedures.

BonSAI BonSAI is a software application that can be used to help with assigning subject achievement indicators (SAIs) and checking the reasonableness of SAI distributions. It imports and exports data to and from SDCS (Student Data Capture System).

boundary Boundaries are the scaled SAIs bounding a level of achievement. They are used in the calculation of scaled SAIs for small subject-groups.

CCEs See *Common Curriculum Elements*.

coarse-grained See *granularity*.

Common Curriculum Elements The 49 Common Curriculum Elements (CCEs) represent the common testable elements in the Queensland senior curriculum. They are generic skills that are present in more than one syllabus, likely to be accessible to most students through the set of subjects they study and are testable in pen-and-paper format.

criterion See *basket*.

Cronbach's Alpha (α) A coefficient of reliability. Cronbach's α is used as a measure of the internal consistency or reliability of a psychometric test score for a sample of examinees. It is defined as

$$\alpha = \frac{K}{K-1}\left(1 - \frac{\sum_{i=1}^{K}\sigma_{Y_i}^2}{\sigma_X^2}\right)$$

K is the number of components
σ_X^2 is the total variance
$\sigma_{Y_i}^2$ is the variance for component i for the current sample of persons.

equivalent FP-eligible An equivalent FP-eligible student must be equivalent OP-eligible (see *equivalent OP-eligible*) and have 60 weighted units of credits, i.e. semester units times subject weight.

equivalent OP-eligible An equivalent OP-eligible student must meet **all** of the following criteria:

- complete full-time internal Year 12
- be a visa student
- study at least three Authority subjects for 4 semesters each
- study a total weight (sum of semester units in all Authority subjects by subject weight) of at least 100
- take all papers of the QCS Test (or have an acceptable reason for not doing so).

FAI See *field achievement indicator*.

field There are five fields:

- A – extended written expression involving complex analysis and synthesis or elements of writing necessary to complete such tasks
- B – short written communication involving reading comprehension, pictorial interpretation and basic English expression or understanding the elements necessary to complete such tasks
- C – basic numeracy involving simple calculation and graphical, diagrammatic and tabular interpretation
- D – solving complex problems involving mathematical symbols and abstractions or elements of problem solving necessary to complete such tasks. Including complex graphical and scientific interpretation.
- E – substantial practical performance involving physical or creative arts or expressive skills.

field achievement indicator There are five field achievement indicators (FAIs) — one for each field. An FAI is a fine grained measure that is ranked and divided into bands to form Field Positions.

Field Position A number from 1 to 10 reflecting a student's position among all students in the state who are eligible for a position in that field. See *FP-eligible*.

field weight See *subject weight*.

fine-grained See *granularity*.

Form R6 The official document that records the history of the written communication between the school and the QSA concerning the verification and confirmation of school decisions and panel recommendations about the achievement of students exiting an Authority subject in each Year 12 subject cohort.

FP See *Field Position*.

FP-eligible An FP-eligible student must be OP-eligible and have 60 weighted units of credits, i.e. semester units times subject weight in that field.

granularity The extent to which a system (in this case OP calculations) is broken down into separate components — more fine-grained components offer more detail.

intermediate See *subject-group — intermediate*; *school — intermediate*.

Interstate Translation Index The Interstate Translation Index (ITI) is an index from 1 to 100 used by states to determine equivalent positions for tertiary entrance purposes of students from other states. See *ATAR*.

iso-weight A term given to lines on the QCS–WSM plot. The primary iso-weight lines are a smoothed fit through approximately the median points either side of the $y = x$ line. The weighting given to a student's scaling score when calculating subject-group scaling parameters is derived from the position of that student's results on the QCS–WSM plot and the position of the iso-weight curves.

item weight The weight given to each item of the QCS Test when calculating the scaling score for each field.

ITI See *Interstate Translation Index*.

large See *subject-group — large; school — large*.

level of achievement The standard reached by a student at exit judged by matching the standards in the student's work with the exit criteria and standards stated in the syllabus. The levels of achievement are: Very Limited Achievement (VLA); Limited Achievement (LA); Sound Achievement (SA); High Achievement (HA); Very High Achievement (VHA).

LoA See *level of achievement*.

linear scaling Linear scaling changes the location and spread of a set of numbers in a uniform manner. For a set of numbers x_1, x_2,..., x_n with location M and spread S, the linear scaling to take that set to a new location M' and spread S' is:

$$\overline{X'} = \frac{(\overline{X} - M)}{S}.S' + M'$$

The other form of scaling is non-linear, of which ranking and normalising is an example.

mean See *arithmetic mean*; *weighted mean*.

mean difference An alternative to the standard deviation.

OAI See *overall achievement indicator*.

OP See *Overall Position*.

OP-eligible An OP-eligible student must meet **all** of the following criteria:

- complete full-time internal Year 12
- not be a visa student
- study at least three Authority subjects for 4 semesters units of credit each
- study a total weight (sum of semester units in all Authority subjects by subject weight) of at least 100
- take all papers of the QCS Test (or have an acceptable reason for not doing so).

See also *equivalent OP-eligible*.

OP-ineligible An OP-ineligible student is a Year 12 student who does not meet one or more of the criteria to be an OP-eligible student.

overall achievement indicator The overall achievement indicator (OAI) is a fine-grained measure that is divided into bands to form OPs. It is the weighted mean of a student's best 20 semester units of scaled SAIs, including at least three subjects studied for 4 semesters.

Overall Position A number from 1 to 25 representing the overall position of a student among all OP-eligible students in that year.

polyscore A measure of overall achievement based on levels of achievement. The polyscore is calculated through a converging iterative process based on a percentile ranking of levels of achievement and students within levels of achievement.

QCS score The QCS raw score is the sum of the scores on the four papers of the QCS Test.

QCS Test The Queensland Core Skills (QCS) Test comprising multiple-choice questions, short-response items, and the writing task. The test is conducted over two consecutive days in four sessions with four papers, one per session, two multiple choice, one short response, and the writing task.

SAI See *subject achievement indicator*.

scaled SAI The scaled SAI (Subject Achievement Indicator) is a number on a state-wide scale of (175,25) that reflects the student's achievement in a subject.

scaling See *linear scaling*.

scaling parameters The parameters of the distribution of scaling scores, usually the *weighted mean* and the *mean difference*.

scaling score A score derived from the *QCS score* by ranking and fitting to a Gaussian distribution — also termed the QCS scaling score. Each OP-eligible student potentially has six scaling scores, one for the *Overall Position* calculation and five for the *Field Position* calculations.

school — intermediate A school with 16 to 19 OP-eligible students.

school — large A school with 20 or more OP-eligible students.

school — small A school with 15 or fewer OP-eligible students.

school — visa A school where the number of equivalent OP-eligible students is 11 or more and is greater than 20 per cent of the number of OP-eligible students.

semester unit One semester of study in a subject.

small See *subject-group — small; school — small*.

subject achievement indicator A subject achievement indicator (SAI) is a representation of a student's achievement in a subject. For large subject-groups the SAI is a number — from 200 to 400 — that is assigned by schools to students reflecting their relative achievement in that subject-group. The 200 is the lowest and the 400 is the highest and for each subject-group at least one student must get 200 and one must get 400. For small and intermediate subject-groups the SAI reflects the level of achievement and the rung position within that level. For use in OP and FP calculations, SAIs are transformed to scaled SAIs. SAIs are only given to OP-eligible and equivalent-OP-eligible students.

subject-group Students within a school taking the same Authority subject. A subject-group may, therefore, comprise more than one class group.

subject-group — intermediate A subject-group with 10 to 13 OP-eligible students who have studied the subject for at least one semester.

subject-group — large A subject-group with 14 or more OP-eligible students who have studied the subject for at least one semester.

subject-group — small A subject-group with 9 or fewer OP-eligible students who have studied the subject for at least one semester.

subject-group — visa A subject-group that meets the following criteria:

- has 10 or more OP-eligible students who have studied the subject for at least one semester
- has a number of equivalent OP-eligible students greater than 20% of the number of OP-eligible students.

There are two other implicit criteria:

- because a visa school is also defined, a visa subject-group cannot be in a visa school
- because the visa subject method uses WSMs, which are not calculated for small schools, a visa subject-group cannot be in a small school.

subject weight A weighting for each subject for use in OP and FP calculations. The subject weight for OP is currently five for all subjects. The subject weight for each field may vary in integer steps from zero to five.

Tertiary Entrance score The number used for tertiary entrance prior to the introduction of the OP/FP system in 1992. The TE score reflected a student's position on an order of merit list using a scale of percentile ranks. The scores were assigned downwards in intervals of 5 (990, 985, . . .) until all students had been assigned a score. The highest possible TE score was 990. The number of students receiving each TE score was a function of the state's 17-year-old population.

visa See *subject-group — visa; school — visa*.

visa student A visa student is a Year 12 student at a school in Queensland who holds a student visa issued under the Migration Act 1958 (Cwlth). When used in this guideline the term is usually synonymous with equivalent OP-eligible student but, by the definition, a visa student need not be equivalent OP-eligible.

weighted mean The weighted mean of n observations of x each with weight w is:

$$\bar{x} = \frac{\sum_{i=1}^{n} w_i x_i}{\sum_{i=1}^{n} w_i}$$

When all values of x have an equal weight, this is equivalent to the arithmetic mean.

weighting A process whereby the influence of an observation on a summary statistic is affected by a weight — a numerical value. In the OP/FP process many things are weighted. Subjects have subject weights for Field Positions; items in the QCS Test have item weights for the calculation of scaling scores for Field Positions; for a large subject-group the contribution of each student's scaling score to determining the parameters of the distribution is weighted by the number of semester units taken and by a weight determined by its position in the two-dimensional space of scaling score and WSM. See also *Iso-weight*.

within-school measure The within-school measure (WSM) is calculated within a school among students based on their wins and losses in terms of SAIs. WSMs are calculated for large schools only and are scaled to the parameters of that school's unweighted scaling score distribution.

WSM See *within-school measure*.

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