

Standards in the ‘everyday adult mathematics’ safety-net test

Background

To get the Tasmanian Certificate of Education, a student must meet standards for:

- everyday adult reading and writing
- everyday adult mathematics
- everyday adult use of computers and the internet.

These standards were approximately aligned with the National Reporting System, level 3, now replaced by the Australian Core Skills Framework¹, level 3. The alignment is only approximate, in that the framework is more comprehensive.

At its meeting on April 1, 2009 the Authority determined that literacy, numeracy and ICT tests are to be a 'safety-net' only. The Authority expects students in formal learning programs with senior secondary providers to meet standards through course pathways. 'Safety-net' testing is available to students no earlier than October following their completion of Year 10.

These 'safety-net' tests *sample some* of the skills expected of a person who can do reading, writing, mathematics, use of computers and the internet at the standards now expected of adults. A person who is well prepared for the demands of everyday adult standards in reading, writing and so on passes the test easily. A person who finds the test difficult must develop their skills – and neither a test nor preparation for a test is an adequate substitute for learning.

The items² on the test are chosen as a sample of the expected skills, suitable for use in a test. The Australian Core Skills Framework specifies that

A person's performance at any time in any of the core skills derives from the interplay between the chosen activity, the features of the text/task, and the context and level of support under which the activity is performed and its performance requirements must be interpreted in the context of the level of support provided during assessment.

The items on the test are ones where the person's performance is in the context of a task completed without any external support. The items are therefore chosen to be simpler than those that would be expected of a person with some or moderate support or working in a group context.

¹ <http://www.deewr.gov.au/SKILLS/PROGRAMS/LITANDNUM/ACSF/Pages/default.aspx>

² Items on the test may be questions ('how much ...?') or tasks ('do the following ...')

The Authority decided that the pass mark should be set so that it was very likely that people who score above the pass mark *do* meet the required standards. This means that those just below the pass mark *may* meet the required standards – but their performance does not clearly show this to be so. This approach is appropriate for a ‘safety-net’ test: our advice is that any student who does not clearly have the required skills should include appropriate courses in their post-year 10 studies. These skills are too important to their future to be left undeveloped. Those students who feel reluctant to take courses in these areas may well be those who are most in need of them – and relying on passing the ‘safety-net’ test as a substitute for learning is likely to be an unwise choice. The performances we have seen on the numeracy test so far – two-thirds do not pass – suggest that such unwise choices are being made too often.

Method

We used Item Response Theory (IRT) modeling³ to analyse the performance of 276 students in the numeracy test in 2010.

IRT modeling fits a mathematical model to the test data, identifying separate estimates of candidates’ ‘ability’ and the ‘difficulty’ of each item (see http://en.wikipedia.org/wiki/Item_response_theory).

For the purposes of this report, this IRT model is useful in the way it puts items and candidates’ abilities on the same scale, producing what is known as an ‘item-person’ map.

An item-person map lets us relate performance on individual items to the ability of a ‘typical’ candidate.⁴ For example, an item at the top end of the scale is ‘typically’ got right by high ability candidates and wrong by low ability candidates – it is a ‘difficult’ item. An item towards the bottom of the scale is ‘typically’ got right by low ability candidate – it is an ‘easy’ item (and, of course, we should expect high ability candidates to get easy items right).

We used the item-person map for the numeracy test, with results from 276 students, 80 of whom scored at or above the ‘pass’ mark.

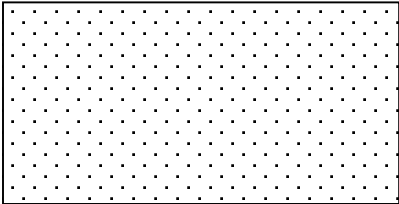
We were then able to relate types of items to overall performance on the test for two groups of candidates: those scoring around the pass-mark and those well below the pass mark. Some of these types of items are ‘easy’ for all, some are hard for those who score below the pass-mark but are easy enough for those who pass and some are too difficult for all but the top scoring students.

Results

The results of this analysis are given in the following table:

³ We used ConQuest (a generalised modelling program developed by *Margaret L. Wu, Raymond J. Adams, Mark R. Wilson and Sam Haldane*) to fit a partial credit model. See <http://www.assess.com/xcart/product.php?productid=220&cat=1&page=1>

⁴ The word ‘typical’ is important – real people are more variable than the ‘typical’.

Example item	Students around the pass mark ...	Students who clearly fail this test ...
Multiply 23x50	... often give the right answer to this sort of item	... sometimes give the right answer to this sort of item
<p>A rectangle has a perimeter of 124 cm and a length of 42 cm.</p> <p>What is the width of the rectangle in centimetres?</p> <div style="text-align: center;">  </div>	... often give the right answer to this sort of item	... sometimes give the right answer to this sort of item
<p>Complete the following division</p> $15 \overline{)390}$	... often give the right answer to this sort of item	... sometimes give the right answer to this sort of item
<p>A second hand furniture shop owner purchased a pine wardrobe from a customer for \$60 and later sold it for \$100.</p> <p>How much profit did the shop owner make?</p>	... often give the right answer to this sort of item	... sometimes give the right answer to this sort of item
Round off \$10.918 to the nearest cent	... usually give the right answer to this sort of item	... sometimes give the right answer to this sort of item

Complete the following subtraction. $\begin{array}{r} 9065 \\ -7687 \\ \hline \end{array}$	... usually give the right answer to this sort of item	... sometimes give the right answer to this sort of item
Find the answer to this problem : $9 \times 7 - 7 + 19 =$	... sometimes give the right answer to this sort of item	... rarely give the right answer to this sort of item
Express 600 ml as a percentage of 4 litres	... sometimes give the right answer to this sort of item	... rarely give the right answer to this sort of item
Estimate to the nearest 100 the answer to the following problem $\frac{107 \times 389}{93}$	... occasionally give the right answer to this sort of item	... do not give the right answer to this sort of item
A carton of apple juice contains 1.75 litres and costs \$5.25 at the local Fresh Fruit Shop. What is the unit price per 100ml ?	... occasionally give the right answer to this sort of item	... do not give the right answer to this sort of item
A second hand furniture shop owner purchased a pine wardrobe from a customer for \$60 and later sold it for \$100 . What was the profit as a percentage of the purchase price? (show calculations).	... rarely give the right answer to this sort of item	... do not give the right answer to this sort of item
Multiply $2\frac{1}{4} \times 1\frac{1}{3}$.	... do not give the right answer to this sort of item	... do not give the right answer to this sort of item

From this table, the pass-mark on the test can be described in the following terms. Those who just pass can do simple subtraction without support. In this situation, they often find items involving percentages and estimations difficult and do not succeed with fractions. Those who fail the test have difficulty with

simple multiplication and subtraction items and do not succeed with percentages, estimations and fractions.

Implications

Some may consider that the pass-mark on this test has been set too low, that after twelve years of school students should be readily able to do these sorts of tasks, without support.

The pass-mark should be kept under review, with input from external experts about the sorts of items used and the standards expected.

It is really important that schools and colleges make sure that students have the required skills to the level that they can readily pass this sort of test. Concentrating on test preparation – coaching students to pass the sorts of items described above – is not in their best interests.

Anyone with the required level of skills will pass the test easily⁵ but it is possible to be *coached* to get items like the ones on this test right without having the required level of skill and understanding. For example, it is possible to teach someone that when an item has a box with a number against each of four sides, the required answer is the total of these four numbers (which will give the correct answer when the item requires the perimeter, but the wrong answer when the item requires the area). That is, coaching can produce the ‘right’ answer without the understanding that the real world will require. The more that test items like those above are generally available, the greater the risk of this sort of coaching.

Developing the skills to the required level through a sound learning program will lead to the understanding needed for the real adult world and, as by-product, a pass result on the test, if this ‘safety-net’ is needed.

⁵ We have trialled this test with people many years out of school, who have not taken tests or examinations since leaving school, and who describe themselves as not having or using mathematics skills beyond those of ‘everyday adults’. They get scores well above the pass mark without any preparation or coaching.