

NUMERACY BENCHMARKING PROJECT

There are many learning progressions that show the development of reading and mathematics. Nowhere in the world has defined a benchmark for literacy or numeracy that defines what an adult needs to have to usefully contribute to the community in adult life.

The literacy benchmark programme is well under way with focus groups responses favouring one particular passage and a survey of about 1000 people being conducted to get a city picture. This is also benchmarked to actual known student reading ages for some 200 plus individual students.

The next task is to attempt to define where the Mathematics benchmark should go and how we could assess that level given some overarching considerations.

- The “test” is to be able to be administered by a non-Mathematics specialist.
- Needs to be aural so any reading difficulties are negated. (Assume they can hear) and also so they don’t use any writing or calculating aids.
- Needs to be single sheet and done in less than 5 minutes.
- It is only to be a preliminary screening tool that can be done in malls, public places etc to determine who needs help, then other assessment tools are put in place so that appropriate remedial action can be offered.
- Needs to focus on important strand(s), and not cover every strand. Research would appear to suggest that to be able to progress to higher level thinking skills, a person must be multiplicative (as defined in the Secondary Numeracy Programme). Therefore a focus on that as a benchmark is probably appropriate.

Concentrating on money for this benchmark seems to cover all of these options.

- Other demographic information needs to be gathered to ensure that proportionate groups are surveyed – compared to the literacy benchmark surveys.

A wide ranging group of Mathematics educators were consulted including numeracy facilitators and assessment experts such as Warrick Elley and Des Rainey.

Quite a few trials were considered until in the end we decided to go with a single test based on money. This is still a work in progress, but it has been aligned with the numeracy project

Mathematics Benchmarking Exercise

- | | | | |
|-----|---|--|--------------------|
| 1. | You go to the shop and buy two items that cost \$6 and \$7.
How much do you pay? | | \$13 |
| 2. | If the items were \$14 and \$17, how much would you pay? | | \$31 |
| 3. | If the items were \$6.40 and \$3.30, how much would you pay? | | \$9.70 |
| 4. | If the items were \$17.80 and \$4.90, how much would you pay? | | \$22.70 |
| 5. | If you buy items to the value of \$6 and you hand over a \$10 note.
How much change would you get? | | \$4 |
| 6. | If the items cost \$37 and you hand over a \$50 note,
How much change would you get? | | \$13 |
| 7. | If the items cost \$3.30 and you hand over a \$5 note,
How much change would you get? | | \$1.70 |
| 8. | If the items cost \$18.80 and you received \$5 change,
how much money did you hand over? | | \$23.80 |
| 9. | You buy 6 items each costing \$8. What is the total cost? | | \$48 |
| 10. | You buy 7 items each costing \$2.40. What is the total cost? | | \$16.80 |
| 11. | You and a friend buy a \$5 raffle ticket and win \$45.
If you paid \$3 and your friend paid \$2, what is a fair split of the \$45? | | \$27 : \$18 |

Ethnicity	NZ Pakeha	NZ Maori	Pacifica	Other - specify		Male / Female
Age Range	Under 16	17-25	26-35	36-50	51-65	Older than 66
I am a	Good reader	Average reader	Below average reader	Reluctant reader	Can't read	
I am	Good at Maths	Comfortable with numbers	Can cope with maths	Hopeless with maths	Can't do maths	

Question alignment with Numeracy project.

1. EA Stage 5 , CL2, simple addition of single digit numbers.
2. EA still as numbers under 20.
3. EA/early AA CL2. We have discovered some students see money as two whole numbers. The dollar and the cent. They add these independently and in this case there is no carry to \$. This is a low level question. It is not an indicator of decimal expertise.
4. This is more CL3 or AA Stage 6. The issues of decimals and adding the two parts remains. The correct answer indicates carry in the head (memory) and place value knowledge.
5. Stage 5, CL2. A simple comparison or difference problem. It does not indicate anything beyond simple understanding of whole numbers.
6. Early Stage 6. Still addition is the focus.
7. Still Stage 5 and maybe a little higher into early Stage 6. It would be interesting to know if a student who got this correct could also get $500 - 330$ correct.
8. As above money is not decimals nor place value. This is addition if we do use it and CL3, Stage 6 at the most.
9. At last a simple product. 6×8 is 48. How do you rate someone who says 40 and explains $6+6+6+6+6+6+6+6$ or slightly better $8+8+8+8+8+8$ or $3 \times 8 = 24$ so it is double $24 = 48$, or $5 \times 8 = 40$ (easy and common know fact) therefore it is $40 + 8$ (derived fact Stage 6). At best this is a stage 6 or CL 3 problem. Stage 7 students know basic facts and this is an easy basic fact.
- 10 This is Still Stage 7 unless someone adds $2.4 + 2.4 + 2.4 + 2.4 + \text{etc}$ correctly. The most likely answer is part whole the 2.40 and get $14 + 2.80$ which makes it early Stage 6. A stage 7 student might see $7 \times 12 = 84$ in the problem and double the answer to get 16.80. Someone who needs help will not answer this question.
11. What is fair in love and war? Assuming fair is a moral component of the person answering this (and they probably do not need help!) the unit rate of \$9 per \$ appears and so a multiplicative person will see the 27 and 18 quite easily. This question unattempted tells a story as well. It would be worth trialling. This is a Stage 4 multiplicative application and is not CL5 because it is whole numbers and small ones at that. Stage 7 or CL4 to someone who answers this successfully.

Re the descriptions.

The reading ones are OK.

The maths ones

1. #10 and #11 correct, Numeracy OK, Probably Stage 7 multiplicative , CL4. Copes in society. Has the potential or can reason mathematically.
2. #'s 4, 7 , 8, 9, correct, CL3, additive, can cope with most situations in society. Has mastered how to apply addition in many situations otherwise the problem is simply too hard.
3. #'s 2,3, 5, 6 correct, CL2, early additive, sometimes counts solutions, hides from maths, lets someone else do the thinking and uses a calculator believing any answer that appears.
4. #1 correct, perhaps #2 and 7. CL2, Early adder or counter.
5. None correct. Person may well be in need of learning skills and many more that are more important than thinking mathematically.

This test has been trialed on 200+ students at Linwood and some others around the country. Results are still coming in and we will be able to analyse these to see if the test meets the need of it needs to be modified.

The supervisory group assessed the results of the preliminary trial and suggested modifications to this task. See 2009 new task. It is a work in progress.

Mathletics at Linwood College

Mathletics is an internet-based maths tuition program, written in Australia but used by school children around the world. It is suitable for a wide range of ages and abilities and one of its chief strengths is that students can proceed at their own pace and at their own desired level of difficulty. Mathletics has a huge ability to motivate students who might otherwise not be very interested in maths by using a competitive element, “Live Mathletics”.

This works by students competing in real time with others from around the world to answer questions the fastest and also to gain credits which they can “spend” on their on-screen character. There is also a wide variety of lessons, tasks and difficulty levels which can be set by class teachers for individual students, groups or whole classes.

In New Zealand the site can be found at www.mathletics.co.nz although a password is required to actually use the program. Students must pay an annual fee for unlimited access during that year. Support to teachers is free and unlimited via phone or email. Linwood College had a visit from Yvonne Blanch to teach us how to use the program earlier in the year.

Here are some quotes from the website about the program:

"Mathletics is Australasia's most used educational website." "Mathletics covers Year 1 to Year 13 curriculum" "It is used by 2000 schools and 500,000 students" "Over 3.5 billion correct answers have been given since the program started" "Over 200,000 students have doubled their accuracy"

Mathletics has been used primarily in the four low ability year 9 classes at Linwood. Each class has at least one period per week using the program, although some teachers at some times have used it for two or three periods a week. The program has generally been

enthusiastically enjoyed by pupils, with a common question at the start of a period being “*Are we doing Mathletics today?*” with disappointment if the answer is no.

Some other comments are:

“It’s fun, it gets you out of the classroom, you can work at your own speed and nobody yells at you” Ryan O’Neill, 9CO

“It’s good so you can learn stuff you didn’t know about before” Vena Taaso, 9CO

“Oh, it’s really cool ‘cos you can race against people from all over the world” Ashley Thompson, 9CO

The competitive aspect is very attractive, especially (but not exclusively) to boys. Often teachers will set a task that must be done before the pupils can progress to the much liked Live Mathletics. Competition is able to be displayed at three levels – the individual games of Live Mathletics, the highest points in this class for this day and the grand total of all points for all pupils in this school ever. (See “Daily and yearly top scores” document). All these are avidly followed by many children. The program also lists the top 50 schools, top 100 individuals and top 50 classes around the whole world.

My job here at Linwood has entailed being in most of the Mathletics classes, so I have seen more of this program in action than others at school. I have seen enthusiastic, motivated kids enjoy coming to maths classes. I have seen pupils who had only rudimentary knowledge of their times tables whose speed, ability and confidence in numeracy has improved tremendously.

Richard Taylor.