

Russo – Numeracy Intervention Program

Presented at

Critical Intersections: the 12th Biennial Conference of the Association for
Academic Language and Learning

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Numeracy Support for Nursing Students

Incorporating the encounter between literacy and numeracy

A Program of Intervention

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Until recently . . .

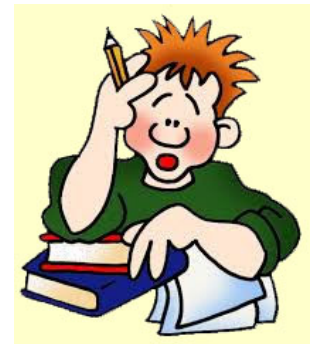
- Students enrol, go to lectures
- Sit for drug calc exam, week 4, 5 or 6
- < 100% = Fail!
- More practice examples → Resit exam
- Fail resit BUT pass all other aspects of course → More practice examples → Resit exam
- Fail resit → Fail unit



The situation . . .

- Many students cannot perform drug calculations
- Not only ACU, not only Vic, not only Aus, but many countries
- Based on observations, school mathematics seems largely irrelevant
- OECD survey: Australia ranked 4 of 23 countries in literacy but **13th in numeracy**

- The Age: Saturday August 29, 2015 p.8



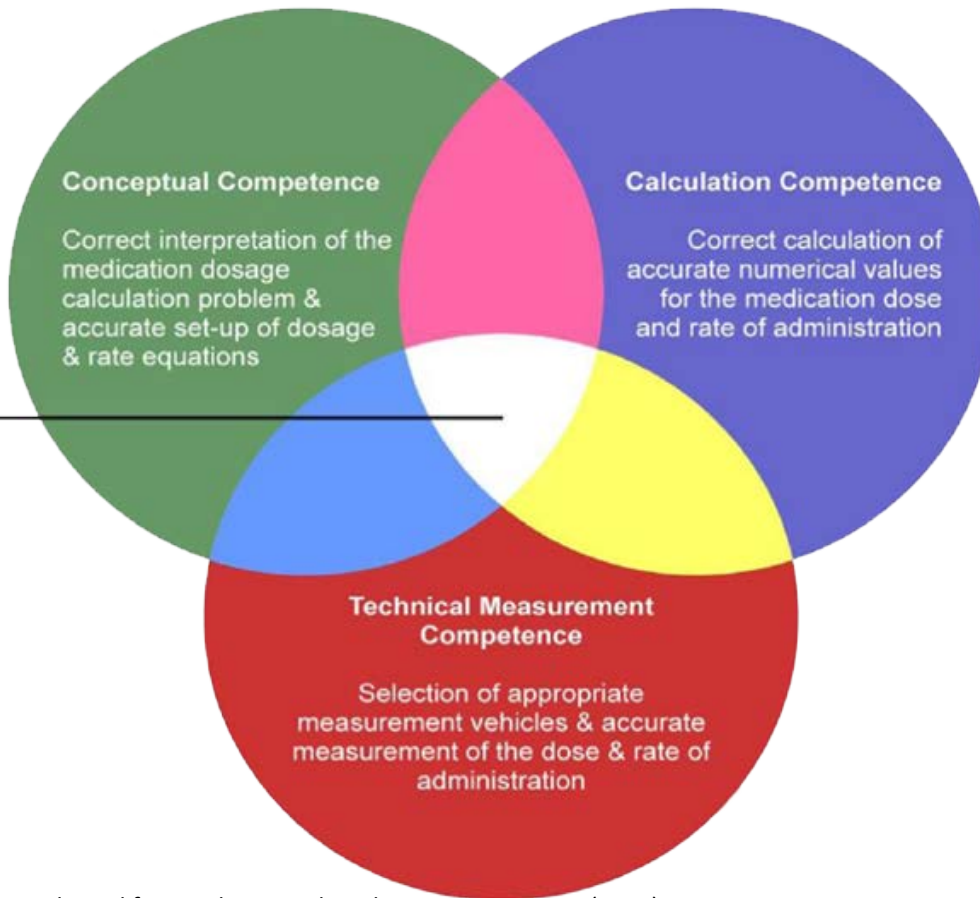


Musings . . .

- Diagnostic tool – question items to test specific competencies required to do drug calculations.
- Identify students likely to struggle
- Identify areas of support needed
- Topic-specific workshops → Drug calcs exam
- Fail exam → Further topic specific workshops → Resit exam
- Informed by the work of Hutton, as quoted in Wright (2007, 279): A revision program for 184 out of 231 students who scored less than 75% on a 50-item maths test.

Numeracy and Literacy

Competence in Medication Dosage Calculation Problem Solving



Coben and Weeks (2014) hold that the intersection between literacy and numeracy is critical to effective assessment of competence in drug calculations

Benseman, Sutton & Lander (2005) recommend that numeracy should be taught by specialists rather than the lecturer.

Adapted from: Educational Studies in Mathematics (2014) 86:253–270
DOI 10.1007/s10649-014-9537-3

Other studies . . .

- Kerri Wright: University of Greenwich, London, has encountered similar issues in her nursing students.
- Wright (2004): student nurses need both mathematical skills and the ability to conceptualise clinical information to perform drug calculations.
- Wright's 2007 study: important for an intervention program to address both conceptual skills and mathematical ability.
- Our experience: many students made incorrect dosage calculations either through lacking certain mathematical skills or through not understanding exactly what the question was asking.
- Review conducted by van de Mortel, Whitehair and Irwin (2014) showed the importance of students' understanding of terminology and contextual meaning
- Backed up by Bliss-Holtz (as quoted in Wright (2007, 279)) who found that students made errors either in arithmetic or their understanding of mathematical concepts.



Actions . . .

- Diagnostic tool developed
- Enlisted help and advice of Prof. Doug Clarke & assistant researcher
- Administered diagnostic “quiz” to 1st & 2nd yr Students
- Quiz corrected; feedback results to Lecturers
- Lecturers schedule workshops & encourage students to attend. (Cannot make them compulsory)
- Students re-sit exam → improved performance.

Sample Questions – First Draft

Write one half as a fraction.

Which is larger: $\frac{2}{3}$ or $\frac{2}{5}$?

Arrange in order from smallest to largest: 0.54, 0.6, 0.312

$$\frac{1}{5} \times \frac{2}{3} =$$

$$\frac{2}{3} \times 5 =$$

You have a bottle of 100ml of medicine. The strength of the medicine is 5mg per 2 ml. If you give 10ml, how many mg are you giving?

$$5 : 8 = x : 20, \quad x = ?$$

(Many students found this difficult)

Results . . .

| 5 | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----|------------------------|----------------------------------|-----------|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|------|
| 6 | | Highest | Yrs Since | Conf. | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 7 | STUDENT CODE | Lvl Maths | Achieved | Level | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | Total | %age |
| 107 | S00 | 11 | 8 | 2 | 1 | 0 | 0 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 16 | 64% |
| 108 | S00 | 12 | 10 | 9 | 0 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 0 | 0 | 1 | 1 | 1 | 1 | 21 | 84% |
| 109 | S00 | 13 | 1 | 7 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 48% |
| 110 | S00 | 10 | 6 | 4 | 0 | 1 | 0 | 1 | 1 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 10 | 40% |
| 111 | S00 | 12 | 3 | 4 | 1 | 1 | 1 | 1 | 1 | 3 | 0 | 1 | 1 | 0 | 2 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 17 | 68% |
| 112 | S00 | 13 | 1 | 10 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 1 | 0 | 19 | 76% |
| 113 | S00 | 10 | 5 | 5 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 7 | 28% |
| 114 | S00 | 13 | 1 | 8 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 3 | 1 | 1 | 1 | 1 | 1 | 0 | 20 | 80% |
| 115 | S00 | 12 | 7 | 9 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 0 | 24 | 96% |
| 116 | S00 | 12 | 8 | 7 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 20 | 80% |
| 117 | S00 | 10 | 5 | 7 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 18 | 72% |
| 118 | S00 | | | 10 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 23 | 92% |
| 119 | S00 | 12 | | 4 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 9 | 36% |
| 120 | S00 | 13 | 1 | 9 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 0 | 2 | 1 | 1 | 3 | 1 | 0 | 0 | 1 | 1 | 1 | 22 | 88% |
| 121 | S00 | 10 | 11 | 5 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 2 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 0 | 0 | 17 | 68% |
| 122 | 114 students took part | No. Correct Responses | | | 95 | 110 | 107 | 107 | 114 | 74 | 101 | 114 | 110 | 76 | 49 | 70 | 51 | 73 | 73 | 95 | 80 | 86 | 66 | 24 | | |
| 123 | | No. who did not score full marks | | | 19 | 4 | 7 | 7 | 0 | 40 | 13 | 0 | 4 | 38 | 65 | 44 | 63 | 41 | 41 | 19 | 34 | 28 | 48 | 90 | | |
| 124 | | % who did not score full marks | | | 17% | 4% | 6% | 6% | 0% | 35% | 11% | 0% | 4% | 33% | 57% | 39% | 55% | 36% | 36% | 17% | 30% | 25% | 42% | 79% | | |

Problems involving reading and understanding the question, and deciding which strategy to use to solve the problem or answer the question.

Analysis . . .



- > 80% → OK
 - > 60% but < 80% → Attend workshops
 - < 60% → Make an appointment for support
 - Similar difficulties demonstrated by both 1st & 2nd yr
 - Areas identified: rounding, conversions, estimating, fractions, ratios, formula substitution
-
- Highest level of maths achieved prior to enrolling not relevant.
 - A significant worsening of results (pro rata) from Yr 1 to Yr 2

Actions following 1st attempt . . .

- First year students were given verbal feedback by email on areas done well and areas needing further consolidation
- First year students were directed to set aside time to access the online software tool and work on these areas, along with other on-line resources, such as the Khan Academy.
- Session on drug calculations given in the (2nd year) lecture by AS numeracy person
- Organised a series of “numeracy support” sessions before scheduled exam
- A “remedial” lecture session the week after scheduled exam
- Reinforced through lectures the availability of and importance of attending, consultation appointments
- Promoted further revision resources on the LMS and online software tool, to be completed prior to re-sit

Some further results . . .

- First year results:
 - Sem 1 2014
 - ❖ HLSC110 – 93.2% pass rate

- Second year results:
 - Improved pass rate on first attempt Sem. 1, 2015
 - ❖ Pass rate for the first attempt: 64% which is better than last year
 - Improved eventual total pass rate 86%

Refinements . . .

Wanted to make it more diagnostic

Decided on a Multiple Choice version – wrong answers would indicate what specific skill needed improving

Developed wrong answer options for each question, based on variety of wrong answers encountered when correcting previous attempts

Considered how students might think “mistakenly” to arrive at wrong answer – not just random incorrect answers

ACER personnel ratified the answer options, hence the design of the quiz

Quiz A and Quiz B developed

Possibilities . . .

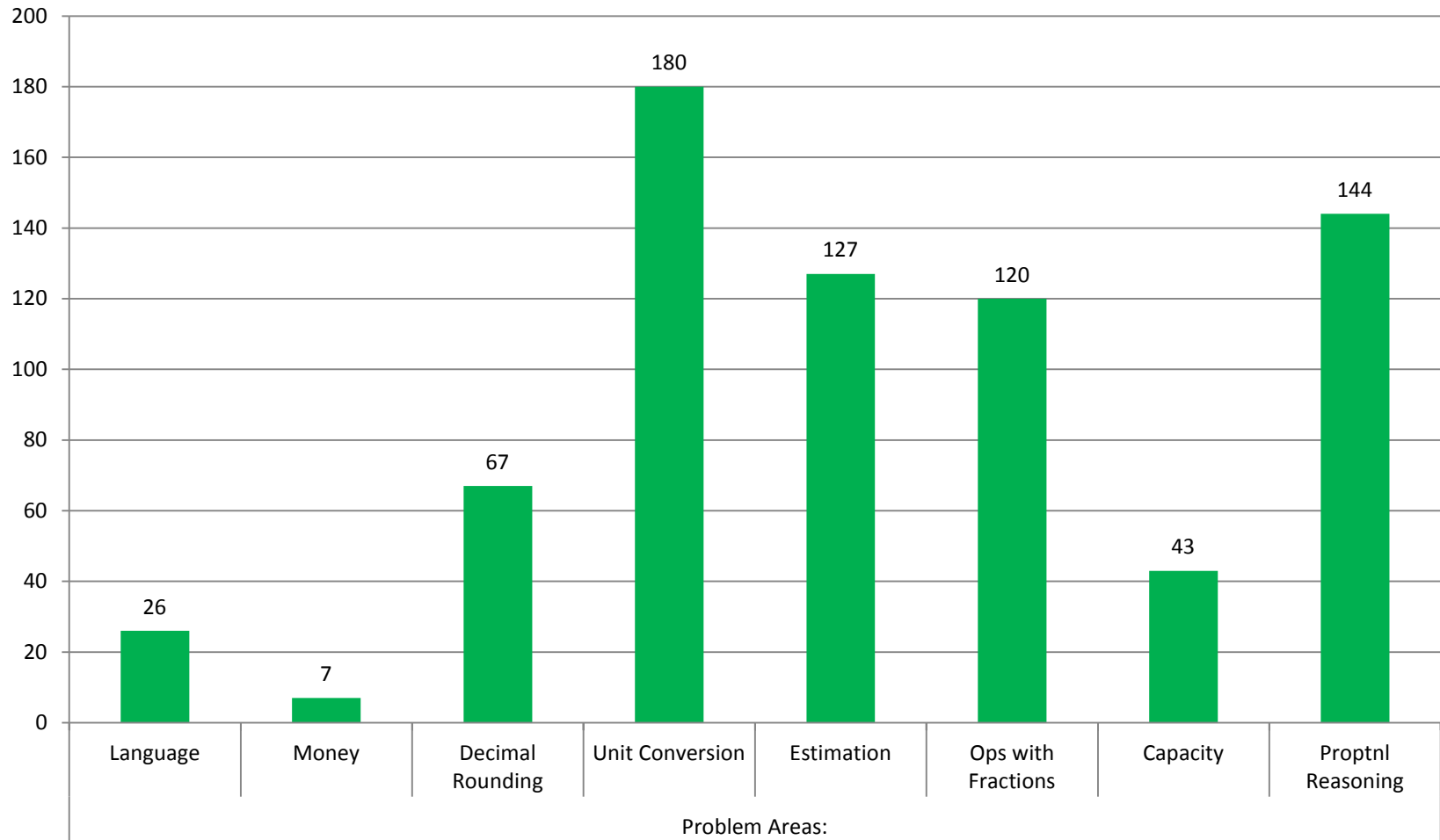
- Target 2nd year students only
- Completion of diagnostic quiz a hurdle task.
- For those who need it, workshops compulsory – attendance marked.
- Develop worksheets to be completed as hurdle task – on line or hard copies
- Failure on drug calcs exam → compulsory to make an appointment for AS support
- Completion of diagnostic quiz again at end of semester → map improvement
- Long term project → record results each semester over 3 – 4 years
- Publish project description, results, findings → Education & Nursing Journals



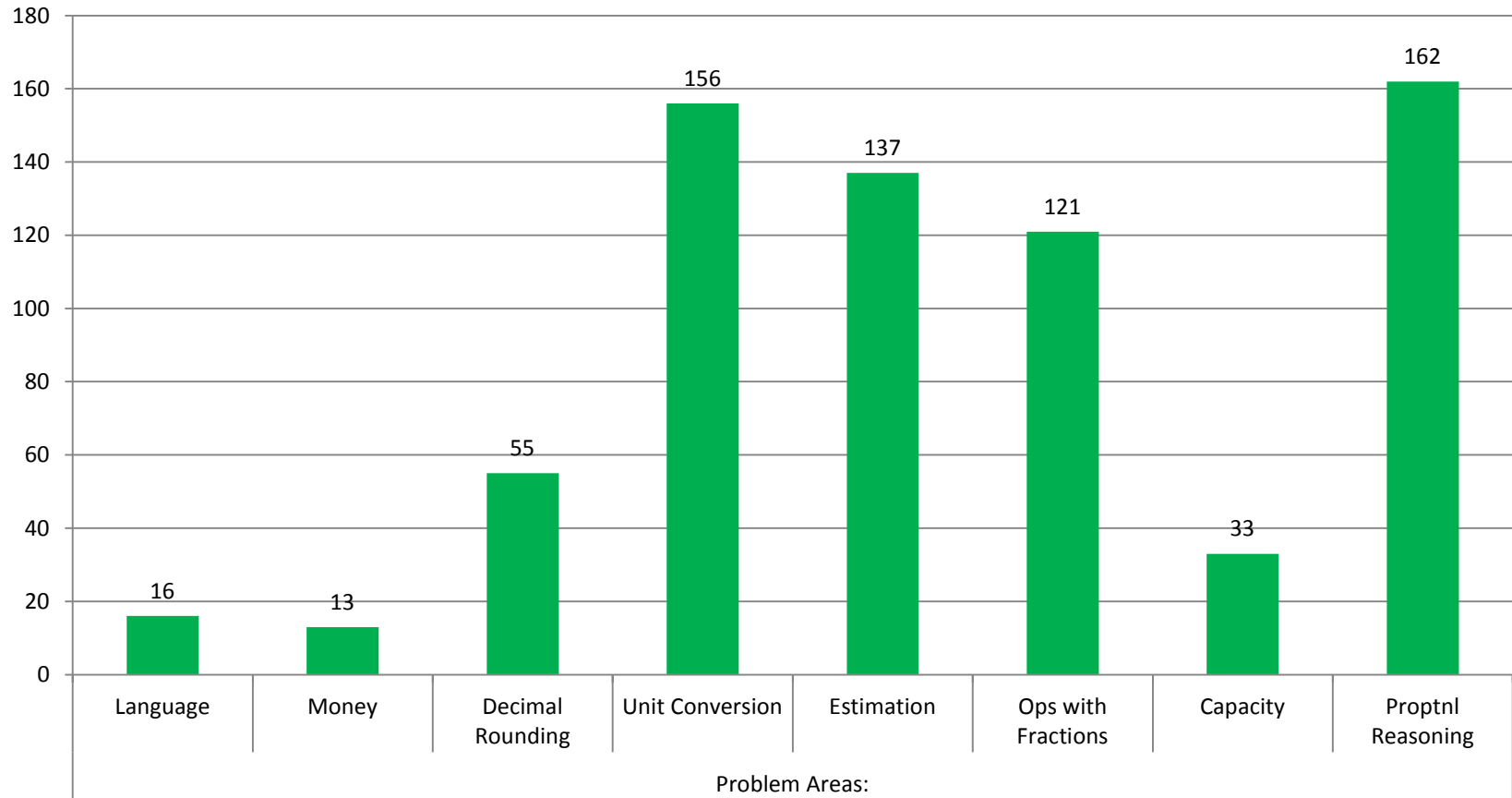
Most recent results . . .

- Second year results:
 - Improved pass rate on first attempt (Sem.2 , 2015)
 - The total pass rate is 63%
 - That is an improvement from 50% (previous years).
 - Improved eventual total pass rate 93%

Analysis of Problem Areas – 1st Year students Sem1, 2015 (Group A)



Analysis of Problem Areas – 1st Year students Sem1, 2015 (Group B)



New Initiatives . . .

Generic workshops, online and video resources for different platforms (PC, tablet, smartphone) in

- Problem solving
- Algebra
- Unit conversions
- Critical reading of graphs/tables
- Terminology
- Ratio and proportion

being developed, refined and scheduled for introduction in 2016.

Examples:
(Click on image)



Academic Skills Unit

Workshop

Terminology



References

- Benseman, J., Sutton, A., & Lander, J. (2005). Working in the Light of Evidence, as Well as Aspiration: A Literature Review of the Best Available Evidence about Effective Adult Literacy, Numeracy and Language Teaching. *Online Submission*.
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- Van de Mortel, T., Whitehair, P. & Irwin, P. (2014) A whole-of-curriculum approach to improving nursing students' applied numeracy skills. *Nurse Education Today* 34, 462 – 467.

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Wright, K. (2004). Maths for student nurses: an investigation into strategies used to improve their skills. *British Journal of Nursing* 13 (21), 1280 – 1287.

Wright, K. (2007). Student nurses need more than maths to improve their drug calculating skills. *Nurse Education Today* 27, 278 – 285.

Watch this space . . .

