

Accessible calculator workshop

SPEVI Conference, 15/01/2020, Charlie Roberts

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Food for thought

Mathematics curricula is accessible to blind and partially sighted learners (Maguvhe, 2015).

Appropriate accommodations, accessible calculators included; are needed to perform as well as sighted peers.

Students who use Braille are less likely to participate in advanced mathematics classes (Klingenberg, Holkesvik & Augestad, 2019).

In Victoria, largely inaccessible CAS calculators are a barrier to participation.

Students with VI tend to perform below their ability in mathematics compared with in other academic subjects (Freeland, Emerson, Curtis, & Fogarty, 2010).

Do we agree? If so, are calculator challenges contributing to this trend?

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Workshop outline

Tactile diagram of a CAS calculator, produced by the SVRC (omitted).

1. Calculator advice
2. SPEVI calculator survey
3. A range of accessible options: Cranmer Abacus- Computer Algebra System calculators.
4. Demonstrate calculators of most interest to participants.
5. Senior Mathematics: comparing calculator requirements from state to state

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Which calculator is best for your student?

When advising a student about calculator options, consider:

- observing how the student operates in their Maths class.
- using the same or most similar accessible calculator to that being used in the class.
- some students prefer a hand-held unit over software options; while others prefer using the iPhone calculator or an app over another piece of specialised equipment.
- the benefit of a calculator that can be independently operated post secondary education.

- if you have a Yr. 9 or 10 student, be familiar with the approved calculator list for Year 12 exams and begin trialling & practising in Year 10.
- educate your states curriculum authority of the need for the chosen Yr 11&12 calculator and seek approval for exam use at the earliest opportunity.

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SPEVI calculator survey

STEM has presented challenges for many of our students.

Objectives of this survey:

We would be interested to know your experiences using calculators with your students. Would you please comment on the following?

- What brand and model calculators have you successfully used with your students?
- Could their display be magnified?
- Was emulation software provided with the unit?
- If emulation software was provided, was it able to be used with screen magnification software?
- Have you successfully used any calculators with speech output to meet your students STEM needs?
- What other solutions have you used instead of a calculator if no suitable calculator could be found?
- Are there any other software solutions to perform calculator functions that met your student's needs?

All responses and discussion in this challenging area will be valuable. Responses can be emailed to Pranitha.moodley@ridbc.org.au

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Types of accessible calculators

Configuration

handheld/desktop stand alone unit, software, tablet/phone application, & braille device.

Low tech

Fingers: can be used to count from 1-99 & perform addition & subtraction.

Abacus: there are benefits in teaching both vertical arithmetic & the abacus to braille users, letting them decide which they prefer.

What are the outcomes achieved by primary aged braille students performing vertical arithmetic, that can't be met by the abacus?

Need our braille students spend so much time brailleing vertical arithmetic?

Some NZ braille Maths specialists believe that vertical arithmetic is a visual technique and prefer to teach the abacus, a faster technique once learnt.

Slide 7. A range of accessible calculators

Most images from the presentation are for visual familiarisation only, and have been omitted from this document. Descriptions of the image appear if the information is useful.

Cranmer Abacus

Suppliers & description:

APH USD \$36 <https://www.aph.org/product/cranmer-abacus/>

Vision Australia \$55 <https://shop.visionaustralia.org/shop/product/braille-abacus>

Diagram of the Cranmer abacus (omitted): all beads moved away from the active bar to demonstrate the value zero.

UAbacus app gives step by step instructions for addition and subtraction (free).

App [app/](#)

Hadley School video tutorials <https://hadley.edu/InstructionalVideos/Abacus.asp>

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What calculators are working well for your students?

Please comment on the pros & cons of your experiences, as we discuss the options.

Slide eight: Table of two calculators

1. Calculator: Talking desktop calculator. Function: Four function. Audience: Primary aged. Cost: AUD \$80, USD \$55. Image: omitted. Supplier link: <https://visionaustralia/talking-desktop-calculator-earphone>
2. Calculator: Reizen Jumbo talking calculator. Function: Four function. Audience: Primary aged. Cost: USD \$29. Image: omitted. Supplier link: <https://www.maxiaids.com/reizen-12-digit-jumbo-talking-calculator> .

What Large Print options can you recommend?

Slide 9 Table of three calculators

3. Calculator: iPhone. Function: Four function (portrait mode), scientific (landscape mode). Audience: Primary & Secondary aged. Cost: included with phone. Image: omitted. Supplier: Apple.
4. Calculator: Talking scientific calculator app. Function: scientific. Audience: Primary & Secondary aged. Cost: \$7.99. Image: omitted. Supplier link: <https://apps.apple.com/us/app/talking-scientific-calculator/id411433609?ign-mpt=uo%3D8>
5. Calculator: Calcbot 2 app. Function: scientific. Audience: Primary & Secondary aged. Cost: free. Image: omitted. Supplier link: <https://itunes.apple.com/us/app/calcbot-2/id376694347?mt=8>

Slide 10 Table of four calculators

6. Calculator: Calculator Pad Edition. Function: Four function (portrait mode), scientific (landscape mode). Audience: Primary & Secondary aged. Cost: free, Image: omitted. Supplier link: <https://appadvice.com/app/calculator-pad-edition/685860762>

7. Calculator: MyScript Calculator app (App store & Google Play). Function: scientific (no audio). Audience: Secondary aged large print users. Cost:\$4.49. Image: omitted. Supplier link: <https://www.myscript.com/calculator/>

8. Calculator: Orion TI-30XS Multiview Talking. Function: scientific. Audience: Primary & Secondary aged. Cost: USD \$529. Image: omitted. Supplier link: <https://www.orbitresearch.com/product/orion-ti-30xs/>

9. Calculator: TI Smartview emulator software. Function: scientific. Audience: Secondary aged. Cost: free trial. Image: omitted. Supplier link: <https://www.orbitresearch.com/product/orion-ti-30xs/>

Slide 11. Table of four calculators

10. Calculator: Desmos Scientific online & app. Function: scientific. Audience: Secondary aged. Cost: free, Image: omitted. Supplier link: <https://www.desmos.com/scientific>

11. Calculator: SciPlus 2500, 2300 & 2200. Function: 2500 Graphing; 2300 scientific with audio; 220 scientific. Audience: Secondary aged. Cost: \$720-1030, Image: omitted. Supplier link: <https://www.quantumrlv.com.au/low-vision/portable-audio-devices>

12. Calculator: GTcalc. Function: Graphing, talking. Audience: Secondary aged. Cost: \$430, Image: omitted. Supplier: <https://www.quantumrlv.com.au/gt-calc.html>

13. Calculator: Viewplus Audio Graphing software. Function: Graphing. Audience: Secondary aged. Cost: free trial then USD \$195, Image: omitted. Supplier link: <https://viewplus.com/product/audio-graphing-calculator/>

Slide 12: Table of four calculators.

14. Calculator: Orion TI-84 talking graphics calculator and emulator. Function: Graphing. Audience: Secondary aged, emulator for large print users. Cost: USD \$649 Image: omitted. Supplier link: <https://www.orbitresearch.com/product/orion-ti-84-plus/>

15. Calculator: Desmos Graphing Calculator Online & app (App store & Google play). Function: Graphing. Audience: Secondary aged. cost: free. Image: omitted. Supplier links: Online <https://www.desmos.com/calculator>

App store: <https://apps.apple.com/us/app/desmos-graphing-calculator/id653517540>

Google Play <https://play.google.com/store/apps/details?id=com.desmos.calculator>

16. Calculator: KeyCalc BrailleNote Touch, Function: Scientific with Desmos Graphing. Audience: Primary & Secondary aged. Cost: included with BrailleNote purchase. Image: omitted. Supplier: Humanware.

17. Calculator: BrailleSense Polaris calculator. Function: Scientific with Desmos Graphing. Audience: Primary& Secondary aged. Cost: included with BrailleSense purchase. Image: omitted. Supplier: Pacific Vision

Slide 13. Table of two Computer Algebra System calculators.

18. Calculator: TI CAS Nspire emulator & app, Function: Computer Algebra System, Audience: Secondary aged large print users. Cost: 30 day free trial. Image: omitted. Supplier link:

https://education.ti.com/en/software/details/en/B4F6E4EE05B94D75AAB4DFE24B2720AE/ti-nspirexcas_pc_trial

19. Calculator: Wolfram Mathematica (online & app). Audio in command line. Function: Computer Algebra System. Audience: Secondary aged, more readily accessible to large print users. Supplier link: <https://www.wolfram.com/mathematica/pricing/students-individuals.php>

Slide 14 Senior Mathematics: calculator requirements from state to state

How many of our students attend schools that use the TI-84 Plus calculator in Yr 11&12?

The following table shows the approved type of calculator function from state to state, listing accessible options.

State/territory	Approved function	Approved calculator with accessibility option	Accessibility option
NSW	Scientific		Orion TI-30XS Multiview Talking Scientific
NT	Graphic	TI 84+ graphing, talking	
QLD	Graphic	TI 84+ graphing, talking	
SA	Graphic	TI 84+ graphing, talking	
TAS	Scientific, graphic & CAS	TI 84+, graphing, talking. Casio Classpad 300 emulator.	
VIC	CAS & scientific	TI Nspire CAS emulator. Casio Classpad 430 emulator. Wolfram Matematica CAS command line input is screen reader accessible.	
WA	Calculators must be silent, hand-held and contain their own power source, must not have the functionality to communicate wirelessly		TI 84+ graphing, talking. CAS emulators.

End of table

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My Contact details

EduVis Education support. Empowering students who are blind or have low vision.

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Slide 16. References

Freeland, A. L., Emerson, R. W., Curtis, A. B., & Fogarty, K. (2010). Exploring the relationship between access technology and standardized test scores for youths with visual impairments: Secondary analysis of the national longitudinal transition study 2. *Journal of Visual Impairment & Blindness*, 104(3), 170–182. Retrieved on 10/09/2019, from [https](https://doi.org/10.1080/2331186X.2019.1626322)

Klingenberg, O.G., Holkesvik, A.H., Augestad, L.B. (2019). Research evidence for mathematics education for students with visual impairment: A systematic review. Retrieved on 10/09/2019, from <https://www.tandfonline.com/doi/full/10.1080/2331186X.2019.1626322?scroll=top&needAccess=true>

Maguvhe, M., 2015, Teaching science and mathematics to students with visual impairments: Reflections of a visually impaired technician', *African Journal of Disability* 4(1), Art.#194, 6 pages. <http://dx.doi.org/10.4102/ajod.v4i1.194>

