

## Useful Resources for Integrating Technology in Post-secondary Mathematics Instruction

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This document aims at proposing useful resources for mathematicians who wish to (continue) integrate technology in their post-secondary mathematics teaching.

*In what follows: (P) stands for pragmatic resource, and (R) for research resource*

### 1. Status of CAS integration in University Mathematics Instruction

- a. Lavicza, Z. (2010). [Integrating technology into mathematics teaching at the university-level](#). *ZDM*. 42(1). 105-119. [See abstract](#).  
*A (chronological) overview of technology integration in university math instruction (with many references) and description of an international survey (Hungary, UK, USA) of mathematicians' conceptions and use of CAS in teaching. (R)*
- b. Buteau, C., Marshall, N., Jarvis D., & Lavicza Z. (2010) Integrating Computer Algebra Systems in Post-Secondary Mathematics Education: Preliminary Results of a Literature Review. *International Journal for Technology in Mathematics Education*. 17(2). 57-68. [See abstract](#).  
*A pilot study literature review of CAS use in tertiary mathematics. (R)*
- c. Jarvis, D., Buteau C., & Lavicza, Z. (2010). [Computer Algebra Systems in University Instruction: An International Research Study in CAS Usage and Sustainability](#).  
*This website documents the progress of a literature review, a survey of Canadian mathematicians, as well as case studies on CAS integration. (R)*

### 2. Integrating technology in undergraduate mathematics programs: departmental consideration

- a. MAA Committee on the Undergraduate Program in Mathematics: ["Section 5: Use computer technology to support problem solving and to promote understanding"](#) in Curriculum Guide 2004 (Undergraduate programs and Courses in the Mathematical Sciences — in Part I - Recommendations for departments, programs, and all courses; pp.12-14)
- b. Assude, T., Buteau, C., & Forgasz, H. (2010). [Factors Influencing Implementation of Technology-Rich Mathematics Curriculum and Practices](#). In C. Hoyles & J. Lagrange (Eds.), *Mathematics Education and Technology-Rethinking the Terrain*, New ICMI Study Series (Vol. 13, pp. 405-419). Springer US. Retrieved from [http://dx.doi.org/10.1007/978-1-4419-0146-0\\_19](http://dx.doi.org/10.1007/978-1-4419-0146-0_19)
- c. Muller, E., Buteau, C., Klincsik, M., Perjési-Hámori, I., & Sárvári, C. (2009). [Systemic integration of evolving technologies in undergraduate mathematics education and its impact on student retention](#). *International Journal of Mathematical Education in Science and Technology*, 40(1), 139. doi:[10.1080/00207390802551602](https://doi.org/10.1080/00207390802551602)

### 3. Introducing a weekly lab to 1st-year courses (calculus, linear algebra)

- a. P. Bogacki, Melrose, G. & Wohl, P. (1995). [Laboratory Manual for Calculus](#).  
*A manual, self-study guide and reference guide to using MathCAD and Maple (150 pages). (P)*
- b. Dad-del, A. [Computer Lab for Linear Algebra : MAT 22AL](#).  
*A laboratory course for introductory linear algebra. MATLAB. (P)*
- c. Rahn, J. [Calculus Labs](#).  
*An applied calculus course with weekly graphing calculator labs. (P)*

#### 4. Issues of technology integration

- a. Anderson, M., Bloom, L., Mueller, U., & Pedler, P. (1999). [The impact of the graphics calculator on the assessment of calculus and modelling](#). *International Journal of Mathematical Education in Science and Technology*, 30(4), 489. doi:[10.1080/002073999287770](#) (P)
- b. Kidron, I., & Dana-Picard, T. (2005). To See or Not to See. *International Journal for Technology in Mathematics Education*, 12(3), 115-124. (P)
- c. Oates, G. (2009) [Issues in Undergraduate Mathematics Assessment in an Integrated Technology Environment](#). (P)
- d. Paige, R., Seshaiyer, P., & Toda, M. (2008). Student Misconceptions Caused by Misuse of Technology. *International Journal for Technology in Mathematics Education*, 14(4), 189-195 (P)
- e. Pountney, D., Leinbach, C., & Etchells, T. (2002). [The issue of appropriate assessment in the presence of a CAS](#) - PB - Taylor & Francis. *International Journal of Mathematical Education in Science and Technology*, 33(1), 15. doi:[10.1080/00207390110086616](#) (R)
- f. Tiffany, P. & Farley R. (2004). [Jumpstarting Technology in the Calculus Classroom](#). *Electronic Proceedings of the 17<sup>th</sup> ICTCM*. (P)

#### 5. Evidence of impact on student learning

- a. Connors, M. A., & Snook, K. G. (2001). The Effects of Hand-Held CAS on Student Achievement in a First Year College Core Calculus Sequence. *International Journal of Computer Algebra in Mathematics Education*, 8(2), 99-114. (P)
- b. Fox, W., & West, R. (2004). Beginning with a 21<sup>st</sup> Century View: Technology and Modelling with Interdisciplinary Applications in College Algebra. *International Journal for Technology in Mathematics Education*, 11(2), 45-58. Retrieved from Education Research Complete database. (P)
- c. Park, K. & Travers, K. (1991). A Comparative Study of a Computer-Based and a Standard College First-Year Calculus Course. In Kaput, A. Schoenfeld & Ed Dubinsky (Ed.), *Research in collegiate mathematics education II* (pp. 154-176). [Link](#) (google books preview) (R)
- d. Quesada, A. R. (2003). Transforming an Introductory Linear Algebra Course with a TI-92 Hand-Held Computer. *International Journal of Computer Algebra in Mathematics Education*, 10(1), 23-34.

#### 6. Exemplary material of technology integration

- a. Langtry, T., Coupland, M., & Moore, B. (2003). [Mathematica™ in context](#). *International Journal of Mathematical Education in Science and Technology*, 34(5), 699. doi:[10.1080/0020739031000148967](#) (P)
- b. Blomhøj, M. & Kjeldsen, T. (2007) [Learning the integral concept through mathematical modeling](#). *Electronic Proceedings of the 5<sup>th</sup> CERME*. (pp. 2070-2079). (P)
- c. Lehman, J. [Calculus Computer Laboratory: Experience Guiding Current Practice](#). *Electronic proceedings of the 18<sup>th</sup> ICTCM*. (P)

#### 7. Assessment: with or without technology?

- a. Malabar , I, & Pountney, D. (2000). How Do traditional examination questions fare in the presence of a computer algebra system (CAS)? *The International Journal for Technology in Mathematics Education*, 7(4), 241-254.

**8. Programming for mathematics learning**

**9. Technology in graduate mathematics programs**

**10. Technology use in mathematics instruction for service courses**

- a. Noss, R. (1999). [Learning by design: undergraduate scientists learning mathematics](#). *International Journal of Mathematical Education in Science and Technology*, 30(3), 373. doi:[10.1080/002073999287897](#)
- b. Colgan, L. (2000). [MATLAB - in first-year engineering mathematics](#). *International Journal of Mathematical Education in Science and Technology*, 31(1), 15. doi:[10.1080/002073900287345](#) (P)
- c. [The University of Minnesota Calculus Initiative](#).  
*Several applied technology modules for calculus and engineering students. (P)*

**11. Communications Technology in the tertiary mathematics classroom**

- a. Engelbrecht, J., & Harding, A. (2005). Teaching Undergraduate Mathematics on the Internet. *Educational Studies in Mathematics*, 58(2), 253-276. doi:[10.1007/s10649-005-6457-2](#). [Link](#).

**12. Conferences welcoming participation of 'mathematicians interested in educational discussions'**

- a. *Applications of Computer Algebra*. [Link](#).
- b. *Canadian Mathematical Society Winter Meeting*. [Link](#).
- c. *Computer Algebra in Mathematics Education*. [Link](#)
- d. *Congress of the European Society for Research in Mathematics Education*. [Link](#).
- e. *Delta Symposium*. [Link](#).
- f. *International Congress on Mathematics Education*. [Link](#).
- g. *International Conference on Technology in Collegiate Mathematics*. [Link](#).
- h. *Research in Undergraduate Mathematics Education*. [Link](#).

**13. Journals publishing about technology in post-secondary mathematics instruction**

- a. *International Journal for Computers in Mathematical Learning*. [Link](#)
- b. *International Journal for Technology in Mathematics Education*. [Link](#)
- c. *International Journal of Mathematical Education in Science and Technology*. [Link](#).
- d. *Canadian Journal of Science, Mathematics and Technology Education*. [Link](#).
- e. *Educational Studies in Mathematics*. [Link](#).
- f. *For the Learning of Mathematics*. [Link](#).
- g. *Journal for Research in Mathematics Education*. [Link](#).