

# **A Quarter of a Century of Computing Education Research – Selected Writings**

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## References

### Part 1 Introductory programming education for computing specialists

- 1.1 Caspersen, M.E. and Christensen, H.B.: "**Here, There and Everywhere — On the Recurring Use of Turtle Graphics in CS1**", *Proceedings of the fourth Australasian Computing Education Conference*, ACE 2000, Melbourne, Australia, pp. 34-40. ACM Press, 2000. ISBN 1-58113-271-9.
- 1.2 Caspersen, M.E.; Christensen, H.B.: "**Frameworks in CS1 — a Different Way of Introducing Event-driven Programming**", *Proceedings of the seventh Annual Conference on Innovation and Technology in Computer Science Education*, ITiCSE 2002, Aarhus, Denmark, 24-26 June 2002.
- 1.3 Caspersen, M.E. and Bennedsen, J.: "**Instructional Design of a Programming Course: A Learning Theoretic Approach**", *Proceedings of the 3rd International Computing Education Research Conference*, Atlanta, Georgia, USA, September 2007, pp. 111-122.
- 1.4 Bennedsen, J., and Caspersen, M.E.: "**Persistence of Elementary Programming Skills**", *Computer Science Education*, Vol. 22 (2), June 2012, pp. 81-107.
- 1.5 Caspersen, M.E.: "**Principles of Programming Education**", Chapter 18 in *Computer Science Education: Perspectives on Teaching and Learning in School*, Bloomsbury Publishing, 2023, pp. 219-236.

### Part 2 Failure rates

- 2.1 Bennedsen, J.B. and Caspersen, M.E.: "**Failure Rates in Introductory Programming**", In: *SIGCSE Bulletin inroads*, Volume 39, Number 2, June 2007, pp. 32-36.
- 2.2 Bennedsen, J.B. and Caspersen, M.E.: "**Failure Rates in Introductory Programming—12 Years Later**", *ACM Inroads*, Vol. 10, No. 2, June 2019, pp. 30-36.

### Part 3 Exemplary examples

- 3.1 Börstler, J., Caspersen, M.E., and Nordström, M.: "**Beauty and the Beast — Toward a Measurement Framework for Example Program Quality**", Technical Report, Department of Computing Science, Umeå University, 2007. ISSN 0348-0542
- 3.2 Alphonse, C., Caspersen, M.E., and Decker, A.: "**Killer 'Killer Examples' for Design Patterns**", *Proceedings of the 38th SIGCSE Technical Symposium on Computer Science Education*, Covington, Kentucky, USA, 2007, pp. 228-232.
- 3.3 Börstler, J., Christensen, H.B., Bennedsen, J., Nordström, M., Westin, L.K, Moström, J.E., and Caspersen, M.E.: "**Evaluating OO Example Programs for CS1**", *Proceedings of the 13th Annual Conference on Innovation and Technology in Computer Science Education*, ITiCSE 2008, Madrid, Spain, 30 June - 2 July 2008, pp. 47-52.
- 3.4 Börstler, J., Caspersen, M.E. and Nordström, M.: "**Beauty and the Beast: on the readability of object-oriented example programs**", *Software Quality Journal*, Springer US, 2015, pp. 1-16.

### Part 4 Indicators of success for learning computer science

- 4.1 Bennedsen, J.B. and Caspersen, M.E.: "**An Investigation of Potential Success Factors for an Introductory Model-Driven Programming Course**", *Proceedings of the 1st International Computing Education Research Conference*, Seattle, Washington, USA, 2005, pp. 155-163.
- 4.2 Bennedsen, J.B. and Caspersen, M.E.: "**Abstraction Ability as an Indicator of Success for Learning Object-Oriented Programming?**", *SIGCSE Bulletin inroads*, Volume 38, Number 2, June 2006, pp. 39-43.
- 4.3 Caspersen, M.E., Bennedsen, J., and Larsen, K.D.: "**Mental Models and Programming Aptitude**", *Proceedings of the 12th Annual Conference on Innovation and Technology in Computer Science Education*, ITiCSE 2007, Dundee, Scotland, 25 - 27 June 2007, pp. 206-210.

- 4.4 Bennedsen J. and Caspersen, M.E.: "**Optimists Have More Fun, But Do They Learn Better? On the Influence of Emotional and Social Factors on Learning CS and Math**", *Computer Science Education*, Vol. 18 (1), March 2008, pp. 1-16.
- 4.5 Bennedsen, J. and Caspersen, M.E.: "**Abstraction Ability as an Indicator of Success for Performance in Learning Computer Science?**", *Proceedings of the 4th International Computing Education Research Conference*, Sydney, New South Wales, Australia, September 2008.

## Part 5 Teaching the process of programming

- 5.1 Bennedsen, J.B. and Caspersen, M.E.: "**Exposing the Programming Process**", In: Reflections on the Teaching of Programming, LNCS 4821, *Springer-Verlag*, 2008, pp. 7-18.
- 5.2 Caspersen, M.E. and Kölling, M.: "**STREAM: A First Programming Process**", *ACM Transactions on Computing Education (TOCE)*, Vol. 9 (1), Article No. 4, 2009.
- 5.3 Aureliano, V., Tedesco, P. and Caspersen, M.E.: "**Learning Programming Through Stepwise Self-explanations**", *Proceedings of CISTI 2016*, Gran Canaria, Spain, June 2016.

## Part 6 Programming education for all

- 6.1 Andersen, P.B., Bennedsen, J., Brandorff, S., Caspersen, M.E., and Mosegaard, J.: "**Teaching Programming to Liberal Arts Students — a Narrative Media Approach**", *Proceedings of the eighth Annual Conference on Innovation and Technology in Computer Science Education, ITiCSE 2003*, Thessalonica, Greece, 30 June - 2 July 2003.
- 6.2 Nowack, P. and Caspersen, M.E.: "**Model-Based Thinking and Practice — A Top-Down Approach to Computational Thinking**", *Proceedings of the 14th Koli Calling International Conference on Computing Education Research*, Koli, Finland, November 2014, pp. 147-151.

## Part 7 Informatics for all

- 7.1 Caspersen, M.E. and Nowack, P.: "**Computational Thinking and Practice — A Generic Approach to Computing in Danish High Schools**", *Proceedings of the 15th Australasian Computing Education Conference, ACE 2013*, Adelaide, South Australia, Australia, January 2013.
- 7.2 Caspersen, M.E., Gal-Ezer, J., McGettrick, A. and Nardelli, E.: "**Informatics as a Fundamental Discipline for the 21st Century**", *Communications of the ACM*, Vol. 62, No. 4, April 2019, pp. 58-63.
- 7.3 Caspersen, M.E.: "**Informatics as a Fundamental Discipline in General Education: The Danish Perspective**", chapter 7.2, pp. 191-200, in *Perspectives in Digital Humanism*, Eds.: Ghezzi, C., Lee, E., Prem, E., Werthner, H. Springer Verlag, 2021.
- 7.4 Caspersen, M.E., Dindler, C., Iversen, O.S. and Smith, R.C.: "**Computational Empowerment**", Chapter 6 in *Computational Thinking Education in K-12: Artificial Intelligence Literacy and Physical Computing*, Vol. 1, Eds.: Kong, S.-C. and Abelson, H., MIT Press, 2022.
- 7.5 Caspersen, M.E., Gal-Ezer, J., McGettrick, A. and Nardeli, E.: "**Informatics Education for School – A European Initiative**", *ACM Inroads*, Vol. 14, No. 1, March 2023, pp. 49-53.
- 7.6 Caspersen, M.E., Gal-Ezer, J., McGettrick, A. and Nardeli, E.: "**European Digital Transformation Needs Indicators of Informatics Competence**", *ACM Inroads*, Vol. 15, No. 4, December 2024, pp. 74-81.