

Tracy LOGAN  
Associate Professor  
STEM Education Research Centre  
Education  
Email: Tracy.Logan@canberra.edu.au



## Biography

Tracy Logan is an Associate Professor in Education at the University of Canberra. Her research focuses on mathematics education and in particular, how students encode and decode mathematical information. More recently, her work aims to better understand how students' spatial reasoning is critical for success in mathematics (particularly in digital environments) and how this skill can be improved through teaching.

## Qualifications

PhD, Sustaining mathematics education research: A secondary data analysis framework  
1 Jan 2014 → 1 Jul 2019  
Award Date: 1 Aug 2019

Master, Master of Education (Research), Queensland University of Technology  
Award Date: 1 Apr 2010

Bachelor, Bachelor of Education (Primary), Charles Sturt University  
Award Date: 1 Apr 2006

## Research output

### **VISUALIZATION AND SPATIAL VISUALIZATION IN GEOMETRY**

Harris, D., Logan, T. & Lowrie, T., 2024, *The Twenty-Sixth ICMI Study Advances in Geometry Education: Conference Proceedings*. Lowrie, T., Gutiérrez, A. & Emprin, F. (eds.). IREM de REIMS, p. 1-7 7 p.

### **Spatial visualization supports students' math: Mechanisms for spatial transfer**

Lowrie, T. & Logan, T., 20 Jun 2023, In: *Journal of Intelligence*. 11, 6, p. 1-21 21 p., 127.

### **Spatial visualization and measurement of area: A case study in spatialized mathematics instruction**

Harris, D., Logan, T. & Lowrie, T., Jun 2023, In: *The Journal of Mathematical Behavior*. 70, p. 1-18 18 p., 101038.

### **Sketching as a Spatial Tool: A Qualitative Study of Grade Three Students' Representation of Reflection**

Harris, D., Logan, T. & Lowrie, T., 2023, *Proceedings of the 45th Annual Conference of the Mathematics Education Research Group of Australasia, July 2-6: Weaving mathematics education research from all perspectives*. Reid-O'Connor, B., Prieto-Rodriguez, E., Holmes, K. & Hughes, A. (eds.). Mathematics Education Research Group of Australasia, p. 1-8 8 p.

### **Authentic Perspective-taking: Looking beyond abstract spatial skills to the influence of culture and environment.**

Harris, D., Logan, T. & Lowrie, T., Apr 2022, In: *Learning, Culture and Social Interaction*. 33, p. 1-16 16 p., 100611.

### **Culture and geography: how do primary students map their local environment?**

Lowrie, T., Jorgensen, R., Logan, T. & Harris, D., Apr 2022, In: *The Australian Educational Researcher*. 49, 2, p. 261-284 24 p.

### **Unpacking mathematical-spatial relations: Problem-solving in static and interactive tasks**

Harris, D., Logan, T. & Lowrie, T., Sept 2021, In: *Mathematics Education Research Journal*. 33, 3, p. 495-511 17 p.

### **Spatial reasoning, mathematics, and gender: Do spatial constructs differ in their contribution to performance?**

Harris, D., Lowrie, T., Logan, T. & Hegarty, M., Mar 2021, In: *British Journal of Educational Psychology*. 91, 1, p. 409-441 33 p.

**Contextualising space: Using local knowledge to foster students' Location and Transformation skills**

Harris, D., Logan, T. & Lowrie, T., 2021, *Proceedings of the 43rd annual conference of the Mathematics Education Research Group of Australasia*. Leong, Y. H., Kaur, B., Choy, B. H., Yeo, J. B. W. & Chin, S. L. (eds.). Singapore: Mathematics Education Research Group of Australasia, p. 227-234 8 p.

**The Impact of a Spatial Intervention Program on Students' Spatial Reasoning and Mathematics Performance**

Lowrie, T., Harris, D., Logan, T. & Hegarty, M., 2021, In: *Journal of Experimental Education*. 89, 2, p. 259-277 19 p.

**In search of the mechanisms that enable transfer from spatial reasoning to mathematics understanding**

Lowrie, T., Resnick, I., Harris, D. & Logan, T., 20 Jun 2020, In: *Mathematics Education Research Journal*. 32, 2, p. 175-188 14 p.

**The relation between mathematics achievement and spatial reasoning**

Resnick, I., Harris, D., Logan, T. & Lowrie, T., 30 May 2020, In: *Mathematics Education Research Journal*. 32, 2, p. 171-174 4 p.

**The re-emergence of spatial reasoning within primary years mathematics education**

Woolcott, G., Logan, T., Marshman, M., Ramful, A., Whannell, R. & Lowrie, T., 1 Apr 2020, *Research in Mathematics Education in Australasia 2016-2019*. Way, J., Attard, C., Anderson, J., Bobis, J., McMaster, H. & Cartwright, K. (eds.). Singapore: Springer, p. 245-268 23 p.

**A practical, iterative framework for secondary data analysis in educational research**

LOGAN, T., Mar 2020, In: *The Australian Educational Researcher*. 47, 1, p. 129-148 20 p.

**The Influence of Spatial Visualization Training on Students' Spatial Reasoning and Mathematics Performance**

LOWRIE, T., LOGAN, T. & HEGARTY, M., 20 Oct 2019, In: *Journal of Cognition and Development*. 20, 5, p. 729-751 23 p.

**Facebook as a mechanism for informal teacher professional learning in Indonesia**

PATAHUDDIN, S. & LOGAN, T., 1 Jan 2019, In: *Teacher Development*. 23, 1, p. 101-120 20 p.

**Early Learning STEM Australia (ELSA): The Policy and Practice(s) of Engagement in the Early Years**

LOWRIE, T. & LOGAN, T., 2019, *Mathematics Education Research: Impacting Practice (Proceedings of the 42nd annual conference of the Mathematics Education Research Group of Australasia): Proceedings of the 42nd Annual Conference of the Mathematics Education Research Group of Australasia*. Hine, G., Blackley, S. & Cooke, A. (eds.). Adelaide, Australia: Mathematics Education Research Group of Australasia, p. 73-76 4 p.

**Part I Commentary 3: Proposing a pedagogical framework for the teaching and learning of spatial skills: A commentary on three chapters.**

LOWRIE, T. & LOGAN, T., 8 Dec 2018, *Visualizing mathematics: The role of spatial reasoning in mathematical thought*. 1 ed. The Netherlands: Springer, p. 171-182 12 p. (Research in Mathematics Education).

**The interaction between spatial reasoning constructs and mathematics understandings in elementary classrooms.**

LOWRIE, T. & LOGAN, T., 1 Dec 2018, *Visualizing mathematics: The role of spatial reasoning in mathematical thought*. Mix, K. S. & Battista, M. T. (eds.). 1 ed. Springer, p. 253-276 24 p. (Research in Mathematics Education).

**The impact of an intervention program on students' spatial reasoning: Student engagement through mathematics enhanced learning activities**

Lowrie, T., Logan, T., Harris, D. & Hegarty, M., Dec 2018, In: *Cognitive Research: Principles and Implications*. 3, 50, p. 1-10 10 p.

**A learning design for developing mathematics understanding: The ELPSA framework**

Lowrie, T., Logan, T. & Patahuddin, S., Nov 2018, In: *Australian Mathematics Teacher*. 74, 4, p. 26-31 6 p.

**Capturing student mathematical engagement through differently enacted classroom practices: Applying a modification of Watson's analytical tool**

Patahuddin, S., Puteri, I., Lowrie, T., Logan, T. & Rika, B., 3 Apr 2018, In: International Journal of Mathematical Education in Science and Technology. 49, 3, p. 384-400 17 p.

**Characteristics of spatial visualisation: Perspectives from area of composite shapes**

PATAHUDDIN, S., LOGAN, T. & RAMFUL, A., 2018, *Making Waves, Opening Spaces: Proceedings of the 41st annual conference of the Mathematics Education Research Group of Australasia*. Hunter, J., Darragh, L. & Perger, P. (eds.). Adelaide: Mathematics Education Research Group of Australasia Inc., p. 623-630 8 p.

**Measurement of Spatial Ability: Construction and Validation of the Spatial Reasoning Instrument for Middle School Students**

Ramful, A., Lowrie, T. & Logan, T., Oct 2017, In: Journal of Psychoeducational Assessment. 35, 7, p. 709-727 19 p.

**Gender perspectives on spatial tasks in a national assessment: A secondary data analysis**

Logan, T. & Lowrie, T., 1 Aug 2017, In: Research in Mathematics Education. 19, 2, p. 199-216 18 p.

**Decoding map items through spatial orientation: Performance differences across grade and gender**

Logan, T., Lowrie, T. & Ramful, A., 2017, *Proceedings of the 41st annual conference of the International Group for the Psychology of Mathematics Education*. Kaur, B., Ho, W. K., Toh, T. L. & Choy, B. H. (eds.). Singapore: The International Group for the Psychology of Mathematics Education (IGPME) Inc, Vol. 3. p. 193-200 8 p.

**The influence of students' spatial reasoning on mathematics performance across different test mode formats**

LOWRIE, T. & LOGAN, T., 2017, *Proceedings of the 41st annual conference of the International Group for the Psychology of Mathematics Education*. Kaur, B., Ho, W. K., Toh, T. L. & Choy, B. H. (eds.). Singapore: International Group for the Psychology of Mathematics Education (IGPME) Inc, Vol. 3. p. 201-208 8 p.

**The "math" in STEM practices: The role of spatial reasoning in the early years**

Lowrie, T., Logan, T. & Larkin, K., 2017, *40 years on: We are still learning! : Proceedings of the 40th Annual Conference of the Mathematics Education Research Group of Australasia*. Downton, A., Livy, S. & Hall, J. (eds.). Melbourne: Mathematics Education Research Group of Australasia, p. 625-628 4 p.

**Visuospatial training improves elementary students' mathematics performance**

LOWRIE, T., LOGAN, T. & RAMFUL, A., 2017, In: British Journal of Educational Psychology. 87, 2, p. 170-186 17 p.

**Cross cultural comparison of grade 6 students' performance and strategy use on graphic and non-graphic tasks**

Lowrie, T., Logan, T. & Ramful, A., Dec 2016, In: Learning and Individual Differences. 52, p. 97-108 12 p.

**Spatial Reasoning Influences Students' Performance on Mathematics Tasks**

Lowrie, T., Logan, T. & Ramful, A., 1 Jul 2016, *39th annual conference of the Mathematics Education Research Group of Australasia: Opening up mathematics education research*. White, B., Chinnappan, M. & Trenholm, S. (eds.). Adelaide: Mathematics Education Research Group of Australasia Incorporated, p. 407-414 8 p.

**Reflections on the MERGA Research Review 2008-2011: Taking stock**

Perry, B., MacDonald, A., Greenlees, J., LOGAN, T. & LOWRIE, T., 2016, *Research in mathematics education in Australasia 2012-2015*. Makar, K., Dole, S., Visnovska, J., Goos, M., Bennison, A. & Fry, K. (eds.). Singapore: Springer, p. 13-27 15 p.

**The influence of test mode and visuospatial ability on mathematics assessment performance**

LOGAN, T., 1 Dec 2015, In: Mathematics Education Research Journal. 27, 4, p. 423-441 19 p.

**Digital game and mathematics learning: The state of play**

LOGAN, T. & Woodland, K., 2015, *Digital games and mathematics learning: Potential, promises and pitfalls*. Lowrie, T. & Jorgensen, R. (eds.). Netherlands: Springer, Vol. 4. p. 277-304 28 p.

### **Facebook as a learning space: An analysis from a community of practice perspective**

PATAHUDDIN, S. & LOGAN, T., 2015, *Mathematics in the margins (Proceedings of the 38th annual conference of the Mathematics Education Research Group of Australasia)*. Marshman, M., Geiger, V. & Bennison, A. (eds.). Queensland: Mathematics Education Research Group of Australasia, p. 485-492 8 p.

### **Starting a Conversation about Open Data in Mathematics Education Research**

LOGAN, T., 2015, *Mathematics education in the margins: Proceedings of the 38th annual conference of the Mathematics Education Research Group of Australasia*. Marshman, M., Geiger, V. & Bennison, A. (eds.). Queensland: Mathematics Education Research Group of Australasia, p. 373-380 8 p.

### **Students' performance on graphics-rich mathematics tasks: Interactions between gender and culture**

Lowrie, T. & Logan, T., 2015, In: *The Mathematics Educator*. 16, 1, p. 91-104 14 p.

### **The role of test-mode effect: Implications for assessment practices and item design**

LOWRIE, T. & LOGAN, T., 2015, *In Pursuit of Quality Mathematics Education for All (Proceedings of the 7th ICMI-East Asia Regional Conference on Mathematics Education)*. Yu, C. V. (ed.). Philippines: Philippine Council of Mathematics Teachers Educators (MATHTED, Inc, Vol. 12. p. 649-656 8 p.

### **Co-thought gestures : supporting students to successfully navigate map tasks**

LOGAN, T., LOWRIE, T. & Diezmann, C., Sept 2014, In: *Educational Studies in Mathematics*. 87, 1, p. 87-102 16 p.

### **Do students solve graphic tasks with spatial demands differently in digital form?**

LOWRIE, T., RAMFUL, A., LOGAN, T. & HO, S. Y., 2014, *Curriculum in Focus: Research Guided Practice: Proceedings of the 37th Annual Conference of the Mathematics Education Research Group of Australasia*. Anderson, J., Cavanagh, M. & Prescott, A. (eds.). Adelaide: MERGA Inc, p. 429-436 8 p.

### **The influence of graphics in mathematics test item design**

Greenlees, J. & LOGAN, T., 2014, *Proceedings on the Joint Meeting of PME 38 and PME-NA 36*. Oesterle, S., Liljedahl, P., Nicol, C. & Allan, D. (eds.). Vancouver, Canada: International Group for the Psychology of Mathematics Education (IGPME) Inc, Vol. 3. p. 209-216 8 p.

Navigating and decoding dynamic maps: Gender preferences and engagement differences within and outside of game experiences

LOWRIE, T., Jorgensen, R. & LOGAN, T., 2013, In: *Australasian Journal of Educational Technology*. 29, 5, p. 626-639 14 p.

Students' performance on a symmetry task

HO, S. Y. & LOGAN, T., 2013, *Mathematics Education: Yesterday, today and tomorrow-Proceedings of the 36th annual conference of the Mathematics Education Research Group of Australasia*. Steinle, V., Ball, L. & Bardini, C. (eds.). Melbourne, Australia: Mathematics Education Research Group of Australasia Inc., p. 747-750 4 p.

The classic word problem: The influence of direct teaching

LOGAN, T. & HO, S. Y., 2013, *Mathematics Education: Yesterday, today and tomorrow-Proceedings of the 36th annual conference of the Mathematics Education Research Group of Australasia*. Steinle, V., Ball, L. & Bardini, C. (eds.). Melbourne, Australia: Mathematics Education Research Group of Australasia Inc., p. 743-746 4 p.

### **Visual processing on graphics task: The case of a street map**

Logan, T. & Lowrie, T., 2013, In: *Australian Primary Mathematics Classroom*. 18, 4, p. 8-13 6 p.

Research in mathematics education in Australasia 2008-2011

Perry, B., Lowrie, T., Logan, T., MacDonald, A. & Greenlees, J., 1 Jan 2012, Sense Publishers. 377 p.

A framework for mathematics graphical tasks: the influence of the graphic element on student sense making

LOWRIE, T., Diezmann, C. & LOGAN, T., 2012, In: *Mathematics Education Research Journal*. 24, 2, p. 169-187 19 p.

Assessment beyond all: The changing nature of assessment

LOWRIE, T., Greenlees, J. & LOGAN, T., 2012, *Research in mathematics education in Australasia 2008-2011*. Perry, R., Lowrie, T., Logan, T., MacDonald, A. & Greenlees, J. (eds.). Rotterdam, The Netherlands: Sense Publishers, p. 143-165 23 p.

Gender factors in primary-aged Singaporean students' performance on mathematics tasks

Logan, T. & Lowrie, T., 2012, *Proceedings of the 36th Annual Conference of International Group for Psychology of Mathematics Education : Opportunities to learn in mathematics education*. Tso, T-Y. (ed.). Taipei, Taiwan: The International Group for the Psychology of Mathematics Education (IGPME) Inc, Vol. 3. p. 177-184 8 p. (International Group for the Psychology of Mathematics Education; vol. 1).

Mathematics experiences with digital games: Gender, geographic location and preference

LOWRIE, T., Jorgensen, R. & LOGAN, T., 2012, *Opportunities to learn in mathematics education*. Tso, T-Y. (ed.). Taipei, Taiwan: International Group for the Psychology of Mathematics Education (IGPME) Inc, Vol. 3. p. 185-192 8 p.

Perspectives on Geometry and Measurement in the National Curriculum: Mathematics

LOWRIE, T., LOGAN, T. & Scriven, B., 2012, *Engaging the Australian National Curriculum: Mathematics - perspectives from the field*. Atweh, B., Goos, M., Jorgensen, R. & Siemon, D. (eds.). 1 ed. Australia: Mathematics Education Research Group of Australasia, p. 71-88 18 p.

Primary students' performance on map tasks: The role of context

Lowrie, T., Diezmann, C. & Logan, T., 2011, *Developing Mathematical Thinking*. Ubuz, B. (ed.). Ankara, Turkey: International Group for the Psychology of Mathematics Education (IGPME) Inc, Vol. 3. p. 145-152 8 p. (Conference of the International Group for the Psychology of Mathematics Education; vol. 1).

Understanding graphicacy: Students' sense making on mathematics assessment items

Lowrie, T., Diezmann, C. & Logan, T., 2011, In: *International Journal for Mathematics Teaching and Learning*. p. 1-32 32 p.

Gender differences in orientation on primary students' performance on items rich in graphics

LOWRIE, T., Diezmann, C. & LOGAN, T., 2009, *In search for theories in mathematics education*. Tzekaki, M., Kaldrimidou, M. & Sakonidis, H. (eds.). Thessaloniki, Greece: International Group for the Psychology of Mathematics Education (IGPME) Inc, Vol. 4. p. 33-39 7 p.

The visual side to numeracy: Students' sensemaking with graphics

Diezmann, C., Lowrie, T., Sugars, L. & Logan, T., 2009, In: *Australian Primary Mathematics Classroom*. 14, 1, p. 16-20 5 p.

Standardised assessment in mathematics: The tale of two items

LOGAN, T. & Greenlees, J., 2008, *Navigating currents and charting directions-Proceedings of the 31st annual conference of the Mathematics Education Research Group of Australasia*. Goos, M., Brown, R. & Makar, K. (eds.). Brisbane, Australia: Mathematics Education Research Group of Australasia Inc., Vol. 2. p. 655-658 4 p.

Using spatial skills to interpret maps: Problem solving in realistic contexts

Lowrie, T. & Logan, T., 2006, In: *Australian Primary Mathematics Classroom*. 12, 4, p. 14-19 6 p.

## Awards