

Orly Buchbinder - Curriculum Vitae

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EDUCATION

2010 **Ph.D., Mathematics Education**

Dept. of Education in Technology & Science. Technion, Israel.

Thesis: The role of examples in establishing the validity of universal and existential mathematical statements. (Supervisors: Orit Zaslavsky & Uri Leron).

For English abstract of my Ph.D. thesis:

<http://www.graduate.technion.ac.il/Theses/Abstracts.asp?Id=25132>

2005 **M.Sc. (Cum Laude), Mathematics Education**

Dept. of Education in Technology & Science. Technion, Israel.

Thesis: Counter Examples in Mathematics: Generation Processes and Modes of their Use. (Supervisor: Orit Zaslavsky).

For English abstract of my M.Sc. thesis:

<http://www.graduate.technion.ac.il/Theses/Abstracts.asp?Id=19175>

1998 **B.Sc. (Cum Laude), Mathematics Education**

Dept. of Education in Technology & Science. Technion, Israel.

PROFESSIONAL EXPERIENCE

2014 – to **Assistant Professor of Mathematics Education**

date *Department of Mathematics and Statistics, University of New Hampshire*

Courses taught:

MATH 425 - Calculus I

MATH 709 – Teaching Mathematics in Grades 7-12

MATH 760 – College Geometry (writing intensive)

MATH 790 – Historical Foundations of Mathematics

MATH 928 – Reasoning and Proof across Secondary Curriculum

MATH 958 – Foundations of Mathematics Education

MATH 978 – Topics in Mathematics Education

2014 – to **Research Affiliate**

date *The Center for Mathematics Education, University of Maryland, US.*

Thought Experiments in Mathematics Teaching (ThEMaT). PIs: Dr. Daniel Chazan, University of Maryland – College Park, and Dr. Patricio Herbst, University of Michigan.

2011 – 2014 **Research Associate / Postdoctoral fellow**

The Center for Mathematics Education, University of Maryland, US.

NSF-funded project ThEMaT (Thought Experiments in Mathematics Teaching) led by D. Chazan and P. Herbst. The project examined mathematics teachers' practical rationality and norms, using innovative technologies and

mixed-methods techniques. Supervised a team of graduate students, and coordinated the work on: design and piloting of rich-media online surveys; data collection and analysis; managing project documentation; writing technical reports and journal papers. Specialize in creating online educational experiences for pre-service and in-service teachers.

2013 – 2014 **Co-Instructor and Instructor**

The Center for Mathematics Education, University of Maryland, US.

EDCI 457 - Teaching and Learning Middle School Mathematics;
MATH 312 - Mathematical Reasoning and Proof for Pre-Service Middle School Teachers.

2007 – 2015 **Co-Author and Consultant**

Curriculum Development Project, Technion, Israel.

Co-Author of a team-written mathematics textbook series for grades 7-9, including teacher guides, and of a mathematical and pedagogical resource book for teachers on Teaching and Learning Calculus.

2008 – 2011 **Mentor**

Outreach program for fostering excellence in mathematics, Technion, Israel.

Responsible for designing and conducting in-service professional development workshops for middle and high school mathematics teachers.

2008 – 2011 **Instructor, Clinical faculty**

Dept. of Education in Technology & Science, Technion

214206 – Algebra in Junior High school

214207 – Geometry in Junior High School

2004 – 2011 **Co-instructor and Teaching Assistant**

Dept. of Education in Technology & Science- Technion

214103 – Teaching Methods and Skills

214206 – Algebra in Junior High school

214207 – Geometry in Junior High School

214208 – Mathematics in Senior High School

2000 – 2005 **Secondary Mathematics Teacher**

Bosmat High School, Haifa, Israel.

Taught all secondary mathematics courses: Algebra, Geometry, Statistics, Trigonometry and Calculus; and specialized in preparing students for the National Matriculation Examinations at three ability levels: low, middle and high.

2000 - 2002 **Science and Mathematics Instructor**

Education Center of Israel National Museum of Science, Technology and Space.

Responsible for developing innovative learning materials in physics and mathematics for the Museum's Education Center; taught a variety of science topics for all levels and grades: K-12; designed and taught workshops for mathematics and science teachers, and for general public.

1998 - 2001 **Secondary Mathematics Teacher**
Krayot Gymnasium- High School and College, Israel.

AWARDS AND HONORS

2008 Award for Consistent Excellence in Teaching, Technion.
2007 Israeli Ministry of Education special scholarship for excellent doctoral candidates.
2007 The Levi Eshkol, Israeli Ministry of Science special scholarship for excellent doctoral candidates.
2007 Kaplan Award for excellent doctoral candidates, Technion.
2006 M.Sc. in Mathematics Education - Cum Laude.
2006 Avital Foundation Prize for promoting teaching initiatives in mathematics education.
2006, 2007, 2008 Three times winner of Vivian Konigsberg Award for Excellence in Teaching, Technion.
2005 Kaplan Award for excellent master candidates, Technion.
1998 B.Sc. in Mathematics Education - Cum Laude.

GRANT WORK

2017 – 2021: National Science Foundation - Noyce Scholarship Program 111089470:
Culturally Responsive and Effective Stem Teaching (CREST): Strengthening the Foundation for Teacher Success in High Needs Schools. PI: Dawn Meredith; Co-PIs: **Orly Buchbinder**, Margaret Greenslade, Carrie Hall, and Elysse ; \$1,429,337
2017 - 2020: National Science Foundation - IUSE 1711163: *Enhancing Preparation of Secondary Preservice Mathematics Teachers: Mathematical Reasoning and Proving as a Lens for Teaching.* PI: **Orly Buchbinder**, Co-PI: Sharon McCrone. \$ 283,249.
2014 – 2017: *LessonSketch Research and Development Fellow.* One of ten fellows in the U.S. selected by the ThEMaT 3 project (PI Daniel Chazan) to create and disseminate rich media modules for mathematics teacher preparation courses.

PUBLICATIONS

Journal publications & Book Chapters

Buchbinder, O. (accepted). Supporting prospective secondary mathematics teachers in creating instructional explanations through video based experience. Accepted to *Journal of Technology and Teacher Education*.
Buchbinder, O., & Zaslavsky, O. (accepted pending revisions). Students' understanding of the role of examples in proving: strengths and inconsistencies. Submitted to *Journal of Mathematical Behavior*.

- Buchbinder, O., Chazan, D. & Capozzoli, M. (under review). Solving Equations: Exploring Instructional Exchanges as Lenses to Understand Teaching and its Resistance to Reform. Submitted to *Journal for Research in Mathematics Education*.
- Buchbinder, O. (2018). Systematic exploration of examples as proof: analysis with four theoretical frameworks. In G. Harel and A. Stylianides (Eds.), *Advances in mathematics education research on proof and proving: An international perspective*. (pp. 253-268). Springer, Cham.
- Buchbinder, O., & Cook, A. (2018). Examining the mathematical knowledge for teaching of proving in scenarios written by pre-service teachers. In O. Buchbinder & S. Kuntze (Eds.), *Mathematics Teachers Engaging with Representations of Practice* (pp. 131-154). Springer, Cham.
- Buchbinder, O., & Kuntze, S. (2018). Representations of Practice in Teacher Education and Research—Spotlights on Different Approaches. In O. Buchbinder & S. Kuntze (Eds.), *Mathematics Teachers Engaging with Representations of Practice* (pp. 1-8). Springer, Cham.
- Buchbinder, O. (2018). “Who is right?” What students’ and prospective teachers’ responses to scripted dialog reveal about their conceptions of proof. In R. Zazkis & P. Herbst (Eds.), *Scripting approaches in mathematics education: Mathematical dialogues in research and practice* (pp. 89-113), New York, NY: Springer
- Buchbinder, O. (2017). Guided discovery of the Nine-point Circle Theorem and its proof. *International Journal of Mathematical Education in Science and Technology*, 49(1), 1-16. doi.org/10.1080/0020739X.2017.1363422
- Buchbinder, O., Ron, G., Zodik, I. & Cook, A. (2016). What can you infer from this example? Applications of on-line, rich-media task for enhancing pre-service teachers’ knowledge of the roles of examples in proving. In A. Leung and J. Bolite-Frant (Eds.), *Digital Technologies in Designing Mathematics Education Tasks – Potential and Pitfalls*. (pp. 215-235). Springer, Cham.
- Buchbinder, O., Chazan, D., & Fleming, E. (2015). Insights into the school mathematics tradition from solving linear equations. *For the Learning of Mathematics*, 35(2), 1-8.
- Pedemonte, B. & Buchbinder, O. (2011). Examining the role of examples in proving processes through a cognitive lens. *ZDM - The International Journal on Mathematics Education*, 43(2), 257-267.
- Buchbinder, O. & Zaslavsky, O. (2011). Is this a coincidence? The role of examples in fostering a need for proof. *ZDM - The International Journal on Mathematics Education*, 43(2), 269-281.

Peer-reviewed conference proceedings

- Buchbinder, O. (2016). Supporting classroom implementation of proof-oriented tasks: lessons from teacher researcher collaboration. Paper presented at 10th Congress of European Research in Mathematics Education (CERME 10) https://keynote.conference-services.net/resources/444/5118/pdf/CERME10_0281.pdf

- Buchbinder, O. (2016). Attending to structure of mathematical statements: secondary students' difficulties and interpretations. Paper presented at AERA 2016 Conference.
<http://www.aera.net/Publications/OnlinePaperRepository/AERAOnlinePaperRepository>
- Buchbinder, O. (2016). Systematic exploration of examples as proof: analysis from four theoretical perspectives. Paper presented at ICME 13 - International Congress on Mathematical Education, Hamburg, Germany. July 2016.
- Buchbinder, O., & Cook, A. (2015). Pre-service teachers' construction of algebraic proof through exploration of math-tricks. In K. Krainer; N. Vondrová (Eds.). *Proceedings of 9th Congress of European Research in Mathematics Education*, Prague, Czech Republic (pp.100-106). <https://hal.archives-ouvertes.fr/CERME9-TWG01/hal-01280547v1>
- Buchbinder, O., & Zaslavsky, O. (2013). A Holistic Approach for Designing Tasks that Capture and Enhance Mathematical Understanding of a Particular Topic: The Case of the Interplay between Examples and Proof. In C. Margolinas (Ed.). *Proceedings of ICMI Study 22: Task Design in Mathematics Education Conference*, (Vol. 1, pp. 27-35) Oxford, UK.
- Buchbinder, O., & Zaslavsky, O. (2013). Inconsistencies in students' understanding of proof and refutation of mathematical statements. In A. M. Lindmeir & A. Heinze (Eds.). *Proceedings of the 37th Conference of the International Group for the Psychology of Mathematics Education*, (Vol. 2, pp. 129-136). Kiel, Germany: PME.
- Buchbinder, O. & Zaslavsky, O. (2009). A framework for understanding the status of examples in establishing the validity of mathematical statements. In Tzekaki, M., Kaldrimidou, M. & Sakonidis, C. (Eds.). *Proceedings of the 33rd Conference of the International Group for the Psychology of Mathematics Education*. (Vol. 2, pp. 225-232). Thessaloniki, Greece.
- Buchbinder, O., & Zaslavsky, O. (2009). Uncertainty: A driving force in creating a need for proving. Online collection of accepted papers of the *International Commission on Mathematical Instruction (ICMI), Study 19: Proof and Proving in Mathematics Education*, Taipei, Taiwan, May 2009.
- Buchbinder, O. & Zaslavsky, O. (2007). How to decide? Students' ways of determining the validity of mathematical statements. In D. Pita-Fantasy & G. Philippot (Eds.), *Proceedings of the 5th Congress of the European Society for Research in Mathematics Education* (pp. 561-571), Larnaca, University of Cyprus.

Mathematics Textbooks Co-authored

- Pedagogical Secretariat, Israeli Ministry of Education (2013). *Teaching and Learning of Calculus: mathematical and pedagogical resource book for teachers*. (In Hebrew). Tel-Aviv: Maalot Publications. Full electronic version:
http://cms.education.gov.il/EducationCMS/Units/Mazkirut_Pedagogit/Matematika/ChativaElyona/Analiza.htm
- Efshar Gam Acheret (2010). [*There is another way*]. Team-written mathematics textbooks and teacher guides for 7th, 8th and 9th grades. Bonus Books Publishing Company. (in Hebrew). A product of the curriculum design projects. Sample electronic version:
<http://www.matheducation.co.il/sites/default/files/books/ega8b/index.html>.

Buchbinder, O. & Shmueli, E. (2005): *Mathematics for State Final Examination – module 3*. Ort Publications, Tel-Aviv. (Mathematical textbook for high schools, (in Hebrew). Includes chapters on Algebra, Geometry, and Calculus).
<http://demo.ort.org.il/clickit2/files/forums/608292931/667215698.JPEG>

Publications in Progress

Buchbinder, O., Milewski, A., Chazan, D., & Cappozoli, M. (in preparation). Algebra teachers' decision making about non-standard student solutions when solving linear equations.

CONFERENCES AND SEMINARS

Conference Presentations

February 2018: *Mathematical Reasoning and Proving for Prospective Secondary Teachers*. (with S. McCrone) Poster presented at RUME conference, San Diego, CA.

April 2017: *Can algebra word problems be solved without an equation? Surveying teachers*. (with D. Chazan and S. Sharpe). Paper presented at NCTM research conference, San Antonio, TX.

February 2017: *Supporting classroom implementation of proof-oriented tasks: lessons from teacher researcher collaboration*. Paper presented at the 10th Congress of European Research in Mathematics Education (CERME), Dublin, Ireland

February 2017: *Supporting students' reasoning and proving in geometry: Analysis of PSTs' lesson scripts*. (With A. Cook, R. Sears). Paper presented at 21th Annual Conference of the Association of Mathematics Teacher Educators (AMTE), Orlando, FL.

February 2017: *Considering Technique and Purpose as Represented in Lesson Plans*. (With K. Bieda, L. Males). Paper presented at 21th Annual Conference of the Association of Mathematics Teacher Educators (AMTE), Orlando, FL.

July 2016: *Systematic exploration of examples as proof: analysis from four theoretical perspectives*. Paper presented at ICME 13 - International Congress on Mathematical Education, Hamburg, Germany.

July 2016: *Using representations of practice for teacher education and research – opportunities and challenges*. (With S. Kuntze, C. Webel, A. Dreher, M. Friesen). Discussion Group presented at ICME 13 - International Congress on Mathematical Education, Hamburg, Germany.

April 2016: *Attending to structure of mathematical statements: secondary students' difficulties and interpretations*. Paper presented at AERA - The Annual Conference of the American Educational Research Association, Washington DC.

February 2016: *Enhancing prospective teachers' knowledge of proof and dispositions towards productive struggle through exploration of Math-tricks*. (With A. Cook). Paper presented at the 20th Annual Conference of the Association of Mathematics Teacher Educators (AMTE), Irvine, CA.

February 2016: *Supporting Prospective Secondary Teachers' Understanding of the Common Core Standards for Mathematical Practice*. (With K. Bieda, L. Males, S. Otten).

Paper presented at the 20th Annual Conference of the Association of Mathematics Teacher Educators (AMTE), Irvine, CA.

November 2015: *What can you infer from this example? An experience for enhancing pre-service teachers' knowledge of the roles of examples in proving.* Working Group on Representations of Mathematics Teaching and Their Use in Transforming Teacher Education: Studying Preservice Teachers' Learning from Work with Representations of Teaching. (With P. Herbst, D. Chazan, A. Milewski, U. Gursel, J. Amidon, O. Buchbinder, R. Wieman). 37th Annual Conference of the North American Chapter of the International Group for the Psychology of Mathematics Education (PME-NA 2015). Michigan State University, East Lansing, MI.

April 2015: *Surveying an exchange at the heart of the doing of word problems in school* (With D. Chazan) Paper presented in the Research Symposium at AERA, The Annual Conference of the American Educational Research Association, Chicago, IL.
<http://www.aera.net/Publications/OnlinePaperRepository/AERAOnlinePaperRepository>

Have reform impact teachers' views on solving word problems without equations? (With D. Chazan). Paper presentation at NCTM 2015, Boston, MA.

February 2015: *Pre-service teachers' construction of algebraic proof through exploration of math-tricks* (With A. Cook). Paper presented at the 9th Congress of European Research in Mathematics Education (CERME), Prague, Czech Republic.

April 2014: *Using Representations of Practice in Survey Research with Mathematics Teachers.* (With D. Chazan, J. Dimmel, A. Erikson, K. Hanby, P. Herbst, R. Phillip) Research Symposium given at NCTM research pre-session, New Orleans, LA.

February 2014: *The use of pedagogies of enactment in practice-based mathematics teacher education and professional development.* (with J. Walkoe and A. Edwards) Extended sessions given at AMTE, Irvine, CA.

April 2013: *Assessing recognition of norms of doing word problems: Multimedia questionnaires and analytic techniques.* (with D. Chazan) Paper presented at the NCTM research pre-session, Denver, CO.

April 2013: *Is this a coincidence? Students' understanding of the role of examples in proving or refuting of algebraic statements.* (with O. Zaslavsky). Paper presented at the NCTM research pre-session, Denver, CO.

April 2013: *Using non-standard student solutions to probe what it means to solve linear equations in school.* (with D. Chazan). Paper presented at AERA, The Annual Conference of the American Educational Research Association, San Francisco, CA. Available at: <file:///C:/Users/Orly%20Buchbinder/Downloads/609937.1.pdf>

June 2012: *Helping teachers support students' understanding of the roles of examples in determining the validity of mathematical statements: workshop in planning.* Poster presentation at The 3rd Conference Creating and Using Representations of Mathematics Teaching in Research and Teacher Education. University of Michigan, Ann Arbor, MI.

July 2011: *The role of examples in establishing the validity of universal and existential mathematical statements*. Colloquium Lecture at Institut für Mathematik and Informatik, Ludwigsburg, Germany.

October 2007: Attended an international workshop: *The role of examples in mathematical thinking and learning*. Certosa di Pontignano, Siena, Italy.

An invited workshop, organized by the University of Siena, Italy addressed contemporary issues of the role and effective use of examples in teaching and learning mathematics. The workshop resulted in two research papers (one with O. Zaslavsky and one with B. Pedemonte) which appeared in Special issue on 'Examples in Mathematical Thinking and Learning from an Educational Perspective'. ZDM - The International Journal on Mathematics Education.

March 2007: *Counterexamples in mathematics as vehicles to enhance content knowledge and argumentation skills*. Developer and Instructor of the workshop session for the Annual Conference of Kesher-Cham – The Israeli Pedagogical Center for the Improvement of Mathematics Education.

March 2007: *Proofs and Refutations – the model of knowledge construction*. Developer and Instructor of the workshop session for the Annual Conference of Kesher-Cham – The Israeli Pedagogical Center for the Improvement of Mathematics Education.

PROFESSIONAL DEVELOPMENT AND OUTREACH

October 2016: *Argumentation and critical thinking in and outside the classroom – more of the same, or totally different?* – Presentation at The Association of Teachers of Mathematics in New England (ATMNE) annual conference in Manchester NH.

March 2016: *Proportional Reasoning in the Elementary Grades: Beyond Ratios and Missing-Value Problems* (With S. McCrone). NHTM Spring Conference at Keene, NH.

March 2016: *Exploring Ratios in Nature with Technology*. Workshop session at 2016 Girls Technology Day, Durham, NH.

September – November 2015: *Enhancing engagement with CCSS MP3: Developing students' capacity to construct viable arguments and critique the reasoning of others*. Professional development workshop series for secondary teachers.

May 2014: *LessonSketch Workshops: Using animated representations of teaching in Research and Teacher Education*. Workshop for researchers of the University of Pittsburgh, PA and Education Development Center, Boston, MA.

February – March 2013: *LessonSketch Workshops: Using animated representations of teaching in Teacher Education*. (With D. Chazan) College of Education, University of Maryland. Workshop series to support teacher educators at the College of Education at UMD to implement High Leverage Teaching Practices in methods courses.

November 2012: *Blue Teacher, green student: Using animations to discuss interaction in the mathematics classroom*. Developer and Instructor of the two-days seminar for teachers. College of Education, University of Maryland.

ADVISING

Dissertation committees

- 2013 Jason Miller (Ph.D.) University of Maryland
- 2016 Eyob Demke (Ph.D.) University of New Hampshire
- 2017 David Earls (Ph. D). University of New Hampshire
Neil Bornstein (Ph. D). University of New Hampshire
Marita Freinsen (Ph. D). Pedagogosche Hochschule Ludwigsburg, Germany

Undergraduate research advising

- 2017 Hannah Bush. Honors Thesis. (B.Sc. 2017).

PROFESSIONAL SERVICE

Editing

- 2016 - 2017 Co-Editor of *ICME 13 - International Congress on Mathematical Education Post-Conference Monograph of DG on Representations of Teaching*. Springer.
- 2013– present Associate Editor, *International Newsletter on the Teaching and Learning of Mathematical Proof*.

Working-Group & Discussion Group Leadership

- 2016 - 2017 Co-leader of the Working Group on Argumentation and Proof at 10th Congress of European Research in Mathematics Education (CERME), Dublin, Ireland
- 2015 - 2016 Co-organizer of the Discussion Group on: Using representations of practice for teacher education and research – opportunities and challenges, at ICME-13: International Congress on Mathematical Education. Hamburg, Germany.
- 2014 - 2015 Co-leader of the Working Group on Argumentation and Proof at 9th Congress of European Research in Mathematics Education (CERME), Prague, Czech Republic.

Reviewing

- 2015 *National Science Foundation*. Review Panel for Education and Human Resources Directorate.
- 2015- 2016 Peer review of book chapters submitted to R. Zazkis and P. Herbst (Eds.), *Mathematical Dialogue: Scripting approaches in mathematics education research and practice*. Springer.
- Peer review of book chapters submitted to A. Leung and J. Bolite-Frant (Eds.), *Digital Technologies in Designing Mathematics Education Tasks – Potential and Pitfalls*. Springer.
- 2011– present Reviewer for scholarly journals and conference proceedings:
Journal of Computer Assisted Learning
Educational Studies in Mathematics
Journal of Mathematical Behavior
Canadian Journal of Science, Mathematics and Technology Education

ZDM - The International Journal on Mathematics Education.

AMTE - Association of Mathematics Teacher Educators

NCTM Research Pre-Session

CERME 9, 10 – proceedings, and summary chapter of the Working Group on Argumentation and Proof.

Discussant

2016 Symposium titled: *Transforming Teacher Learner through Mathematics Professional Development*.
AERA, Washington DC.

University Service Committees

2016 – 2017 Undergraduate Research Conference – Interdisciplinary Science and Engineering Symposium program committee.
Research and Engagement Academy applications reviewer
College of Engineering and Physical Sciences teaching awards committee.
STEM education learning community.
Graduate program committee.

2015 – 2016 Elementary Mathematics Education Specialists. Certification Program development.
College of Engineering and Physical Sciences teaching awards committee.
STEM education learning community
Calculus Committee.
Undergraduate program committee.

2014 – to date Preservice Teaching Council.

Professional Affiliations

American Educational Research Association.

Association of Mathematics Teacher Educators.

International Group for the Psychology of Mathematics Education.

National Council of Teachers of Mathematics.

New Hampshire Teachers of Mathematics

RESEARCH INTERESTS

- o Argumentation processes, mathematical reasoning and decision making.
- o The role of examples and counterexamples in mathematics teaching and learning and in students' approaches to proof.
- o Mathematics teacher education, and teacher knowledge of argumentation.
- o Educational technologies and e-learning.
- o Instructional and curriculum design for middle and secondary school.
- o History and philosophy of mathematics.

LANGUAGES

English, Hebrew and Russian: fluent spoken, excellent read and write.