Suzanne White Brahmia

Education

Ph.D. Physics, Rutgers University 2014
Dissertation title: Mathematization in Introductory Physics
Dissertation Advisor: Eugenia Etkina

M.S. Physics, Rutgers University 2013

ABD; PhD program, Physics, Cornell University 1993
Thesis title: Premelting in a Li:Al Alloy
Research Advisor Robert Cotts

B.S. Physics, University of Washington 1986

Professional Experience

Assistant Professor 2017-Present
University of Washington, Department of Physics

Associate Professor of Teaching 2015-2016
Director, STEM TRIAD (Transformations, Research, Instructional practices, Assessment and Dissemination) Coalition
Rutgers University, School of Arts and Sciences

Director, Physics Gateway Program 1993 - 2016
Rutgers University Physics Department, Piscataway, NJ

Associate Director, Math and Science Learning Center 1993 –2015
Rutgers University Physics Department, Piscataway, NJ

High School Teacher/Teacher Trainer 2006-2009
Noor-Ul-Iman School

Teaching Assistant 1990-1993
Cornell University Department of Physics , Ithaca, New York.

Peace Corps Volunteer 1987-1989
United States Peace Corps , Gabon, Africa.

Grants

1. National Science Foundation DUE IUSE-1832836; Collaborative Research: Physics Inventory of Quantitative Literacy; with T.I. Smith and A. Boudreaux 2018-2020 (Grant total award $340,000)
2. NJ DOEd Math Science Partnership: NGSS Implementation; with E. Etkina, R. Duncan, C. Chin, D. Shernoff, 2016-2018 (Grant total award $720,000)
3. National Science Foundation TUES-0733140—Collaborative Project: Developing Proportional Reasoning in a Physics Context with Invention Tasks with A. Boudreaux and S. Kanim 2011-2014 (Grant total award $300,000)
4. National Science Foundation DRL-0733140-- PUM (Physics and Mathematics) Exploration, with E.Etkina, A.Van Heuvelen 2008-2010 (Grant total award $300,000)

5. National Science Foundation CCLI-EMD -- ISLE Investigative Science Learning Environment: Science and Cognition Combined, with E.Etkina, A.Van Heuvelen and X. Zou. 2001-2003 (Grant total award $500,000)
6. Rutgers Teaching Excellence Center – Laboratory Improvements for Engineering Physics 1998 (Grant award $10,000)

Publications

Refereed Articles

1. **White Brahmia, S** , Olsho, A., Boudreaux, A. & Smith, T.I., A Framework for the Natures of Negativity in Introductory Physics, Phys. Rev. ST Phys. Educ. Res. *(in press)* https://arxiv.org/abs/1903.03806

2. **White Brahmia, S**., Boudreaux, A., and Kanim, S. E., Developing mathematization with Physics Invention Tasks, American Journal of Physics *(in press)*. https://arxiv.org/pdf/1602.02033.pdf

3. **White Brahmia, S**., "Quantification and its importance to modeling in introductory physics", European Journal of Physics, Invited paper, Focus Collection on Modeling in Physics Instruction, 2019. http://iopscience.iop.org/10.1088/1361-6404/ab1a5a

4. **White Brahmia,** S. Olsho, A., Smith, T. I. and Boudreaux, A., NoNIP: Natures of Negativity in Introductory Physics, 2018 PERC Proceedings [Washington, DC, August 1-2, 2018], edited by A. Traxler, Y. Cao, and S. Wolf, doi:10.1119/perc.2018.pr.Brahmia.

5. **White Brahmia, S** , Olsho, A., Smith, T.I. & Boudreaux, A., A Framework for the Natures of Negativity in Introductory Physics, Proceedings of the 22nd Annual Conference on Research in Undergraduate Mathematics Education, Oklahoma City, OK (2019)

6. Olsho, A., **White Brahmia, S**, Boudreaux, A. & Smith, T. I., The Physics Inventory of Quantitative Reasoning: Assessing Student Reasoning About Sign, Proceedings of the 22nd Annual Conference on Research in Undergraduate Mathematics Education, Oklahoma City, OK (2019)

7. **White Brahmia, S,** Negative quantities in mechanics: a fine-grained math and physics conceptual blend?, Proceedings from Physics Education Research Conference, July 2017 http://www.per-central.org/items/detail.cfm?ID=14570

8. **White Brahmia, S** & Boudreaux, A., Signed Quantities: Mathematics Based Majors Struggle to Make Meaning Proceedings of the 20th Annual Conference on Research in Undergraduate Mathematics Education, San Diego, California (2017) http://sigmaa.maa.org/rume/RUME20.pdf

9. **White Brahmia, S** & Boudreaux, A. Exploring student understanding of the negative sign in introductory physics contexts, In (Eds.) T. Fukawa-Connelly, N. Infante, M. Wawro, and S. Brown, Proceedings of the 19th Annual Conference on Research in Undergraduate Mathematics Education, Pittsburgh, Pennsylvania (2016) http://sigmaa.maa.org/rume/RUME19v3.pdf

10. **Brahmia, S., "**Developing expert mathematization in the introductory physics course: an impedance mismatch." Proceedings of 2nd International Conference On Research, Implementation And Education Of Mathematics And Sciences (2nd ICRIEMS), Yogyakarta, May 17-19, 2015. Ed. E. Retnowati, Yogyakarta State University, Yogyakarta, Indonesia, ISBN 978-979-96880-8-8 https://www.physics.rutgers.edu/~brahmia/1505ICRIEMS_Brahmia_KeynotePOSTED.pdf

11. **Brahmia, S.,** Improving Learning for Underrepresented Groups in Physics for Engineering Majors, Proceedings from Physics Education Research Conference, July 2008 https://www.physics.rutgers.edu/~brahmia/PERC08_Brahmia.pdf

12. Eugenia Etkina , Alan Van Heuvelen, **Suzanne White Brahmia,** David T. Brookes, Michael Gentile, Sahana Murthy, David Rosengrant, and Aaron Warren, Scientific abilities and their assessment, Phys. Rev. ST Phys. Educ. Res. 2, 020103 (2006) https://journals.aps.org/prper/pdf/10.1103/PhysRevSTPER.2.020103

13. **Brahmia, S.** and Etkina, E., Emphasizing Social Aspects of Learning to Foster Success of Students At-Risk, Proceedings from Physics Education Research Conference, July 2001 http://www.compadre.org/per/items/detail.cfm?ID=4382

14. **Brahmia, S.,** and Etkina, E., Switching Students on to Science: An Innovative Course Design for At-Risk Students in Physics ; Journal of College Science Teaching November 2001. https://www.physics.rutgers.edu/~brahmia/Brahmia&EtkinaJCST2001.pdf

Papers in Progress

1. Olsho, A., **White Brahmia, S**., Boudreaux, A**,** Smith, T.I., "When negative is not "less than zero": electric charge as a signed quantity", the Physics Teacher *(under review)*
2. **Brahmia, S.**, Kanim, S. E., and Boudreaux, A., Obstacles to Mathematization, American Journal of Physics *(under revision)*. https://arxiv.org/abs/1601.01235
3. Boudreaux, A., Kanim, S. E., and **Brahmia, S. ,** Student facility with ratio and proportion: Mapping the reasoning space in introductory physics, American Journal of Physics *(under revision)*. http://arxiv.org/abs/1511.08960
4. Boudreaux, A**, White Brahmia, S**., Olsho, A., Smith, T.I., "A framework for the natures of proportional reasoning in introductory physics", to be submitted in Phys. Rev. Phys. Educ. Res.

Textbooks/Reports/Dissertation

5. Brahmia, S., Mathematization in Introductory Physics, Rutgers University, PhD Dissertation, 2014. https://rucore.libraries.rutgers.edu/rutgers-lib/45215/
6. National Research Council. Adapting to a Changing World--Challenges and Opportunities in Undergraduate Physics Education. Washington, DC: The National Academies Press. 2013. ISBN: 978-0-309-28303-8
7. Lindenfeld, P and **Brahmia S. W.**, Physics, the First Science, Rutgers University Press, 2012. ISBN: 978-0-8135-4937-8

Web Publications

8. **Brahmia, S**, Boudreaux, A, Kanim, S, Physics Invention Tasks, updated 2016. http://faculty.washington.edu/pits
9. Eugenia E. , Van Heuvelen, A., **Brahmia, S. W.,** Brookes, D., Gentile,M., Sahana,M., Rosengrant, D., and Warren,A., Scientific Abilities Rubrics, Rutgers University, updated 2016. https://sites.google.com/site/scientificabilities/rubrics
10. Etkina, E., **Brahmia, S.** Zisk, R, Flakker, J, Bugge, D., Robinson, S, D'Amato, C. Blackman, M, Physics Union Mathematics, Rutgers University, updated 2016. http://pum.rutgers.edu

11. K. Lancaster, J. Blanco, S. Reid, J. Barbera, **S. Brahmia,** P. Loeblein, R. Parson, K. Perkins, Build An Atom, PhET Simulation, University of Colorado, 2011. https://phet.colorado.edu/en/simulation/build-an-atom

Non-refereed articles

12. Lindenfeld, P. and **Brahmia, S.**, Is the textbook obsolete? APS Forum on Education Newsletter, Spring 2012
13. **White Brahmia**. **S.,** Docktor, J and Mestre, J., FFPER Working Group Report: NRC commissioned report on Undergraduate Physics Education, APS Forum on Education Newsletter, Fall 2011

Invited Talks

1. Jackson State University, Department of Physics 2019
   "PIQL: A New Assessment of Mathematical Reasoning Development in Physics Instruction"
2. Oregon State University, Department of Physics Colloquium 2019
   "PIQL: A New Assessment of Mathematical Reasoning Development in Physics Instruction"
3. Ohio State University, Department of Physics Colloquium 2019
   "PIQL: A New Assessment of Mathematical Reasoning Development in Physics Instruction"
4. University of Oregon, Department of Physics Colloquium 2019
   "PIQL: A New Assessment of Mathematical Reasoning Development in Physics Instruction"
5. AAPT (American Association of Physics Teachers) Winter meeting 2019
   "Assessing physics quantitative literacy development"
6. Physics Education Research Conference, 2018
   "NoNIP: Natures of Negativity in Introductory Physics"
7. North Dakota State University, Department of Physics 2018
   "Equity and inclusion by design in calculus-based introductory physics"
8. APS NW Annual Meeting 2018
   "Student reasoning about signed quantities in introductory-level physics" (*Alexis Olsho, first author*)
9. APS April Meeting 2018 "Equity and inclusion by design in calculus-based introductory physics"
10. Yale University, 2017, *ENDOWED LECTURE*
    Helmsley Trust, STEM Education Series "Developing Mathematical Creativity: Physics Invention Tasks"
11. University of Bridgeport, 2017, Invited Special Lecture
    "Physics Invention Tasks: Developing Mathematical Creativity as a Scientific Practice"
12. Physics Education Research Conference, 2017
    "A tight conceptual blend of physics context, symbols and operations: Example of Negative Work"
13. Physics Education Research Conference, 2017
    "Promoting Student Mathematization using Physics Invention Tasks"
14. AAPT (American Association of Physics Teachers) Summer Meeting, 2017
    "Reducing the DFW rate by design in calculus-based physics"
15. Western Washington University, 2017, *KEYNOTE ADDRESS*
    Irwin L. Slesnick Symposium "Mathematization: A tight cognitive blend of content and practices"
16. South Seattle Community College, 2017, Invited Special Lecture,
    "Physics Invention Tasks in Introductory Physics"
17. Research in Undergraduate Mathematics Education National Conference 2017
    "Quantification with Physics Invention Tasks"

18. University of Washington, Seattle, Department of Physics Colloquium 2016
"Mathematization: Enhancing learning by fostering physics creativity"

19. APS (American Physical Society) April Meeting 2015
"PER efforts to promote diversity: Challenges and opportunities"

20. AAPT - New Jersey Section Spring Meeting 2014, *PLENARY*
"NGSS, CCSS-Math and the new AP: An opportunity to develop physicists' ways of thinking"

21. Yogyakarta State University, Yogyakarta, Indonesia, 2015, *KEYNOTE ADDRESS*
"Developing expert mathematization in the introductory physics course: an impedance mismatch."

22. Purdue University, West Lafayette, Indiana, 2014
"Mathematization in Physics Through a Socioeconomic Lens"

23. AAPT Summer Meeting, 2014
"Mathematization in Physics Through a Socioeconomic Lens"

24. University of California, Irvine, Department of Physics Colloquium 2014
"Adapting to a changing world: Building learning equity in physics"

25. AAPT Winter Meeting 2014
"Establishing a path to mathematization in introductory physics"

26. Frontiers and Foundations in Physics Education Research Conference 2013, *PLENARY*
"Building learning equity through mathematization"

27. Pacific NW Association for College Physics 2013 , *KEYNOTE ADDRESS*
James Gerhart Memorial Lecture: "Establishing a path to mathematization in introductory physics"

28. University of Oregon Department of Physics Colloquium 2013
"Establishing a path to mathematization in introductory physics"

29. National Science Foundation TUES- PI Conference 2013
"Using invention tasks to promote students' proportional reasoning in a physics context"

30. APS March Meeting 2012
"Using Mathematics to Make Sense in Undergraduate Physics"

31. APS and AAPT Physics Teachers Education Coalition Conference 2012
"Using Invention Tasks to Promote Sense-making and Proportional Reasoning"

32. AAPT Winter Meeting 2011
"Sense-making in physics: What assumptions are we making about the students?"

33. Physics Education Research Conference Summer 2010
"Developing Mathematical Reasoning within the Physics Curriculum"

34. APS March meeting 2010
"Gender and Ethnic Equity in Engineering: How Can Physics Help?"

35. AAPT Winter 2009
"Improving Learning for Underrepresented Groups in Physics for Engineering Majors"

36. AAPT Summer 2007
"Physics Textbooks: How and Why are They Used?"

37. Princeton University Department of Physics, 2005
"Improving Learning for Underprepared Students in Physics"

38. AAPT Summer 2004
"From Zululand to the Jersey Shore: Comparing Physics Education in Africa and the U.S."

39. APS/AAPT ; Spring Joint Meeting 2004 New York State Section , *PLENARY*
"Recruiting and Retaining Underrepresented Populations: How Can We Help? – the Rutgers Story"

40. Rutgers University Northeast Regional Teaching Workshop 2000
"Fostering Success of At-Risk Students in a Large Enrollment Mechanics Course"

Professional Service

1. American Physical Society Topical Group on Physics Education Research, Executive Board Member-at-large, (2019-present)
2. American Association of Physics Teachers Diversity and Inclusion Website Task Force (2019-present)
3. College Board Advanced Placement (AP) Physics 1 - Development Committee for new AP physics; Co-Chair (2017-present)
4. Co-PI in the organization of the Conference for Undergraduate Women in Physics (CUWIP), held at the UW in Jan 2019
5. UW Department of Physics First Year Graduate Student Advising Committee (2018-present)
6. UW Department of Physics 12x Committee (2017-present)
7. UW Department of Physics Lab Transformation Sub-Committee (2017-present)
8. UW Department of Physics Colloquium Committee (2016-2019)
9. UW Department of Physics Graduate Admissions Committee (2016-2018)
10. College Board Advanced Placement (AP) Physics 1&2 – Special Articulation Committee for development of measurable learning objectives (2017-present)
11. Advisory Board: Raising Physics to the Surface; NSF-DUE #1611970 (2017 – present)
12. Physics Education Research Conference Organizing Committee (2016-2017)
13. College Board Advanced Placement (AP) Physics 1 - Development Committee for new AP physics; Higher Education Representative (2016-2017)
14. College Board Advanced Placement (AP) Physics 2 – Standards Setting Committee for new AP physics; Higher Education Representative (2015)
15. Project Evaluator: Foundational Research on Problem Mathematization in Undergraduate Physics; NSF-DUE #1430967
16. National Research Council Committee on Undergraduate Physics Education (2010-2013)
17. Next Generation Science Standards: New Jersey representative for college readiness in physics and for NGSS implementation. (2012-2016)
18. Book reviewer – Springer (2016-present)
19. Grant proposal reviewer - National Science Foundation Reviewer (multiple years)
20. Manuscript reviewer – Physical Review- Physics Education Research, American Journal of Physics, American Physical Society, Physics Education Research Conference Proceedings, The Physics Teacher, European Journal of Physics, Research for Undergraduate Mathematics Education Conference Proceedings (multiple years)
21. Rutgers University Department of Physics and Astronomy Undergraduate Studies Committee (1993-2000)

Honors, Awards and Certificates

1. Education Equal Opportunity Fund (EOF) Champion (2004)
   State of New Jersey Commission of Higher EOF Fund Board of Directors, awarded for "developing new approaches that have a significant impact on EOF students."
2. Outstanding Teacher of the Year (2000)
   Awarded by Rutgers University chapter of the Society of Physics Students
3. Rutgers University Outstanding Professor (2000)
   Rutgers chapter of the Delta Gamma sorority, "for motivating female students to reach their highest potential"
4. US Department of Education GAANN Fellowship (1992-93)
5. Certificate of Secondary School Teacher Preparation (1987)
   U.S. Peace Corps Teacher Training Program
6. University of Washington Department of Physics, Departmental Honors (1986)

Professional Development Workshops (leader)

1. Jackson State University, Jackson, MS, 2019, Workshop, "Problem Solving Readiness: Linking Disparate Knowledge to Expedite Undergraduate Transitions from STEM Aspirations to STEM Learning."
2. University of Bridgeport, Bridgeport, CT, November 2017, Workshop, "Physics Invention Tasks"
3. AAPT (American Association of Physics Teachers) Workshop, Summer 2017
   "Physics Invention Tasks: Developing Mathematical Creativity as a Scientific Practice"
4. Western Washington University, Bellingham, WA, April 2017, Irwin L. Slesnick Symposium
   "Physics Invention Tasks"
5. Research in Undergraduate Mathematics Education National Conference, San Diego, CA, Feb 2017, "Education Research at the Interface of Mathematics and Physics: Mathematization of Introductory Physics"
6. NJ_DOEd MSP July 2016 "Mathematization and NGSS"
7. FFPER Puget Sound July 2016 "Physics Invention Tasks"
8. AAPT Workshop, Summer 2015 "Strengthening Mathematical Sensemaking in Physics"
9. Yogyakarta State University, Yogyakarta, Indonesia, May 2015 "Using Invention Instruction to Develop Mathematical Sensemaking"
10. AAPT Workshop Summer 2014 "Strengthening Mathematical Sensemaking in Physics"
11. AAPT Workshop Summer 2014 "Physics Union Mathematics (PUM)"
12. PUM Workshop 2014 For Nj Middle School And High School Teachers "Invention Instruction To Develop Proportional Reasoning"
13. University Of California, Irvine 2014 "Reducing the Achievement Gap Using Invention Instruction"
14. AAPT Workshop Winter 2014 "Using Invention Tasks to Promote Mathematical Thinking"
15. AAPT Workshop Summer 2013 "Using Invention Tasks to Promote Sensemaking and Proportional Reasoning"

16. PUM Workshop 2013 for NJ middle school and high school teachers "Invention instruction to develop proportional reasoning"
17. AAPT Workshop Winter 2013 "Reducing the Achievement Gap Using Invention Instruction"
18. Physics Teachers Education Coalition Workshop 2012, "Using Invention Tasks to Promote Sense-making and Proportional Reasoning"
19. PUM Workshop 2012 for NJ middle school and high school teachers "Invention instruction to develop proportional reasoning"
20. PUM Workshop 2011 for NJ middle school and high school teachers "Invention instruction to develop proportional reasoning"
21. PUM Workshop 2010 for NJ middle school and high school teachers "Invention instruction to develop proportional reasoning"

Students/Post Docs Mentored

Charlotte Zimmerman - Grad Student, University of Washington, Dept of Physics	2018-present
Jared Cartwright - Grad Student, University of Washington, Dept of Physics	2018-present
Alexis Olsho – Post Doc, University of Washington, Dept of Physics	2017-present
Chaz Ruggieri – Post Doc, Rutgers, Dept of Physics and Astronomy	2016-2018
Eugene Geis – PhD, Rutgers, Graduate School of Education	2013-2019
Debbie Andres – BS, School of Engineering, MS GSE	2011-2017
Josh Smith –BS, Department of Physics and Astronomy, MS GSE	2011-2013

Teaching Experience

2019	Graduate Ind. Study: Mathematization in introductory physics - University of Washington
2019	Graduate Ind. Study: Learning with Virtual Reality in E&M - University of Washington
2018	Graduate Ind. Study: Student Design in Introductory Labs - University of Washington
2017	Graduate Ind. Study: Affective measures in introductory physics - University of Washington
2018-present	Introductory Physics Laboratory – University of Washington
2017-2018	Introductory Physics: mechanics – University of Washington
1993-2016	Gateway Physics course: introductory mechanics, thermodynamics, waves - Rutgers
2014-2016	Introductory Physics: mechanics, thermodynamics, waves, E&M, Modern Physics - Rutgers
2010-2012	High school Physics – Noor Ul Iman School, NJ
2009-2010	High school Physical Science – Noor Ul Iman School, NJ
2008-2009	7^{th} grade physical science – Noor Ul Iman School, NJ
1992 (spring)	Intro. Physics for Scientists: Mechanics and Thermo. – Cornell University
1991 (spring)	Intro. Physics for Engineers: Waves and Modern Physics – Cornell University
1990 (fall)	Intro. Physics for Engineers: Electricity and Magnetism – Cornell University
1987-1989	Middle School Physical Science– Lycee d'Etat Makokou Gabon
1987-1989	High school Physics– Lycee d'Etat Makokou Gabon
1987-1989	High school Chemistry – Lycee d'Etat Makokou Gabon
1986-1987	Electronics Lab – University of Washington