

Professional Appointments

Associate Professor	2020 – Present
Assistant Professor	2014 – 2020
Department of Physics & Astronomy and Department of Content Area Teacher Education, Rowan University	
Visiting Assistant Professor	2011 – 2014
Department of Physics & Astronomy, Dickinson College	
Assistant Director	2010
Pride of Maine Black Bear Marching Band, University of Maine	

Education: University of Maine

Doctor of Philosophy	Physics	2011
Identifying and Addressing Specific Student Difficulties in Advanced Thermal Physics		
Advisor: John R. Thompson		
Master of Science in Teaching	Concentration in Physics	2007
Comparing the Effectiveness of Research-based Curricula for Teaching Introductory Mechanics		
Advisor: Michael C. Wittmann		
Bachelor of Science, cum laude	Physics	2005
Minor in Mathematics		

Grants and Awards

Scholarly Awards

Rowan University College of Science & Mathematics Outstanding Colleague Award, 2024
Outstanding Referee, Physical Review Journals, American Physical Society, 2024
Rowan University College of Science & Mathematics Excellence in Scholarship of Teaching and Learning Research Award, 2022

Funded External Awards

1. Collaborative Research: Physics Quantitative Literacy: Model-driven Activity Development. **Lead PI** (S. White Brahmia, PI—University of Washington). Duration: 2 years. (NSF: Improving Undergraduate STEM Education)
Submitted: Winter 2024 (\$384,272 total; \$102,734 Rowan portion starting 10/1/24), Status: **Awarded** (DUE-2417103) https://www.nsf.gov/awardsearch/showAward?AWD_ID=2417103
2. Collaborative Research: Measuring and Improving Physics Quantitative Literacy throughout the Undergraduate Curriculum. **PI** (S. White Brahmia, Lead PI—University of Washington). Duration: 2 years. (NSF: Improving Undergraduate STEM Education)
Submitted: Winter 2022 (\$298,087 total; \$35,975 Rowan portion starting 10/1/22), Status: **Awarded** (DUE-2214283) https://www.nsf.gov/awardsearch/showAward?AWD_ID=2214283
3. Defining almost correct: Quantifying student understanding hidden in wrong answers. **PI** (N. Bendjilali, Co-PI). Duration: 3 years. (NSF: Improving Undergraduate STEM Education)
Submitted: Spring 2018 (\$206,876 starting 10/1/18), Status: **Awarded** (DUE-1836470) https://www.nsf.gov/awardsearch/showAward?AWD_ID=1836470
4. Collaborative Research: PIQL: Physics Inventory of Quantitative Literacy. **PI** (S. White Brahmia, Lead PI—University of Washington; A. Boudreaux, PI—Western Washington University). Duration:

2 years. (NSF: Improving Undergraduate STEM Education)

Submitted: Spring 2018 (\$299,824 total; \$46,553 Rowan portion starting 10/1/18), Status: **Awarded** (DUE-1832880) https://www.nsf.gov/awardsearch/showAward?AWD_ID=1832880

5. South Jersey STEM Education Scholars: Recruiting and Supporting STEM Teachers from Underrepresented Populations. **PI** (R. Wieman, Co-PI, I. Abi-El-Mona, Co-PI, J. Perry, Co-PI, D. Klassen, co-PI). Duration: 5 years. (NSF: Robert Noyce Teacher Scholarship Program)
Submitted: Fall 2016 (\$1,200,000 starting 7/1/17), Status: **Awarded** (DUE-1660694) https://www.nsf.gov/awardsearch/showAward?AWD_ID=1660694
6. Rowan's PhysTEC Comprehensive Site. **Co-PI** (K. Magee-Sauer, PI, I. Abi-El-Mona, D. Klassen). Duration: 3 years. (Physics Teacher Education Coalition)
Submitted: Fall 2014 (\$300,000 starting 9/1/15), Status: **Awarded**.
7. Travel Grant. **PI**. (American Association of Physics Teachers — Physics Education Research Topical Group)
 - (a) Submitted: Spring 2017 (\$500 to Attend the 2017 AAPT Summer Meeting), Status: **Awarded**.
 - (b) Submitted: Fall 2016 (\$500 to Attend the 2017 AAPT Winter Meeting), Status: **Awarded**.
 - (c) Submitted: Fall 2015 (\$500 to Attend the 2016 AAPT Winter Meeting), Status: **Awarded**.
 - (d) Submitted: Spring 2015 (\$500 to Attend the 2015 AAPT Summer Meeting and PERC), Status: **Awarded** (\$400).

Funded Internal Awards

8. Frances R. Lax Faculty Development Grant. **PI**.
Submitted: Fall 2015 (\$1,000 to Attend the 2016 AAPT Winter Meeting), Status: **Awarded**.
9. RU Seed Funding. **PI**. Duration: 1 year.
Submitted: Spring 2015, (\$10,000 starting 7/1/15), Status: **Awarded**.

External Award Support

1. Educational Evaluator on NSF-funded project EVSC/CAREER: Synthesizing Structural Uncertainty of Sea-level Rise Projections to Improve Application in Decision Making. Rowan PI: A. Garner.
2. Educational Evaluator on NSF-funded project CAREER: Magnetic Resonance Characterization and Application of Carbon-Based Quantum Dots as Multimodal Chemical Sensors. Rowan PI: N. Whiting.
3. External Evaluator on NASA-funded project Behind the Telescope: Building Girls' Confidence in STEM Through Hands-on Astronomy Outreach. Rowan PI: A. Barraclough.
4. Educational Evaluator on NSF-funded project CAREER: Parallel Two-Dimensional Liquid Chromatography Utilizing Capillary Columns. Rowan PI: J. Grinias.
5. Collaborator on NSF-funded project CAREER: Experimental Studies of Protein Thermodynamics Facilitated by NMR with Reverse Micelles. Rowan PI: N. Nucci.

Publications

Publications with Student Authors

1. C. J. Richardson*, **T. I. Smith**, and P. J. Walter. Replicating analyses of item response curves using data from the Force and Motion Conceptual Evaluation. *Phys. Rev. Phys. Educ. Res.*, 17:020127, 2021

2. **T. I. Smith**, K. J. Louis*, B. J. Ricci*, and N. Bendjilali. Quantitatively ranking incorrect responses to multiple-choice questions using item response theory. *Phys. Rev. Phys. Educ. Res.*, 16(1):010107, 2020
3. B. T. Boyle*, C. Zimmerman, S. White Brahmia, and **T. I. Smith**. Validating shorter versions of the Physics Inventory of Quantitative Literacy. In *Physics Education Research Conference 2024*, PER Conference, pages 46–51, Boston, MA, July 10–11 2024
4. **T. I. Smith**, Z. Bischoff*, B. Boyle*, J. Sayers*, C. Zimmerman, P. Eaton, A. Olsho, and S. White Brahmia. Creating Statistically Equivalent Versions of a Test of Quantitative Literacy in Physics Contexts. In S. Cook, B. Katz, and D. Moore-Russo, editors, *Proceedings of the 26th Annual Conference on Research in Undergraduate Mathematics Education*, pages 1447–1449, Omaha, NE, 2024
5. **T. I. Smith**, P. Eaton, S. W. Brahmia, A. Olsho, A. Boudreaux, C. DePalma*, V. LaSasso*, S. Straguzzi*, and C. Whitener*. Using psychometric tools as a window into students' quantitative reasoning in introductory physics. In Y. Cao, S. Wolf, and M. Bennett, editors, *Physics Education Research Conference 2019*, PER Conference, page <http://arxiv.org/abs/1907.05491>, Provo, UT, July 24–25 2019
6. K. J. Louis*, B. J. Ricci*, and **T. I. Smith**. Determining a hierarchy of correctness through student transitions on the FMCE. In A. Traxler and Y. Cao, editors, *Physics Education Research Conference 2018*, PER Conference, Washington, DC, August 1–2 2018
7. **T. I. Smith**, K. A. Gray*, K. J. Louis*, B. J. Ricci*, and N. J. Wright*. Showing the dynamics of student thinking as measured by the FMCE. In L. Ding, A. Traxler, and Y. Cao, editors, *Physics Education Research Conference 2017*, PER Conference, pages 380–383, Cincinnati, OH, July 26–27 2017
8. I. T. Griffin*, K. J. Louis*, R. Moyer*, N. J. Wright*, and **T. I. Smith**. A Multi-faceted Approach to Measuring Student Understanding. In D. L. Jones, L. Ding, and A. Traxler, editors, *Physics Education Research Conference 2016*, PER Conference, pages 132–135, Sacramento, CA, July 20–21 2016
9. **T. I. Smith**, M. A. Kazmi*, R. R. Sarles III*, J. A. Sbrana*, C. W. Soper*, and N. Bendjilali. Comparing item response theory models for ranking incorrect response options, 2024. arXiv: 2410.05231
10. **T. I. Smith**, S. W. Brahmia, A. Olsho, A. Boudreaux, P. Eaton, P. J. Kelly*, K. J. Louis*, M. A. Nussenbaum*, and L. J. Remy*. Developing a reasoning inventory for measuring physics quantitative literacy, 2019. arXiv: 1901.03351

*Rowan undergraduate student

Other Publications

11. J. P. Grinias, **T. I. Smith**, and M. L. Kovarik. LCGC and ACS subdivision on chromatography and separations chemistry survey 2023: What skills do new analytical chemistry employees need? *LCGC North America*, 41:284–286, July/August 2023
12. **T. I. Smith**, P. Eaton, A. Olsho, and S. White Brahmia. Enriching Assessment of Physics Quantitative Literacy: IRT with Multiple-Response Items. In S. Cook, B. Katz, and D. Moore-Russo, editors, *Proceedings of the 25th Annual Conference on Research in Undergraduate Mathematics Education*, pages 1346–1348, Omaha, NE, 2023
13. A. Olsho, **T. I. Smith**, P. Eaton, C. Zimmerman, A. Boudreaux, and S. White Brahmia. Online test administration results in students selecting more responses to multiple-choice-multiple-response items. *Phys. Rev. Phys. Educ. Res.*, 19:013101, Feb 2023
14. **T. I. Smith**, P. Eaton, S. White Brahmia, A. Olsho, C. Zimmerman, and A. Boudreaux. Analyzing multiple-choice-multiple-response items using item response theory. In *Physics Education Research Conference 2022*, 2022

15. A. Olsho, C. Zimmerman, A. Boudreaux, **T. I. Smith**, P. Eaton, and S. White Brahmia. Characterizing covariational reasoning in physics modeling. In *Physics Education Research Conference 2022*, 2022
(Selected as a PERC Notable Paper)
16. C. Zimmerman, A. McCarty, S. White Brahmia, A. Olsho, M. De Cock, A. Boudreaux, **T. I. Smith**, and P. Eaton. Assessing physics quantitative literacy in algebra-based physics: lessons learned. In *Physics Education Research Conference 2022*, 2022
17. **T. I. Smith** and N. Bendjilali. Motivations for using the item response theory nominal response model to rank responses to multiple-choice items. *Phys. Rev. Phys. Educ. Res.*, 18:010133, Apr 2022
18. P. J. Walter and **T. I. Smith**. Comparing pre/post item response curves to identify changes in misconceptions. In *Physics Education Research Conference 2021*, PER Conference, Virtual Conference, August 4-5 2021
19. S. White Brahmia, A. Olsho, **T. I. Smith**, A. Boudreaux, P. Eaton, and C. Zimmerman. Physics Inventory of Quantitative Literacy: A tool for assessing mathematical reasoning in introductory physics. *Phys. Rev. Phys. Educ. Res.*, 17:020129, Oct 2021
(Selected as a PRPER Editors' Suggestion)
20. A. Olsho, S. White Brahmia, A. Boudreaux, and **T. I. Smith**. When negative is not “less than zero”: electric charge as a signed quantity. *The Physics Teacher*, 59(4):253–256, 2021
21. J. P. Grinias and **T. I. Smith**. Preliminary Evidence on the Effect of an Open-Source Textbook in Second-Year Undergraduate Analytical Chemistry Courses. *Journal of Chemical Education*, 97(8):2347–2350, 2020
22. **T. I. Smith**, P. Eaton, S. White Brahmia, A. Olsho, A. Boudreaux, and C. Zimmerman. Toward a valid instrument for measuring physics quantitative literacy. In S. Wolf, M. Bennett, and B. Frank, editors, *Physics Education Research Conference 2020*, PER Conference, pages 496–502, Virtual Conference, July 22–23 2020
23. A. Olsho, S. White Brahmia, **T. I. Smith**, C. Zimmerman, A. Boudreaux, and P. Eaton. Online administration of a reasoning inventory in development. In S. Wolf, M. Bennett, and B. Frank, editors, *Physics Education Research Conference 2020*, PER Conference, pages 382–387, Virtual Conference, July 22–23 2020
24. C. Zimmerman, A. Olsho, A. Boudreaux, **T. I. Smith**, P. Eaton, and S. White Brahmia. Exploring student facility with “goes like” reasoning in introductory physics. In S. Wolf, M. Bennett, and B. Frank, editors, *Physics Education Research Conference 2020*, PER Conference, pages 605–610, Virtual Conference, July 22–23 2020
25. A. Boudreaux, S. E. Kanim, A. Olsho, S. White Brahmia, C. Zimmerman, and **T. I. Smith**. Toward a framework for the natures of proportional reasoning in introductory physics. In S. Wolf, M. Bennett, and B. Frank, editors, *Physics Education Research Conference 2020*, PER Conference, pages 45–50, Virtual Conference, July 22–23 2020
26. **T. I. Smith**, S. White Brahmia, A. Olsho, and A. Boudreaux. Physics Students' Implicit Connections Between Mathematical Ideas. In S. Smith Karunakaran, Z. Reed, and A. Higgins, editors, *Proceedings of the 23rd Annual Conference on Research in Undergraduate Mathematics Education*, pages 940–946, Boston, MA, 2020
27. S. W. Brahmia, A. Olsho, A. Boudreaux, **T. I. Smith**, and C. Zimmerman. A conceptual blend analysis of physics quantitative literacy reasoning inventory items. In S. Smith Karunakaran, Z. Reed, and A. Higgins, editors, *Proceedings of the 23rd Annual Conference on Research in Undergraduate Mathematics Education*, pages 853–858, Boston, MA, 2020
28. S. White Brahmia, A. Olsho, **T. I. Smith**, and A. Boudreaux. Framework for the natures of negativity in introductory physics. *Phys. Rev. Phys. Educ. Res.*, 16(1):010120, 2020

29. C. Zimmerman, A. Olsho, S. White Brahmia, M. Loverude, A. Boudreaux, and **T. I. Smith**. Toward understanding and characterizing expert physics covariational reasoning. In *Physics Education Research Conference 2019*, PER Conference, Provo, UT, July 24–25 2019
30. **T. I. Smith**, S. White Brahmia, A. Olsho, and A. Boudreaux. Developing a reasoning inventory for measuring physics quantitative literacy. In A. Weinberg, D. Moore-Russo, H. Soto, and M. Wawro, editors, *Proceedings of the 22nd Annual Conference on Research in Undergraduate Mathematics Education.*, pages 1181–1182, Oklahoma City, OK, 2019
31. A. Olsho, S. White Brahmia, A. Boudreaux, and **T. I. Smith**. The physics inventory of quantitative reasoning: Assessing student reasoning about sign. In A. Weinberg, D. Moore-Russo, H. Soto, and M. Wawro, editors, *Proceedings of the 22nd Annual Conference on Research in Undergraduate Mathematics Education.*, pages 992–997, Oklahoma City, OK, 2019
32. S. White Brahmia, A. Olsho, **T. I. Smith**, and A. Boudreaux. A framework for the natures of negativity in introductory physics. In A. Weinberg, D. Moore-Russo, H. Soto, and M. Wawro, editors, *Proceedings of the 22nd Annual Conference on Research in Undergraduate Mathematics Education.*, pages 68–75, Oklahoma City, OK, 2019
33. S. White Brahmia, A. Olsho, **T. I. Smith**, and A. Boudreaux. NoNIP: Natures of Negativity in Introductory Physics. In A. Traxler, Y. Cao, and S. Wolf, editors, *Physics Education Research Conference 2018*, PER Conference, Washington, DC, August 1–2 2018
34. **T. I. Smith**. Representing uncertainty on model analysis plots. *Phys. Rev. Phys. Educ. Res.*, 12(2), 2016
35. **T. I. Smith**, W. M. Christensen, D. B. Mountcastle, and J. R. Thompson. Identifying student difficulties with entropy, heat engines, and the Carnot cycle. *Phys. Rev. ST Phys. Educ. Res.*, 11(2):20116, 2015
36. **T. I. Smith**, D. B. Mountcastle, and J. R. Thompson. Student understanding of the Boltzmann factor. *Phys. Rev. ST Phys. Educ. Res.*, 11(2):20123, 2015
37. **T. I. Smith**. Telling new stories using old data: FMCE edition. In A. D. Churukian, D. L. Jones, and L. Ding, editors, *2015 PERC Proceedings*, pages 315–318, College Park, MD, July 29–30 2015
38. **T. I. Smith**, M. C. Wittmann, and T. Carter. Applying model analysis to a resource-based analysis of the Force and Motion Conceptual Evaluation. *Physical Review Special Topics - Physics Education Research*, 10(2), 2014
(Selected as a PRPER Editors' Suggestion)
39. **T. I. Smith**, J. R. Thompson, and D. B. Mountcastle. Student understanding of Taylor series expansions in statistical mechanics. *Physical Review Special Topics - Physics Education Research*, 9(2), 2013
40. **T. I. Smith**, D. B. Mountcastle, and J. R. Thompson. Identifying student difficulties with conflicting ideas in statistical mechanics. In P. V. Engelhardt, A. D. Churukian, and D. L. Jones, editors, *AIP Conference Proceedings*, volume 1513, 2013
41. **T. I. Smith**, J. Thompson, and D. Mountcastle. Addressing student difficulties with statistical mechanics: The Boltzmann factor. In C. Singh, M. Sabella, and N. S. Rebello, editors, *AIP Conference Proceedings*, volume 1289, 2010
42. **T. I. Smith**, W. Christensen, and J. Thompson. Addressing student difficulties with concepts related to entropy, heat engines and the Carnot cycle. In M. Sabella, C. Henderson, and C. Singh, editors, *AIP Conference Proceedings*, volume 1179, 2009
43. M. Wittmann, M. Anderson, and **T. I. Smith**. Comparing three methods for teaching Newton's Second Law. In M. Sabella, C. Henderson, and C. Singh, editors, *AIP Conference Proceedings*, volume 1179, 2009

44. **T. I. Smith** and M. C. Wittmann. Applying a resources framework to analysis of the Force and Motion Conceptual Evaluation. *Physical Review Special Topics - Physics Education Research*, 4(2), 2008
45. **T. I. Smith** and M. C. Wittmann. Comparing three methods for teaching Newton's third law. *Phys. Rev. ST Phys. Educ. Res.*, 3(2):20105, 2007

Presentations

Invited Presentations

1. **T. I. Smith**. Defining almost correct: Quantifying student understanding hidden in wrong answers. Department of Physics and Astronomy, Lafayette College, 2020
2. **T. I. Smith**. Defining almost correct: Quantifying student understanding hidden in wrong answers. Department of Physics and Astronomy, Michigan State University, 2019
3. **T. I. Smith** and N. Bendjilali. Using IRT to rank incorrect responses FMCE questions. (poster) PERC. Provo, UT, 2019
4. **T. I. Smith**. The opposite of right isn't just wrong: Using statistical analyses to interpret incorrect responses. Department of Physics and Astronomy, Drexel University, 2017
5. **T. I. Smith**. Revealing new insights through deeper analyses. (plenary talk) FFER. Bar Harbor, ME, 2017
6. **T. I. Smith**, W. M. Christensen, D. B. Mountcastle, and J. R. Thompson. Identifying and Addressing Student Difficulties in Advanced Thermal Physics Courses. AAPT Winter Meeting. New Orleans, LA, 2016
7. **T. I. Smith**, J. R. Thompson, & D. B. Mountcastle. Identifying Student Difficulties with Conflicting Ideas in Statistical Mechanics. (poster) PERC. Philadelphia, PA, 2012

Presentations with Student Authors

8. **T. I. Smith**, B. Boyle*, C. Zimmerman, and S. White Brahmia. Validating Shorter Versions of the Physics Inventory of Quantitative Literacy. (poster) PERC. Boston, MA, (July, 2024)
9. **T. I. Smith**, B. Boyle*, P. Eaton, C. Zimmerman, A. Olsho, and S. White Brahmia. Creating Statistically Equivalent Versions of the Physics Inventory of Quantitative Literacy. (talk) AAPT Summer Meeting. Boston, MA, (July, 2024)
10. **T. I. Smith**, Z. Bischoff*, B. Boyle*, Z. Sayers*, C. Zimmerman, P. Eaton, A. Olsho, and S. White Brahmia. Creating Statistically Equivalent Versions of a Test of Quantitative Literacy in Physics Contexts. (poster) 26th Annual Conference of the SIGMAA on RUME. Omaha, NE, 2024
11. L. Han*, J. Talucci*, K. Yildiz*, V. Fasino*, and **T. I. Smith**. (poster) 2022 Physics Congress. Washington, DC, 2022
12. **T. I. Smith**, M. Kazmi*, R. Sarles*, J. Sbrana*, C. Soper*, and N. Bendjilali. Comparing item response theory models for ranking incorrect response options. (poster) PERC. 2021
13. **T. I. Smith**, M. Hoang*, P. Eaton, S. White Brahmia, A. Olsho, C. Zimmerman, and A. Boudreaux. Examining Response Patterns to Multiple-Response Items Using Module Analysis. (invited talk) AAPT Virtual Winter Meeting. 2021
14. **T. I. Smith**, P. Eaton, S. White Brahmia, A. Olsho, A. Boudreaux, C. DePalma*, V. LaSasso*, S. Straguzzi, and C. Whitener*. Using psychometric tools as a window into students' quantitative reasoning in introductory physics. (poster) PERC. Provo, UT, 2019

15. **T. I. Smith**, K. J. Louis*, and B. J. Ricci*. Using Quantitative Analyses to Rank Incorrect Responses to FMCE Questions. (talk) AAPT Winter Meeting. Houston, TX, 2019
16. **T. I. Smith**, K. J. Louis*, and B. J. Ricci*. Quantitative Analyses for Valuing Students' Incorrect Responses to Common Assessments. (talk) AAPT Summer Meeting. Washington, DC, 2018
17. K. J. Louis*, B. J. Ricci*, and **T. I. Smith**. Determining hierarchies of "correctness" through student transitions on the FMCE. (poster) PERC. Washington, DC, 2018
18. **T. I. Smith**, K. A. Gray*, K. J. Louis*, B. J. Ricci*, and N. J. Wright*. Analyzing transitions between mental models as measured by the FMCE. (poster) PERC. Cincinnati, OH, 2017
19. **T. I. Smith**, I. T. Griffin*, N. J. Wright*, K. J. Louis*, and R. Moyer*. Words vs. Graphs: Tracking Shifts in Students' Understanding of Forces. (talk) AAPT Summer Meeting. Sacramento, CA, 2016
20. **T. I. Smith**, N. J. Wright*, I. T. Griffin*, K. J. Louis*, and R. Moyer*. Tracking shifts in students' understanding: Forces, acceleration, and graphs. (poster) AAPT Summer Meeting. Sacramento, CA, 2016
21. **T. I. Smith**, I. T. Griffin*, N. J. Wright*, R. Moyer*, and K. J. Louis*. A multi-faceted approach to measuring student understanding. (invited poster) PERC. Sacramento, CA, 2016

Other Presentations

Lead Author

22. **T. I. Smith** and S. White Brahmia. Measuring and Improving Physics Quantitative Literacy throughout the Undergraduate Curriculum. (poster) IUUSE Summit. Washington, DC, (June, 2024)
23. **T. I. Smith** and N. Bendjilali. Consistency of item response theory results between data sets. (talk) APS April Meeting. Minneapolis, MN, 2023
24. **T. I. Smith**, P. Eaton, A. Olsho, and S. White Brahmia. Enriching Assessment of Physics Quantitative Literacy: IRT with Multiple-Response Items. (poster) 25th Annual Conference of the SIGMAA on RUME. Omaha, NE, 2023
25. **T. I. Smith**, P. Eaton, S. White Brahmia, A. Olsho, C. Zimmerman, and A. Boudreaux. Analyzing multiple-choice-multiple-response items using item response theory. (poster) PERC. Grand Rapids, MI, 2022
26. **T. I. Smith** and N. Bendjilali. Interpreting Item Response Theory Results Using a Thermodynamic Analogy. (talk) AAPT Summer Meeting. Grand Rapids, MI, 2022
27. **T. I. Smith** and N. Bendjilali. Defining Almost Correct: Quantifying Student Understanding Hidden in Wrong Answers. (poster) IUUSE Summit. Washington, DC, 2022
28. **T. I. Smith**, P. Eaton, S. White Brahmia, A. Olsho, C. Zimmerman, and A. Boudreaux. Toward a valid instrument for measuring physics quantitative literacy. (poster) PERC. 2020
29. **T. I. Smith** and N. Bendjilali. Modeling Students as Thermodynamic Systems using the Canonical Ensemble. (talk) AAPT Virtual Summer Meeting. 2020
30. **T. I. Smith**, S. White Brahmia, A. Olsho, and A. Boudreaux. Physics Students' Implicit Connections Between Mathematical Ideas. (talk) 23rd Annual Conference of the SIGMAA on RUME. Boston, MA, 2020
31. **T. I. Smith** and N. Bendjilali. Toward a more nuanced approach for scoring responses to RBAs. (talk) AAPT Winter Meeting. Orlando, FL, 2020

32. **T. I. Smith**, P. Eaton, S. White Brahmia, A. Olsho, and A. Boudreaux. A Method for Measuring Resource Activation in Physics Quantitative Literacy. (talk) AAPT Summer Meeting. Provo, UT, 2019
33. **T. I. Smith**. Physics Education Research at Rowan University. (poster) Rowan University Faculty Research Day. Glassboro, NJ, 2019
34. **T. I. Smith**, S. White Brahmia, A. Olsho, A. Boudreaux, and P. Eaton. Developing a Reasoning Inventory for Measuring Physics Quantitative Literacy. (poster) 22nd Annual Conference of the SIGMAA on RUME. Oklahoma City, OK, 2019
35. **T. I. Smith**, S. W. Brahmia, A. Olsho, A. Boudreaux, P. Eaton, P. J. Kelly, K. J. Louis, M. A. Nussenbaum, and L. J. Remy. PIQL: Measuring Physics Quantitative Literacy using Multiple-Choice/Multiple-Response Questions. (poster) PERC. Washington, DC, 2018
36. **T. I. Smith**, R. M. Wieman, I. H. Abi-El-Mona, J. A. Perry, and D. R. Klassen. South Jersey STEM Education Scholars: Recruiting and Supporting STGEM Teachers from Underrepresented Populations. (poster) 2018 Noyce Summit. Washington, DC, 2018
37. **T. I. Smith**. Shades of Gray: Quantifying the Spectrum Between Right and Wrong. (poster) Rowan University Faculty Research Day. Glassboro, NJ, 2018
38. **T. I. Smith**, I. H. Abi-El-Mona, P. Chestnut, P. R. La Porta, and K. P. Magee-Sauer. Building Capacity for Training and Supporting Physics Teachers. (talk) AAPT Winter Meeting. San Diego, CA, 2018.
39. **T. I. Smith**. Investigating Less Common Ideas About Force and Motion. (talk) AAPT Summer Meeting. Cincinnati, OH, 2017
40. **T. I. Smith**, I. H. Abi-El-Mona, P. R. La Porta, P. Chestnut, and K. P. Magee-Sauer. Rowan's PhysTEC Program: Successes and Challenges. (poster) AAPT Winter Meeting and 2017 PhysTEC Conference. Atlanta, GA, 2017
41. **T. I. Smith**, P. Chestnut, P. R. La Porta, I. H. Abi-El-Mona, and K. P. Magee-Sauer. (poster) PhysTEC Project at Rowan University: Year 1. 2016 PhysTEC Conference. Baltimore, MD, 2016
42. **T. I. Smith**. Correlating Students' Use of Multiple Representations on the FMCE. (poster) AAPT & PERC. College Park, MD, 2015
43. **T. I. Smith**. Student Consistency when Answering FMCE Questions. (poster) FFER. Bar Harbor, ME, 2015
44. **T. I. Smith**, J. R. Thompson, & D. B. Mountcastle. Multiple Perspectives on Student Syntheses of Concepts in Thermal Physics. (poster) AAPT & PERC. Portland, OR, 2013
45. **T. I. Smith**. Seeking Theoretical Perspectives for Analyzing Data. (poster) FFER. Bar Harbor, ME, 2013
46. **T. I. Smith**, J. R. Thompson, & D. B. Mountcastle. Student Difficulties Coping with Conflicting Ideas in Statistical Mechanics. (talk) AAPT, Philadelphia, PA, 2012
47. **T. I. Smith**, J. R. Thompson, & D. B. Mountcastle. Benefits of Pre-Tutorial Homework Assignments in Advanced Thermal Physics Courses. (poster) AAPT. Philadelphia, PA, 2012
48. **T. I. Smith**, J. R. Thompson, & D. B. Mountcastle. Student Understanding of Taylor Series Expansions in Statistical Mechanics. (poster) AAPT & PERC. Omaha, NE, 2011
49. **T. I. Smith**, J. R. Thompson, & D. B. Mountcastle. Student Ideas Relating to the Boltzmann Factor and Its Derivation. (talk) AAPT. Portland, OR, 2010

50. **T. I. Smith**, J. R. Thompson, & D. B. Mountcastle. Addressing Student Difficulties with the Boltzmann Factor: Preliminary Results. (poster) AAPT & PERC. Portland, OR, 2010
51. **T. I. Smith**, W. M. Christensen, J. R. Thompson, & D. B. Mountcastle. Preliminary Results of Curriculum Development in Upper-Level Thermodynamics: Heat Engines. (talk) AAPT. Ann Arbor, MI, 2009
52. **T. I. Smith**, J. R. Thompson, & D. B. Mountcastle. Addressing Student Difficulties Considering Entropy and Heat Engines. (poster) AAPT & PERC. Ann Arbor, MI, 2009
53. **T. I. Smith**, W. M. Christensen, J. R. Thompson, and D. B. Mountcastle. Addressing Student Difficulties Considering Entropy and Heat Engines, (poster) Foundations and Frontiers of Physics Education Research. Bar Harbor, ME, 2009
54. **T. I. Smith**, M. C. Wittmann, and T. Carter. Analyzing the Force and Motion Conceptual Evaluation using Model Analysis. (poster) AAPT & PERC. Greensboro, NC, 2007
55. **T. I. Smith**, M. C. Wittmann, and T. Carter. Revised methods for analyzing the Force and Motion Conceptual Evaluation. (talk) AAPT. Greensboro, NC, 2007
56. **T. I. Smith** and M. C. Wittmann. Comparing Three Methods for Teaching Newton's Third Law. (poster) AAPT & PERC. Syracuse, NY, 2006

Co-author

57. C. Zimmerman, S. White Brahmia, **T. I. Smith**, and A. Olsho. Mathematical Reasoning in Algebra-Based Physics. (poster) PERC. Boston, MA, 2024
58. A. Olsho, C. Zimmerman, A. Boudreaux, **T. I. Smith**, P. Eaton, and S. White Brahmia. Characterizing covariational reasoning in physics modeling. (poster) PERC. Grand Rapids, MI, 2022
59. C. Zimmerman, A. McCarty, S. White Brahmia, A. Olsho, M. De Cock, A. Boudreaux, **T. I. Smith**, and P. Eaton. Assessing physics quantitative literacy in algebra-based physics: lessons learned.(poster) PERC. Grand Rapids, MI, 2022
60. S. White Brahmia and **T. I. Smith**. Leveraging the Physics Inventory of Quantitative Literacy to Assess Reasoning in STEM Courses. (talk) 2022 IUSE Summit, Washington, DC, 2022
61. P. Walter and **T. I. Smith**. Comparing pre/post item response curves to identify changes in misconceptions. (poster) PERC. 2021
62. A. Olsho, S. White Brahmia, **T. I. Smith**, and A. Boudreaux. Electric Charge as a Signed Quantity. (talk) AAPT Virtual Summer Meeting. 2021
63. S. White Brahmia, **T. I. Smith**, P. Eaton, C. Zimmerman, A. Olsho, and A. Boudreaux, Finding potential pathways between expert and student physics quantitative reasoning. (talk) AAPT Virtual Winter Meeting. 2021
64. A. Boudreaux, S. E. Kanim, A. Olsho, S. White Brahmia, C. Zimmerman, and **T. I. Smith**. Toward a framework for the natures of proportional reasoning in introductory physics. (poster) PERC. 2020
65. A. Olsho, S. White Brahmia, C. Zimmerman, **T. I. Smith**, P. Eaton, and A. Boudreaux. Online administration of a reasoning inventory in development. (poster) PERC. 2020
66. C. Zimmerman, A. Olsho, S. White Brahmia, A. Boudreaux, **T. I. Smith**, and P. Eaton. Exploring student facility with "goes like" reasoning in introductory physics. (poster) PERC. 2020
67. S. White Brahmia, A. Olsho, A. Boudreaux, and **T. I. Smith**. Assessing Mathematical Reasoning: The Physics Inventory of Quantitative Reasoning. (talk) AAPT Virtual Summer Meeting. 2020

68. S. White Brahmia, A. Olsho, **T. I. Smith**, A. Boudreaux, and C. M. Zimmerman. A Conceptual Blend Analysis of Physics Quantitative Literacy Reasoning Inventory Items. (talk) 23rd Annual Conference of the SIGMAA on RUME. Boston, MA, 2020
69. S. White Brahmia, A. Olsho, C. Zimmerman, and **T. I. Smith**. A conceptual blend analysis of student reasoning about Physics Quantitative Literacy Reasoning Inventory (PIQL) items. (talk) PERC. 2020
70. C. Zimmerman, A. Olsho, S. White Brahmia, A. Boudreaux, and **T. I. Smith**. Comparing Covariational Reasoning of Experts in Physics and in Mathematics. (talk) AAPT Summer Meeting. Provo, UT, 2019
71. C. J. Richardson* and **T. I. Smith**. Were they right? Replicating IRC-based analyses using FMCE data. (poster) PERC. Provo, UT, 2019
72. C. Zimmerman, A. Olsho, M. Loverude, A. Boudreaux, **T. I. Smith**, and S. White Brahmia. Toward Understanding and Characterizing Expert Physics Covariational Reasoning. (poster) PERC. Provo, UT, 2019
73. A. Olsho, C. Zimmerman, S. White Brahmia, A. Boudreaux, and **T. I. Smith**. The natures of covariational reasoning in introductory physics. (talk) 20th Annual Meeting of the APS Northwest Section. Bellingham, WA, 2019
74. S. White Brahmia, A. Olsho, A. Boudreaux, and **T. I. Smith**. PIQL: A new assessment of mathematical reasoning development in physics instruction. (talk) APS April Meeting. Denver, CO, 2019
75. A. Olsho, S. White Brahmia, A. Boudreaux, and **T. I. Smith**. The Physics Inventory of Quantitative Literacy: Assessing Student Reasoning About Sign. (talk) 22nd Annual Conference of the SIGMAA on RUME. Oklahoma City, OK, 2019
76. S. White Brahmia, A. Olsho, **T. I. Smith**, and A. Boudreaux. A Framework for the Natures of Negativity in Introductory Physics. (talk) 22nd Annual Conference of the SIGMAA on RUME. Oklahoma City, OK, 2019
77. K. P. Magee-Sauer, **T. I. Smith**, P. L. Chestnut, P. R. La Porta, and D. R. Klassen. PhysTEC Comprehensive Site at Rowan University — What Worked. (talk) AAPT Winter Meeting. Houston, TX, 2019
78. S. White Brahmia, A. Olsho, **T. I. Smith**, and A. Boudreaux. Assessing Physics Quantitative Literacy Development. (panel) AAPT Winter Meeting. Houston, TX, 2019
79. S. W. Brahmia, **T. I. Smith**, A. Olsho, and A. Boudreaux. PIQL: Physics Inventory of Quantitative Literacy. (talk) AAPT Summer Meeting. Washington, DC, 2018
80. S. W. Brahmia, A. Olsho, **T. I. Smith**, and A. Boudreaux. Natures of Negativity in Introductory Physics. (poster) PERC. Washington, DC, 2018
81. S. W. Brahmia, A. Olsho, **T. I. Smith**, and A. Boudreaux. Assessing physics quantitative literacy development. (poster) AAPT Summer Meeting. Washington, DC, 2018
82. I. H. Abi-El-Mona and **T. I. Smith**. Impact of Learning Assistant Model on Undergraduate Physics Learning Assistants and Faculty Dispositions. (poster) 2018 PhysTEC Conference. College Park, MD, 2018
83. P. L. Chestnut and **T. I. Smith**. Learning Assistant Program Impact on Non-Traditional Transfer Students. (talk) AAPT Winter Meeting. San Diego, CA, 2018
84. I. H. Abi-El-Mona, **T. I. Smith**, P. R. La Porta, P. Chestnut, and K. P. Magee-Sauer. (poster) First Year Impact of the Learning Assistant Model on Undergraduate Physics Learning Assistants' Dispositions Towards Teaching Science as a Profession. 2017 PhysTEC Conference. Atlanta, GA, 2017

85. P. R. La Porta, P. Chestnut, **T. I. Smith**, I. H. Abi-El-Mona, and K. P. Magee-Sauer. (poster) PhysTEC Project at Rowan University: Pivot to Sustainability. 2017 PhysTEC Conference. Atlanta, GA, 2017
86. J. R. Thompson, **T. I. Smith**, & D. B. Mountcastle. Student Difficulties with a Taylor Series Expansion in Statistical Mechanics. (talk) AAPT. Omaha, NE, 2011
87. D. B. Mountcastle, J. R. Thompson, & **T. I. Smith**. Curriculum Development Addressing Multiplicity and Probability in Statistical Physics. (poster) AAPT & PERC. Portland, OR, 2010
88. J. R. Thompson, **T. I. Smith**, and D. B. Mountcastle. Investigations of student understanding of the Boltzmann factor and its applications, (talk) 2010 April Meeting of the American Physical Society, Washington, DC.
89. D. B. Mountcastle, J. R. Thompson, and **T. I. Smith**. Exploring student difficulties with multiplicity and probability in statistical physics, (talk) 2010 March Meeting of the American Physical Society, Portland, OR.
90. W. M. Christensen, **T. I. Smith**, & J. R. Thompson. Curriculum Adaptation in Upper-Level Thermodynamics: Entropy and the Second Law. (talk) AAPT. Ann Arbor, MI, 2009
91. D. B. Mountcastle, J. R. Thompson, and **T. I. Smith**. Conceptual Difficulties with Binomial Distributions in Statistical Physics. (poster) AAPT. 2009
92. D. B. Mountcastle, J. R. Thompson, and **T. I. Smith**. Exploring Student Difficulties with Multiplicity and Probability in Statistical Physics, (talk) AAPT, Ann Arbor, MI.
93. T. Carter, **T. I. Smith**, and M. C. Wittmann. Effect of a PER-Based Textbook and Online Tutoring Systems on Two-Year College Students. (poster) AAPT, Edmonton, AB, Canada, 2008
94. T. Carter, **T. I. Smith**, and M. C. Wittmann. Effect of Instructional Method Changes on an Introductory Physics Class at a Two-Year College. (poster) AAPT, Greensboro, NC, 2007

Conference Abbreviations

AAPT: American Association of Physics Teachers

APS: American Physical Society

FFPER: Foundations and Frontiers of Physics Education Research

IUSE: Improving Undergraduate STEM Education (NSF program)

PERC: Physics Education Research Conference

PhysTEC: Physics Teacher Education Coalition

SIGMAA on RUME: Special Interest Group of the Mathematical Association of America on Research in Undergraduate Mathematics Education

Mentoring Student Research

2018–2021: 1 graduate EdD candidate (Patrick Chestnut)

2015–2024: 50 undergraduate research assistants

Fall 2024	2 students	(K. Endicott, E. Ward)
Summer 2024	4 students	(N. Clark, M. Crawford, K. Endicott, E. Ward)
Spring 2024	2 student	(B. Boyle; Robert Morgan)
Fall 2023	4 students	(Z. Bischoff, B. Boyle, J. Sayers; Robert Morgan)
Summer 2023	2 students	(P. Schmal, N. Wood)
Spring 2023	3 students	(Z. Bischoff, J. Sayers, A. Zia)
Summer 2022	4 students	(V. Fasino, L. Han, J. Talucci, K. Yildiz)
Summer 2021	4 students	(M. Kazmi, R. Sarles, J. Sbrana, C. Soper)
Spring 2021	5 students	(J. Kwak, E. Marquez Auza, D. Shubiak, C. Stump, R. Vasquez)
Fall 2020	5 students	(M. Hoang; J. Francobandiero, C. Mahoney, E. Marquez Auza, C. Stump)
Spring 2020	3 students	(N. Baltera, M. Hoang, K. Shine)
Fall 2019	3 students	(C. DePalma, M. Hoang, C. Newkirk)
Summer 2019	5 students	(C. DePalma, V. LaSasso, S. Straguzzi, C. Whitener; C. Richardson)
Spring 2019	4 students	(J. Mendez, C. Ratcliffe, Z. Tribbett; T. Slater)
Fall 2018	6 students	(N. Baltera, P. Kelly, M. Lentini, M. Nussenbaum, C. Richardson; T. Slater)
Summer 2018	5 students	(P. Kelly, K. Louis, M. Nussenbaum, L. Remy, B. Ricci)
Spring 2018	1 student	(K. Louis)
Fall 2017	1 student	(B. Ricci)
Summer 2017	4 students	(K. Gray, K. Louis, B. Ricci, N. Wright)
Fall 2016	1 student	(I. Griffin)
Summer 2016	4 students	(I. Griffin, K. Louis, R. Moyer, N. Wright)
Spring 2016	2 students	(I. Griffin, N. Wright)
Fall 2015	2 students	(I. Griffin, N. Wright)
Spring 2015	1 student	(M. Pultrone)

Student Presentations at Rowan University

1. B. Boyle* and **T. I. Smith**. Further validating two half-length versions of a test of physics quantitative literacy. (poster) Rowan University College of Science & Mathematics Student Research Day. Glassboro, NJ, 2024
2. P. Schmal*, N. Wood*, and **T. I. Smith**. Network Analysis of Students Across Introductory Physics Courses. (poster) CSM SURP Poster Session. Glassboro, NJ, 2023
3. J. Sayers*, Z. Bischoff*, A. Zia*, and **T. I. Smith**. Modeling Networks to Analyze Student Trends in Development of Mathematical Reasoning Skills. (poster) Rowan University College of Science & Mathematics Student Research Day. Glassboro, NJ, 2023
4. C. Soper*, M. Kazmi*, J. Sbrana*, R. Sarles*, and **T. I. Smith**. Comparing item response theory models for ranking incorrect response options. (poster) Rowan University College of Science & Mathematics Student Research Day. Glassboro, NJ, 2022
5. C. J. Richardson*, N. Baltera*, P. J. Kelly*, M. Lentini*, M. A. Nussenbaum*, and **T. I. Smith**. (poster) Rowan University Student Scholars Symposium. Glassboro, NJ, 2019
6. P. J. Kelly*, K. J. Louis*, M. A. Nussenbaum*, L. J. Remy*, and **T. I. Smith**. Developing a reasoning inventory for measuring physics quantitative literacy. (poster) CSM SURP Poster Session. Glassboro, NJ, 2018
7. K. J. Louis*, B. J. Ricci*, and **T. I. Smith**. Determining a Hierarchy of “Correctness” for a Multiple-Choice Assessment. (poster) 21st annual Rowan University STEM Symposium. Glassboro, NJ, 2018

8. K. A. Gray*, K. J. Louis*, B. J. Ricci*, N. J. Wright*, and **T. I. Smith**. Analyzing transitions between mental models as measured by the FMCE. (poster) CSM SURP Poster Session. Glassboro, NJ, 2017
9. K. J. Louis*, N. J. Wright*, and **T. I. Smith**. Tracking shifts in students' understanding: Forces, acceleration, and graphs. (poster) 20th annual Rowan University STEM Symposium. Glassboro, NJ, 2017
10. K. J. Louis*, I. T. Griffin*, R. Moyer*, N. J. Wright*, and **T. I. Smith**. Tracking shifts in students' understanding: Forces, acceleration, and graphs. (poster) CSM SURP Poster Session. Glassboro, NJ, 2016
11. N. J. Wright*, I. T. Griffin*, and **T. I. Smith**. Incorrect isn't necessarily wrong: Tracking shifts in student understanding in the physics classroom. (poster) 19th annual Rowan University STEM Symposium. Glassboro, NJ, 2016
12. M. Pultrone* and **T. I. Smith**. An Analysis of Student Learning in Single and Double- Lecture Physics Classes. (poster) 18th annual Rowan University STEM Symposium. Glassboro, NJ, 2015

Frequently Taught Courses

Physics & Astronomy: Electricity & Magnetism I (PHYS 00.320), Statistical Physics (PHYS 00.430), Physics Research Methods I/II (PHYS 00.351/2), Physics Research I–IV (PHYS 00.250/1, 00.350, 00.450)

Content Area Teacher Education: STEM Teaching & Research Methods I (STEM 60.501), STEM Education Residency I/II (STEM 60.512/3)

Service Roles and Activities

Department

Department of Physics & Astronomy	
Department Coordinator	2024–present
Assessment Coordinator; Chair of Assessment Committee	2014–2021; 2022–2024
Chair, Dept. of Physics & Astronomy Program Review Committee	2022–2024
Tenure & Recontracting Committee member	2022–2023
Inclusion, Diversity, and Equity Committee member	2023–present
Physics & Astronomy representative to the Teacher Education Advisory Council (TEAC)	2014–2021; 2022–present
Curriculum Committee member	2016–2021
Learning Assistant Coordinator	2015–2016
AFT Representative	2022–present
Department of Content Area Teacher Education (previously STEAM Education)	
Chair, Elections Committee	2023–present
Sabbatical Committee member	2023–present
AFT Representative	2016–2021; 2022–present
Elections Committee member	2017

College

College of Education TR&P Committee (AFT representative)	2024
College of Education Induction & Pinning Ceremony Committee member	2023–present
College of Science & Mathematics Award Selection Committee member	2023, 2025
College of Science & Mathematics Strategic Planning: Education Group member	2022
Dissertation committee member (for Patrick Chestnut, EdD candidate)	2018–2021
Co-Presenter: College of Science & Mathematics annual Graduate School Workshop	2017–2021
Search committee member:	
Planetarium Assistant (CSM)	2021
Assistant Professor of Science or Math Education in the Early Grades (CED)	2015–2017
Contributor: CSM/SBSHP Exploratory Studies Workshop	2015
Sponsored curriculum proposals (Lead: 5, Co-sponsor: 4)	2014–2018

University

Institutional Review Board member (Glassboro/CMSRU)	2023–present
Learning Assessment & Rowan Core Committee member	2024–present
Judge: Idea Challenge	2024
Membership Chairperson, Rowan chapter of the American Federation of Teachers	2023–present
Council Delegate, Rowan AFT	2019–2023
Rowan University Senate Budget and Planning Committee member	2017–2021
Attended Rowan Seminar preparation workshops	2015–2017
Search committee member:	
Senior Proposal Specialist, Office of Sponsored Programs (internal)	2016
Senior Proposal Specialist, Office of Sponsored Programs (external)	2016

Wider & Professional Community

Professional Memberships:	
American Physical Society (APS)	2004–present
Topical Group on Physics Education Research (GPER)	2013–present
American Association of Physics Teachers (AAPT)	2004–present
Physics Education Research Topical Group (PERTG)	2006–present
AAPT: Research in Physics Education (RiPE) Committee Chair and <i>ex officio</i> member of the Physics Education Research Leadership Organizing Council	2020–2021
AAPT: RiPE Committee Vice Chair	2019–2020
AAPT: RiPE Committee member	2018–2019
APS GPER Nominating Committee member	2023–present
Journal/Conference Proceedings Referee:	
Physics Education Research Conference Proceedings	2009–present
American Journal of Physics	2011–present
Physical Review Physics Education Research	2012–present
European Journal of Physics	2017–present
The Physics Teacher	2018–present
Proceedings of the Conference on Research in Undergraduate Mathematics Education	2020–present
PLOS One	2021–present
Frontiers in Psychology	2024–present
Grant Proposal Reviewer: National Science Foundation	2020, 2021
Paper sorter: AAPT Summer Meeting	2016
Session presider: AAPT Summer Meeting	2016–2024
Session presider: PhysTEC Conference	2018
Conference Organizer: PERC	2020–2021

Participation on Advisory Boards:

NSF award 2322015, Promoting Equity and Research Using Adaptive Testing to Support Individualized Instruction at Scale: An Incubator Project, PI: Ben Van Dusen, Iowa State University	2023–present
NSF award 2336911, Collaborative Research: Scaffolding the Calculus in Calculus Based Physics, PI: Warren Christensen, North Dakota State University	2024–present
Program review, BS in Physics and BA in Physics, Department of Physics & Astronomy, University of Maine	2024
Career Day Presenter: J. Harvey Rodgers School, Glassboro, NJ	2017
Judge: Glassboro Public Schools Science Fair, Glassboro, NJ	2019, 2023–2025
Volunteer Instructor: Glassboro High School Marching Band	2024