

Andrew Elby

I. Personal Information

Contact Information

Andrew R. Elby
Dept. of TLPL, 2311 Benjamin Bldg., University of Maryland, College Park 20742
elby@umd.edu

Academic Appointments at UMD

08/2002 – 08/2011 *Assistant Research Scientist*, part time until 2008
Dept. of Physics (2002-2011)
Dept. of Curriculum & Instruction (2007-2011)

08/2011 - present *Associate Professor*
Dept. of Teaching & Learning, Policy & Leadership.
Affiliate Associate Professor, Dept. of Physics.

Other Employment

08/1997 – 08/1998 *Research Associate*, half-time. Assessment Coordinator.
University of California, Berkeley, College of Engineering.

08/1997 – 06/1998 *High school teacher* half-time. Regular and advanced placement physics.
Albany High School, Albany, California.

08/1998 – 06/1999 *High school teacher*, half-time. Physics.
Thomas Jefferson High School for Science & Tech., Annandale, VA.

07/1999 – 08/2007 *Textbook writer*, Independent contractor for John Wiley & Sons.

Educational Background

Harvard University	Chemistry & Physics	B.A., 1988
Cambridge University	History & Philosophy of Science	M.A., 1989
U. of California, Berkeley	Physics	M.A., 1991
U. of California, Berkeley	Individual major, Physics/Philosophy	Ph.D., 1995
U. of California, Berkeley	Education	M.A., 1997

Professional Certifications, Licenses, and Memberships

American Educational Research Association
American Association of Physics Teachers & Physics Education Research Topical Group
International Society of the Learning Sciences

II. Research, Scholarly, Creative, and Professional Activities¹

II.A. Books

II.A.1. Books Authored

Levin, D., Hammer, D., Elby, A., & Coffey, J. (2012). *Becoming a Responsive Science Teacher: Focusing on Student Thinking in Secondary Science*. Arlington, VA: National Science Teachers Association / NSTA Press. ISBN 978-1936959051

II.B. Chapters

II.B. Books (all invited)

Hammer, D., & Elby, A. (2002). On the form of a personal epistemology. In B. K. Hofer & P. R. Pintrich (Eds.), *Personal Epistemology: The Psychology of Beliefs about Knowledge and Knowing* (pp. 169-190). Mahwah, NJ: Erlbaum. ISBN 978-0805852356

DiSessa, A. A., Elby, A., & Hammer, D. (2002). J's epistemological stance and strategies. In G. M. Sinatra & P.R. Pintrich (Eds.), *Intentional Conceptual Change* (pp. 237-290). Mahwah, NJ: Erlbaum. ISBN 978-0805838251

Hammer, D., Elby, A., Scherr, R. E., & Redish, E. F. (2005). Resources, framing, and transfer. In J. Mestre (Ed.), *Transfer of Learning: Research and Perspectives* (pp. 89-120). Greenwich, CT: Information Age Publishing. ISBN 978-1593111649

Gillespie, N., & Elby, A. (2009). Content Preparation for Physics Teachers. In A. Collins & N. Gillespie (Eds.), *The continuum of secondary science teacher preparation: Knowledge, questions and research recommendations* (pp. 129-142). Rotterdam: Sense Publishers. ISBN 978-9087908027

Elby, A., & Hammer, D. (2010). Epistemological resources and framing: A cognitive framework for helping teachers interpret and respond to their students' epistemologies. In L. D. Bendixen & F. C. Feucht (Eds.), *Personal epistemology in the classroom: Theory, research, and implications for practice* (pp. 409-434). Cambridge: Cambridge University Press. ISBN 978-1107412507

Elby, A. (2011). Getting Started with Research on Epistemologies and Expectations, in *Getting Started in PER*, edited by C. Henderson and K. A. Harper (American Association of Physics Teachers, College Park, MD, 2011). Series: Reviews in PER Vol. 2, <<http://www.per-central.org/items/detail.cfm?ID=10578>>

Robertson, A., Richards, J., Elby, A., & Walkoe, J. (2015). Documenting Variability Within Teacher Attention and Responsiveness to the Substance of Student Thinking. In A.

¹ (*) = Graduate student. (†) = Post-doctoral research associate

Robertson, D. Hammer, & R. Scherr (Eds.), *Responsive Teaching in Science and Mathematics* (pp. 227-248). Routledge.

Gupta, A., Elby, A. & Sawtelle, V. (2015). Bridging Knowledge Analysis and Interaction Analysis Through Understanding the Dynamics of Knowledge in Use. In M. Levin., A. diSessa, & N. Brown (Eds.). *Knowledge and Interaction* (pp. 260-291). Routledge.

Elby, A. (2015). Commentary – “IA Lite”: Capturing Some of the Explanatory Power of Interaction Analysis without Committing to its Ontology. In M. Levin., A. diSessa, & N. Brown (Eds.). *Knowledge and Interaction* (pp. 252-259). Routledge.

Elby, A., Macrander, C. (*), & Hammer, D. (2016). Epistemic cognition in science. In J. A. Greene, W. A. Sandoval, & I. Braten (Eds.), *Handbook of Epistemic Cognition* (pp. 113-127). Routledge.

Secules, S., Gupta, A., & Elby, A. (2016). Piecemeal Versus Integrated Framing of Design Activities. In Adams, R. S., & Siddiqui, J. A. (Eds.). *Analyzing Design Review Conversations*. Purdue University Press.

II.C. Refereed Journals

II.C.1. Refereed Journal Articles

Elby, A. (1999). Another reason that physics students learn by rote. *American Journal of Physics, Physics Education Research Supplement* 67(7), S52-S57.

Elby, A. (2000). What students' learning of representations tells us about constructivism. *Journal of Mathematical Behavior*, 19, 481-502.

Elby, A. & Hammer, D. (2001). On the substance of a sophisticated epistemology. *Science Education*, 85, 554-567.

Elby, A. (2001). Helping physics students learn how to learn. *American Journal of Physics, Physics Education Research Supplement*, 69(7), S54-S64.

Hammer, D. & Elby, A. (2003). Tapping Epistemological Resources for Learning Physics. *Journal of the Learning Sciences*, 12, 53-90.

Louca, L. (*), Elby, A., Hammer, D., & Kagey, T. (2004). Epistemological resources: Applying a new epistemological framework to science instruction. *Educational Psychologist*, 39, 57-68. Invited.

Lising, L. (†), & Elby, A. (2005). The impact of epistemology on learning: A case study from introductory physics. *American Journal of Physics*, 73(4), 372-382.

- Elby, A. (2009). Defining Personal Epistemology: A response to Hofer & Pintrich (1997) and Sandoval (2005). *Journal of the Learning Sciences*, 18(1), 138-149.
- Goertzen, R. M. (*), Scherr, R. E., & Elby, A. (2009). Accounting for tutorial teaching assistants' buy-in to reform instruction. *Physical Review Special Topics — Physics Education Research*, 5(2), 020109.
- Goertzen, R. M. (*), Scherr, R. E., & Elby, A. (2010). Tutorial teaching assistants in the classroom: Similar teaching behaviors are supported by varied beliefs about teaching and learning. *Physical Review Special Topics — Physics Education Research*, 6(1), 010105.
- Tang, X. (*), Coffey, J., Elby, A., & Levin, D. (2010). The scientific method and scientific inquiry: Tensions in teaching and learning. *Science Education*, 94(1), 29-47.
- Goertzen, R. M. (*), Scherr, R. E., & Elby, A. (2010). Respecting tutorial instructors' beliefs and experiences: A case study of a physics teaching assistant. *Physical Review Special Topics — Physics Education Research*, 6(2), 020125.
- Elby, A. (2010). Coherence vs. fragmentation in student epistemologies: A reply to Smith & Wenk. *Electronic Journal of Science Education*. 14(1).
- Gupta, A. (†), & Elby, A. (2011). Beyond epistemological deficits: Dynamic explanations of engineering students' difficulties with mathematical sense-making. *International Journal of Science Education*, 33(18), 2463-2488.
- Yerdelen-Damar, S. (*), Elby, A., & Eryilmaz, A. (2012). Applying beliefs and resources frameworks to the psychometric analyses of an epistemology survey. *Physical Review Special Topics — Physics Education Research*, 8(1), 010104.
- Kuo, E. (*), Hull, M. (*), Gupta, A., & Elby, A. (2013). How students blend conceptual and formal mathematical reasoning in solving physics problems. *Science Education*, 97(1), 32-57.
- Hull, M. (*), Kuo, E. (*), Gupta, A., & Elby, A. (2013). Problem-solving rubrics revisited: Attending to the blending of informal conceptual and formal mathematical reasoning. *Physical Review Special Topics — Physics Education Research*, 9(1), 010105.
- Watkins, J. & Elby, A. (2013). Context dependence of students' views about the role of equations in understanding biology. *CBE – Life Sciences Education*, 12(2), 274-286.
- Danielak, B. (*), Gupta, A., & Elby, A. (2014). The Marginalized Identities of Sense-makers: Reframing Engineering Student Retention. *Journal of Engineering Education*, 103(1), 8-44.
Editor's choice (≤1 article per issue): Summary included in associated practitioner journal
- Gupta, A., Elby, A., & Conlin, L. (2014). How substance-based ontologies for gravity can be productive: A case study. *Physical Review Special Topics – Physics Education Research*, 10(1). 010113. **Editor's suggestion (~10% of articles)**

Yerdelen-Damar, S. (*), & Elby, A. (2016). Sophisticated epistemologies of physics versus high-stakes tests: How do elite high school students respond to competing influences about how to learn physics?. *Physical Review – Physics Education Research*, 12(1), 010118.

Quan, G. (*), & Elby, A. (2016). Connecting self-efficacy and views about nature of science in undergraduate research experiences. *Physical Review – Physics Education Research*, 12(2), 020140.

II.D. Published Conference Proceedings

II.D.1. Refereed Conference Proceedings

Hammer, D., & Elby, A. (2000). Epistemological resources. In B. Fishman & S. O'Connor-Divelbiss (Eds.), *Proceedings of the Fourth International Conference of the Learning Sciences* (pp. 4-5). Mahwah, NJ: Erlbaum.

McCaskey, T. L. (*), Dancy, M. H., & Elby, A. (2004). Effects on assessment caused by splits between belief and understanding. In S. Franklin, J. Marx & K. Cummings (Eds.), *American Institute of Physics Conference Proceedings: 2003 Physics Education Research Conference* (Vol. 720, pp. 37-40). Melville, NY: American Institute of Physics.

McCaskey, T. L. (*), & Elby, A. (2005). Probing students' epistemologies using split tasks. In S. Franklin, J. Marx & P. R. Heron (Eds.), *American Institute of Physics Conference Proceedings: 2004 Physics Education Research Conference* (Vol. 790, pp. 57-60). Melville, NY: American Institute of Physics.

Scherr, R. E., & Elby, A. (2007). Enabling informed adaptation: Open-source physics worksheets integrated with implementation resources. In P. R. Heron, L. McCullough & J. Marx (Eds.), *American Institute of Physics Conference Proceedings: 2006 Physics Education Research Conference* (Vol. 883, pp. 46-49). Melville, NY: American Institute of Physics.

Goertzen, R. M. (*), Scherr, R. E., & Elby, A. (2008). Indicators of understanding: What TAs listen for in student responses. In C. Henderson, M. Sabella, & L. Hsu (Eds.), *American Institute of Physics Conference Proceedings: 2008 Physics Education Research Conference* (Vol. 1064, pp. 119-122). Melville, NY: American Institute of Physics.

Danielak, B. (*), Gupta, A. , & Elby, A. (2010). Incorporating Affect in an Engineering Student's Epistemological Dynamics. In K. Gomez, L. Lyons, & J. Radinsky (Eds.), *Proceedings of the 9th International Conference of the Learning Sciences* (Vol. 2, pp. 411-412). Chicago: International Society of the Learning Sciences.

Gupta, A. , & Elby, A. (2010). Beyond epistemological deficits: Incorporating flexible epistemological views into fine-grained cognitive dynamics. In K. Gomez, L. Lyons, & J. Radinsky (Eds.), *Learning in the disciplines: Proceedings of the 9th International*

Conference of the Learning Sciences (Vol. 2, pp. 372-373). Chicago: International Society of the Learning Sciences.

Gupta, A., Danielak, B. (*), & Elby, A. (2010). Understanding students' difficulties in terms of coupled epistemological and affective dynamics. *Proceedings of 2010 Frontiers in Education Conference*. Washington, DC: Institute of Electrical and Electronics Engineers.

Danielak, B. (*), Gupta, A., & Elby, A. (2010). The marginalized identities of sense-makers: Reframing engineering student retention. *Proceedings of 2010 Frontiers in Education Conference*. Washington, DC: Institute of Electrical and Electronics Engineers.

Hull, M., & Elby, A. (2013). A conceptual physics class where students found meaning in calculations. In P. V. Engelhardt, A. D. Churukian, & J. N. Rebello (Eds.), *American Institute of Physics Conference Proceedings: 2012 Physics Education Research Conference* (Vol. 1513, pp. 190-193). Melville, NY: American Institute of Physics. **Finalist, best paper award.**

Hutchison, P., & Elby, A. (2013). Evidence of epistemological framing in survey question misinterpretation. In P. V. Engelhardt, A. D. Churukian, & J. N. Rebello (Eds.), *American Institute of Physics Conference Proceedings: 2012 Physics Education Research Conference* (Vol. 1513, pp. 194-197). Melville, NY: American Institute of Physics.

Richards, J., Conlin, L., Gupta, A., & Elby, A. (2013). Coupling epistemology and identity in explaining student interest in science. In P. V. Engelhardt, A. D. Churukian, & J. N. Rebello (Eds.), *American Institute of Physics Conference Proceedings: 2012 Physics Education Research Conference* (Vol. 1513, pp. 334-337). Melville, NY: American Institute of Physics.

Korff, J. V., Elby, A., Hu, D., & Rebello, S. (2014). Student Epistemology about Mathematical Integration in a Physics Context: A Case Study. In Engelhardt, P. V., Churukian, A. D., and Jones, D. L. (Eds.), *2013 Physics Education Research Conference (PERC) Proceedings* (pp. 353-356). College Park, MD: American Association of Physics Teachers.

Richards, J., Elby, A., & Gupta, A. (2014). Characterizing a New Dimension of Change in Attending and Responding to the Substance of Student Thinking. In Polman, J. L., Kyza, E. A., O'Neill, D. K., Tabak, I., Penuel, W. R., Jurow, A. S., O'Connor, K., Lee, T., and D'Amico, L. (Eds.). (2014). Learning and becoming in practice: The *International Conference of the Learning Sciences (ICLS) 2014*, Volume 1 (pp. 286-293). Boulder, CO: International Society of the Learning Sciences.

Alonzo, A. & Elby, A. (2014). The Nature of Student Thinking and Its Implications for the Use of Learning Progressions to Inform Classroom Instruction. In Polman, J. L., Kyza, E. A., O'Neill, D. K., Tabak, I., Penuel, W. R., Jurow, A. S., O'Connor, K., Lee, T., and D'Amico, L. (Eds.). (2014). Learning and becoming in practice: The *International Conference of the Learning Sciences (ICLS) 2014*, Volume 1 (pp. 1037-1041). Boulder, CO: International Society of the Learning Sciences.

- Elby, A., Richards, J., Walkoe, J., Gupta, A., Russ, R. S., Luna, M. J., Robertson, A., Coffey, J. E., Edwards, A. R., Sherin, M. G., Elizabeth A. van Es (2014). Differing Notions of Responsive Teaching across Mathematics and Science: Does the Discipline Matter? In Polman, J. L., Kyza, E. A., O'Neill, D. K., Tabak, I., Penuel, W. R., Jurow, A. S., O'Connor, K., Lee, T., and D'Amico, L. (Eds.). (2014). *Learning and becoming in practice: The International Conference of the Learning Sciences (ICLS) 2014*, Volume 1 (pp. 1406-1415). Boulder, CO: International Society of the Learning Sciences.
- Alonzo, A. C. & Elby, A. (2015). How Physics Teachers Model Student Thinking and Plan Instructional Responses When Using Learning-Progression-Based Assessment Information. In Churukian, A. D., Jones, D. L., and Ding, L. (Eds.), *2015 PERC Proceedings*. doi:10.1119/perc.2015.pr.003.
- Dreyfus, B. W., Sohr, E. R., Gupta, A., & Elby, A. (2015). "Classical-ish": Negotiating the Boundary between Classical and Quantum Particles. In Churukian, A. D., Jones, D. L., and Ding, L. (Eds.), *2015 PERC Proceedings*. doi:10.1119/perc.2015.pr.023
- Quan, G. & Elby, A. (2015). Connecting Self-Efficacy and Nature of Science Shifts in Undergraduate Research Experiences. In Churukian, A. D., Jones, D. L., and Ding, L. (Eds.), *2015 PERC Proceedings*. doi:10.1119/perc.2015.pr.062
- Sohr, E. R., Dreyfus, B. W., Gupta, A., & Elby, A. (2015). "Because math": Epistemological stance or defusing social tension in quantum mechanics? In Churukian, A. D., Jones, D. L., and Ding, L. (Eds.), *2015 PERC Proceedings*. doi:10.1119/perc.2015.pr.075.
- Quan, G., Gupta, A., & Elby, A. (2015). Problematizing Best Practices for Pairing in K-12 Student Design Teams. *2015 ASEE (American Society of Engineering Education) Annual Conference and Exposition*, Seattle, Washington. 10.18260/p.12565
- Secules, S., Gupta, A., & Elby, A. (2015). Theorizing can contribute to marginalized students' agency in engineering persistence. *2015 ASEE (American Society of Engineering Education) Annual Conference and Exposition*, Seattle, Washington. 10.18260/p.24918
- Elby, A., Kuo, E., Gupta, A., & Hull, M. M. (2015). Tensions and Trade-offs in Instructional Goals for Physics Courses Aimed at Engineers. *2015 ASEE (American Society of Engineering Education) Annual Conference and Exposition*, Seattle, Washington. 10.18260/p.24836
- Gupta, A., Elby, A., Philip, T. M. (2015). How Engineering Students Think About the Roles and Responsibilities of Engineers with Respect to Broader Social and Global Impact of Engineering and Technology. *2015 ASEE (American Society of Engineering Education) Annual Conference and Exposition*, Seattle, Washington. 10.18260/p.24192
- Secules, S., Gupta, A., Elby, A. (2015). Piecemeal Versus Integrated Design: Framing meets Design Thinking. In Adams, R. S. (Ed.), *Proceedings of DTRS 10: Design Thinking Research Symposium 2014*. West Lafayette, IN: Purdue University.

Gupta, A., Elby, A., Turpen, C. T., & Philip, T. (2016). The Dynamics of Perspective-taking in Discussions on Socio-technical Issues. 2016 *ASEE (American Society of Engineering Education) Annual Conference and Exposition*, New Orleans, LA.

Secules, S. D., Elby, A., & Gupta, A. (2016). "Turning away" from the Struggling Individual Student: An Account of the Cultural Construction of Engineering Ability in an Undergraduate Programming Class. 2016 *ASEE (American Society of Engineering Education) Annual Conference and Exposition*, New Orleans, LA. **Best Diversity Paper Award, Division of Educational Research & Measurement; Finalist, conference-wide Best Diversity Paper**

Quan, G., Turpen, C. T., & Elby, A. (2016). Attending to Scientific Practices within Undergraduate Research Experiences. 2016 *PERC Proceedings* [Sacramento, CA, July 20-21, 2016], edited by D. L. Jones, L. Ding, and A. Traxler. doi:[10.1119/perc.2016.pr.058](https://doi.org/10.1119/perc.2016.pr.058).

Sohr, E. R., Gupta, A., Elby, A., & Dreyfus, B. W. (2016). Sense-making with Inscriptions in Quantum Mechanics. 2016 *PERC Proceedings* [Sacramento, CA, July 20-21, 2016], edited by D. L. Jones, L. Ding, and A. Traxler, doi:[10.1119/perc.2016.pr.076](https://doi.org/10.1119/perc.2016.pr.076).

II.E.13. Symposia (competitively selected)

Organizer and Chair, "Good intentions, problematic epistemologies: Why common 'supports' for science students hinder inquiry." *Annual Meeting of the Jean Piaget Society*. June 4, 2011, Berkeley.

Organizer and Chair, "Differing Notions of Responsive Teaching across Mathematics and Science: Does the Discipline Matter?" *2014 International Conference of the Learning Sciences*, June 26, 2014.

Organizer and Discussant, "Student learning with PhET simulations: Beyond conceptual gains in classroom settings." *2015 Physics Education Research Conference*, July 30, 2015.

Organizer and Chair, "Applying Cultural Construction Frameworks in Engineering Education Research." *AERA 2016 Annual Meeting*, April 9, 2016. Washington, DC.

Organizer and Chair, "Differing Notions of Responsive Teaching Across Mathematics and Science: Does the Discipline Matter?" *AERA 2016 Annual Meeting*, April 10, 2016, Washington, DC.

II.E.14. Workshops (competitively selected)

Gupta, A., & Elby, A. (2012). Video Analysis Workshop: Reconciling Cognitivist and Interaction Analysis Methodologies. Workshop presented at the *2012 Physics Education Research Conference*, Philadelphia, 08/02/2012.

Gupta, A., Elby, A., & Conlin, L. (2015). Examining metacognition and epistemology in introductory labs: Video Workshop. Workshop presented at the *2015 Physics Education Research Conference*, College Park, MD, 07/30/2015.

II.J. Sponsored Research and Programs

II.J.1. Grants

NSF postdoctoral fellowships in science, mathematics, engineering and technology education. NSF DGE-9714474. **Principal Investigator: Andrew Elby.** 09/01/1997 – 08/31/2000. **\$102,000.**

Helping students learn how to learn: Open-source physics worksheets integrated with TA development resources. NSF DUE-0341447. **Principal Investigator: Andrew Elby;** Co-Principal Investigators: Rachel Scherr, David Hammer, Edward Redish, Seth Rosenberg, Stamatis Vokos. 07/01/2004 – 06/30/2007. **\$405,463.**

Toward a new Conceptualization of What Constitutes Progress in Learning Physics, K-16: Resources, Frames, and Networks. NSF DRL-0440113. Principal Investigator: David Hammer; **Co-Principal Investigators:** Uri Wilensky, Rachel Scherr, **Andrew Elby**, Edward Redish. 04/01/2005 03/30/2009. **\$799,800.**

What Influences Teachers' Modifications of Curriculum? NSF DRL-0455711. Principal Investigator: David Hammer; **Co-Principal Investigators: Andrew Elby**, Janet Coffey, Alan Berkowitz. 06/01/2005 – 05/31/2010. **\$1,453,677.**

Developing Conceptual and Teaching Expertise in Physics Graduate Students: An Integrated Approach. NSF DRL-0529482. Principal Investigator: Rachel Scherr; **Co-Principal Investigators: Andrew Elby**, Edward Redish, David Hammer. 01/01/2006 – 12/31/2009. **\$209,806.**

Collaborative Research: Open-source physics tutorial worksheets with faculty/TA development and implementation resources. NSF DUE-0715567. Principal Investigator: Rachel Scherr; **Co-Principal Investigators: Andrew Elby**, Rachel Scherr, Edward Redish, David Hammer. 09/15/2007 - 09/14/2010. **\$258,841.**

Learning Progressions for Scientific Inquiry: A Model Implementation in the Context of Energy. NSF DRL-0732233. Principal Investigator: Fred Goldberg; **Co-Principal Investigators:** Sharon Bendall, **Andrew Elby**, Janet Coffey, David Hammer. 01/01/2008 – 06/30/2013. **\$2,907,792 (~\$1,500,000 @ UMD)**

Disciplinary Experts in Science Education Research: A University of Maryland Program for Producing STEM Education Researchers. NSF DRL-0733613. **Principal Investigator: Andrew Elby;** Co-Principal Investigators: David Hammer, Spencer Benson, Janet Coffey, Mike Stieff. 01/01/2008 – 12/31/2013. **\$1,311,072.**

Improving students' mathematical sense-making in engineering: Research and development. NSF EEC-0835880. **Principal Investigator: Andrew Elby**; Co-Principal Investigators: E.F. Redish, David Hammer, David Bigio, Wesley Lawson. 09/01/2008 – 08/31/2013. **\$499,991.**

Minority Student Pipeline MSP. NSF DRL-0831970. Principal Investigator: Anisha Campbell; **Co-Principal Investigators: Andrew Elby**, Nancy Shapiro, Gladys Whitehead, Christine Barrow. 10/01/2008 – 09/30/2014. \$12,424,182 (~**\$1,350,000 @ UMD**)

University of Maryland Noyce Scholars Program for Science Teachers. NSF DUE-1239999. **Principal Investigator: Andrew Elby**; Co-Principal Investigators: Daniel Levin, Lawrence Clark, Edward Redish. 01/01/2013 – 12/31/2017. **\$1,199,674.**

Changing how physics students approach learning with simulations: Research and development of PhET-based tutorials. NSF DUE-1245400. **Principal Investigator: Andrew Elby**; Co-Principal Investigator: Ayush Gupta. 06/15/2013 – 06/14/ 2015. **\$199,983.**

Collaborative Research: Helping Engineering Students Transform Their Understanding of Quantum Phenomenon and Devices. NSF DUE-1323129. Principal Investigator: Ayush Gupta; **Co-Principal Investigator: Andrew Elby.** 09/01/2013 – 08/31/2016. **\$393,261.**

An application-based learning approach to introductory C programming language courses. NSF DUE-1245745. Principal Investigator: Wesley Lawson; **Co-Principal Investigators: Andrew Elby**, Shuvra Bhattacharyya, Ayush Gupta. 09/01/2013 – 08/31/2015. **\$199,354.**

Collaborative Research: Modeling the dynamics of integrated technical and moral reasoning in contexts of socio-scientific issues. NSF SES-1338700. Principal Investigator: Ayush Gupta; **Co-Principal Investigator: Andrew Elby.** 01/14/2014 – 12/31/2016. **\$225,561.**

Forging identity and community in physics: Evaluation and dissemination of Compass. NSF DUE-1245590. **Principal Investigator: Andrew Elby.** 04/01/2014 – 03/30/2016. **\$97,500.**

Research on Practice Using STEM Inquiry Embedded with Computational Thinking in Elementary School. NSF DUE-1543061. **Principal Investigator: Andrew Elby**; Co-Principal Investigators: Ayush Gupta, Aman Yadav. 09/01/2015 – 08/31/2017. **\$1,013,651.**

Collaborative Research: Integrating conceptual reasoning with mathematical formalism: Teaching and assessing mathematical sense-making in quantum mechanics. NSF DUE-1625797; Principal Investigator: Ayush Gupta; **Co-Principal Investigator: Andrew Elby.** 09/01/2016 – 08/31/2019. **\$385,349.**

Awards

Spencer Foundation Mid-Career Grant (2016-2017). One of seven fellowships awarded in 2016, for scholars 7 to 20 years out from their Ph.D. Pays full salary and expenses for one year.

Graduate Faculty Mentor of the Year Award, University of Maryland, 2012. One of four such awards given campuswide by the Graduate School.

Outstanding Reviewer (referee) award, AERA & AERJ (American Educational Research Journal – Teaching, Learning, and Human Development), 2011. One of about 50 such awards given, across all AERA journals.

Outstanding Referee Award, American Physical Society, 2009. Given to fewer than 1% of active reviewers for APS journals.