

Gay B. Stewart

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Education

University of Illinois, Urbana-Champaign
Urbana, IL Ph.D. Physics 1994, M.S. Physics 1990
Thesis Supervisor: Bob I. Eisenstein;
Title: Search for CP Violation in D-Meson Decays

University of Arizona
Tucson, AZ BS Physics 1988
minor: business

Professional experience

West Virginia University
Professor of Physics and Eberly Professor of
STEM Education, Fall 2014-current
University of Arkansas, Fayetteville
Assistant Professor of Physics 1994-2000
Associate Professor of Physics 2000-2011
Professor, 2011-2014 (adjunct 2014-)

University of Illinois, Urbana-Champaign
Graduate Teaching Assistant 1988-1989
Graduate Research Assistant 1989-1994
University of Arizona, Tucson
Analyst of Educational Software 1987-1988
Arizona Range News, Willcox, AZ
Assistant Editor/Reporter 1980-1981
Reporter 1979-1980

Teaching Interests and Courses Taught

The NSF program officers felt it best that I taught University Physics II (UPII) while it was funded (2 semesters before and 10 during funding). PhysTEC required a complete reworking of UPI, so I then taught that for 14 semesters. This, combined with Lab and Classroom Practices in Physics (PHYS 400V) and the independent study courses (teacher, and special topics, graduate and undergraduate) required all of my teaching time, with the exception of one summer Modern Physics course, one summer course for the College of Education and Health Professions (Science Teaching), one section of electromagnetic theory taught for students off sequence, and one Physics in Perspective taught specially for future teachers. With the launch of UTeach, I began teaching the junior-level Research Methods course, which I have now taught at two institutions. I have also supervised many undergraduates and graduate students in independent learning projects related to physics or to science teaching and learning.

- Developed the new University Physics II class in 1994. Developed approximately 20 new activities for the class and reworked some existing laboratories to make them fit the course structure. Continued revision of the course and development of new materials with John Stewart. In 1997, adapted the UPII format to allow possible adoption in other courses. In 2000, reworked existing University Physics I laboratories and developed new activities and demonstrations to fit this format.
- Developed “Lab and Classroom Practices in Physics” a dual-enrollment course and helped plan five new and revised courses to support the revisions to BA and BS degrees. Developed a new MA degree for physics teachers and helped revise the BA and BS degrees at UA.
- Helped revise the BA and all BS areas of emphasis at WVU.
- Supervise independent study courses in modern physics and physics education (UA) and physics education (WVU) at the graduate and undergraduate level and for area high school teachers unable to attend courses during normal times.

Awards

- Oersted Medalist, American Association of Physics Teachers (AAPT, their highest award), 2019
- WVU Rising Star award, presented by Gordon Gee and Joyce McConnell at the Department of Physics and Astronomy Holiday Party, 2018 (I did not get the lapel pin they give now!)
- University of Arkansas Freshman Engineering Program Director’s Service Award, 2013-14

- Arkansas-Oklahoma-Kansas Section, AAPT Recognition for exceptional contributions to physics education, 2014
- CASE Arkansas Professor of the Year, 2002; U of A Alumni Association 2007 Teacher of the Year
- UA Advising Award, 2006; Honors College Fellowship Advising Gold Medal, 2003
- Fulbright College Master Teacher, 2002; Fulbright College Outstanding Adviser, 1998

Current research interests

Supported in part by NSF since May 1995. Much of my time is spent in managerial functions associated with large projects, and significant time is spent mentoring faculty in proposal development. However, I have maintained some research presence: with 40+ peer-reviewed publications and 50+ invited talks at national meetings dealing with physics or science education. Areas:

- 1) Preparing graduate students to join the professoriate and masters and undergraduate students to become high school physics teachers; STEM preparation of elementary teachers
- 2) Curriculum Development: materials and class strategies effective for small and large institutions in introductory calculus-based physics courses.
 - Created K-12 teacher resources and course materials.
 - Developed activities for and involved in production of lab manuals for six intro physics courses
 - Focus on assessment and evaluation of students *and* curricula.
- 3) Retention in STEM career pathways, particularly for rural and first-generation students
- 4) Professional learning for in-service mathematics, physics and computer science teachers

Select Publications across areas of interest

- Contributor to 15 of the 33 posted sections in “A Guide to Effective Practices for Physics Programs (EP3)”, S. McKagan, D. A. Craig, M. Jackson, and T. Hodapp, Eds., (American Physical Society, College Park, MD, Version 1), 2021, 2022, 2023.
- Wrote a textbook to support AP Physics 1 (2019). Some teachers found it so helpful that I revised it to support the new AP curriculum framework and expanded it to include AP Physics 2 (2023).
- Stewart, J., Cochran, G. L., Henderson, R., Zabriskie, C., DeVore, S., Miller, P., Stewart, G. & Michaluk, L. (2021). Mediation effect of prior preparation on performance differences of students underrepresented in physics. *Physical Review Physics Education Research*, 17(1), 010107.
- Yang, J., Wells, J., Henderson, R., Christman, E., Stewart, G., & Stewart, J. (2020). Extending modified module analysis to include correct responses: Analysis of the Force Concept Inventory. *Physical Review Physics Education Research*, 16(1), 010124.
- Stewart, G., Freedman, R., Ruskell, T. & Kesten, P. (2019) *College Physics for the AP Physics 1 Course*, Boston, MA: Bedford, Freeman and Worth. Primary Author.
- Wells, J., Henderson, R., Stewart, J., Stewart, G., Yang, J., and Traxler, A. (2019). Exploring the structure of misconceptions in the Force Concept Inventory with modified module analysis. *Physical Review Physics Education Research*, 15, 020122.
- Traxler, A., Henderson, R., Stewart, J., Stewart, G., Papak, A. & Lindell, R. (2018). Gender fairness within the Force Concept Inventory, *Physical Review Physics Education Research*, 14, 010103.
- Michaluk, L., Stoiko, R., Stewart, G. & Stewart, J. (2018). Beliefs and Attitudes about Science and Mathematics in Pre-Service Elementary Teachers, STEM, and Non-STEM Majors in Undergraduate Physics Courses, *Journal of Science Education and Technology*, 27: 99.
- Henderson, R., Stewart, G., Stewart, J., Michaluk, L. & Traxler, A. (2017). Exploring the gender gap in the conceptual survey of electricity and magnetism, *Physical Review Physics Education Research*, 13, 020114
- Michaluk, L. M., DeVore, S., Stewart, G. B., & Stewart, J. C. (2016). New directions in educational research, methodology, and analytical techniques. In M. d' Souza (Ed). *Teaching and Learning in Higher Education: Emerging Trends*, pp.90-131. Anaheim, CA: United Scholars Publications.
- Stewart, J., DeVore, S., Stewart, G., & Michaluk, L. (2016). “Behavioral self-regulation in a physics class,” *Physical Review Physics Education Research*, 12(1), 010125.

- Stewart, G. and Stewart, J. (2015). Invited: Case studies of successful preservice physics education programs: Physics teacher preparation at the University of Arkansas, in *Recruiting and Educating Future Physics Teachers: Case Studies and Effective Practices*, edited by C. Sandifer and E. Brewster (American Physical Society, College Park, MD), pp. 53-62.
- Stewart, J., Oliver III, W., and Stewart, G. (2013). "Revitalizing an Undergraduate Physics Program: A Case Study of the University of Arkansas," *American Journal of Physics*, 81, 943.
- Using cluster analysis to identify patterns in students' responses to contextually different conceptual problems, John Stewart, Mayo Miller, Christine Audo, and Gay Stewart, *Phys. Rev. ST Physics Ed. Research* 8, 020112 (2012).
- John Stewart, Gay Stewart, and Jennifer Taylor; (2012). Using time-on-task measurements to understand student performance in a physics class: A four-year study; *Phys. Rev. ST Physics Ed. Research*, 8 (010114), (2012).
- J. Stewart and G. Stewart "Correcting the Normalized Gain for Student Guessing", *Physics Teacher*, 48:194-196, March (2010).
- Gay Stewart, Charles Stegman, Pete Joenks, (2010). *College Ready: First Year Successes and Challenges*, NSF 2010 MSP Learning Network Conference, Washington, DC, January 2010. (Refereed by NSF committee and published on MSP-Net.)
- Patricia Heller and Gay Stewart, (2010). [Physics Standards for College Success: A Look to the Future](http://www.compadre.org/osp/items/detail.cfm?ID=10310), Retrieved September 6, 2010 from the ComPADRE OSP Collection Web site: <http://www.compadre.org/osp/items/detail.cfm?ID=10310>.
- The AAPT/APS/AIP Focus Group Report on the NRC-BOSE Draft Frameworks discussion was compiled into the following report which was transmitted to the NRC as a public response to the draft Frameworks. One of the 13 members. The AAPT Executive Board also used the document as part of their discussions of the draft Frameworks. Available on the AAPT web site at <http://www.aapt.org/Resources/upload/100815-Focus-Group-Report-on-Draft-Frameworks.pdf>
- AP Physics 1 & 2 Curriculum Framework, one of 26 authors, published by The College Board, NY, NY, 2012, revised 2014, 242 pp.
- Science College Board Standards for College Success, one of 12 authors, published by The College Board, NY, NY, 2009, 211 pp.
- John C. Stewart, Heather Griffin and Gay B. Stewart, "Context sensitivity of the Force Concept Inventory", *Physical Review Special Topics: PER*, 3 (1), (2007).
- Gay B. Stewart, "Changing to a student-centered learning environment", *Project Kaleidoscope, Volume IV: What works, what matters, what lasts*, http://www.pkal.org/template2.cfm?c_id=1419 (2006).
- One chapter in: A. S. Pruitt-Logan, J.G. Gaff and J.E. Jentoft, *Preparing future faculty in the sciences and mathematics: A guide for change*. Council of Graduate Schools and the Association of American Colleges and Universities, Washington, DC, (2002).
- Gay B. Stewart, John C. Stewart, Stephen Skinner and Crystal Bailey, "Using Linguistic References to Characterize Class Integration," *Physics Education*, 34:266 (1999).
- Gay B. Stewart and Jon Osborn♦♦, "Closing the Gender Gap in Student Confidence: Results from a University of Arkansas Physics Class." *Journal of Women and Minorities in Science and Engineering*. 4:27 (1998)
- Gay B. Stewart, "Part I: Toward a System of Educational Engineering for Traditional Class Elements in Introductory Physics Courses." *Journal of Science Education and Technology*, 6:173 (1997).
- Gay B. Stewart, John C. Stewart, Sean Slape♦ and Jon Osborn♦♦, "Optimally Engineering Traditional Introductory Physics Classes." *Journal of Science Education and Technology*, 6:297 (1997).
- "Persuade Colleagues at Large Universities that Substantive Changes are Necessary and Viable," Project Proceedings, 1993 Summer Seminar *Teaching Introductory Physics Using Interactive Methods and Computers*, Dickinson College.

- “First Measurement of the Left-Right Asymmetry in Z Boson Production,” SLD Collaboration (R. D. Elia, et al.), Mod. Phys. Lett. **A8**, 2237 (1993).
- Undergraduate Student **Graduate Student

Relevant Grants Received as PI, CoPI or project lead:

West Virginia

- GP-IN: Appalachian Geoscience Learning Ecosystem (AGLE) and Exploring Geosciences Solutions (EGeoS) Curriculum: Empowering Appalachian Students to Address Climate Challenges, NSF, \$408,319 06/23 – 05/26, PI Amy Hessel, co-PI Gay Stewart
- RII Track-1: West Virginia Network for Functional Neuroscience and Transcriptomics (WV-NFNT), (coordinated by HEPC) NSF, to WVU: \$9,300,000, 07/23 – 06/28, WVU Workforce development lead.
- Collaborative Research: Constructing Valid, Equitable, and Flexible Kinematics and Dynamics Assessment Scales with Evidence Centered Design, NSF, to WVU: \$150,962, 05/23 – 04/26, Co-PI, WVU PI John Stewart.
- BCSER-IIID: Effective Strategies to Recruit Underserved Students to Baccalaureate Engineering Success and Transition Programs (Recruit-BEST), NSF, \$350,000, 2024 – 2026 PI: Xinyu Zhang, Center providing Research Mentorship, wrote analyses plans and edited all narrative drafts.
- An Inaugural Professional Development Community program for new WV STEM Educators, Aramco Corporation, \$50,000, 07/23 – 06/24 , PI.
- Enacting the State Computer Science Plan, WV Department of Education, (6/19 – 6/23, **\$773K**, PI, director of CodeWV. CodeWV has become a permanent partnership representing WVU, WV Department of Education, Code.org, and Apple, leading the enactment of the state CS plan by coordinating CS professional development for K-12 educators and assisting with development of licensures and credentials. It grew from CodeWV, middle and high school teacher professional development, Code.org, **\$144K** (they provide significant funding directly paying participant costs, over doubling the benefit to the state) 09/17 – 06/20, PI – and - Code.org CS Fundamentals (elementary teacher professional development), Code.org, **\$73K**, 03/18 – 06/20).
- Secure and Upgrade Computer Science in Classrooms through an Ecosystem with Scalability & Sustainability (SUCCESS), National Science Foundation (06/21 – 05/24, **\$1M**, CoPI). PI Lynnette Michaluk. Received **\$200K** through a dear colleague letter supplement request to add data science, Pilot Data Science Class Curriculum for Middle Schools in West Virginia.
- Mountaineer Mathematics Master Teachers (M3T): Supporting Teacher Leadership and Networked Improvement of Mathematics Education in West Virginia, National Science Foundation (07/20 – 06/26, **\$3M** NSF, **\$1M** WVDE, senior personnel). PI Matthew Campbell.
- NRT-HDR: Bridges in Digital Health, National Science Foundation (10/21 – 09/26, **\$3M**, CoPI). PI Don Adjero.
- Howard Hughes Medical Institute Inclusive Excellence Learning Community, HHMI (03/21 – 03/23, **\$30K**, Program Director). This small amount of money was to support activity while we work with our learning community. Our learning community (15 institutions) was be granted over \$7M over 6 years, starting November 2022, to carry out work around improving student success. Some of those funds support work across the entire learning community, while **\$450K** comes directly to WVU to lead research activities that are part of this work.
- RII Track 2 FEC: Multi-scale Integrative Approach to Digital Health: Collaborative Research and Education in Smart Health in West Virginia and Arkansas, NSF (**\$2M**, 08/2019 - 07/2023) PI Don Adjero. Workforce Development Lead: Gay Stewart
- Breaking the Cycle: Preparing West Virginia's Rural, First Generation College Goers for the Careers of the Future through Computational Physics (CPHYS), a Track 2 Design and Development Project, NSF (**\$1M**, 7/19 – 6/24, Co-PI). PI John Stewart.
- GP-IMPACT: Improving Geoscience Education for Rural and First-Generation College Students

through a Shared-Instruments Collaboration - Bridging the High School to Undergraduate Divide, NSF (**\$306K**, 7/19 – 6/23, Co-PI). PI Louis McDonald,

- NSF INCLUDES Alliance: Expanding the First2 STEM Success Network, NSF-Education & Human Resources, **\$820K**, (with 2023 supplement) 09/18 – 08/24, PI (research arm for one of the first 5 NSF INCLUDES Alliances).
- Mountaineer Mathematics Master Teacher (M³ T): A Network Improvement Community Building Capacity for Mathematics Teacher Leadership to Transform Math Education in West Virginia, NSF (**\$75K** planning grant, 07/18 – 12/19, Co-PI).
- MakerMinded, The American Lightweight Materials Manufacturing Innovation Institute (**\$182K**, 07/18 – 06/19, PI). Although a student activity platform, we are working to use this as a professional learning tool. Teachers submit project-based instruction units they wish to include for points for their students, and our Master Teachers provide feedback and encouragement.
- STEMx Challenge Grant: A Conference to Improve Computer Science in the Schools of West Virginia, Battelle Memorial Institute (**\$15K**, 07/17 – 06/18, PI).
- WVUteach-Noyce: Building the Educational Infrastructure to Transform the Economy of West Virginia, NSF (**\$1.2M**, 07/17 – 06/22, CoPI). PI John Stewart.
- Project Accelerate: University – High School AP Physics Partnership Program, NSF (**\$449K**, (primary Boston University), 08/17 – 07/20, PI for local subaward).
- Adapting the Next Generation Physical Science and Everyday Thinking curriculum for a lecture-laboratory format, NSF (**\$221K**, 09/16 – 08/20, PI).
- WVUteach: The Pinnacle on a Mountain of Excellence, HHMI (**\$1,450,000**, 01/15 – 08/19, PI).
- Developing a New Model for PhysTEC sustainability, American Physical Society (**\$180,000**, 08/15 – 07/18, CoPI). PI John Stewart.

Arkansas

- Math and Science Together, **\$500K**, Department of Education MSP, 9/1/2014–8/30/2017. (PI until summer 2015, then left project except as consultant)
- YouTeach Physical Science: Noyce Scholars Enhancing Technical Capacity in Arkansas, **\$1,199,198**, National Science Foundation (CoPI until summer 2015).
- UTeach Arkansas, Arkansas Workforce Cabinet, Michael and Susan Dell Foundation **\$0.9M**, 5/1/2012–4/30/2016 (with a goal of raising funds to be sustainable after 2016.) CoPI until left.
- College Ready in Mathematics and Physics Partnership, NSF, **\$7.3M**, 1/1/09–06/30/2015, PI which build a network of 38 school districts in Arkansas and Oklahoma and provided a new professional development model where teachers directed the professional learning in their schools after/while using us to help them develop the expertise they needed in intensive summer workshops and academic year follow ups over a 3-4 year period.
- ARK-PHYS - Physics Scholarships to Build Technical Capacity in Arkansas, NSF, **\$600K**, 6/1/2010 – 5/31/2015, CoPI.
- Robert Noyce Scholarship Program, NSF, **\$1,050K**, 9/15/2007–9/14/2015, PI.
- State MSP, Professional Development Opportunities in Physics and Physical Science, **\$350K**, June 2008–May 2011.
- TOPP: Taxonomy of Physics Problems, Improving Student Understanding In Introductory Physics, NSF, **\$150K**, 5/16/06–4/30/11, Co-PI.
- "Track 2, GK-12: Teaching the Science in Everyday Life" NSF, **\$1.86M** Oct 06 – Sept 2014, Co-PI
- "GK-12: Inquiry and Innovative Thinking by Design," NSF **\$1.55M** June 02 – May 2006, Co-PI
- One of six primary program institutions for the "Physics Teachers Education Coalition" NSF/FIPSE, (\$6.2M overall, **\$500K** to site), Aug 01 – July 06, Site director. PI: AIP/APS/AAPT. Chosen for further participation upon NSF recommendation, **\$117K**, Aug 06 – July 2008, Site director.
- "Implementing Interactive Laboratory-Based Learning Techniques in Second-Semester Introductory Physics." NSF/DUE-9455732, 15 May 95 – 30 Sept 2000, **\$231K**, PI.

- One of four pilot sites in physics for the “Shaping the Preparation of Future Science Faculty.” NSF/AAPT, (\$5M overall, **\$40K** directly to site), July 99 – June 01, Site director, PI: AAPT.
- “Preparing Future Physics and Physical Science Teachers.” Arkansas Department of Higher Education, **\$32K**, 01/01 – 12/01, PI.
- “Intensive TA Training: Improving Undergrad Education, and Preparing Grad Students for Employment.” University of Arkansas Teaching Academy Grant, **\$2K**, May 96 – Sep 97, PI.

Relevant National Service

- Code.org Advocacy Coalition representative for West Virginia (2018-)
- AP Physics refresh (2020- 2023)
- APS Committee on Education, member (2023-), vice chair, 2023, chair 2024.
- Praxis Exam Standards committees, Physics and Natural Sciences, (2019)
- APS Best Practices in Undergraduate Physics Programs Task Force (now Effective Practices in Physics Programs) (2016-2022). Elected to Editorial Board that replaces the task force (2023-2025)
- Senior Advisor, APS/ACS/AMTE Get the Facts Out About High School Teaching program (2022-)
- Change agent, APS/ACS/AMTE Get the Facts Out About High School Teaching program (2018-22)
- APS Board of Directors (2014 [inception]-2016), APS Executive Board (2011-2014)
- APS Council Steering Committee (2014 [inception]-2016)
- APS Councilor (2009-2014) Council of Representatives (2014 [inception]-2016)
- APS Forum on Education Executive Committee (elected positions, 1999-2006, 2009-2016), (AAPT liaison, then chair line, then council representative), council representative, APS Forum on Outreach and Engaging the Public and Topical Group on Physics Education Research (2015-2016)
- AAPT Executive Board (2011 vice pres., 2012 president elect, 2013 president, 2014 past president.)
- Physics Education Research Advisor, AAPT Physics Teacher Resource Agents (one of the largest collections of professional development materials for physics teachers in the country 2007- 2012).
- Advisory Board, AAPT PTRA (2007- 2012); AIP Governing Board (2011-2014)
- APS Committee on Education (2002-2005)
- PKAL Physics task Force; Faculty for the 21st Century (1998-) (Helped organize 2004 meeting.)
- AP Physics Curriculum Development and Assessment Committee (2008-2011; co-chair AP Physics 2 2012-2016); AP Physics Review Advisory Panel (2008)
- AP Physics Test Development Committee (1997-2003), Chair for 2000-2003
- College Board Science Advisory Committee (2002-2012), Chair 2003-2009
- Co-Chair AP Physics Redesign (2006-2007) (Prior: Appointed by joint agreement of professional societies, College Board, and NSF to Instrument Development and Content Validation Panels (05-06)
- Review Panels for NSF grant proposals: physics, engineering and interdisciplinary. Review Panel for NSF director’s award for Distinguished Teacher Scholars, CCD, CCLI; MSP; TUES; DRK-12; ATE.
- PhysTEC Leadership Council [created 2004] (2004-08); Steering committee [created 2006] (2006-10), PhysTEC Senior Fellow, advising new PhysTEC sites (2015-).

Relevant University and Department Service

- Director, Code.org Regional Partnership for West Virginia, CodeWV (2017-)
- WVUteach Co-Director, (2014-2019), Executive Director, (2019-2023)
- Director, WVU Center for Excellence in STEM Education (2015-)
- Co-Director (senior adviser), UAteach (2012-2014)
- Engineering College Task force on Retention (2006-2008)
- Chancellor’s Task Force for Recruiting and Retention (1999-2001)
- Teaching Assistant Effectiveness Advisory Committee (2001-2014)
- Prepared and taught summer workshops for area middle and high school physics teachers
- Advisor to UA University Museum Discovery Room, Prepared “Science Saturdays” for University Museum, did two summer workshops for children through the University Museum.

- Teacher Assistant Mentor (1994-2014); Organized, developed and taught departmental TA training program (1996-7, 2002-2005); Consulted and prepared materials for departmental TA training program (1998 -2001, 2006-2014).
- Public School Liaison: Hosted High School Physics Day for which attendance increased by a factor of 10; produced 2 newsletters each year (1995-2011), each to over 300 high school teachers. Did demonstrations for local area elementary and middle schools, presentation for area teachers for University Day. Provided resources to teachers and parents for demonstrations and elementary science fairs. Organized judges and demonstrations for junior high/HS science fairs. (1994-2014)
- Secondary Education Adviser for Physics (2001-2014)

Additional relevant professional activities

- West Virginia state coordinator for STEMx
- WVU representative to Beyond100K
- Member, APS, AAPT, American Association for the Advancement of Science